Fevers in the Garden:
A History of Malaria in Colonial Assam from 1826 – 1939

Ethan Friederich

Thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in the Faculty of History at the University of Oxford

Wolfson College, University of Oxford

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Short Abstract

Malaria was the deadliest infectious disease in colonial Assam, but the malady received less attention from government officials and medical officers than other diseases. Additionally, malaria in Assam has received relatively little attention from modern historians. This project sits at the intersection of medical, colonial, and environmental histories, and contributes to discussions in the history of malaria, Assam, and British India. It explores the history of malaria in colonial Assam between 1826 and 1939. The approach is largely one of historical epidemiology; it analyses mortality and morbidity data on 'Fevers' and attempts made by the government and medical officers to understand and prevent the disease.

Assam was transformed by British rule, and the trajectories of both malaria and society were strongly influenced by colonial rule during this time period. The ecology of Assam was heavily modified to support the province's biggest industry- tea. In the process, jungles were cleared, millions of immigrant labourers were recruited, and malaria flourished. Efforts to reduce malaria across the province failed, and public health as a practice was often structured around keeping immigrant labourers healthy and industrial enclaves productive. Exploring anti-malarial measures in the province and the relationship between the creation of medical knowledge and public health praxis, this project touches on the topics of colonial 'development', quinine, mosquito control measures, and epidemiology.

This dissertation argues that malaria played a pivotal role in the history of colonial Assam; that historians are able to gain some understanding of the presence and effects of the disease even when knowledge in the past was limited; and that perceptions of the disease, attempts to control it, and that both human and non-human factors that contributed to malaria were heavily influenced by colonial forces.

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Long Abstract

This project explores the history of malaria in colonial Assam between 1826 and 1939. The approach is largely one of historical epidemiology; it analyses mortality and morbidity data on 'Fevers' and attempts made by the government and medical officers to understand and prevent the disease. This dissertation argues that malaria played a pivotal role in the history of colonial Assam; that historians are able to gain some understanding of the presence and effects of the disease even when knowledge in the past was limited; and that perceptions of the disease, attempts to control it, and that both human and non-human factors that contributed to malaria were heavily influenced by colonial forces.

Study Design

This analysis of malaria utilises mortality and morbidity data on 'Fevers', which entails differentiating deaths due to malaria from those caused by other diseases likely to have been recorded in this category. Unfortunately, unpacking mortality and morbidity data on 'Fevers' is troublesome for historians. Records were not always taken from every village in the province and, in many cases, those who reported causes of death were village leaders rather than medical professionals. Additionally, deaths due to several diseases, not just malaria, were recorded under the heading of 'Fevers'. Despite the drawbacks of incomplete data and imprecise categories, recorded mortality and morbidity from 'Fevers' can indicate the presence and prevalence of malaria. Though it was understood by those during the colonial period to be flawed, it was

nevertheless used as a metric for many diseases including malaria and evidence to develop, support, or challenge public health schemes. Acknowledging the flaws of mortality and morbidity on 'Fevers' and placing the information within the appropriate context allows historians to gain a sense of the presence of malaria. Though it is impossible to provide a completely accurate number of individuals who suffered or died from malaria, it is possible to gain an understanding of how the data was being recorded and if malaria was present. This approach has been used before by historians of medicine studying malaria in British India to measure trends over time, though it has never been applied to colonial Assam. This project utilises similar methods to those employed by other historians and adapts the approach to the unique setting of Assam.

The arguments in this dissertation are supported largely by government reports and medical publications as there is little mention of malaria in other sources such as the native presses within Assam. The complete history of malaria in colonial Assam is varied and complex; those in many different localities developed their own relationship to the disease and the narrative of malaria presented here does not pretend to provide an in-depth analysis of these histories. The trajectories of both malaria and Assam were, however, strongly influenced by colonial rule between 1826 and 1939. Exploring government reports and medical publications enables an analysis of the colonial transformation of Assam and an acknowledgement that malaria was an influential historical actor in the process.

The 113 years between 1826 and 1939 is undoubtedly a long timeline, and to accomplish the historical inquiry the body of project is divided into four main chapters, and each explores a significant period in the history of both Assam and malaria. Chapter One briefly touches on the pre-colonial period but focuses primarily on colonial Assam between 1826 and 1874. Assam was annexed to British controlled Bengal in 1826 and then became an independent province within the Raj in 1874. There were no mortality and morbidity statistics from this period, and the

presence of malaria is determined mostly by evidence from sources that make note of anything that may indicate malaria, for example the presence of fevers thought to be caused by climate. Chapter Two covers the period from 1874 and 1897. The provincial government of Assam began recording vital statistics in 1874 and the presence of malaria is determined by utilising these figures. However, conversations on malaria were dominated by kala-azar which was considered a form of malarial fever (though it is now understood as a separate disease entirely). Chapter Three focuses on the period between 1897 and 1919. Ronald Ross made his famous discovery in 1897, that malaria is transmitted via the bite of an anopheline mosquito. As a result, many in public health called for mosquito control measures as a way of reducing the presence of malaria. These ideas did not take hold in colonial Assam and the province relied mostly on quinine as its primary method of reducing malaria mortality and morbidity during this period. Despite a lack of consensus on efficacious anti-malarial measures, malaria received an increased level of attention in colonial Assam than in previous decades. Chapter Four covers the interwar years, 1919 to 1939. During the interwar years, the idea of implementing mosquito control measures slowly began to gain popularity in colonial Assam. After the successful reduction of kala-azar, financial resources were reallocated to mosquito surveys, and medical officers began recommending species-specific mosquito control measures. Unlike in previous decades, species sanitation was viewed as much more affordable and feasible than previous methods of mosquito control. While some malaria surveys were carried out and species sanitation proved successful in select locations, total malaria mortality in Assam did not decrease between 1919 and 1939, a distinct trend in comparison to other provinces.

Major Findings

This dissertation highlights the fact that malaria was the deadliest infectious disease in colonial Assam. Despite this fact, the malady received less attention from government officials

and medical officers than other diseases within the province. Perhaps consequently, malaria in colonial Assam has received relatively little attention from modern historians, although this is likely also due to several additional factors that influence the nature of historical research particularly regarding medicine and British India. The long history of malaria's widespread presence in colonial Assam indicates that the disease was a feature in the lives of millions of the province's residents. Additionally, the nature of Assam's colonial transformation underscores a close relationship between malaria and life on the periphery of the British Empire. The narrative of malaria presented in this project touches on themes of colonial and ecological histories, public health, quinine, colonial development, medical entomology, and epidemiology as those in the past struggled to understand and prevent malaria.

In the early 19th century, malaria was framed by the British as a danger to foreigners who entered the territory. When the British discovered tea, they began slowly to transform the ecology of certain localities in Assam. Jungles were cleared in an effort to make space for tea plantations and immigrant labourers were brought into Assam to work. Malaria was then reframed as a problem for industry, not just a danger to Europeans in the province. Clearing jungles and establishing tea plantations inadvertently created optimal breeding grounds for anopheline mosquitoes, and the workers on plantations frequently caught malaria. Unfortunately, the same cultivation that increased the presence of malaria in Assam was viewed as a panacea for the disease. It is difficult to quantify the presence of malaria in Assam prior to 1874, but it is possible to determine that the disease was present and deadly.

Assam became a province in 1874 and started recording statistics on mortality and morbidity. With this data, it has been possible to show that malaria was indeed present and prevalent throughout the province. Though malaria was widely regarded as the province's greatest scourge, it received relatively little attention from government officials and medical

officers. One disease, however, attracted plenty of attention: kala-azar. Kala-azar was thought to have emerged in the 1860s (although it is likely the disease existed within Assam long before) but government officials were not aware of kala-azar until the 1880s. One of the primary symptoms of kala-azar was a fever and, alongside malaria, deaths due to the disease were placed under the heading of 'Fevers' in vital statistics. Kala-azar attracted the attention of the government because the public in Assam often reacted drastically when a case was discovered in their community. Villagers abandoned their homes, and the sufferers of kala-azar were often isolated or even killed. This frightened government officials and leaders within the local industries, it threatened the peace of Assam and the ability to have a productive workforce. Medical officers within Assam believed that kala-azar was either another term for malaria or some form of malarial fever, not a separate disease altogether. Assam sought the attention of the Government of India and was able to eventually host two medical officers, G. M. Giles and later Leonard Rogers, who researched the disease within the province. In the early 1890s, Giles argued that kala-azar was not malaria, that kala-azar was in fact caused by hookworm. He was incorrect, and his conclusions were quickly dismissed. In 1897, Rogers completed his study of kala-azar in Assam and concluded that the disease was a form of malaria. Rogers was also wrong in his assessment of the disease, but his sanitary recommendations were embraced widely in the province.

When examining mortality and morbidity statistics on 'Fevers', it is possible to see that malaria had a much stronger presence in colonial Assam than kala-azar, and that much of the deaths that were attributed to kala-azar were in fact due to malaria. The period between 1874 and 1897 was one of transition for public health in colonial Assam. In the 1870s, medical officers in colonial Assam had a very limited purview- maintaining the health of local labourers. Over the following two decades, medical research in the province was taken more seriously by medical

officers and government officials, and much of this transition was ushered in by research on kala-azar. Nevertheless, there is still the question of why kala-azar was regarded as a more pressing concern than malaria. Historical actors did not know that many of the deaths attributed to kala-azar were actually due to malaria, but, beyond that, malaria was normalised in the province. Although deleterious, it was an everyday part of life. Kala-azar, on the other hand, was perceived as new, dangerous, and disruptive. The motivation to address kala-azar over malaria contributes to discussions on the structure of public health and society in colonial Assam.

By the turn of the twentieth century, malaria in colonial Assam was taken more seriously. Ronald Ross' discovery of mosquitoes as the vector of malaria encouraged some schemes to eradicate mosquitoes in Assam in around 1900, but these failed to gain popularity or produce results. Mosquito eradication measures similarly failed to gain popularity in other locations in India as well. In 1905, Assam was combined with an eastern portion of Bengal to for the province of Eastern Bengal and Assam, though the province was dissolved in 1912 and Assam became its own province once again. Anti-malarial measures in British India progressed considerably between 1905 and 1912. The Malaria Conference in Simla was hosted in 1909 and attendees were recommended to continue distributing quinine and embrace new malaria surveys to employ species sanitation, targeting specific species rather than attempting to eradicate mosquitoes completely. Some malaria surveys were performed in the Eastern Bengal portion of the province, but the insights from these surveys could not be applied to Assam. Additionally, mosquito control measures previously performed in the Eastern Bengal portion of the province made medical officers wary of such schemes. Though more attention was paid to malaria in Assam than ever before, few malaria surveys were performed in Assam between 1897 and 1919. Quinine remained the dominant anti-malarial method in Assam as efforts to distribute the drug were refined during the twenty-year timeline.

It was not until the 1920s that malaria surveys were first performed on tea plantations in Assam. There were a few malaria surveys in the province prior to the end of the First World War, but these were done with the cooperation and partial funding of the Assam-Bengal Railway Company. Tea plantations were considered relatively healthy, but this perception was challenged during the late 1920s and early 1930s as cases of malaria remained high. During the 1920s and 1930, medical officers employed medical entomology to perform malaria surveys on tea plantations in Assam and recommend appropriate public health measures. Though these measures were successful on small scales, they were not applied to the province as a whole and deaths due to malaria did not decline in colonial Assam as they did in other provinces in the Raj.

Contemporary efforts to reduce malaria across the province failed, and public health in Assam was often structured around keeping immigrant labourers healthy and industrial enclaves productive. By exploring anti-malarial measures in the province and the relationship between the creation of medical knowledge and public health practice, this project engages with the history of colonial 'development', quinine, mosquito control measures, and epidemiology.

This study has broader implications for the historiography of Assam and for the historiography of public health in British India as a whole. Malaria has been only lightly touched upon within histories of colonial Assam. This dissertation argues that malaria was a significant actor in Assam's history; the mortality and morbidity rates alone demonstrate the overwhelming presence of the disease; but historical sources focusing on malaria are relatively limited, especially in comparison to other provinces in India. The limited perspectives on malaria underscore a tension between perceptions of that disease and the impact of mortality and morbidity of 'Fevers'. It is necessary for historians to reassess the analysis of diseases such as malaria and kala-azar in colonial Assam and recognise the relationship between social recognition of disease and the biological presence and impact. This dissertation also contributes

to the historiography of public health in British India by providing a narrative of malaria in colonial Assam and a depiction of a disease within a periphery of the empire. The methods of historical inquiry used in this project are informed by the work of other historians, and the approach strengthens the practice of historical epidemiology and analysis of malaria. Overall, the trajectory of malaria in Assam was distinctly colonial, and this narrative of malaria in colonial Assam has explored attempts to create medical knowledge and transition that knowledge to public health praxis within a distinct historical environment.

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List of abbreviations:

ASA	Assam State Archives
ASRPA	Annual Sanitary Report of the Province of Assam for the Year
APHRPA	Annul Public Health Report of the Province of Assam for the Year
BL	British Library
EIC	British East India Company
IMS	Indian Medical Service
RJAPA	Report on the Jail Administration of the Province of Assam for the Year
RPAPA	Report on the Police Administration in the Province of Assam for the Year
SAPHRPA	Supplement to the Annual Public Health Report of the Province of Assam for the Year

List of illustrations:

Introduction:

> It is unnecessary here to emphasize the importance of control of a disease which causes a greater amount of sickness, inefficiency, and mortality than any other disease in the world, and the ravages of which have formed one of the greatest obstacles to colonization and civilization. Malaria is undoubtedly Assam's greatest problem, and has cost the local Government and the industries many crores of rupees.[1]

Malaria was by far the deadliest infectious disease in the history of colonial Assam. Over five million deaths were attributed to 'Fevers' (principally malaria) between 1874 and 1947, a staggering figure for a province with a registered population of less than five million in 1874 and just ten million in 1947.[2] Malaria is endemic to the northeast of India and the presence of the disease predates British contact, but the history of the disease in the province underscores a close relationship between colonial rule and malarial infection/death. The purpose of this dissertation is to explore the history of malaria in colonial Assam. A complete history of malaria in this province could not fit into a dissertation of this length and probably should not. As is evident, malaria is inextricably linked to numerous events in Assam's history, and the actual relationship between the disease and residents is as nuanced and varied as the many lifestyles Assam supported and peoples who have made it their home. This analysis focuses mostly on the attempts of government officials and medical officers to gain an understanding of the disease and their attempts to prevent it. The approach emphasises how much Assam was transformed by British rule and understands that the trajectories of both malaria and society were distinctly colonial during this period. This dissertation is largely narrative in structure, but it touches on several important themes as it explores both social perceptions of malaria and the biological presence of

[1] G. C. Ramsay and J. De La M. Savage, 'The Principles and Methods of Malaria Control in Assam', *The British Medical Journal*, (Oct 29, 1932), p. 790

[2] Fever was a catch all category used in public health records for diseases with fever symptoms; malaria was overwhelmingly the most common disease within this category.

the disease. Though it is not an exhaustive assessment, this dissertation examines an underexplored and under-appreciated aspect of the histories of medicine, Assam, India, and empire. It argues that malaria played a pivotal role in the history of colonial Assam, that historians are able to gain some understanding of the presence and effects of the disease even when knowledge in the past was limited, and that perceptions of the disease, attempts to control it, and that both human and non-human factors contributing to malaria were heavily influenced by colonial forces.

Malaria was endemic to colonial Assam and in many ways its presence was normalised, but the disease was never entirely ignored. Residents – Indian and European alike – tried to combat the disease in many ways. They cleared jungles, installed drainage, distributed quinine, and eventually tried to control populations of mosquitoes, but they did so with varying levels of urgency and coordination throughout the period examined. Some of these measures helped to stem the spread of malaria and some, as will be shown, inadvertently created the optimal environmental conditions for anopheline mosquitoes, the vector of malaria, to breed. Through it all, there was a reflexive relationship between malaria and society in colonial Assam; a bidirectional influence in which the presence of malaria affected the lives of Assam's residents just as the actions of those residents affected the presence of the disease. The evidence of the success of anti-malaria campaigns is reflected in the numbers; whether mortality and morbidity went up or down there was always a response one way or another. The cause-and-effect relationship between what people thought malaria was (which guided preventative measures and treatments) and the actual presence and effects of the disease (reflected most accurately in the epidemiological data) determined the place of malaria in society, and unpacking this phenomenon requires examining medical, colonial, and ecological factors.

The approach of this project is distinct from other histories of colonial Assam because it focuses primarily on malaria. Exploring the history of colonial Assam has been done by concentrating on many different phenomena, including labour practices, politics, religion, and environmental features to name a few. Focusing specifically on malaria emphasises the ever presence of the disease as well as how the disease was entangled with almost every aspect of society within colonial Assam; it adds to the limited discourse on how scientific and medical research in the province related to life and colonial development. These relationships expose the extent to which malaria itself must be included in the historical narrative. This project also connects research on colonialism and disease within Assam to similar works on the relationship between scientific research and empire. [3] Ultimately, malaria was one of the fundamental components that contributed to how Assam was characterised by the British Empire and how the province developed during the colonial period. Additionally, research on the disease in colonial Assam influenced popular and scientific conceptions of malaria around the world. The history of malaria in colonial Assam explores the relationships between to the histories of Assam, colonialism/empire, and the deadliest infectious disease in human history.

A Brief Overview of Colonial Assam, 1826 - 1947

This section provides a very brief timeline of the history of colonial Assam. The changes which occurred in this period influenced many aspects of the political and ecological landscape of Assam and by extension the systems of public health, and for the duration of the 121 years of British rule, Assam was situated firmly in the colonial network. This section also introduces the concept of colonial 'development' in Assam and how it relates to malaria in the province. The

[3] H. Tilley, *Africa as a Living Library* (Chicago, 2013), p. 2.

concept of development will be explored in greater depth in the following chapters of this dissertation.

Colonial Assam was a province in the northeast of India, situated between Bengal and Burma. [4] Prior to the colonial period, Assam was not a part of the Mughal Empire and was composed of several different peoples and political groups, but the largest and most prolific was the Ahom Kingdom. British rule was strikingly different to the Ahom Kingdom that preceded it. The military-feudal lifestyle in the Ahom Kingdom gave way to colonial priorities; the society, economy, and ecology of Assam were all transformed to support the empire. In 1826, Assam was annexed to British-controlled Bengal at the end of the First Anglo-Burmese War. The British discovered tea in Assam during the 1830s and tea cultivation eventually became the dominant industry.[5] In 1874, Assam was separated from Bengal and made its own independent province within the Raj. In 1905, Assam was coupled with an eastern portion of Bengal (much of what is modern-day Bangladesh) to create the Province of Eastern Bengal and Assam. This province was short lived; in 1912 the Province of Eastern Bengal and Assam was dissolved, and Assam was made its own province once again. The government of colonial Assam during the early part of the twentieth century was concerned primarily with maintaining the major industries, tea, oil, and coal, and its management of disease was shaped heavily by these priorities. This was interrupted during the Second World War when Assam hosted several battles in the allied attempt to halt Japanese forces advancing through Burma. In 1947, Indian Independence brought an end to British rule in colonial Assam.

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[4] Colonial Assam is continuously referred to as a province for the sake of continuity, although its official status does vary between 1826 and 1947, and it was not technically its own province until 1874.

[5] This refers to tea in Assam as discovered by the British and highlights the desire for mass cultivation, but some locals had been gathering and using wild tea long before the colonial period.

The history of colonial Assam is one of development on the periphery of the empire. The province was set apart from the rest of British India geographically and was home to a distinct culture, but it was eventually dominated by its major colonial industries. Prior to the colonial period there was little contact between Bengal and Assam, and even by the middle of the nineteenth century travel to and from Assam took weeks. Goalpara was the western-most district of Assam and the gateway to the province, but it took 25 to 35 days to travel from Goalpara to Calcutta and 33 to 43 days from Calcutta to Goalpara.[6] This was due to the difficulty of navigating the Brahmaputra River, the lifeblood of the Assam Valley, where travel times were heavily affected by currents and wind conditions. Travel between Assam and Bengal eventually became quicker with the establishment of railways, but many parts of the province remained relatively remote.

The landscape of Assam was transformed during the nineteenth and early twentieth century. Prior to British control, myths of Assam circulated among Westerners with tales of fantastical beasts, supernatural tribespeople, and mystical jungles.[7] It was a land few foreigners had ever set foot in. Although much of Assam was covered in jungle, the British found the soil and climate ideal for agricultural 'development'. The British deconstructed and reorganised what they considered to be 'unproductive spaces' into 'productive gardens'.[8] By the middle of the 19th century, numerous factors in international trade made land in Assam an attractive commodity for bio-prospectors.[9] It is important to note that contemporary language that characterised Assam as an 'unproductive wasteland' was the reflection of colonial ambitions within the province and not

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[6] S. K. Bhuyan, *Anglo-Assamese Relations 1771-1826* (Guwahati, 1949), p. 55
[7] J. Sharma, *Empire's Garden – Assam and the Making of India* (Durham, 2011), p. 2.
[8] Sharma, *Empire's Garden,* p. 11.
[9] In the 1820s, the British were involved in a trade war with Chinese forces over tea. Using the land in Assam to grow tea was an opportunity for British merchants to secure a new, less politically volatile source for tea. (Sharma, *Empire's Garden,* p. 14.)

a true depiction of Assam. The land was widely populated and politically and economically organised long before the European presence. In addition to the Assamese in the Ahom Kingdom, aboriginal tribes of varying ethnic identities lived in, or were forcefully driven to, the hills and jungles far away from the fertile valleys British colonists were interested in.[10] This transformation of Assam is explored by historian Jayeeta Sharma in her work *Empire's Garden*.[11]

In *Empire's Garden*, Sharma explores the colonial transformation of Assam and the relationship between the environmental and social transition. Sharma's contribution to the concept of colonial modernity, however, does not include health and the management of disease. While the source material used in this dissertation differs from Sharma's work, the shared themes of 'development' and 'progress' included aspects of health and disease that should be acknowledged. Not only was disease an extremely deleterious aspect of local life, but disease also exemplified an aspect of colonial classification and control central to contemporary discussions of colonial development. Additionally, the establishment and maintenance of the tea industry, one of the fundamental components of *Empire's Garden*, was influenced tremendously by disease and fevers in particular. Just as Sharma's work 'connects the labour history and the exploration of colonial modernity', this dissertation connects colonial modernity/development with an exploration of health and disease.[12]

By far the most important crop in Assam's new agro-industrial society was tea, and establishing plantations was a major driving force behind colonial 'development' in Assam. Edward Gait, an early historian of Assam and colonial administrator of the province during the late nineteenth century, estimated that in 1878, tea planters occupied and utilised a quarter of the

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[10] R. Gopalakrishnan, *Assam: Land and People* (New Delhi, 2000), p.7.
[11] Sharma, *Empire's Garden*.
[12] Ibid., p. 11.

land in Assam. Then, between 1878 and 1923, tea production multiplied by roughly 8 times.[13] After years of environmental modification, the plantations and resource extraction schemes that dominated the landscape by the turn of the 20th century were a far cry from the pre-colonial period.

By the early 20th century, numerous exports were produced in Assam, but the cost of both colonisation and commercial operations was ecological reorganisation, cultural displacement, and death in the millions, all of which were connected in various ways to malaria. The ecological shift from feudal agricultural systems to productive plantations underscores several changes to the ecological landscape of Assam. The environment was heavily modified to create more cultivated space, and vast numbers of immigrant labourers were brought into Assam to work on plantations. Between 1874 and 1939, an average of about 1.5% of the population of Assam and a median figure of 1.4% died every year due to 'Fevers' (principally malaria).[14] Considering the fact that the population of Assam more than doubled between 1874 and 1947, the median mortality supports the larger argument that malaria maintained a significant influence on life in Assam over the span of British rule.[15]

The relationship between colonial 'development' and malaria is rooted in ecological factors. Mosquitoes, specifically female anopheline mosquitoes, are the vector of malaria because their bite inadvertently spreads Plasmodium parasites. The Plasmodium parasite, the microorganism that causes malaria, survives and replicates in a number of animal hosts including

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[13] The total tea produced in 1878 is estimated at 28.5 million pounds, and in 1923 at 237 million pounds. (E. Gait. *A History of Assam* (Calcutta, 1926), p. 356.)
[14] These statistics were taken from the Annual Sanitary Reports and Public Health Reports of Assam between 1874 and 1939.
[15] Population statistics were taken from the sanitary reports and dispensary reports of Assam between 1876 and 1944.

mosquitoes, humans, and even birds and is transmitted from organism to organism by anopheline mosquitoes, primarily *Anopheles maculatus* and *Anopheles minimus* in colonial Assam.[16] Inside the human body, the parasites travels through the circulatory system, replicate in the liver, and, for the duration of their lifecycles, can cause a series of symptoms including severe fever, chills, headaches, and occasionally vomiting. The specific pathologies depend on the malaria plasmodium involved. If left untreated, complications from malaria can be fatal. In Assam, on average between 1874 and 1939, 57% of the total population who died from any disease died from 'Fevers' (principally malaria).[17] To understand malaria in Assam, it is essential to understand the lifecycle, patterns, and spread of mosquitoes, and to do this one must examine the local ecosystem and determine what factors allow Anopheles mosquitoes to flourish, perish, or come in contact with human beings. In Assam, where the larger history of the province involves a social and ecological transformation that exists in tandem with a high presence of malaria, the presence of anopheline mosquitoes carrying malaria is a strong indication of the connections between the disease and other forces within the province.

During the 1920s, surveys on malaria closely linked deforestation in Assam to increasing cases of malaria. Large portions of the land had been deforested in Assam to make way for the British plantation system, and it is likely that this process indirectly created the conditions necessary for the reproduction of anopheline mosquitoes. In his 1924 report, Sir Malcolm Watson, an accomplished malariologist, was one of the first to mention this phenomenon. According to Watson, tea plantations were often the sites of malaria epidemics because they were

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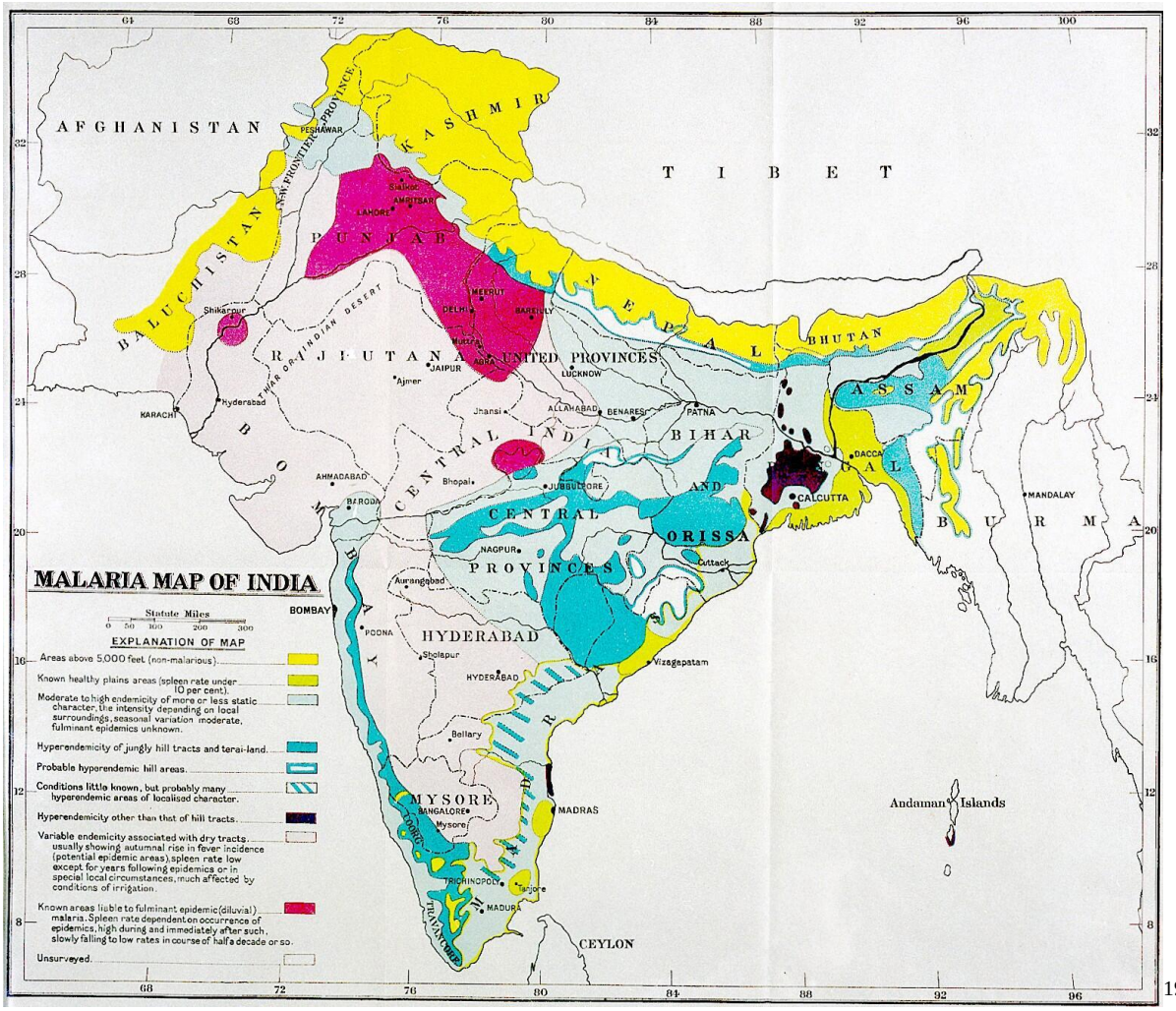
[16] M. Watson, 'Observations on Malaria Control, With Special Reference to the Assam Tea Gardens, and Some Remarks on Mian Mir, Lahore Cantonment', *Transactions of the Royal Society of Tropical Medicine and Hygiene,* 18 no. 4 (23 Oct. 1924), p.149.
[17] These statistics were taken from the Annual Sanitary Reports and Public Health Reports of Assam between 1876 and 1944.

perfect habitats for anopheline mosquitoes.[18] The illustration below presents a map of malaria in colonial India in 1926, but it should be noted that this was done before many of the detailed malaria maps of Assam were produced.



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In the Assam Valley, the area of Assam where the largest segment of the population lived, the Brahmaputra River flows through two floodplains. Prior to the creation of the tea estates, these floodplains were covered by jungle. Immigrant labourers cleared away the jungle to plant rice and other crops. After malaria surveys, Watson wrote, 'in these places I found *A. maculatus*

[18] Watson, 'Observations on Malaria', p. 151.
[19] [cited as fig. 1.]

and *A. minimus* in abundance, and I was not surprised to find much malaria.'[20] Modern scientific studies on Assam in the 21st century support these claims. A 2012 study on malaria stated that, 'the adverse effect of deforestation includes increase in soil erosion and changing patterns of vector-borne diseases like malaria.'[21] With jungles transformed into tea plantations, the conditions for malaria in Assam were ripe and the presence of the disease can, in part, be explained by the ecological conditions unintentionally created by deforestation and the expansion of plantations. This information was not well known to inhabitants until the 1920s and 1930s, long after the process was complete, but the ecological consequences of transforming land in Assam were similar phenomenon to those experienced in other Indian provinces. The discovery of the role 'development' played in the history of malaria in colonial Assam will be explored in greater depth in Chapter 4 of this project, but here it serves as an entry point into the wider historiography on malaria in British India.

Historiography

This section provides a brief overview of modern historiography on malaria in British India and the history of colonial Assam, particularly as it regards disease. Many of the works of major historians will be returned to and elaborated upon in subsequent chapters, but they are mentioned here in order to determine the main trends and debates in the historiography of malaria in British India.

One of the first historians to discuss the role of colonial 'development' and its relationship with malaria in British India was Ira Klein in his 1971 work 'Malaria and Mortality in Bengal, 1840-1920'. Klein argues that malaria in Bengal was not an independent variable and focuses on

[20] Ibid., p.149.
[21] M. J. Nath, et al., 'A Longitudinal Study of Malaria Associated with Deforestation in Sontipur District of Assam, India'. *Geocarto International*, no. 1 (Feb 2012), p. 79.

the impact of 'British modernising,' specifically in this case the construction of embankments and canals. He argues that modernisation projects in India often unintentionally increased the spread of disease.[22] Klein utilised data on mortality to better understand the effects of colonial development. He states, 'perhaps most important for the historian attempting to assess the impact of the British on India, mortality rates and population figures help cast light on the British effect on development and decay'.[23] According to Klein, as early as the 1840s, investigations into fevers suggested a link between canal and embankment construction and malaria. Limited scientific knowledge meant that those in the past could not understand the complete relationship between malaria and the larger environment, but the connection was clear.[24] Debates between contemporary researchers and the prevailing state of medical knowledge at the time limited the overall impact of these insights in the 19th. The true connection between development and malaria was not realised until the early twentieth century. Additionally, Klein notes that in Bengal rates of malaria transmission were affected by a variety of social, economic, and biological factors such as immunity among labourers. Adding another layer of nuance to his previous claims, in his 2001 article 'Development and death: Reinterpreting malaria, economics and ecology in British India', Klein reaffirms his original argument that economic development directly caused death in British India by spreading malaria by stating that contemporary researchers in British India were aware of the ecological implications of certain British development projects, but their warnings were 'systematically minimised', leaving little room for widespread action. Klein also raises the possibility that quinine reduced malaria mortality.[25]

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[22] I. Klein, 'Malaria and Mortality in Bengal, 1840-1921', *The Indian Economic and Social History Review,* 9/2 (1 June 1972), p. 132.
[23] Ibid., p. 133.
[24] Ibid., pp. 139-40.
[25] I. Klein, 'Development and death: Reinterpreting malaria, economics and ecology in British India', *The Indian Economic and Social History Review*, 38/2 (2001), p. 149.

Klein's work has been criticised by Sheldon Watts. Watts acknowledges that medical officers understood that 'modernisation' had increased malaria but argues that due to the skewed political and economic interests of parliament, wealthy investors, and the 'gentlemanly' class who ruled India and the British Empire, little was done to reduce the 'modernised' environments' effect on malaria. According to Watts, it could not have been a recognition of the relationship between 'development' and malaria that reduced mortality within Bengal.[26] Watts' argument is off on a few counts, perhaps most notably that officials did recognise the relationship between malaria and 'development' after medical officers made the connection in the early twentieth century; the government responded with the Malaria Conference in Simla in 1909. The relationship between the development of scientific knowledge and the implementation of public health measures was complicated. Though often paternalistic, even good faith plans to implement public health schemes were affected by many factors that influenced the transition from medical theory to policy to practice. The factors that affected the implementation of public health measures were specific to each location.

Bengal is a useful point of comparison for Assam, the two provinces were neighbours and Assam was annexed to Bengal before it was made its own province. Nevertheless, Klein is careful to note that conditions in Bengal and Assam differed greatly. While a variety of factors influenced the spread of malaria within Bengal, Klein suggests that differing labour conditions and structures could indicate the ecological conditions had a greater impact on malaria within Assam than Bengal. Klein does not spend much time on this suggestion, and the statement is more speculative than a core part of his argument.[27] Despite this, the main argument of Klein's

[26] S. Watts, 'British Development Policies and Malaria in India 1897- C.1929', *Past and Present* 165/1 (1 Nov. 1999), p. 160.
[27] Klein, 'Malaria and Mortality', p. 142.

work, that ‘malaria was facilitated by economic development’ stands as a testament to the impact British modernising had on disease and the ability of medical officers to adjust their anti-malarial measures accordingly. Though Klein’s arguments cannot be blindly applied to circumstances in Assam, the larger implications of his work do suggest direct links between environmental modification, the spread of malaria within Assam, and the response of medical officers.

The work of other historians on the history of malaria in Assam stand out as arguments that malaria mortality and morbidity could not simply rely on the presence of anopheline mosquitoes. In many cases, the work of historian Sheila Zurbrigg on malaria in the Punjab is in line with the claims of Klein: that malaria played a much larger role in the history of the province than previously believed, and that the relationship between the humans and the local ecology had an effect on malaria. In ‘Hunger and Epidemic Malaria in Punjab, 1868-1940’ , Zurbrigg also relies on mortality data and the information in Sanitary/Public Health Reports and makes the claim that nutrition and hunger played a significant role in malaria mortality, specifically that it is possible that hunger and poor nutrition made one less susceptible to malaria rather than more.[28] Historian Elizabeth Whitcombe also discusses the role of nutrition on malaria in her article ‘Indo-Gangetic River Systems, Monsoon and Malaria’. Whitcombe establishes that the silting of the Ganges-Brahmaputra and Indus delta were contributing factors to the underlying, long-term problems of malaria and were exacerbated by subsequent British development. She also claimed that it was not nutrition itself that was a causative factor in malaria mortality, but that the availability of food and prevalence of anopheline mosquitoes could both be correlated to a similar

[28] S. Zurbrigg, ‘Hunger and Epidemic Malaria in Punjab, 1868- 1940’, *Economic and Political Weekly,* 27/4 (25 Jan. 1992), p. PE-2. Also see, S. Zurbrigg, *Malaria in Colonial South Asia: Uncoupling Disease and Destitution* (New York, 2020) and S. Zurbrigg, *Epidemic Malaria and Hunger in Colonial Punjab: Weakened by Want* (London, 2019).

phenomenon: rainfall.[29] She does so by analysing price data as a proxy for hunger- i.e., when prices rise, hunger is assumed to increase. In the Punjab, prolonged drought prior to late but heavy monsoon rains caused malaria to increase because cattle died and the main vector (*Anopheles culicifacies*) in Punjab was zoophilic. However, the causes in Bengal were different – i.e. long-term river decay exacerbated by the embankment of rivers, railways and roads.

In her article 'The Logic of Location: Malaria Research in Colonial India, Darjeeling and Duars, 1900-1930', Nandini Bhattacharya explores the logic that defined anti-malarial measures on mostly tea plantations in Bengal. Bhattacharya claims that within colonial medical research, local ecologies were often understood as causing diseases, but knowledge of this did not always translate into effective anti-malarial campaigns.[30] Fundamental to Bhattacharya's work is the concept that malaria and the development of anti-malarial policy should be studied within local contexts. She expands upon this in her monograph *Contagion and Enclaves,* in which Bhattaharya broadly argues that Europeans built their own spaces within the tropics, and these enclaves became spaces in which colonial officials and medical officers developed unique understandings of 'labourers, commodities, soldiers, prostitutes, markets and traders as well as pathogens.'[31]

Historian Mridula Ramanna examines the history of disease and its relationship to colonial dynamics in Bombay and offers descriptions of the acceptance or rejections of western medicine among both British and Indian residents. In 'Indian Attitudes Towards Western

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[29] E. Whitcombe, 'Indo-Gangetic River Systems, Monsoon and Malaria', *Philosophical Transactions of the Royal Society A Mathematical, Physical and Engineering Science*, 370, no. 1966 (13 Mar. 2012), p. 2216.
[30] N. Bhattacharya, 'The Logic of Location: Malaria Research in Colonial India, Darjeeling and Duars, 1900-30', *Medical History* 55/2 (April 2011), p.184.
[31] Bhattacharya, *Contagion and Enclaves,* p. 12.

Medicine: Bombay, A Case Study', Ramanna argues that malaria in Bombay was regarded as even more prone to outbreaks than Madras or Calcutta, and the reception of preventive medicine and public health measures on malaria were received relatively positively by residents.[32] This was especially true when compared to the reception of public health policies on other diseases. Though Ramanna's works focus primarily on Bombay, they offer perspectives that are useful for historians exploring the histories of medicine in British India. Support for public health measures was received with varying levels of enthusiasm, for example, some measures were occasionally resisted by British residents and embraced by Indians. The reactions of local residents, both for and against certain schemes, shaped both the development of preventive medicine and the effectiveness of the schemes themselves. This awareness is important when researching the history of malaria in Assam. Local perceptions of disease and public health measures, which could vary between different groups, had a strong effect on the development of anti-malarial measures.

This sample of historians who have published on malaria in British India is by no means an exhaustive list of all historians who have explored the topic of malaria but it highlights the themes which are most pertinent to this project. The first is the idea that colonial 'development' played a massive role in increasing malaria (it modified the environment and created the optimal breeding grounds for anopheline mosquitoes and moved around people with varying levels of immunity) and that the realisation of development's relationship to malaria influenced anti-malarial measures during the 20th century. Second, that malaria mortality and morbidity are affected by a number of factors beyond just the presence of anopheline mosquitoes but that mortality and morbidity figures, though not exactly accurate, can be used to examine malaria.

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[32] M. Ramanna, 'Indian Attitudes Towards Western Medicine: Bombay, A Case Study', *Indian Historical Review*, 27/1 (2000), p. 46.

Third, that it is beneficial to explore malaria in British India within a local context to better understand the dynamics that shaped both disease and attempts to prevent and treat disease. This dissertation adds to each of these discussions.

Additionally, and more generally, this dissertation is informed by and contributes to the themes presented by historians working in the field of the history of public health in the British Empire and colonial India. Historian Michael Worboys' early publications on tropical medicine and the history of parasitology were foundational within the field of medical history in relation to colonial medicine and malaria.[33] Broadly, the works of historians David Arnold and Mark Harrison provide insights into the state of public health and its relationship between medicine, policy, and colonialism particularly in British India.[34] These and other works on public health in British India help one place the history of malaria in colonial Assam within the broader context and offer useful knowledge on the complicated dynamics of medicine, public health, politics, and society.

Within Assam, the history of disease in general is little touched upon. Some of the existing work mentions malaria within ecological histories. For example, historian Arupjyoti Saikia places the Brahmaputra River at the centre of the history of Assam in his biography of the Brahmaputra, *Unquiet River*. Saikia argues that the river was the source of political, economic,

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[33] See: (M. Worboys, 'The Emergence and Early Development of Parasitology', in K. S. Warren and J. Z. Bowers (eds.), *Parasitology: A Global Perspective* (New York, 1983), pp. 1-18.), and (M. Worboys, 'Manson, Ross and Colonial Medical Policy: Tropical Medicine in London and Liverpool, 1899-1914', in M. Lewis and R. Macleod (eds.), *Disease, Medicine and Empire* (London, 1988), pp. 21-37)

[34] Their works are referred to in greater detail later in this project, but in general see: D. Arnold, *Colonizing the Body: State Medicine and Epidemic Disease in Nineteenth century India* (Berkeley, 1993) and M. Harrison, *Public Health in British India Anglo-Indian Preventive Medicine 1859-1914* (Cambridge, 1994)).

and military strength for centuries and unifies the Assam Valley in its history.[35] In a small section of his work, he also notes that the river's alluvial soils contributed to malaria within the province.[36] Saikia's exploration of malaria, however, is of almost trivial significance to the work as a whole and stands as only a minor note. Additionally, though the Brahmaputra River was one of the most significant ecological fixtures of Assam, it was not the only feature that contributed to the malariousness of the province. While Saikia's work does acknowledge the tremendous influence that colonial rule had on the river, it does not go so far as to break down the relationship between the ecological transformation of the river and the river's relationship to malaria. Therefore, it is difficult to determine the river's relationship with malaria during the colonial period and difficult to draw conclusions about malaria in places far from the banks of the Brahmaputra. Nevertheless, Saikia's cursory level of inquiry is enough to suggest that malaria was indeed an important dynamic in the history of the Brahmaputra River and the contributions of this dissertation contribute to this scholarship.

Historian Arnab Dey explores the ecology of tea plantations in Assam in his article 'Bugs in the Garden: Tea Plantations and Environmental Constraints in Eastern India (Assam), 1840-1910'. Dey only focuses minimally on malaria but emphasises the role rice paddies on tea plantations had in fostering malaria, and that malaria had a particularly deleterious effect on labourers working on tea plantations.[37] In his work, Dey highlights the agency of both human and non-human factors and explores the 'development' of plantations with Assam. He focuses especially on the desire of planters and the colonial administration to understand and control the natural environment to generate 'development'. This is undoubtedly an essential theme within the

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[35] A. Saikia, *The Unquiet River, A Biography of the Brahmaputra* (New Delhi, 2019), p. xxiii.
[36] Saikia, *Unquiet River*, p. 316.
[37] A. Dey, 'Bugs in the Garden: Tea Plantations and Environmental Constraints in Eastern India (Assam), 1840-1910', *Environmental History*, 21 (2015), p. 563.

narrative of ecological transformation in Assam, but Dey's analysis does not adequately explore the specific mechanisms by which planters attempted to understand and control the local ecology. Notably, Dey argues that the concept of climate, diseases, and pests were specific ecological factors that planters worked to understand and control. Planters did struggle to understand these concepts, but the concepts themselves changed significantly over the 120 years of colonial rule in Assam. Malaria itself highlights the complexity of this change. Malaria was originally believed to be a disease associated with climate- not the infectious disease spread via anopheline mosquitoes as it is understood today. Over the course of the nineteenth and early twentieth centuries, the arc of this dissertation, anti-malarial methods themselves changed and experts began to embrace medical entomology as the disease was disconnected from previous notions of climate. Though it is true that planters worked to understand and control the local ecology of Assam, the mechanisms they employed to achieve these goals as well as their knowledge of local ecology itself changed radically. The actual development of this is explored throughout this dissertation, but here it highlights the importance of exploring disease, ecology, and power by understanding the specific mechanisms those in the past utilised in their attempts to categorise, classify, and control the natural environment- an important contribution to the ecological history of colonial Assam.

Much the historiography on Assam focuses on labourers and tea plantations.[38] Disease was an important aspect of life on plantations: residents who both laboured-in and managed plantations often suffered from disease. It is also important to note that that the presence of the tea plantations and the massive influence of industries affected the implementation of public

[38] See: N. Varma, *Coolies of Capitalism* (Boston, 2016), and R. P. Behal, 'Coolie Drivers or Benevolent Paternalists? British Tea Planters in Assam and the Indenture Labour System', *Modern Asian Studies*, 44/1 (2010), pp. 29-51.

health policies. In 'Diseased Plantations: Law and Political Economy of Health in Assam, 1860-1920', Arnab Dey offers an interpretation of disease control in Assam that contextualises the dynamic between the medical, public, and private sectors. Dey comments on Assam's status in the British Empire's periphery and argues that commercial industries in Assam influenced the transition of medical knowledge from theory to praxis.[39] According to Dey, the aetiology of disease in Assam was affected, in large part, by the running of tea plantations.[40] Dey's insights are a valuable addition to the field, but his focus on a variety of diseases as well as placing a strong emphasis on labour leaves room for further exploration. Focusing on malaria in particular opens up new avenues for analysis and connects the medical history of the province to its ecological state.

Malaria in Assam has only lightly been touched upon by historians but focusing on the disease adds to current discussions on the history of the province. The effects of malaria were devastating, but the number of people who suffered from malaria is only one indication of the role of the disease. The development of colonial enterprises in Assam shaped the ecology of the province and influenced the prevalence of malaria; for example, immunity was one of the categories used to select labourers on tea plantations. Overall, anti-malarial measures and conceptions of disease within the province were shaped by the presence of colonial industries. The desire to maintain a healthy workforce, separate from the desire to boost the health of every resident of Assam, was the primary motivation behind most anti-malarial measures in colonial Assam, and this phenomenon can be explored by examining data on mortality and morbidity, government sources, and contemporary medical research.

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[39] A. Dey, 'Diseased Plantations: Law and the Political Economy of Health in Assam, 1860–1920', *Modern Asia Studies*, 52/2 (Mar. 2018), p. 647.
[40] Dey, 'Diseased Plantations', p. 650.

Histories of disease, particularly malaria, contribute significantly to conversations on the history of colonial Assam. While undertaking historical research, one of the primary questions historians must grapple with is how to characterise Assam itself. Both Assam and malaria have a long history that predates colonisation, but many of the contemporary sources available present viewpoints from outside of (or from outsiders within) Assam and cast the province as a separate 'frontier' or 'border state'. Therefore, some narratives can marginalise Assam by presenting an image of the landscape through the lens of empire. Historian Sanghamitra Misra argues that one of the ways to explore the history of Assam and avoid this pitfall is to focus on local histories and the many dynamics present within the geographic space.[41] This project does just that; it explores the dynamic relationships between malaria and other institutions/phenomena within colonial Assam. On the one hand, colonial Assam's status as it was viewed by contemporaries in power- a border state- is reaffirmed because of the responses of colonial administrators to malaria. These responses were often different from the actions taken in other provinces within the Raj. On the other hand, research on the history of malaria simultaneously challenges narratives that side-line colonial Assam's relevance in histories of India and the British Empire.

Sanghamitra Misra's work *Becoming a Borderland* is an influential example of the historical analysis of Assam. Regarding the colonial period, Misra argues that 'through its institutions of economic, administrative, and judicial control that included cartography, classification through the census, surveys and measurements, the colonial state realised its idea of a unified economic space.'[42] Misra makes it clear that colonialism influenced a multitude of dynamics within Assam, but Misra's work falls short of exploring the dynamics of health and

[41] S. Mishra, *Becoming a Borderland: The Politics of Space and Identity in Colonial Northeastern India* (New Delhi, 2011), p. 19.
[42] Ibid., p. 24.

disease within the province. This dissertation contributes to Misra's conclusions and the work of other historians by arguing that disease, another method of categorisation and classification within colonial Assam, was a fundamental component of many aspects of life and a powerful dynamic in the province. As is explored in further detail in the following chapters, disease was a factor in structuring and administrating local, social institutions and practices such as borders, trade, and immigration that went far beyond traditional notions of medicine and health. This dissertation highlights the importance of disease categorisation and public health within the 'organization of space' in colonial Assam.

Statement of Methodology

This project is partly a work of historical epidemiology. The content differs from other works on the history of disease in Assam by focusing primarily on malaria and the efforts of medical officers and government officials made to shape responses to the disease. Though this approach has never before been applied exclusively to Assam, this method is present within the history of medicine and malaria. The evidence utilised in this dissertation includes government reports (such as Provincial Proceedings, Sanitary/Public Health Reports, and Dispensary Reports), numerous medical publications, and other sources from a mostly British perspective.[43] The reports provide necessary mortality and morbidity data, the medical publications offer a sense of medical knowledge at any given time, and social commentary provides necessary context that frames the information from the sources.

[43] Much of the in-person research was conducted at the Bodleian Libraries, British Library, Wellcome Library, and Assam State Archives. The use of online archival depositories became necessary when travel was restricted and in-person access was limited, but the sources utilised in this project represent a substantial portion of available material and rely more so on material accessed in-person to adequately support the claims made.

A wide body of historiography explores the relationship between malaria and the political, economic, and environmental factors that influenced its spread and impact. Malaria mortality and morbidity can be connected to numerous social, medical, and ecological factors because of the nature of the Plasmodium parasite. Malaria mortality and morbidity is determined by several factors including, but not limited to, the lifecycle of mosquito hosts, levels of immunity within a population, and access to healthcare. Social, medical, and ecological factors such as these help one present a history of malaria that extends far beyond the disease itself. This section explores methodologies of historical epidemiology and the fundamental questions that must be considered when interpreting epidemiological data. To illustrate this connection, this section outlines the methods used for analysis and the connections to broader historiography where appropriate. Each historical case-study is unique and must be considered on its own terms but using epidemiological data to provide an indication of trends in malaria is consistent with approaches across a wide body of historical research. Historical epidemiology can produce a depiction of history that is far more comprehensive than a simple table of statistics.

Epidemiology attempts to understand the presence of a disease, but it must be viewed in the context of a variety of factors including political, economic, and ecological forces. In his work analysing the nature of malaria epidemics, historian Randall M. Packard offers three key factors influencing malaria. For malaria morbidity to increase an environmental change that fosters anopheline mosquitoes must occur, vulnerable human-beings must be present, and the Plasmodium parasite itself must also be present.[44] Packard's fundamental claim, that social forces drive epidemics, underscores the fact many factors must be taken into consideration to illuminate

[44] R. M. Packard, *The Making of a Tropical Disease* (Baltimore, 2007), pp. 7-9.

epidemiological data.[45] Jim Webb echoes Packard's perspective on malaria, emphasizing the need for historians to connect 'the natural sciences and the social sciences', when studying epidemiological data.[46] In *Humanity's Burden*, Webb provides three specific meta-conditions (population density, vulnerability, and the endemic status of the area in question) that build a framework to help interpret malaria epidemiology. These three meta-conditions, though differing slightly in detail, rely on the same focal points as Packard's list, humans, mosquitos, and parasites.[47] Webb argues that because the behaviour of humans, mosquitoes, and the Plasmodium parasites can vary greatly, one must explore these focal points to understand epidemiological trends.[48] Establishing how epidemiological data connects to social and ecological trends is fundamental for any historical epidemiology.

As Webb claims in an article published in The Lancet, historical epidemiology can provide and understanding of how those in the past gained epidemiological knowledge and how this knowledge affected decision making.[49] The methodology utilised in this dissertation unpacks how those in the past created epidemiological knowledge, particularly during periods of great debate and uncertainty. When combined with aspects of the social history of colonial Assam, this dissertation explores the dynamics of malaria and public health alongside the colonial transformation of the province as a whole. Overall, public health, research into malaria, and epidemiology in Assam maintained a significant relationship with colonialism.

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[45] Packard, *The Making of*, p. 10.
[46] J. L. A. Webb, Jr. *The Long Struggle Against Malaria in Tropical Africa* (Cambridge, 2014), p. 13.
[47] J. L. A. Webb Jr., *Humanity's Burden A Global History of Malaria* (Cambridge, 2009), p. 12.
[48] Webb Jr., *Humanity's Burden*, p. 7.
[49] J. L. A. Webb Jr., 'The Historical Epidemiology of Global Disease Challenges', *The Lancet*, 385/9965 (2015), p. 322.

Using the lens of insect, human, and parasite behaviour to explore the interplay of political, economic, and environmental factors is useful when considering malaria in Assam. The factors that influence malaria mortality and morbidity are numerous; a far from exhaustive list includes using quinine as a malaria prophylactic, clearing forests to expand the tea industry and combat mosquito reproduction, and importing labourers with presumed malaria immunity to work in particularly malarious areas. Interpreting the effects of every factor through its impact on the lifecycle of the anopheline mosquito, the vulnerability/presence of human populations, or the presence of the plasmodium parasite helps to illuminate the relationship between political, economic, and environmental forces and malaria.

While it may not be possible to determine the exact number of malaria deaths and illnesses, analysing the data available and the relationship between mortality and morbidity still highlights broader trends in the epidemiological history of Assam and allows for in-depth analysis over long periods of time, even during periods when no epidemiological data was recorded. Beginning in 1874, public health reports containing data on malaria mortality in colonial Assam were produced and are openly accessible. However, between the annexation of Assam to Bengal in 1826 and Assam becoming an independent territory in 1874, no official records exist. Sources including newspapers, industry reports, and other documents indicate a presence of malaria in Assam prior to the first epidemiological records, but the true epidemiological spread of the disease is difficult to determine with numerical data.[50] Disentangling the factors influencing malaria in Assam is necessary when interpreting epidemiological records that are inaccurate or incomplete. Many of these inaccuracies are evident during years in which mortality and morbidity data was recorded but scientific research had not

[50] 'Tea Cultivation in India', *The Bombay Times and Journal of Commerce* (20 August 1859), p. 535.

yet accurately pinpointed the mechanisms for the spread of malaria. Historical insights are still possible during periods of inaccurate or incomplete data when one notes trends in epidemiology during periods of time when malaria research had progressed enough to connect humans to mosquitoes and the plasmodium parasite, and then applies the connections made to previous years and placing the information within broader political, economic, and environmental contexts. Not only does this method fill in gaps during periods when epidemiological data cannot accurately be linked to social or environmental phenomenon, it also illuminates the interplay between malaria and the political, economic, and environmental factors to be explored over the whole course of Assam's colonial history.

By its very nature, malaria is linked to aspects of society far beyond hospitals. Any factor that affects the susceptibility of humans, the lifecycle of mosquitoes, or the plasmodium parasite affects the spread and impact of malaria. To complete such a study, one must, in Lenore Manderson's words, connect 'global forces to local circumstances.'[51] The actions of powerful institutions (such as the government, tea plantations, and public health groups) drove the transformation of Assam into a functioning colony in the imperial system. In her exploration of health policies in Ceylon, Margaret Jones also raises essential questions that can appropriately be applied to Assam, connecting the interplay of political factors to malaria. Following Jones' example, I ask whether the public health policies brought from the West to Assam were inherently colonial, how changing politics affected public health, and how policy changes

[51] L. Manderson, *Sickness and the State Health and Illness in Colonial Malaya, 1870-1940* (Cambridge, 1996), p. 12.

affected the health of the colony in practice.[52] The political transformation of Assam provides valuable context for assessment of its epidemiological changes.

Economics provides a bridge between the actions of the state, the lives of the people, and malaria. In an analysis of malaria in Italy, F. M. Snowden observed that 'malaria lies at the root of the most important demographic and economic facts.'[53] Fundamental economic factors such as international trade affecting tea plantations and the funding available for public health campaigns against malaria connect global trends to local circumstances. The availability of nutritious foods and medicine, and even the organization of populations were dependent on economic circumstances. Sources such as population statistics, newspaper reports, and the journals of individuals provide insight into these lived experiences and relationships with malaria.

This dissertation focuses largely on government sources and those from medical publications, and mostly from a British perspective which reflects the fact that the trajectory of malaria in Assam was distinctly colonial. But there are limitations to using this source material that should be addressed. This project does not pretend to provide a narrative of malaria that encompasses the perspective of all residents of colonial Assam, but it does attempt to offer some picture of malaria outside of how it was presented in official spaces.

The sources used do not present an Indian perspective on malaria, but 'subaltern' opinions on fever and malaria are present. This dissertation draws inspiration from historians such as Ranajit Guha and his work on subaltern studies. Of particular importance is Guha's emphasis on 'reading against the grain' in official and colonial archives.[54] Interpreting subaltern perspectives in colonial Assam is difficult, however. There is little information on health in the proceedings

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[52] M. Jones *Health Policy in Britain's Model Colony Ceylon (1900-1948)* (New Delhi, 2004), p. 19.
[53] F. M. Snowden, *The Conquest of Malaria Italy, 1900-1962* (New Haven, 2006), p. 3.
[54] R. Guha, *Selected Subaltern Studies* (New York, 1988), p. 59.

compared to other provinces. Additionally, there is almost no information on malaria in reports on the native press, where many historians are able to access subaltern views. As a result, Indian opinions on fever and malaria within this project are gathered from official and scientific sources interpreting 'subaltern' perspectives on fevers. These opinions contributed significantly to understandings of 'fevers', particularly malaria, in colonial Assam, and though most of the source material used in this project does not explicitly focus on these perspectives, the impact was nevertheless significant.[55]

Globally organised approaches to public health and state actions played a part, but the presence of malaria influenced the lives of everyone. Individual human beings lived on tea plantations, worked in government offices, and for every case of malaria, a single mosquito bit a specific individual. The thoughts, actions, and beliefs of these individuals are fundamental to the narrative of malaria in Assam. Connecting epidemiology to the political, economic, and environmental factors in Assam must hinge on the lived experiences of those in the province, and the methodology explored in this paper attempts to accomplish this task by providing a narrative of malaria that can be connected to existing and future research.

This analysis of malaria relies heavily upon data from the category of 'Fevers'. Mortality and morbidity in the vital statistics of Assam were organised into categories, and deaths due to several diseases, not just malaria, were placed in that category. Though it is impossible to gain a completely accurate quantitative breakdown of how many of these deaths were due to malaria specifically, it is possible to gain an understanding of roughly how prevalent malaria was by utilising mortality and morbidity on 'Fevers'. This method has been used by historians before.

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[55] The impact of 'subaltern' opinions on fevers shaping perspectives on malaria in especially evident in the discussion of the relationship between malaria and kala-azar in Chapter 2 of this project.

Sheila Zurbrigg has issues with the category of 'Fevers' and its lack of accuracy, but she writes, the 'limitations can be "overcome and their enormous potential value realized."'[56] Zurbrigg also says,

> Indeed, it is the uniquely identifiable nature of malaria mortality in Punjab which makes a quantitative, and thus epidemiological, analysis of malaria in this region possible. And it is because malaria was considered a leading cause of death in British India that it is an important starting point for analysis of the factors underling more general decline in death rates in India since the early 20th century.[57]

This project argues that a similar analysis is possible in Assam.

Malaria was a well-known issue in Assam and commonly mentioned in discussions on colonising the territory, but perceptions of malaria in the past differed how the disease is now understood. Historian Rohan Deb Roy argues in his work *Malarial Subjects: Empire, Medicine, and Nonhumans in British India 1820-1909,* that during the early 19th century, malaria remained an elusive disease; it was widely acknowledged as a medical category, a cause and eventually subset of fevers ('malarial fever') even by colonial administrators in British India, but the specific details of the disease were 'fluid and contentious'. This was a major reason why malaria was placed under the heading of 'Fevers', but this category remained contentious and was often regarded critically by medical officers.[58]

Malaria was an elusive category, but medical officers were fully aware that trends such as seasonal mortality did reveal some indications of a cohesive disease, i.e., malarial fever, based on seasonal patterns and certain symptoms. The 1876 Sanitary Report of the Province of Assam stated that 'malarial fevers are pre-eminent in number' and claimed, 'its subsidence was

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[56] Zurbrigg, 'Hunger and Epidemic', p. PE-2.
[57] Ibid., p. PE-2.
[58] R. Deb Roy, *Malarial Subjects: Empire, Medicine and Nonhumans in British India 1920-1909* (Cambridge, 2017), p. 4.

synchronous with the advent of heavy rainfall, the relation of the two being sufficiently marked as to offer a suggestion of cause and effect.'[59] Nevertheless, 'Fevers' in Assam were treated as a catchall for any disease where the dominant symptom was fever. In the 1877 Sanitary Report of the Province of Assam, Deputy Surgeon-General and Sanitary Commissioner A. C. C. DeRenzy stated,

> I have long thought that this heading [malarial fevers] in the returns answers no useful purpose. In fact, it only serves to perpetuate erroneous notions regarding the causation of sickness and mortality in India. The entries under this head serve, no doubt, as a rough gauge of the healthiness of a place, but this is a function equally well, if not better, served, by the entries under the head of "Total deaths from all causes;" they do not warrant any conclusion as to the nature of the diseases classed by rude village watchmen as fevers.[60]

Despite the ambiguity of the category of 'Fevers', it is still possible for historians to confirm that malaria was present and to mark its trends over time. One method of accomplishing this to a reasonable degree of certainty utilises knowledge of peak transmission and high mortality for certain months of the year. Due to seasonal rain patterns, mortality was often highest from June to November, with the lowest incidences of malarial deaths recorded in March. In 1933, when medical knowledge reached the point at which malaria trends were appropriately understood, for example, the death toll in June (10,879) was almost double the total for the month of March (6,301)- malaria was often highest in the summer months.[61] In 1880, the Sanitary Report for the Province of Assam indicates that March and April were indeed the months with the lowest incidences of death from malarial fever. [62] Reports between 1874 and 1939 do not vary from this trend.

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[59] W. H. Adley, *Sanitary Report of the Province of Assam for the year 1876* (Simla, 1878), p. 17.
[60] A. C. C. DeRenzy, *Annual Sanitary Report of the Province of Assam for the Year 1877* (Shillong, 1878), pp. 12-3.
[61] T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year* 1933 (Shillong, 1934), p. 17.
[62] J. J. Clarke, *Annual Sanitary Report of the Province of Assam for the Year 1880* (Shillong, 1881), p. 13.

Without completely accurate metrics to identify malaria mortality and morbidity in the 19th century, historian Deb Roy contends an effective method of understanding malaria as a concept in the minds of contemporary inhabitants during this time is by focusing on the drug that was widely used as a prophylactic and treatment, quinine. Malaria was often identified by its ability to be treated by quinine. To an extent, this perspective can be applied to Assam. Exploring the history of malaria in Assam based on attempts to control the disease reveals both medical and social aspects of society, but this can only be applied as an additional and often inaccurate method of understanding the presence of malaria. An analysis of quinine sales is better used as a way to measure some attempts to prevent and treat malaria, not the prevalence of the disease itself. The seasonality of fevers and description of symptoms were used far more than responsiveness to quinine to determine the 'malarial' nature of fevers.

The category of 'Fevers' persisted throughout the colonial period. Each chapter of this dissertation focuses on a different period in the history of colonial Assam, structured around major events in the history of both the province and malaria. Each chapter provides evidence that contributes to the ability of modern historians to gain an understanding of trends in malaria in Assam, particularly in light of data on mortality and morbidity. Altogether, the information supports the argument that malaria maintained a significant presence within Assam with a trend different from some other provinces like Bengal, and though not perfect, when viewed within the right context data on 'Fevers' can be used as a method of assessing the prevalence of malaria.

Chapter Breakdown

Chapter 1 of this project is titled A New British Colony, A New Disease Landscape - Malaria in Assam 1826 -1874. It focuses primarily on colonial Assam during the early colonial period. Information on malaria is obscure during this time and there is no data available on

malaria mortality and morbidity, but there are several indications that malaria was present in the province. Nevertheless, the future of Assam, and its future relationship with malaria, was forged between 1826 and 1874 when the disease was framed as a problem for colonial development. The effects were bidirectional: just as the new colonial landscape created a new landscape for disease, the presence of malaria played a role in shaping the future of Assam.

Chapter 2 of this project is titled Two Fevers, One Name – Malaria in Assam 1874 – 1897. It pays very close attention to the emergence of kala-azar in Assam and explores both contemporary perceptions of malaria and the biological realities of the disease shaped sanitary measures. It argues that it is possible to gain a sense of the presence and effects of malaria in colonial Assam and that the relationship between both the social and biological history of disease provides an informative historical narrative. In a departure from current historiography on disease in colonial Assam, this chapter claims that malaria had a larger presence within the province than kala-azar, and that much of the desire to understand and reduce kala-azar was, at least in part, motivated by malaria that those in the past confused as kala-azar.

Chapter 3 is titled The Turn of the Twentieth Century - Malaria in Assam Between 1897 – 1919. It explores anti-malarial measures in the wake of Sir Ronald Ross's discovery of mosquitoes as the vector of malaria. Malaria received far more attention from medical officers in Assam than ever before. Despite Ross's work, quinine remained the dominant anti-malarial method (both as a prophylactic and treatment) as the province failed to adopt calls to control mosquitoes. By the 1910s, however, some malaria surveys were done in India to inform species sanitation (environmental management) schemes. These surveys were not completed in Assam until after the First World War.

Chapter 4 is titled The Interwar Years - Malaria in Assam 1919 – 1939. The interwar years saw a massive transition in anti-malarial methods in the province. During this time, kala-

azar mortality was reduced and public health funds, though still limited, were reallocated to malaria schemes. Additionally, the growing field of medical entomology enabled species-specific mosquito control measures to be designed after malaria surveys were conducted in the province. Though many of these schemes were successful on a small scale and gained international recognition, they were not sufficient to reduce malaria across the entirety of the province. Malaria mortality did not decrease in colonial Assam as it did in most other provinces in India during the interwar period.

Conclusion

In summary, this dissertation argues that the prevalence of malaria remained high for the duration of colonial rule, and there is evidence to suggest that the colonisation of Assam shaped the presence of the disease just as malaria affected the lives of millions. 'Development' altered the ecological conditions of the province and attempts to prevent malaria or 'Fevers' often missed the mark. Public health measures were heavily influenced by colonial priorities- maintaining the province's industries, predominantly tea. Even by the time public health measures were able to reduce malaria, they were structured in a way that only benefitted those working in select industrial enclaves and were never applied to the province as a whole for the duration of the period explored in this project. Malaria was an important aspect of several complex dynamics within colonial Assam, and the exploration of the disease as it is presented in this dissertation reflect significant transitions within the province itself. This dissertation argues that malaria played a pivotal role in the history of colonial Assam, that historians are able to gain some understanding of the presence and effects of the disease even when knowledge in the past was limited, and that perceptions of the disease, attempts to control it, and that both human and non-human factors contributing to malaria were heavily influenced by colonial forces.

Chapter 1: A New British Colony, A New Disease Landscape - Malaria in Assam 1826 -1874

> The climate is admirably adapted to the European constitution, the people are docile and easily guided, provided that they are properly treated and their prejudices respected. In some districts the population is wretchedly poor and scanty, caused by the malarious jungles and the ravages of wild animals. But in the hands of Europeans, backed by capital, these districts in a few years would be reclaimed, the jungles would disappear, and with them malaria and wild animals.[63]

Introduction

This chapter examines a transformative period in the history of Assam. Beginning in 1826, Assam slowly transitioned into a British colony and in the process developed a new relationship with malaria. Colonisation restructured Assam's society, ecology, and economy in accordance with the needs of the British Empire. From its earliest stages in Assam, colonial language was characterised by a desire to cultivate the landscape. The process meant colonial development: modernising the economy, creating a new system of governance, and repurposing land to suit mass cultivation and resource extraction. The early colonial period in Assam set the

[63] This is an excerpt from an article discussing the future of tea cultivation in Assam. ('Tea Cultivation in India', *The Bombay Times and Journal of Commerce* (20 August 1859), p. 535.)

people and landscape on a particular trajectory, one that situated the province on the periphery of empire. This transition, however, was not inevitable. At its core, colonising, developing, or modernising Assam was complicated and never straight-forward. When Assam was annexed to British-controlled Bengal, the future of the new 'frontier' was uncertain. This presents a unique challenge for historians exploring Assam during the early colonial period. Unlike in future decades when the status of Assam in the British Empire is well established, the identity of Assam and its relationship to the empire changed continually between 1826 and 1874. This transition also applies to Assam's relationship with malaria during these early-colonial years; though its prevalence is impossible to quantify, the role of malaria in the province changes. Nevertheless, the future of Assam, including its future relationship with malaria, was forged between 1826 and 1874 when the disease was framed as a problem for colonial development. The effects were bidirectional: just as the new colonial landscape created a new landscape for disease, the presence of malaria played a role in shaping the future of Assam.

There are very few epidemiological records between 1826 and 1874 which makes quantifying the presence and effects of malaria difficult. Therefore, the sources for this chapter rely largely on reports from a mostly European perspective that comment on the prevalence and effects of 'Fevers' or malaria on both locals and newcomers to Assam. In addition, vague yet revealing comments on the effects of 'climate', 'healthiness', and 'pestilence' provide a general sense of how disease, in most cases probably malaria, defined life in Assam. Malaria has a long history in Assam that predates the British, and by 1826 the locals had been living with the disease for generations. Colonial Assam was subject to alterations of its ecology and society, which changed its relationship to malaria. Exploring this topic provides a foundation that helps one both measure and understand 'Fevers', primarily malaria, in later decades when epidemiological data was recorded.

This chapter briefly touches on the pre-colonial period but focuses primarily on Assam between 1826 and 1874. The justification for this timeline is straightforward. Assam was annexed to British controlled Bengal at the end of the first Anglo-Burmese War when The Treaty of Yandaboo was signed in 1826. During the war, Burma took control of Assam and relegated the Ahom rulers in the process. Assam had been politically devastated by the war, but British leaders who stepped in after the conflict retained the land as a strategic buffer between Bengal and Burma. Very little was known about Assam to outsiders at the time, and British involvement with Assam prior to the war was minimal. A more detailed breakdown of events is provided in this chapter, but 1826 marks the formal establishment of British rule in Assam and, therefore, the beginning of colonial Assam. At the other end of the timeline, 1874 marks the year colonial Assam was officially made a province in its own right; it was independent from Bengal, but still a part of the Raj. This independence marked the creation of Assam's own provincial government and records from government departments such as the Sanitary Department provide the basis for analysis in future chapters. These reports did not begin until 1874 and much of the sanitation in Assam was handled by private industries prompting a slower adoption of government sanitation that often prioritised industry.

There are few epidemiological sources that focus on malaria and 'Fevers' in Assam before 1874 and there are several reasons for this. Incomplete medical knowledge limited the approaches of both the government and individuals concerned with 'Fevers' and malaria. Additionally, the British control of Assam was not absolute. The middle of the nineteenth century was a period when British power was consolidated, often by force, among many different groups and communities. Regarding disease, locals had their own approaches to the treatment of fevers that remained even as Western approaches to medicine spread. It would be inappropriate to overstate the direct influence of the British on the day-to-day lives of the locals during this time

period regarding disease and medicine, and without epidemiological data it is difficult to gauge mortality and morbidity rates. Historical sources, however, did mention malaria and 'Fever' and acknowledged the influences of these diseases. Malaria was an influential non-human actor in the history of Assam and a factor in the development of the province, but the full extent and effects of malaria are difficult to know with certainty. Additionally, shifts that began with British rule influenced the development of malaria. The establishment of a new economy in Assam and consequent environmental changes, new political institutions, and changing social structures forged a new relationship with malaria during this period.

Historiography

Exploring the history of malaria in colonial Assam requires an engagement with several forms of historical inquiry. During the majority of the nineteenth century, Western medical discussions of malaria were closely related to discussions of climate. The presence of malaria is now understood to be closely related to local ecologies, but during the nineteenth century the proposed links between climate and malaria/health involved discussions of heat, elevation, wind, soil composition, and some other environmental factors that have since been dismissed as unrelated to malaria. The relationship between climates and health, particularly within the context of colonial India, is explored in Mark Harrison's work *Climates and Constitutions: Health, Race, Environment and British Imperialism in India 1600 – 1850,* and a particular theme is that of medical topography which developed after the First Burma War.[64] The theme is also explored in David Arnold's 'Warm Climates and Western Medicine: The Emergence of Tropical Medicine,

[64] M. Harrison, *Climates and Constitutions: Health, Race, Environment and British Imperialism in India 1600 - 1850* (New Delhi, 1999).

1500–1900'.[65] The historical analysis of the past within this chapter focuses on discussions that involved climate because of the perceived association between climate and malaria. The reports of British officers provide some insight into how the British understood the relationship between fevers and environmental conditions may be used to estimate the prevalence and effects of malaria.

The narrative of malaria in colonial Assam is also closely related to the transformation of the landscape, particularly during the early stages between 1826 and 1874. Several historians have examined the history of colonial Assam during this early colonial period, but few have focused on disease. Many focused, rather, on the development of colonial enterprises within Assam, and the largest and most important of these was the tea industry. The development of industry in colonial Assam prompted a reorganisation of labour and the local ecology. Restructuring work created a new notion of productivity in Assam, and this process prompted discussions and, ultimately, regulations concerning labour and labourers. As a result of these new approaches to labour, the population of colonial Assam underwent a radical shift during the middle of the nineteenth century. Alongside the new desire for a productive labour force in colonial Assam was a desire for a productive landscape. Several historians have written environmental histories of Assam, and these works are closely linked to the province's colonial development. Historical works that assess labour and the natural environment in Assam contribute to a narrative of colonial transformation as residents formed a new relationship with labour and the natural environment.

Historical scholarship on Assam began in the early 1900s but expanded significantly during the second half of the twentieth century. Edward A. Gait, an administrator in Assam who

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[65] D. Arnold (ed.), *Warm Climates and Western Medicine: The Emergence of Tropical Medicine, 1500–1900* (Amsterdam/Atlanta: Rodopi, 1996), p. 8.

also held various positions in other provinces within the Raj, published his work *A History of Assam* in 1906 and issued a revised version in 1926. In his work, Gait positions Assam as a borderland during the early stages of its colonial history and then champions the development of the tea industry.[66] Gait's work was not the first to explore the history of Assam, and some modern scholars such as Manjeet Baruah have attempted to re-position *A History of Assam* within the discipline as a product of the contemporary period rather than a true work of historical scholarship, but *A History of Assam* is often considered the earliest contribution to modern historiography.[67]

Many of the works published during the second half of the twentieth century focus on aspects of British administration and are largely political in scope. *Anglo-Assamese Relations (1771-1826)* by S. K. Bhuyan provides an analysis of Assam before the colonial period and a brief look at British occupation and the transition to British administration.[68] *Assam in the Days of the Company (1826-1858)* by H. K. Barpujari[69], *British Administration in North-East India 1826-1874* by M. S. Barkataki[70], and *A Brief History of Assam* by N. N. Acharyya[71] are examples of scholarship during the second half of the twentieth century that engages with colonial Assam during its early colonial period but their scope is largely political and economic.

In the wake of several works on the administrative and political histories of Assam in the early colonial period came works that focused on the development and influence of industries in Assam, particularly tea. The research in this area concentrated largely on labour and labour

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[66] E. Gait, *A History of Assam,* (Calcutta, 1906).
[67] M. Baruah, 'At the Frontier of Imperial History: Revisiting Edward Gait's *A History of Assam*', *Asian Ethnicity*, 18/4 (2017), pp. 452-69.
[68] Bhuyan, *Anglo-Assamese Relations*, p. 581.
[69] H. K. Barpujari, *Assam in the Days of the Company (1826-1858)* (Gauhati, 1963).
[70] M. S. Barkataki, *British Administration in North-East India 1826-1874* (Guwahati, 1985).
[71] N. N. Acharyya, *A Brief History of Assam* (Guwahati, 1987).

practices that were established between 1826 and 1874. In the early colonial period, this is often highlighted through the relationship between the government, labourers, and opium, and has been explored by historians such as Amalendu Guha, Jayeeta Sharma, and Stan Neal.[72] The themes closely revolve around the notion of the colonial modernisation of the people of Assam.

In her work *Empire's Garden*, historian Jayeeta Sharma describes the changes in Assam as characterized by a language of 'improvement' and 'progress'.[73] According to Sharma, these concepts were echoed by contemporary scientists, capitalists, local intellectuals, and many other high-ranking members of British and local society. Sharma is careful to note that although the local elite in Assam did often ally themselves with the British in the effort to "improve" Assam, the carefully managed relationship between Assam and the colonial metropoles of Calcutta and London meant that benefits of the 'progress' were often reserved for Europeans.[74]

Sharma's work situates colonial Assam firmly in the imperial network, though on the periphery and far away from the centres of influence. The relationship between Assam and the colonial metropoles reinforced Assam's designation as a place meant to be maintained for the purposes of empire. The transformation of Assam from the feudal Ahom Kingdom to, as Sharma so aptly named it, the 'Empire's garden' underscores the management of both people and environment for a new purpose.

The environmental history of Assam is closely linked to these discussions on colonial development. Arupjyoti Saikia has made several contributions to this discussion with a new focus

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[72] See: A. Guha, 'Imperialism of Opium: Its Ugly Face in Assam (1773-1921)', *Indian History Congress* 37 (1976), pp. 338-346., J. Sharma, 'Lazy Natives, Coolie Labour, and the Assam Tea Industry', *Modern Asian Studies*, 43/6 (2009), pp. 1287-1324., and S. Neal, 'Opium and Migration: Jardine Matheson's Imperial connections and the Recruitment of Chinese Labour for Assam, 1934-39', *Modern Asian Studies* 51/5 (2017), pp. 1626-1655.
[73] Jayeeta Sharma, *Empire's Garden*, p.5.
[74] Ibid., p. 12.

on Assam during the early colonial period. His works including *Forests and Ecological History of Assam, 1826-2000* and *The Unquiet River, A Biography of the Brahmaputra* provide an insight into the ecological transformation of the landscape.[75] This relationship involved both human and nonhuman actors, and insight into this approach to historical research in Assam is present in Arnab Dey's article 'Bugs in the Garden'. In his article, Dey argues that managing the tea plantations and the development of Assam 'was as much a biological and ecological challenge as an economic one.'[76]

Exploring the role of malaria during the early colonial period is a valuable contribution to this complex narrative, especially considering the desire among historians to promote the contributions of both human and non-human actors in the history of Assam. Malaria was a nonhuman actor that featured prominently in the day-to-day life of residents in the north-east. Colonial forces often addressed a variety of issues in their efforts to reshape Assam, but all these decisions were made within an often-insalubrious environment that presented its own challenges to development. Though impossible to quantify malaria mortality and morbidity during this period, the presence of the disease affected the colonial development of the province just as the transformation influenced the outplay of malaria. Within current historiography, it is important to highlight colonial Assam as both a new colonial frontier and a new disease landscape.

The insights provided from their works provide a useful historical narrative of Assam during this time, but the history of malaria shows that it was an important factor in shaping the events described by other historians. Its presence affected the development of the province just as economic development affected the prevalence of malaria.

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[75] See: A. Saikia, *Forests and Ecological History of Assam, 1826-2000* (Delhi, 2011), and Saikia, *The Unquiet River*.
[76] Dey, 'Bugs in the Garden', p. 537.

The Ahoms and the Pre-Colonial Period

Pre-colonial Assam was made up of several different groups, communities, and peoples. Some of these were united, others autonomous. The largest of these and the direct predecessor to the British was the Ahom kingdom. Previously mentioned terms such as ‘modernisation’ and ‘development’ were often used to characterise the transition of Assam from the independent Ahom kingdom to a colonial province, but these terms were applied by the colonialists to describe a specific form of ‘development’ and do not accurately represent Assam before British rule. Pre-colonial Assam was independent, it had its own political institutions and social traditions and by its own accord remained relatively isolated from its neighbours in Bengal and Burma. This section focuses on Assam briefly before the colonial period in order to gauge the extent to which the state was later changed by British rule. This section also focuses on the ecological landscape and the kingdom’s relationship to malaria. Limited records from the pre-colonial period mean that accounts in this chapter are derived mostly from the few reports of foreigners. While using this method of historical inquiry, it became apparent that for centuries, ‘Fevers’ in Assam have had a particularly harmful effect on outsiders. Descriptions of Assam from foreigners provide an early look at how Assam was characterised by those outsiders, both British and non-British, and how these descriptions are an important component in how malaria shaped the history of Assam.

The word Assam was derived from the word Ahom, and the Ahoms were descendants of a Thai family that entered the Brahmaputra Valley from the east in the thirteenth century. The Ahom kingdom ruled Assam for six hundred years after slowly uniting tribes along the Brahmaputra River. Famously, the Ahom kingdom defended Assam from Mughal invasion in the seventeenth century. Assam remained independent of the Mughal Empire and maintained a fair degree of separation from its neighbours to the west and east, Bengal and Burma respectively. By

the nineteenth century, Ahom rule extended primarily along the length of the Brahmaputra River. To provide a rough sense of the size of the Ahom kingdom, contemporary accounts describe Assam during this time as 'about seven hundred miles in length, and from sixty to eighty in breadth'.[77] Geographically, Ahom rule in Assam was situated 'between the 25th and 28th degrees of north latitude, and 94 and 99 degrees of longitude E. from Greenwich'. Eastern limits of the kingdom were difficult to define as the boundaries disappeared into hills and few Ahoms travelled very far east.[78]

The Ahoms were not the only peoples along the Bahmaputra River, in the Assam Valley, or in the whole of what would become colonial Assam. The Bhutanese, Akas, Duflas and Abors were in the north, the Mishmis and Singphos in the hills in the east, and the Garo, Khasi, Naga and Patkai lived in the southeast. Though the Ahom's ruled over the largest stretch of land, many of these peoples lived around the Brahmaputra River and Assam valley in the lead up to the colonial period completely independent of the Ahoms. The borders eventually changed under British rule, but the languages, cultures, and traditions of many of these peoples survived well into the colonial period.[79]

Prior to the nineteenth century, contact between the Ahoms and the British in Bengal was extremely limited, and trade only began at the end of the eighteenth century. The British East India Company (EIC) was interested in expanding trade with Assam and established formal ties with the Ahoms in 1771.[80] Assam exported 'muga silk, stick lac, munjit or madder, elephants' tusks, cotton, pepper and mustard seed' and imported 'salt, copper, English woollens and

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[77] J. P. Wade, 'A Geographical Sketch of Assam', *The Asiatic Annual Register*, 5 (1805), p, *2.*
[78] Ibid., p. 3.
[79] Bhuyan, *Anglo-Assamese Relations*, p. 1.
[80] Ibid., p. 55.

spices.'[81] Despite the emergence of trade between the British in Bengal and the Ahoms, Assam remained largely disconnected from Bengal. This was consistent with Assam's long-established strict policy of isolation. With some limited commercial ties in place by the end of the eighteenth century, British involvement with Assam grew but only slightly.

The largest shift in Britain's relationship with Assam occurred through military involvement. During the late eighteenth century, British forces from the East India Company entered Assam to help the Ahom Kingdom defend itself from violent thieves and ruffians. Many of these ruffians worked in small groups and were former professional soldiers called Barkandazes; the traditions of these Barkandazes can be traced back to the Mughal Empire. Entering the Ahom kingdom from Bengal, the Barkandazes began pillaging and plundering. Though largely unorganised and labelled little more than thugs, the Barkandazes caused a great deal of fear, damage, and chaos across Assam. The greatest threat to the peace came when the Barkanazes offered their services as hired guns for a relatively low fee; their professional military training made them particularly dangerous and destructive.

Captain Thomas Welsh and his troops were sent to Assam in 1792 by the East India Company to aid the Ahom's in their struggle to re-establish stability and push back against the chaos caused by the Barkandazes.[82] Previously shying away from any political or military involvement in Assam, the EIC justified their involvement on the grounds that they were protecting Assam from East India Company subjects, rather than simply interfering in local politics. Though there was some trade, the East India Company had little contact with Assam and under different circumstances would not have become involved with the local issues within

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[81] Ibid., p. 52.
[82] J. Johnstone*, Captain Welsh's Expedition to Assam in 1792, 1793 Printed at the Foreign Department Press* (Calcutta, 1877), p. 13.

Assam. The Barkandazes in Assam were from Bengal, however, and therefore the responsibility of the East India Company.[83] Despite the direct military involvement and efforts to re-establish political stability, the British policy towards Assam remained somewhat anti-interventionist.

Captain Welsh's objective in Assam was straightforward: remove the Barkandazes from Assam and re-establish Ahom rule in the territory. Remaining anti-interventionist proved to be a challenge for Captain Welsh who, upon seeing the conditions of Assam, noted extreme deprivation and suffering among locals that was in his opinion often inflicted by despotic rulers. In response to a plea to Lord Cornwallis to address more issues in Assam than just the Burkandazes, the Governor-General of India reminded Captain Welsh that though humanitarian efforts might benefit the residents of Assam, the object of Welsh's mission was to remove the Burkandazes from Assam and not to interfere with local politics.[84] Lord Cornwallis' stance made it clear that the East India Company was to remain anti-interventionist and avoid over-extending involvement in Assam.

The anti-interventionist policy makes it difficult understand the East India Company's future intentions with their neighbour to the east, especially considering the desire for a growing commercial relationship between Bengal and Assam. Despite Captain's Welsh's expedition, The East India Company did not further involve itself in the local politics of Assam. It is important to note that very little was known about Assam by anyone outside of Assam during this period. The lack of knowledge would have limited the scope of any plans the East India Company may have had regarding Assam beyond some trade. Without the promise of a return on investment, the East India Company had little to justify potentially costly involvement with Assam.

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[83] R. Verma, 'Barkandazes in Assam', *Indian History Congress*, 66 (2005-2006), p. 717.
[84] Bhuyan, *Anglo-Assamese Relations*, p. 335.

Most of the knowledge both Indians and the British had about Assam came from Mir Jumlah's attempted Mughal conquest of the Ahoms during the middle of the seventeenth century. An original source from the conquest, translated from Persian to English and published in 1799, describes various aspects of Assam but still paints a vague picture from the perspective of the Mughals, who were a hopeful, but ultimately unsuccessful, conqueror. The source describes the agricultural prospects of the land as phenomenal, but under-utilised. 'The strength of vegetation and fertility of the soil are such, that whatever seed is sown, or slips planted, they always thrive.' When it comes down to the production of both crops and goods, Mohammed Cazim, the original author, wrote that 'they manufacture very few more than are required for use'.[85] The first half of the article would have proved very useful for anyone looking to establish trade with residents of Assam, noting a reliance on some imported commodities such as salt, but the majority of the writing showed Assam in a negative and disparaging light.[86] The Asamians [sic] were described as 'enterprising, savage, fond of war, vindictive, treacherous, and deceitful', among a number of other epithets to ultimately argue 'the seeds of tenderness and humanity have not been sown in the field of their frames.'[87] Such a negative attitude toward the residents of Assam was, of course, unfair to the locals and doubtlessly influenced by the Mughal's aspirations as hopeful conquers. Henry Vansittart, the English translator of the original work for publication, noted in the piece that disparaging vocabulary was typical of Mughals during the time period, indicating that the British were aware of the bias in the existing reports on Assam.[88]

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[85] M. Cazim, 'A Description of Asam [sic], Translated from Persian by Henry Vansittart, Esq.', in *Asiatic Researches; or, Transactions of The Society Instituted in Bengal, for Inquiring into the History and Antiquities, the Arts, Sciences, and Literature of Asia Volume the Second* (London, 1799), p. 173.
[86] Ibid., p. 174.
[87] Ibid., p. 176.
[88] Ibid., p. 185.

The Westerners reading about Assam from Mughal sources were aware of their slanted perspective, which underscores the fact that little was actually known about Assam. Mohammed Cazim claimed that 'none of the inhabitants of that country are able to come out of it, which is the reason no accurate information has hitherto been obtained relative to the nation.'[89] Assam was therefore known to outsiders largely from myths. 'The natives of Hindustan consider them [those in Assam] as wizards and magicians, and pronounce the name of that country in all their incantations and counter-charms. They say that every person who sets his foot there, is under the influence of witch-craft, and cannot find the road to return.'[90] Assam was left with a peculiar, unflattering, and inaccurate reputation to outsiders.

Little was mentioned about the presence of disease and the general health of the local inhabitants of Assam, but descriptions from the failed Mughal conquest do provide some context. The information that did reach Bengal characterized Assam as a land of witch-craft and, in some locations, 'bad-air and water, and confined space, [that] is rendered the worst place in the world, or rather it is in one of the pits of hell'.[91] At the time, bad-air was thought to be a potential contributory cause of a number of diseases. It is difficult to know what diseases the 'noxious air' was alluding to and the conclusions that can be drawn from such references are limited, but it is an early indication of the presence of deadly disease in Assam.[92] These descriptions formed the base assumptions of Britain's budding relationship with Assam.

One of the first accounts of Assam drawn from the experiences of a Westerner was published as a result of Captain Welsh's military expedition. Dr. John Peter Wade was a physician in Captain Welsh's company. Compiled in 1800, his *A Geographical Sketch of Assam*

[89] Ibid., p. 181.
[90] Ibid., p. 181.
[91] Ibid., p. 182.
[92] Ibid., p. 183.

was published in 1805. Wade's work was very limited in scope and focused mainly on geographic information such as the size and names of districts. He began with a short introduction and claimed that only two Europeans had ever set foot in the Ahom kingdom prior to the British at the end of the eighteenth century.[93] Whether true or not, *A Geographical Sketch of Assam* is the first published work describing Assam in English for a Western audience. The work contains very little about the people or practices of Assam. Wade detailed the size and location of the districts within Assam but offers very little distinguishing characteristics other than names and the occasional description of the weather.[94] In addition to *A Geographical Sketch of Assam,* Dr. Wade also compiled a history on Assam and the Ahoms.

Dr. John Peter Wade's *An Account of Assam* is a detailed history of Assam and the Ahoms up until 1780. It is a translation based on a history of Assam written in an unspecified local language of the Ahoms and sent to Lt. Col. Kirkpatrick in 1800. According to Wade, there were two recorded histories of Assam at that time. One was written in the language of the Ahoms, the other in a dialect of 'Bengalese' [sic].[95] With the help of locals, Dr. Wade translated the work written in the Ahom language into English, which formed the basis of *An Account of Assam.* The picture painted of Assam is a relatively positive one, describing a forgiving climate naturally suited to growing vegetation; it also provides a modest description of the feudal structures of Assam.

Though *An Account of Assam* is very likely the first history of Assam in English and could have influenced the decision making of those at the time, it is difficult to determine the reach of Wade's work and Assam's place in imperial discourse prior to the first Anglo-Burmese

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[93] Wade, 'A Geographical Sketch', p. 1.
[94] Ibid., p. 3.
[95] J. P. Wade, *An Account of Assam edited by Benudhar Sharma* (North Lakhimpur, 1800), pp. i-ii.

war. Historian Benudhar Sharma edited an edition of Wade's *An Account of Assam* in its formal publication and released it to the general public in 1927, over 120 years after Dr. John Peter Wade compiled his work. Sharma acknowledged the limitations of Wade's *An Account of Assam,* writing that Wade's work was in the India Office Library but was very likely not widely read.[96] In a review of Sharma's work as editor and contemporary "discoverer" of *An Account of Assam,* famed British historian of Assam Sir Edward A. Gait wrote that *An Account of Assam* did present a detailed depiction of pre-colonial life in Assam and further established Dr. John Peter Wade as the first western historian of Assam, but Gait also argued that Wade's work had very little reach and was not of much use to his contemporaries.[97] The first direct reference to Wade's *An Account of Assam* occurred in 1838 when Montgomery Martin acknowledged he had read the report when researching for his work, *The History, Antiquities, Topography and Statistics of Eastern India*. This was 12 years after Assam became a British colony and 38 years after Wade sent his work to Colonel Kirkpatrick.[98]

The fact that the only information on the history and culture of Assam before the colonial period, *An Account of Assam,* was not referenced until 1838 and not readily available until the early twentieth century makes it difficult to determine Britain's attitude towards Assam in the pre-colonial period. In contrast, Dr. Wade's *A Geographical Sketch of Assam* was widely available at the time, but the content was very strictly limited in scope to almost purely

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[96] Ibid., p. x.
[97] E. A. Gait, 'Reviewed Work: An Account of Assam by John Peter Wade, Benudhar Sharma', *The Journal of the Royal Asiatic Society of Great Britain and Ireland,* 1 (Jan., 1933), p. 155.
[98] Martin, M, *The History, Antiquities, Topography and Statistics of Eastern India; Comprising the Districts of Behar, Shahabad, Bhagulpoor, Goruckpoor, Dinajepoor, Puraniya, Ronggopoor, and Assam, in Relation to Their Geology, Mineralogy, Botany Agriculture, Commerce, Manufactures, Fine Arts, Population, Religion, Education, Statistics, Etc. Surveyed Under the Orders of the Supreme Government, and collated from the Original Documents at the E. I. House with the Permission of the Honourable court of Directors Vol. III.* (London, 1838), p. 625

geographic descriptions and the locations of districts within the Ahom kingdom.[99] *An Account of Assam* is still useful to historians as a record of political structures in pre-colonial Assam but provides little basis for determining the East India Company's intentions with the Ahom Kingdom. Despite this, it is likely that the burgeoning relationship between the Ahom kingdom and the East India Company provided a basis for Assam's eventual colonial status within the British Empire. Colonial Assam's relationship with international trade and commerce has roots that extend back into the pre-colonial period and there is thus some continuity with later transformations within the region, most of which were due to Assam's incorporation into a global market for commodities such as tea.

Although it is difficult to understand the relationship between Assam and the British in Bengal, Dr. Wade did make some remarks on fevers that indicate a high prevalence of fevers in Assam, particularly among newcomers. Wade was active in medical discourse exploring the influence of the sun and moon, or sol-lunar influences, on fever. In the late 1780s and early 1790s he made some enquires among other physicians on their experiences with the matter.[100] Francis Balfour, a Scottish medical officer in India, reached out to several fellow medical officers in India continuing to explore the idea. Wade responded to Balfour's request for information while he was stationed in Assam during Captain Welsh's expedition. Wade did not think that results were conclusive enough to fully prove the sol-lunar influence on fever, but he was exploring the idea with some level of legitimate inquiry.[101] The question of the sol-lunar influence on fevers in Wade's experience was based on 'the coincidence of fevers or relapses, in a variety of diseases

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[99] Gait, 'Reviewed Work', p. 153.
[100] F. Balfour, *A Treatise on Sol-Lunar Influence in Fevers, &c. Second Edition, Corrected and Enlarged. Vol. 1* (London, 1795), p. 120.
[101] Ibid., p. 187.

with the principal lunar periods'.[102] This is an ambiguous description of the fevers affecting those under Welsh's command in Assam, but it does indicate some potential relationship to malaria. Wade was either referring to some level of intermittent fever in his analysis or a seasonal prevalence of fever, both of which are now associated strongly with malaria in colonial Assam.

The pre-colonial commercial relationship between Assam and the East India Company situated Assam on the periphery of the imperial network, with limited potential for future interaction. Little was known about Assam by outsiders, but it is likely that some of the language used in accounts such as Wade's described fevers, quite possibly malaria. Just as important was the fact that attitudes formed during this time and during the first Anglo-Burmese war had implications for the political structures later built in Assam and subsequent developments within the province.

Though there was some interaction between Assam and the British in Bengal, the colonisation of Assam was not inevitable. Historian Suryya Kumar Bhuyan argues that before the first Anglo-Burmese war, the East India Company had little political interest in Assam. Captain Welsh's military expedition was oriented towards strengthening commercial ties between Assam and the East India Company, and the non-interventionist policy served that point but only extended so far. The annexation of Assam was not the result of the British or the locals in Assam, but the Burmese.[103] Prior to the war with Burma, Assam increased trade with the British, though only slightly, to obtain supplies and arms largely to fend off Burmese conquest.[104] After the First Anglo-Burmese war, it was clear that though the British had made little effort to interfere in the politics of Assam, the instability of the Ahom regime meant that Assam was no longer a secure

[102] Ibid., p. 189.
[103] Bhuyan, *Anglo-Assamese Relations* p. 581.
[104] Ibid., p. 582.

buffer between the East India Company and the Burmese who were a significant threat to British interests.[105] In this sense, Bhuyan argues that the British control of Assam was almost forced. His claims are convincing when examining the political involvement of the British in Assam, but British interests in Assam began before the war. Assam was viewed as a valuable buffer between Bengal and Burma, but pre-colonial interaction speaks to the future of colonial Assam and the East India Company's intentions, even if local political involvement was low.

The First Anglo-Burmese War

The history of malaria in Assam is difficult to chart prior to scientific and epidemiological advances in the late 19th and 20th centuries, but references to the general category of 'Fevers' and symptoms similar to malaria were made for centuries prior to that, and often in military campaigns. Famously, in the 17th century, Ahom forces fought the Mughal Empire and successfully defended their territory. Stories are often told of the role malaria played in the battles, favouring the local Ahom forces and devastating the Mughals. [106] Disease, fevers in particular, was commonly in the immediate pre-colonial history of Assam. The advent of the first Anglo-Burmese War started British involvement in political and social institutions in Assam. The conflict also formed the attitudes on Assam that persisted through the colonial period, particularly regarding disease. The first English-language records involving fever and disease from the British perspective in Assam began during the first Anglo-Burmese war. Dr. John Peter Wade's *A Geographical Sketch of Assam* and his much less widely read *An Account of Assam* do not mention the influence of disease or health beyond the cause of death of some feudal lords and

[105] Ibid., p. 584.
[106] M.D. Ibrahim Ali, 'Perso Arab Relations with Assam and their Impact on Assamese Language' (Gauhati Univ. Ph.D. Thesis, 2002), p.124.

general remarks.[107] There are references to unspecified diseases killing thousands of soldiers and civilians during certain military campaigns, but such events were typical across the world and without specific information it is difficult to determine the nature of these illnesses.[108] Though commercial involvement with Assam began during the pre-colonial period, the first Anglo-Burmese war marks the first large, coordinated campaign in Assam where disease presented a significant problem for East India Company forces. Welsh's military campaign was brief, and though his soldiers undoubtedly confronted disease, the connection between disease during war and the understanding of disease Assam was cemented during the Frist Anglo-Burmese War.

By the early nineteenth century, political unrest and infighting led to the downfall of the Ahom regime. Purandar Singha ascended to the Ahom throne in 1818, but after a series of disputes with other nobles he called upon Burmese rulers for military support. This created a legacy of inviting Burmese forces into Assam and complicated rule of the Brahmaputra Valley.[109] In this time period, Burmese forces in Assam began attacking East India Company land in Bengal, Assam's neighbour. In retaliation, the East India Company entered Assam and pushed back Burmese forces. East India Company soldiers battled both disease and the Burmese forces, but they eventually forced the Burmese out of Assam.

Descriptions of disease in contemporary reports lack clarity but modern knowledge of trends in malaria help disambiguate these reports. During the early nineteenth century, climate was often mentioned as a contributing factor in contracting illness and the 'tropical climate' of Assam was seen as a drain on East India Company soldiers of ever rank. An excerpt from the *Transactions of the Medical and Physical Society of Calcutta* describes the climate,

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[107] Wade, *An Account of Assam*, pp. 175, 286.
[108] Ibid., pp. 119, 147.
[109] Acharyya, *A Brief History of Assam*, p. 190.

> The causes of this sickness were too obvious to be overlooked: the locality was sufficient to satisfy every Medical observer, that troops could not inhabit it with impunity, and a reference to the meterological register, will shew a severity of season to which the men were quite unaccustomed, and which no covering could wholly resist. Exposure to the weather, which no precaution could prevent, and intoxication, which European soldiers are unfortunately too prone to, had their share in producing disease; but a still greater in pre-disposing to our rendering more violent and endemic, with which nearly everyone was visited in a greater or less degree.[110]

A government report on the first Anglo-Burmese war stated 'the use of spirituous liquor, and the want of a sufficient supply of fresh meat and vegetables, the consequence of the unexpected flight of the inhabitants of the town, which there the force wholly upon their sea stock for sustenance, augmented the malignant influence of the climate, and crowded the hospitals with the sick'.[111] The most common illnesses were, above all, fever and dysentery but the causes were described as 'no more than the ordinary consequences of local causes'.[112] In contrast to other diseases such as scurvy or hospital gangrene, fever and dysentery were described as almost inevitable due to inescapable circumstances outside of human control. Nevertheless, the fever was described as an 'epidemic type' similar to that experienced in Bengal.[113] Fever is a symptom

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[110] Also see 'The season also brought with it, its. Usual pestiferous influence, in the midst of a low country overrun with jungle, and intersected by numerous rivers. Notwithstanding the precautions that had been taken in the timely cantonment of the troops at Aracan, fever and dysentery broke out amongst them to an alarming extent, and with the most disastrous results. That the unavoidable privations of troops on service tended to aggravate the severity of the complaints, was a necessary occurrence; but all ranks were equally affected, and a large portion of officers fell victims to the climate. Brigadier General Morrison himself, after struggling through the campaign against it, was obliged to quit the country, and died on his way to Europe. The maladies were so universal, and the chance of subduing them so hopeless, that the Government of Bengal was at last impelled to the necessity of recalling the troops all together, leaving divisions of them on the Islands of Cheduba and Ramree, and the opposite coast of Sandoway, where the climate appeared to be not unfavourable to their health.', (H. H. Wilson, *Documents illustrative of the Burmese War. With an introductory sketch of the events of the war and an appendix* (Calcutta, 1827), pp. 59, 60.)

[111] Ibid., p. 32

[112] Ibid., p. 32.

[113] Ibid., p. 32.

of numerous diseases, but it was often used as if it to describe a singular disease. In this instance, during the first Anglo-Burmese war, it is most likely that fever was often referring to malaria.

One of the indications that the term 'Fevers' in this instance referred to malaria is the seasonal variance. In Assam, malaria often followed a seasonal pattern. Cases would increase in the warmer months with highs in June or July and then decline slowly. Dr. G Waddell, who was among the troops in Assam, claimed that in the colder seasons of the year general sickness was lower than in the other months, with increases in illness in the summer around June.[114] Though this pattern included all diseases, colonial sources indicate that malaria was by far the most common infectious disease in Assam and its prevalence during the first Anglo-Burmese war is therefore very likely.

The climate of the northeast was made out to be perilous to the European constitution, particularly the jungles and marshes that dominated the landscape of both Assam and north-west Burma. Of the troops who travelled through jungles, 'almost all fell ill of fever and died'. These incidences, recorded during the First Anglo-Burmese War, were used to strengthen the association between climate and health.[115] In the case of Assam, the experiences of soldiers were used to support contemporary beliefs in the theory of sickness and medicine and characterise Assam as a whole. The 'noxious and pestilential swamps and jungles' were from a health perspective, in the eyes of the British and the members of the East India Company, almost inhospitable.[116] This was a new interpretation of Assam that developed during the First Anglo-Burmese War and was formed in conjunction with existing medical assumptions on disease and health.

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[114] Wilson, *Documents illustrative of the Burmese War,* p. 32.
[115] Ibid., p. 60.
[116] Ibid., p. 242.

Though the connections to the climate imply a local origin of the causes of disease, people saw a correspondence between fever among troops in Assam and Burma with fever in other parts of India which provides further evidence that the fevers mentioned were malaria. 'The very extensive and melancholy sickness which prevailed in Sri Archibald Campbell's army, from July to November 1824, had its first origin in an epidemic fever, of a casual, not local character, which visited Rangoon in the month of June, as it did Calcutta. We may remark, incidentally, that precisely the same fever has this season raged in Upper India.'[117] Though likely unknown to contemporaries and not recognised as one disease, malaria, referenced in reports as fever, played a role in the first Anglo-Burmese war. Basing their interpretation of malaria on assumptions of an association between illness and climate, contemporary westerners began to characterise Assam and the northeast of India as a land of fever and illness, a perspective that influenced the transformation of Assam after the war into a British colony.

Early Colonial Assam, A Period of 'Development'

The First Anglo-Burmese War concluded in 1826 with the Treaty of Yandaboo, and Assam formally became a part of British controlled Bengal. Burmese forces had destroyed the Ahom kingdom, and in the wake of the conflict, the British East India Company needed to determine their next steps in an effort to govern their new colonial frontier. Previous commercial relationships did create some precedent for further trade, but the new political rulership was complicated by several facts. First, Assam was devastated after the war. Second, very little of

[117] Wilson, *Documents illustrative of the Burmese War,* p. 243.

Assam was known to outsiders. The north-eastern frontier was still a land of myth, magic, and mystery to foreigners.[118]

Descriptions of Assam in the wake of the First Anglo-Burmese War in 1826 from more recent historians focus primarily on the destruction caused by the conflict. Edward A. Gait's *A History of Assam* describes Assam as almost completely devastated by the Burmese military. Gait wrote about stories from British officers who came across 'many of the unfortunate inhabitants, whose bodies, barbarously mutilated, were found by the advancing British along the road and in the stockades at Gauhati'[119] According to Gait, who was writing almost 100 years after the conflict, those in Assam who did not suffer from the direct cruelty of the Burmese soldiers during their occupation of Assam were instead plagued by disease and starvation. Gait's perspective, which was informed primarily by reviewing British military correspondence from the war, does extend sympathies primarily to the British cause in Assam and Burma. Depictions such as these support the antiquated argument that the East India Company needed to rule Assam, that the land was so depraved there could be no other option. Such an argument lacks nuance, particularly in light of the fact that Ahom power was consolidated through a number of different groups along the Brahmaputra and far from absolute, but it nevertheless underscores an important period of transition for Assam. Destabilised by generations of infighting and demolished by the Burmese during the conflict, the fall of the Ahom kingdom left a vacuum of power in Assam, and it was the British East India Company that stepped in as the new governing body.

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[118] W. Hamilton, *The East-India Gazetteer; Containing Particular Descriptions of the Empires, Kingdoms, Principalities, Provinces, Cities, towns, Districts, Fortresses, Harbours, Rivers, Lakes, &c. of Hindostan, and the Adjacent Countries, India Beyond the Ganges, and the Eastern Archipelago; together with Sketches of the Manners, Customs, Institutions, Agriculture, Commerce, Manufacturers, Revenues, Population, Casts, Religion, History, &c. of their Various Inhabitants Vol. I* (London, 1828), p. 331.
[119] Gait, *A History of Assam 1926*, p. 276.

The Treaty of Yandaboo ended the First Anglo-Burmese War and placed Assam under the protection and administration of British controlled Bengal. Based on the popular historical narratives of the British before and during the war with Burma, one could be excused for believing that Assam came under British control almost accidentally; a land devastated by internal disorder during the Ahom regime, taken over by the Burmese, ceded to Bengal as a spoil of war, and maintained as a boundary between Bengal and Burma. While the original cession of Assam to Bengal could be viewed as somewhat unexpected given the East India Company's previous reticence regarding interference with the internal affairs of Assam, the following decades saw a direct and coordinated effort to force Assam into the political landscape of the British Empire. The transformations that occurred had a number of implications for political, economic, and social life. One of the most important of these were dramatic changes to the ecological landscape which slowly turned malaria into a problem that complicated colonisation and colonial rule.

The first step of establishing British rule in colonial Assam came with improved communications to and from Assam. The Ahom Kingdom attempted to remain isolated from its neighbours and, as a result, travel from Bengal to Assam was difficult, laborious, and time consuming. With minimal trade and travel between the two locations rarely necessary before the colonial period, this was not considered an issue by either party. When Assam was annexed to Bengal in 1826 however, East India Company officers began to take transportation to and from their new frontier more seriously. According to a report from 1828, written by William Hamilton, it took the same amount of time to travel from Dacca to Rungpoor (the former capital of the Ahom kingdom) via the Brahmaputra River as it did for a ship to travel from Europe to

Bengal.[120] In his description of the river, Hamilton described the Brahmaputra as 'bounded through very considerable intervals by dense and inhospitable jungles. One mile per day in such situations, and under such circumstances, is a fair average rate of advance'.[121] In an effort to make travel to and from Assam more efficient in an effort to both gain a better understanding of Assam and secure political authority, the Court of Directors authorised the building of two steamboats. The year 1828 was early in colonial Assam's history and the plans of the steamboats were fairly routine. It was hoped that the steamboats would mostly carry supplies and troops.

The quick movement of troops offered strategic advantages but there were also concerns about health. In an editorial written by 'A Bengal Civilian' in 1828, it was argued that due to ill-health in areas such as the new frontier in Assam, the military should be moved to a more salubrious post.

> We must look between the norther limit of Bengal Proper, and the "sea costa,: for the large army which the Bengal Government composed as a body of men of "very extraordinary merits," philanthropically keep up, "where no danger can now be apprehended," "to sicken and die" form malaria and miasma.[122]

Assam, like some other parts of British India, was considered a dangerous place to station military personnel due to the presence of malaria.

Very little was known about Assam by the British at this stage, but reports were quickly written. On the topic in 1828, William Hamilton wrote as a preface to his account of East-India,

> with respect to India beyond the Ganges, the unexpected result of the late Burmese war, begun about a small muddy island in the bay of Bengal, and concluded with the complete establishment of British predominance in that remote quarter, has been the acquisition of much valuable information regarding the condition of its interior, hitherto a region of speculation and conjecture.[123]

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[120] Hamilton, *The East-India Gazetteer Vol I*, p. 479.
[121] Ibid., p. 288.
[122] B. Hurkaru, 'Administration of India', *The Oriental Herald and Journal of General Literature*, (1828), p. 345.
[123] Hamilton, *The East-India Gazetteer Vol 1.*, p. vii

In his report, Hamilton provides a brief description of the residents of various locations such as cities, towns, and districts in the eastern portion of India. Due to the structure of his work, it is difficult to get a sense of colonial Assam as a whole. Hamilton focused on each specific location/ district and this means that a lot of the information provided pertains to individual groups of people/communities rather than the area as a whole. Despite this somewhat disjointed depiction of life within colonial Assam, it is possible to gain a vague understanding of the presence of 'Fevers'. Hamilton does describe the health of certain parts of Assam and, although the descriptions are very general, they nonetheless speak to the role of disease and health within the province.

According to Hamilton's enquiry, there is a long history of disease negatively affecting life in Assam. In 1204 in 'Camroop' (later Kamrup, the district where Guwahati is located), there was an attempted invasion of Assam by Muhammad bin Bakhtiyar Khaljii, who led the Muslim conquests of eastern Indian regions of Bengal and Bihar. The population of 'Camroop' [sic] fled to the jungles until the rainy season when the invading army lost roughly half its number due to disease, what Hamilton called 'the pestilential effects of an unwholesome climate', which likely implies malaria, and subsequently retreated.[124] This story is similar to reports that malaria helped the Ahom kingdom fend off invasion from the Mughals and is also similar to another report form the Garrow Hills, another district in Assam. In 1775, there was an attempted invasion of the Garrow Hills by the 'Chowdries of Mesapara and Currybarry'.[125] The invasion, like several others, failed when 'their followers are said to have fallen victims to the unhealthiness of the climate.'[126] The validity of these stories is difficult to determine, but they reflect the fact that the

[124] Ibid., p. 332.
[125] Ibid., p. 563.
[126] Ibid., p. 563.

residents of Assam were aware that the widespread presence of disease was an asset when trying to fend off invading forces. Though locals were also subjected to the deleterious effects of disease, they appear to have suffered far less than foreigners new to the land. It is impossible to determine if this was due to a biological resistance to disease or different social customs and medical practices, but the image presented to the British in surveying Assam was one in which disease and an unhealthy climate was a particular problem to newcomers.

By 1828, many of the medical works in Assam were related closely to religious ceremonies. These were said to be closely associated with the 'black arts' and contributed to the reputation that Brahmins in Assam had supernatural powers. Though this approach to medicine was not conventional in the Western perspective, it was deeply interwoven within religion and society among many in Assam. According to Hamilton, 'the bites of serpents are cured in the name of Bishahari, and the small-pox in that of Sitola, but other diseases and devils are removed in that of Kamakhya, and occasionally the old goddess of the Teesta river.'[127]

During the earliest stages of colonisation, the British were presented with an image of Assam as an unhealthy frontier. Hamilton's description of Rungpoor, the former capital of the Ahom kingdom, reflects the British perception of both the salubrity of Assam and the people in general.

> The grand check to the population in this district is disease, the natives being exceedingly unhealthy, and the children feeble, so that a large proportion of the infants die, even of those not in a state of indigence; and although for almost fifty years food has never been so scarce as to approach to a famine, a large extent of excellent land still remains unoccupied.[128]

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[127] Ibid., p. 331.

[128] W. Hamilton, *The East-India Gazetteer; Containing Particular Descriptions of the Empires, Kingdoms, Principalities, Provinces, Cities, towns, Districts, Fortresses, Harbours, Rivers, Lakes, &c. of Hindostan, and the Adjacent Countries, India Beyond the Ganges, and the Eastern Archipelago; together with Sketches of the Manners, Customs, Institutions, Agriculture, Commerce, Manufacturers, Revenues, Population, Casts, Religion, History, &c. of their Various Inhabitants Vol. II* (London, 1828), p. 477.

This was a pejorative perspective but the message regarding the state of the new frontier was also one that emphasised a new opportunity for colonial development, the large extent of land and the possibility for increased trade between Assam and the East India Company.

Located on the bank of the Brahmaputra River, Goalpara was the first point of exchange when travelling between Bengal and Assam via the grand waterway. During the beginning of the colonial period, trade was limited. Merchants from Assam would trade cloths, stick-lac, tar, wax, and gold for, more often than not, salt. British rule ushered in a change across Assam, and the East India Company expected a massive increase in trade.

> Recently, however, a great change has taken place in this quarter of Asia, by the expulsion of the Burmese in 1824, and the protection since bestowed on this distracted country by the British government, has had the effect of completely tranquillizing it. A great increase of commercial intercourse, therefore, may not be expected, not only with Assam, but also with the hitherto unknown nations far beyond its limits.[129]

By 1831, the steamboats commissioned by the government to transport people and supplies along the Brahmaputra River had been constructed and tested.[130] Travel between Bengal and Assam, desirable to the East India Company because it was necessary to be able to develop trade, was still slow and negatively affected by the natural environment along the river. The banks of the Brahmaputra were not heavily populated, leaving large stretches of jungle and few waypoints to stop on trips. The currents also meant that travel was difficult without favourable winds. During the seasons without winds, the boat needed a track rope but track ropes would frequently break and thick jungles meant that progress was intensely slow.[131] As a result, the insurance premiums for a journey via steamboat on the Brahmaputra were at the same rate as a trip between England

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[129] Hamilton, *The East-India Gazetteer Vol I.*, p. 582.
[130] *Precis of Reports, Opinions, and Observations on the Navigation of the Rivers of India by Steam Vessels* (London, 1831), p. 8.
[131] Ibid., *p.* 24.

and India.[132] James H. Johnston, Lt, RN, commanding the Company's steam vessels, wrote in his report to the East India Company that on the journeys, 'the loss of human life is also very great, and it rarely happens that a movement of troops by water is unattended by casualties of this nature.'[133]

By the 1830s, Assam remained difficult to travel to from Bengal and information on the new frontier was limited and difficult to obtain. In 1838, Montgomery Martin published a report on the districts of Bhear, Shahabad, Bhagulpoor, Goruckpoor, Dinajepoor, Puraniya, Ronggopoor, and, significant for this project, Assam. The report was written for the East India Company as a survey of the colonial districts. Martin's information on Assam was gleaned from two sources. The first was from the few people who had been in Assam but had made their way to Bengal. Many of these individuals were natives of Assam but, when they spoke to Martin, were fugitives living in Bengal.[134] The second source for Martin's information on Assam, written 12 years after the Treaty of Yandaboo, were the records of Dr. John Peter Wade.[135] As previously noted in this project, the reach of Wade's work was limited when it was first written roughly 40 years prior to Martin's report in 1800. Wade's papers were deposited in the library at the East India House in 1827 by Sir John Malcolm, an East India Company administrator and historian. Wade's descriptive geography was reprinted in Martin's work, but the history of Assam was used only as a reference. The volume was too large to reproduce fully in the report.[136]

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[132] Ibid., p. 25.
[133] Ibid., p. 25.
[134] Martin, *The History, Antiquities, Topography and Statistics of Eastern India,* p. 596.
[135] Ibid., p. 625.
[136] Ibid., p. 625.

The Birth of a Colonial Enterprise, The Tea Industry

The future of the new colonial frontier was uncertain during the early years of British rule in Assam. Annexed to Bengal after the First Anglo-Burmese War and retained as a buffer between Bengal and Burma, very little was known of the people and ecology of Assam. It was intensely difficult and dangerous to travel to and from the province, and the perception of disease and health in Assam indicated that it was particularly dangerous for newcomers. This cast a daunting shadow over the plans of the East India Company. In the late 1830s, however, industrial interest in Assam increased dramatically because of the possibility to cultivate one specific plant: tea. The result was a slow but ultimately considerable transformation of the population, economy, and ecology of Assam. The development of the tea industry is closely linked to the colonial history of Assam, and integral to this transformation is malaria.

China had a monopoly of the tea trade in the early nineteenth century, but East India Company merchants were searching for alternative places to source this commodity. In 1834, the Tea Committee sent their Secretary, G. J. Gordon to China to learn how to cultivate and manufacture tea and to acquire seeds. During this time, officials reported that Assam had the appropriate ecological conditions, climate, and elevation believed to be necessary for tea cultivation. Additionally, six months after Gordon left Calcutta for China, tea plants were discovered growing in Assam naturally.[137] In 1837, Gordon was able to send 80,000 seeds back to Calcutta before he returned to Bengal: 20,000 seeds were distributed to Assam and Kumaon,

[137] H. A. Antrobus, *A History of the Assam Company 1839-1953* (Edinburgh, 1957), p. 30.

and 2,000 to the Madras Presidency.[138] Despite the distribution of the Chinese seeds, the first successful cultivation of tea in India by the British was from an indigenous Assam tea plant.[139]

With a successful cultivation in Suddeya in Upper Assam, in 1838 C. A. Bruce published his account on how to grow and manufacture tea in Assam. Bruce learned the methods from several Chinese experts who were sent to Assam from China. The introduction of their methods helped to establish agricultural practices that enabled the development of the industry. Within Bruce's account, the Chinese experts stated that the methods for tea cultivation in Assam were exactly the same as in China despite a slight difference in plant (the leaves of the plants in Assam were slightly smaller than their Chinese counterparts).[140] Preparing land for tea cultivation meant creating ridges, eight inches to a foot high, roughly three to four feet apart from each other that run in parallel. In between the ridges, hollow spaces were made to allow rainwater to drain. Each tea bush was planted equal distances from others in perfectly straight lines if possible. Around the garden, trenches were often dug to prevent the plants from being washed away in the rain.[141] The result was a structured and ordered garden, but it came at the cost of a large ecological transformation. In some instances, Bruce advocated cutting down large tracts of tea plants in their

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[138] Iid., p. 31.
[139] This was the first cultivation of tea by the British East India Company with an intent to sell the tea on the open market and develop the industry. Tea had been previously cultivated by many groups on a much smaller scale and used in local communities. Groups that had previously cultivated tea in these small quantities notably included the Singphos in Assam, but their efforts were not known to the British until C. A. Bruce's inquiry into the practice. (Antrobus, *A History of the Assam Company,* pp. 33-34.)
[140] C. A. Bruce, *An Account of the Manufacture of the Tea, as Now Practiced at Suddeya in Upper Assam, by the Chinamen Sent Thither for That Purpose with Some Observations on the Culture of the Plant in China, and its Growth in Assam* (Calcutta, 1838), p. 8.
[141] Ibid., p. 7.

cultivated rows and setting the remains ablaze because Bruce believed there would be a greater yield of tea and more plants in the following season.[142]

One aspect of Bruce's mission in Assam was to search the ecological landscape for locations where tea could be cultivated and note the optimal conditions where the bushes would thrive. In this early stage of tea cultivation in Assam, Bruce stated that,

> The tea plants in Assam have in general been found to grow, and to thrive best, near small rivers and pools of water, and in those places where, after heavy falls of rain, large quantities of water have accumulated, and in their struggle to get free, have cut out for themselves numerous small channels.[143]

As more and more plantations were established with this advice in mind, the close proximity to standing water left planters and labourers vulnerable to fevers and disease, including malaria. Awareness of this issue, however, developed well after Bruce's initial insights and will be explored later in this chapter.

The early stages of the development of the tea industry were intended to be a scientific endeavour, meaning that those at the forefront of the new industry were supposed to categorise, catalogue, and organise everything from the plants themselves to the methods of cultivation. Two botanists, Dr. Wallich and Mr. Griffith, were sent to Assam along with a geologist, Dr. Wallich, to work with Bruce.[144] The efforts of these men were in many ways dedicated to reorganising the cultivation of tea and transitioning from the methods used by locals to a systematic approach. Tea grew wild in Assam, but while some groups actively searched for wild tea to be used for their own purposes, others did not use or value the plant at all and treated it as they would any other bush. This caused some tension between British prospectors looking to

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[142] Ibid., p. 13.
[143] Ibid., p. 9.
[144] Ibid., p. 12.

plant gardens for cultivation and locals who wanted to use the land for other purposes. For example, locals living near a newly established tea garden confused the bushes for jungle and cleared the plants away and then replaced them with rice paddies instead.[145] Bruce noted that there were a few places in Assam where tea was relatively plentiful, but locals did not have an interest in redefining their relationship with the plant and setting up mass systems of cultivation. Some did not consider the plant of value, and others like the residents of the Singpho country were satisfied with searching for wild plants in the jungle rather than making gardens.[146] It was not until British prospectors showed an interest in the plant that some of the locals began to re-assess their opinions of it. According to Bruce, the locals in the Muttuck country began working with the British; they brought Bruce and his team wild samples and were given 'little rewards'.[147]

In addition to restructuring the ecological landscape of early-colonial Assam to make way for the development of the tea industry, Bruce and other pioneers called for a re-evaluation of the labour force. In 1839, Bruce remarked that Assam 'would be a delightful place for the manufacture of tea, as the country is well populated, has abundance of grain, and labour is cheap.'[148] Despite the low cost, Bruce noted that the labour force of Assam was beleaguered by a number of other problems that affected their efficiency. Firstly, at this early stage the few tea gardens relied heavily on managers from China. Without a large number of managers, the establishment of an increasing number of tea gardens would struggle.[149] Second, Bruce's opinion of the local labourers was exceedingly low due to his prejudice against the the common

[145] Ibid., p. 12.
[146] Ibid., p. 16.
[147] Ibid., p. 14.
[148] C. A. Bruce, *Report of the Manufacture of Tea, and on the Extent and Produce of the Tea Plantations in Assam* (Edinburgh, 1840), p. 4.
[149] Ibid., p. 5.

consumption of opium. According to Bruce, immigrant labourers needed to be brought into the province to make up for the inefficiencies of the 'Assam opium-eaters', but also noted that opium needed to be controlled to stop the habit from affecting any potential immigrant labourers as well.[150] Immigrant labourers, 'who would not only work themselves, but encourage their women and children to do the same; in plucking and sorting the leaves' were a far cry from 'the Assamese, who will not permit their women to come into the tea garden's. Indeed, unless more labourers can be furnished, a large amount of tea must not be looked for at present.'[151] Bruce's proposals presented an image of Assam that, with the introduction of the tea industry, was noticeably different from the pre-colonial era.

The purpose of these early surveys of tea was to gauge whether it could be cultivated in large quantities to a high standard in Assam and therefore attract investment from Britain. This was a massive transition for both the local ecology and the position of Assam in the British Empire. In a letter from Captain Jenkins, commissioner and agent to the Governor-General in Assam to Lord William Bentinck in 1838, Jenkins wrote that English capital would be necessary to expand the industry in Assam.[152] The desire to attract capital, establish a tea society for Assam, and grow tea in the province was motivated by increasing tensions between British merchants unable to trade tea from China. The tea embargo, along with other hesitations China had concerning trade with the British, eventually culminated in the Opium Wars, but within the scope of the tea trade the development of Assam was closely tied to the British East India Company's desire to avoid further conflict with China and protect British capital. According to Jenkins, 'if but a portion of the capital, which is now jeopardized in China, be carried to the British provinces

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[150] Ibid., p. 7.
[151] Ibid., p. 9.
[152] *Information on the Discovery and Character of the tea Plant in Assam* (London, 1839), p. 10.

in Assam, the transfer will give an impulse to agriculture in those provinces, which will develop many of its other resources, and at the same time, do more to teach the Chinese sounder notions of political economy than even the cannon of a British man-of-war'.[153]

In London on May 7th 1841, a group of directors and auditors met at the London Tavern on Bishopsgate street for the first annual general meeting of the Assam Company. There were some informal discussions before this first meeting, but the formation of the Assam Company was the formal organisation of the future of the tea industry in Assam.[154] The directors in attendance were impressed with the potential of Assam and, as Jenkins had called for, flooded the industry with capital.[155] A sawmill was built and steam boats to travel between Assam and Calcutta were commissioned.[156] The Assam Company could not directly interfere with the lives of the locals other than to restrict the growth, sale, and use of opium to ensure that their labourers were not using the drug.[157] The Assam Company did not guarantee the success of the tea industry in Assam. In fact, H. A. Antrobus wrote in his *A History of the Assam Company 1838 – 1953*, which was sponsored by the Assam company in 1957, that the venture almost failed and struggled severely during the 1840s.[158]

Recommendations from Bruce and other speculators established an industry that transformed Assam. As a result of widespread tea cultivation, the ecological and social landscape of the province was altered. Jungles were cleared to make way for tea plantations, the lifestyles of the locals were affected by demands of the company to produce effective labourers, and a

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[153] Ibid., p. 10.
[154] Antrobus, *A History of the Assam Company*, p. 35.
[155] *Assam Company Report of the Directors and Auditors Made to the Shareholders at the General Annual Meeting, Held at The London Tavern, Bishopsgate Street, on the 7th May, 1841* (London, 1841), p. 9.
[156] Ibid., p. 18.
[157] Ibid., p. 17.
[158] Antrobus, *A History of the Assam Company*, p. 67.

systematic approach to recruiting immigrants to work the field eventually shaped the demographics of the province. In the following decades, the problem changed from disease being solely a threat to Europeans to disease being a threat to imported labour and the profitability of the tea industry.

The Problem of Malaria

Alongside surveys and reports on the future of the tea industry in colonial Assam were reports that noted the presence and effects of disease. In 1841, the same year the Assam Company was founded, William Robinson submitted his work *A Descriptive Account of Asam [sic]: With a Sketch of the Local Geography, and a Concise History of the Tea Plant of Asam* to Major Francis Jenkins, Agent to the Governor General North-East Frontier. The second chapter of the report focused on 'Climate and its Effects on Man'. Robinson defined climate as 'the ordinary state of the atmosphere, with regard to heat and moisture, which prevails in any given portion of the globe', but it should be noted that the notion of climate was tied very closely to disease and health, and Robinson's focus on the topic provides a commentary on his opinion of the general salubriousness of Assam.[159]

Robinson's assessment of climate in Assam investigated heat, elevation, distribution of land and water, 'absorbing and radiating powers', variations in the surface of the land, deserts, forests, etc. to gain a general sense of the climate, and Robinson was greatly influenced by the work of Alexander von Humboldt, a German botanical geographer who studies early meteorology, on the subject.[160] In general, Robinson argued that the climate was very similar to

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[159] W. Robinson, *A Descriptive Account of Asam: With a Sketch of the Local Geography, and a Concise History of the Tea Plant of Assam: To Which is Added, a Short Account of the Neighboring Tribes, Exhibiting Their History, Manners, and Customs* (Delhi, 1841), p. 12.
[160] Ibid., p. 13.

that of Bengal but slightly different because of the prevailing winds caused by the continuous mountain ranges.[161] Robinson argued that the prevailing opinions on the climate of Assam were mixed: some claimed it was among the healthiest in India while others described it as among the worst.[162] According to Robinson, one of the healthiest aspects of the climate were the prevailing winds, but a lack of wind in the 'remarkably varied character of the localities throughout the province' contributed to the presence of 'fevers which are regarded as so dangerous and intractable'.[163] The reason for the prevalence of fevers where there were no winds, in the opinion of Robinson, was the fact that winds would help disperse 'noxious exhalations engendered in the low marshy grounds, and extensive dense forests'.[164]

The 'Fevers' Robinson was referring to were most likely malaria. In Robinson's estimate, the unhealthiest time of the year in Assam was the rainy season, which was from late Spring to early Autumn.[165] This is consistent with Robinson's statement that fevers were most prevalent between June and October and in line with dominant malaria patterns from periods when knowledge on malaria patterns was available.[166] Additionally, Robinson noted the common presence of agues, another term closely associated with malaria. Agues were often coupled with 'enlargement of the spleen, dropsical effusions, bowel complaints, or painful affections in the bones and joints. The cure is then tedious, and but too often hopeless, and especially so at the commencement of the cold weather, when a large portion of such patients are carried off by dysentery.'[167] A 'Fever' was the most common disease, especially among Europeans in Assam.

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[161] Ibid., p. 14.
[162] Ibid., p. 19.
[163] Ibid., p. 19.
[164] Ibid., p. 19.
[165] Ibid., p. 20.
[166] Ibid., p. 22.
[167] Ibid., p. 22.

Many Europeans would contract 'fevers' through 'exposure, in seeking pleasure and amusement in the exciting sports of the field. These fevers are generally attended with considerable local congestions of the brain and stomach; but they rarely end fatally, if seen at an early stage'.[168]

Robinson was not the last to write about the consequences of the climate in colonial Assam on one's constitution, another term for a high prevalence of disease and poor health in the province. In his description to the Garrow [sic] Hills published in his 1847 work A Sketch of Assam, John Butler wrote

> Many parts of the division are so inimical to life, that the mortality both of Europeans and natives, equals, if it does not exceed, that in any district in Assam. The noxious exhalations from the Garrow hills and woods seem more deadly than the climate of the Northern Dooars, of which few persons resident there can long resist the depressing effects. Unless endowed with great stamina, life is here frequently extinguished by jungle fever in the course of a few days.[169]

In the Garrow [sic] Hills, Butler argued that 'no European constitution could endure a lengthened residence'.[170] In the Dooars,

> The country became overgrown with jungle, and the malaria of these plains was so injurious to the constitution of Bengalees or Europeans, that the tract could not be visited with impunity for above a few weeks in a year. The fevers were most fatal, and life was frequently extinguished in four or five days.[171]

Butler's ventures in in the northeast not only provide a brief description of the health and climate in Assam they also provide a brief albeit telling indication of the presence of mosquitoes. It was not until 1897 that the relationship between malaria and anopheline mosquitoes was known, and not all species mosquitoes transmit malaria, but the presence of mosquitoes in Assam and the practices of the locals used to prevent being bitten are an important component of

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[168] Ibid., p. 20.
[169] J. Butler, *A Sketch of Assam with Some Account of the Hill Tribes by an Officer in the Hon. East India Company's Bengal Native Infantry in Civil Employ* (London, 1847), p. 3.
[170] Ibid., p. 181.
[171] Ibid., p. 196.

understanding malaria in the past. Butler's reference to mosquitoes was brief and made whilst describing some encounters with boa-constrictor snakes.

> On one occasion the apothecary brought me two boa-constrictors of about four feet long, which he had found on a table curled up amongst some bottles in the same room where his children were sleeping. In all probability the lives of the infants were saved by the mosquito curtains preventing access to the bed. Boa-constrictors are exceedingly fond of rats, and on this occasion they had evidently been in search of their prey.[172]

The common use of mosquito nets among this party is not an indication of malaria, but it is clear that residents of Assam had developed some methods to prevent themselves from being bitten by mosquitoes with the use of nets. Given the state of medical knowledge on malaria in the West and the approach locals had towards disease, it is likely that the use of nets was not an attempt to prevent malaria, rather an attempt to stop itchy and frustrating bites from the insects and, considering Butler's story, other pests as well. Nevertheless, from a historical perspective this mention of the presence of mosquitoes in early-colonial Assam should not dismissed; an established practice indicating life among mosquitoes is a valuable component in understanding the history of malaria in the province even if in this instance the presence of mosquitoes cannot be directly correlated to the disease.

Writings like those of John Butler contributed to a relatively small pool of information available on colonial Assam that was written in English. The collection of these works that were available among the public within the British Empire and not exclusively officials working with the East India Company was even smaller. Nevertheless, the information made available to the British through works like Butler's helped shape opinions on Britain's handling of colonial Assam and the potential for further 'development'.

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[172] Ibid., p. 14.

Reports that mentioned the climate of Assam had a close association to the expansion of the tea industry in the middle of the twentieth century. Though the industry was still in its very early stages in the 1840s and 1850s, it became apparent to managers and investors that the ill-health of labourers on tea plantations was a growing concern. Butler noted that many of the 'coolies' who were brought to Upper Assam to cultivate tea became sick and died. In Butler's opinion, this was due to the poor planning of managers and their inability to provide adequate food and shelter.[173] Despite this, there was an appetite for the limited information on colonial Assam and in the decades after colonisation the information on the province was beginning to make some in Britain question the place of the frontier in the empire, and malaria played a prominent role in these discussions.

In 1855, Major John Butler published his work *Travels and Adventures in the Province of Assam, during a Residence of fourteen Years'* after serving in the 55th Regiment Bengal Native Infantry. This was a continuation on his previous work *A Sketch of Assam* and was based on official correspondence within the Government of India. His new work was published in London and was not a report reserved for the British East India Company.[174] At the end of a review of Butler's work, the review was published May 19th, 1855 in the British literary magazine *The Athenaeum*, the author of the review expressed amazement concerning the fact that there seemed to be no good policy 'to preserve this land of impenetrable jungle and savage men and precipitous crags and forests pregnant with malaria, as a barrier against the Burmese and other more distant and more barbarous tribes.'[175] Seemingly in defeat, the review states,

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[173] Ibid., p. 107.
[174] J. Butler, 'Travels and Adventures in the Province of Assam, during a Residence of Fourteen Years by Major John Butler, 55th Regt. Bengal Native Infantry. Smith, Elder and Co', *The Athenaeum*, (May 19th, 1855), pp. 582-583.
[175] Ibid., p. 582.

> The scanty revenue which the Indian Government extorts from the inhabitants, which presses heavily on them, but is the merest item in the schedule of our revenue, pays but a fraction of the expenses of our political establishment; yet such are the exigencies of our position, that we are led against our will into these wildernesses, where we shall by degrees, at vast expense to ourselves, civilize the inhabitants and change the forest into cultivated fields.[176]

There was some scepticism about the ability of the British to benefit from colonial Assam, a possession that seemed to be maintained simply as a buffer between Bengal and Burma, but the conclusion was that the only way forward was to continue investing in Assam in the hopes that developing the province would pay off.

Another book review of Butler's work published in *The Spectator* echoed a similar sentiment. Several colonising forces had shaped the social and political landscape of Assam to increase 'Anglo-Indian power'. These included military expeditions against tribes in the hills, the establishment of missionaries and schools, and the development of tea industry, but despite a strengthened colonial grip over the province, the future of the province was still uncertain.[177] There should be no doubt that these colonial transformations reshaped Assam. A far cry from the Ahom Kingdom, even hill tribes that were previously independent of the kingdom were forced under British rule, and Christianity, though far from the dominant religion, had quickly established a base in the province through missionary work. These colonial achievements, as beneficial to the empire as they were devastating to pre-colonial life in Assam, were hard-won and some publications focused on the cost of the accomplishments.

The colonisation of Assam persisted as the tea industry grew and the government was able to, often by force, extend its influence across the province. Despite the establishment of the tea industry, missions, and an expansion of military presence, there were doubters in Britain who

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[176] Ibid., p. 583.
[177] 'Major Butler's Assam (Book Review)', *The Spectator*, 28/1404 (1855), p. 550.

questioned if colonisation was possible by Europeans because of the harshness of the climate; in other words, could Europeans survive in what had proved to be a dangerous environment that, through one way or another, exposed people to a number of life-threatening diseases? In an 1864 article published in the *Calcutta Review*, the author asked, 'is it physically possible to colonize India by Europeans?'[178] The distinguishing characteristic of this question is that it focused on the *physical* capability of a European body living in specific parts of India and is in large part based on the experiences of Europeans and disease in Assam.

The article cited physicians like Dr. James Hunt who examined British troops in the Mediterranean and argued that it would be better to station troops in the Mediterranean to help them acclimatise before being sent to India.[179] The article also cited Dr. William Aikin who wrote on the process of acclimatisation. Despite concerns, there was an 'abundance of profitable work' with 'coffee and tea planting in Assam, Cachar, Darjeeling, Kumaon.'[180] To mitigate the effects of disease, there was a call for environmental conditioning.

> It is also to be borne in mind that the influence which is most inimical to the health of Europeans in India is the ill-destruction of trees and water throughout the country. Jungles and swamps are the main sources of Indian pestilences; the want of trees in the plains of Upper India, as barriers against the hot blasts from Sahara, was fully recognised and profitably remedied, for a time, by the ancient native rulers. By judicious clearing, planting, drainage, and irrigation, India may still be made what similar measures had rendered the lands of Babylon when Herodotus viewed them, the garden of the World, possessing a not disagreeable and tolerably healthy climate, in which European settlers may expect to lead industrious, pleasant, and happy lives in their plantations, sending their children home for education and re-invigoration, and calling them higher again, at full age, to become their successors in the land.[181]

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[178] 'Can India be colonized by Europeans?', *Calcutta Review*, 39/77 (1864), p. 143.
[179] Ibid., p. 151.
[180] Ibid., p. 164.
[181] Ibid., p. 164.

Worries about climate were echoed by the Sanitary Department of the Government of India. The 1870 report of the Sanitary Commissioner included comments that both European and native troops suffered 'more from fever than from any other disease' as a result of the climatic conditions.[182]

In 1871, Dr. John Meredith published his survey of malaria and fevers based on notes made between 1866 and 1869. Meredith's work focused on tea estates, the homes of the labourers, and the living conditions and habits of all the residents on the tea plantations, and how these factors related to ground water and vegetation. In the course of his tour, he visited 200 tea factories, and on these plantations, Meredith observed poorly constructed flimsy huts with pits of water caused by rain surrounding the homes and the rest of the landscape covered in jungle grass. Meredith reported that 'the laborers soon after their arrival became very sickly from fevers-remittent and intermittent; debility followed and deaths were numerous.'[183] Under Meredith's direction, some of the facilities at one estate were moved to higher ground on tea plantations, away from low land, and after these recommendations were followed through dysentery and diarrhoea became more common than fevers, with cases of fevers decreasing. The change in the location of housing and a reduction of fevers itself is not an indication that Meredith's advice was useful, but the managers who often continued to live in the lower ground near water suffered disproportionally higher rates of fever.[184] At another tea estate, the Bidettie Garden, there were reports that 74% of the labourers died in one year, although the labourers who were brought in from the neighbourhood of 'Arrah' suffered far less from fevers, reinforcing the idea that

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[182] 'Report of the Sanitary Commissioner with the Government of India, for 1870', *Calcutta Review*, 54/107 (1872), p. 45.
[183] J. Meredith, 'On Malarial Sites and Fevers, Relating Chiefly to Assam', *Indian Medical Gazette*, 6/8 (August 1, 1871), p. 154.
[184] Ibid., p. 154.

labourers from certain locations were more resistant to fevers.[185] At a third tea estate, the Tiphoot Factory near the Naga Hills, 25% of the residents died during a ten month period in 1867 likely due primarily to dysentery or diarrhoea, though the location was also considered to be 'typically unhealthy and malarious'.[186] Additionally, when the estate opened, all four managers at one point or another needed to be sent away due to malarial fevers, and the 'native doctor' as well his servant died due to malaria. Meredith continued to describe several other locations. At a fourth, the Laojan Factory, the residents slept near a plain that commonly overflowed when it rained and did not drain. Residents commonly suffered from fevers from 'sleeping close to a malarious source and fully exposed to it.'[187] Meredith recommended drainage at this location and argued that the labourers would be much healthier. Drainage was thought to be important, it was beginning to figure in discussion of the prevention of malarial fever in Bengal and other places. At a fifth estate, the Hathipooti Factory, residents of a row of houses near a patch of ground covered in jungle grass suffered much more from malaria from those who lived in houses not near the grass. This was first pointed out by Mr. Caudle, one of the officers of the Assam Company. Dr. J. Reid, another medical officer with the Assam Company, pointed out a similar phenomenon at the Suntock Mookh Factory and undrained jungle grass was closely associated with increased likelihood of suffering from malaria. On the phenomenon, Meredith wrote,

> The question naturally suggests itself- Do grasses in rendering to the earth and air again the elements which constituted their forms, evolves om entirety in great force and abundance different from other orders; or is it only that their texture being looser and less consolidated and capable of great radiating capacity, they udergo decay quicker than others, which are of a more durable constitution?[188]

[185] Ibid., p. 154.
[186] Ibid., p. 155.
[187] Ibid., p. 155.
[188] Ibid., p. 156.

The general advice for tea plantations was drainage and avoiding and clearing jungle grass because the source of malaria was believed to be putrefaction.

Meredith noted that many of the diseases that were prevalent on tea estates were closely related to each other. Those who suffered from fevers often also suffered from cases of diarrhoea or dysentery.[189] Tracing the origins of these symptoms involved a close examination of the local ecology. Based on his experiences in the West Indies, Meredith believed that iron in the soil was the cause of malaria.[190] In his assessment, Meredith referenced the works of Dr. Parkes and Sir James Ranald Martin, both well known arguing deforestation would improve health, regarding 'malarious soils' that contained large amounts of iron.[191] Meredith first learned about this when he was stationed as a medical officer in British Guiana and was taught that iron, often along with quinine, was given to patients suffering from malaria.[192] Meredith's conclusion was that iron alone in soil was not enough to cause malaria, but if iron in the soil mixed with drinking water then areas would be more malarious due to the unsanitary conditions. Meredith's conclusion was therefore that tea estates should not clear brushwood and jungle grass, rather they should plant shrubs and allow bushes to grow around homes in an attempt to rid them of fevers.[193]

By the 1870s, there were calls that Assam should become its own province, independent of Bengal but still within the Raj, and have control over its own future. Colonial Assam was perceived as dangerous, and malaria played a large role in these hesitations. 'From June to September the area is surcharged with moisture; evaporation is suspended and it requires a

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[189] J. Meredith, 'On Malarial Sites and Fevers, Relating Chiefly to Assam', *Indian Medical Gazette,* 6/9 (Sep, 1871), p. 175.
[190] Ibid., p. 175.
[191] Ibid., p. 176.
[192] Ibid., p. 176.
[193] Ibid., p. 177.

constitution more than usually strong and elastic to resist restlessness and debility, or the worse inflictions of fever, dysentery, and rheumatism.'[194] Nevertheless, there were demands that Assam should confront its own problems.

> Let there be a Chief Commissioner-we do wish our Anglo-Indians would invent titles bearing some relation to the duties of those who hold them- on the salary with the responsibilities and powers of others in like situations. Let him have the districts of Assam, our relations with barbarous tribes on the frontier, the Doars taken from Bhootan in the last campaign, and the supervision of the petty chiefs of the Cossia and Tyroleah Hills. There are at least half-a-dozen civil and military officers who are trained to this work, and who would do credit to their nomination. Let a brief Act be passed and a wise choice be exercised, and in ten years' time Assam, through the difficulty of labour must not be lightly regarded, will be in a position to meet its own wants, will be a tempting field for Chinese immigration, and will add both to the financial resources of the Imperial Government and to our national reputation for success in the East.[195]

Conclusion

Colonial Assam went through a massive transformation between 1826 and 1874. There is evidence that suggests that malaria in Assam had been present before the British, but also that colonial development redefined the relationship between malaria and Assam. The landscape was altered to support tea plantations and the problem of malaria transitioned from one that affected mostly Europeans to one that impeded the progress of 'development' itself. The information on malaria during this time period is limited, but it is clear that the colonisation of the province had an effect on the future of malaria within Assam. The content in this chapter makes a significant contribution to the limited work on malaria in Assam, particularly during the early stages of colonisation.

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[194] 'Assam', *The Spectator* 43/2193 (1870), p. 833
[195] Ibid., p. 833.

Chapter 2: Two Fevers, One Name – Malaria and Kala-azar 1874 - 1897

On account of its deadliness in Assam, kala-azar, as it swept onwards, became a terror to the natives. Those suffering from the disease were turned out of the villages; sometimes they were made unconscious with drink, taken into the jungle and burnt to death.[196]

It has been one of the most unfortunate aspects of this epidemic that the disease was commonly believed to be hopelessly fatal and contagious; with the result that villages were abandoned if a single death took place, and that among the Garos the sufferers were not merely shunned, but actually removed to the jungle and left to die of starvation or wild animals.[197]

Introduction

When researching the history of medicine, there is a tension between conceptualising disease as a social or a biological phenomenon. Focusing on a disease as a social phenomenon requires one to explore how the disease was commonly understood by those in the past using their analytical categories and nomenclature. In many cases, historical actors understood disease very differently from ourselves, but even if there were misclassifications, misunderstandings, inaccurate definitions, or mistreatments, the social responses to an epidemic as people became ill or died were none-the-less real. This is evident in the quotations above, which describe reactions to a presumed case of kala-azar. In contrast, focusing on a disease as a biological phenomenon involves an exploration of its aetiology and pathology in order to uncover the actual pathways and presence of a historical malady. All diseases have a consistent set of causes, symptoms, and infection pathways, whether those in the past were aware of them or not. Historians must be mindful of the fact that past descriptions of a disease or epidemic may differ from what actually happened on a biological level. In the quotations above, the extremely limited knowledge of the

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[196] *Manson's Tropical Diseases A Manual of the Diseases of Warm Climates*, ed. P. H. Manson-Bahr (London 1960), p. 132.
[197] A. Eteson, *Annual Sanitary Report of the Province of Assam for the Year 1884* (Shillong, 1885), p. 82.

disease at the time makes it impossible to know if it was in fact kala-azar they were suffering from. Equally, it is impossible to know with certainty if they were suffering from some other disease. Some historians have chosen to focus on diseases exclusively as a social phenomenon while still exploring the lived experiences of those in the past. Though this approach has merit, the biological aspects of disease were nevertheless present and played a role in many aspects of society. If they can, the biological presence and effects of disease should also be highlighted and examined to understand the narrative of the disease. My work is largely one of historical epidemiology, and I argue in this chapter that it is possible to determine prevelance and effects of malaria in colonial Assam and that the relationship between both the social history and the biological history of disease provides the most complete historical narrative.

Acknowledging both social perceptions and the biological aspects of diseases together emphasises the relationship between two methods of historical inquiry: social histories of disease and historical epidemiology. Social histories of disease highlight the fact that, as historian Paul Slack describes, many reactions to epidemics are based on 'perceptions' of disease, and in this sense, diseases are socially 'constructed'.[198] At the same time, the biological characteristics of a disease affect social perceptions. A work of historical epidemiology explores the biological aspects of disease, and the practice attempts to present a narrative of the past based on the actual disease not just contemporary perceptions. The works of Jim Webb are a prime example of historical epidemiology and offer an understanding of how historical epidemiology can work in tandem with social histories of disease to present an informed historical narrative of disease. As Webb wrote in his work *The Lone Struggle Against Malaria in Tropical Africa,* 'in order to get a

[198] P. Slack, 'Introduction', in T. Ranger and P. Slack (eds..), *Epidemics and Ideas: Essays on the Historical Perception of Pestilence,* p. 3.

fuller idea of the epidemiological realities, it is necessary to span the chasm between the natural sciences and the social sciences.'[199] This chapter of my project supports both methods of historical inquiry with the claim that diseases can be socially constructed and also exist as independent, biological actors in their own right. Connecting the two gives merit to both social histories of disease and the practice of historical epidemiology.

In practice, historians can understand disease based on modern scientific knowledge. When applied to the past, this information can be used to analyse and reveal aspects of disease in history that may have been previously misunderstood and misrepresented. For example, malaria is an intermittent or remittent fever caused by the presence of plasmodium parasites that are spread through the bites of anopheline mosquitoes. The disease usually follows typical seasonal trends, though there are some exceptions for periods of epidemic intensity. This understanding of malaria, however, was unknown until around the turn of the twentieth century, but descriptions of 'Fever' symptoms prior to that time suggest the presence of the disease that we now know as malaria. The claim that those in the past were in fact describing malaria becomes even stronger when other characteristics of malaria are noted, for example the fact that in Assam deaths from 'Fevers' tended to be highest during the rainy season, late spring into early autumn. It is now known that late spring to early autumn is the time of year is when malaria is at its peak prevalence in Assam. With these considerations in mind, it is possible for historians to see that when those in the past were describing 'Fevers', it is likely that they were in many cases describing malaria. This practice, however, has its limitations. With inaccurate knowledge, social perceptions of 'Fevers' in the past created imprecise definitions of malaria that unknowingly included other diseases. Many of the illnesses that were previously called 'malaria', 'malarial

[199] Webb Jr., *The Lone Struggle*, p. 13.

fevers', or even just 'fevers' would not now be classified as malaria; they are instead now considered separate diseases all together.

Kala-azar was one of these diseases, and the relationship between malaria and kala-azar in Assam during the last quarter of the nineteenth century exemplifies this larger tension in the history of medicine and historiography. When exploring the history of malaria in Assam, it is impossible to ignore the history of kala-azar as well. The two diseases were closely linked at this time; kala-azar was viewed as a complication of malaria and both diseases were placed into the catch-all category of 'Fevers' in medical records. The struggle of medical officers and the public alike to differentiate these diseases, provide treatment, and successfully control their negative social and physiological effects adds to the history of malaria and informs approaches to the history of disease in general.

In this chapter, I explore the reflexive relationship formed over time in colonial Assam between the social perceptions and biological realities of malaria and kala-azar. Attempts made in the past to understand malaria and kala-azar are broken down and considered alongside evidence that presents a rough indication of the actual presence and effects of each disease. Recognizing the relationship between the real and the perceived effects of a disease allows a historian to better explore the role of malaria in the history of colonial Assam. Malaria and kala-azar were widespread, deaths were numerous, and attitudes toward the diseases affected society on every level. Taken at face value, historical documents suggest that kala-azar had a much larger effect on life in colonial Assam during the last quarter of the twentieth century. When looking at both quantitative and qualitative data from the past and acknowledging the roles of malaria and kala-azar as non-human biological actors, it becomes clear that though kala-azar appeared to be deadlier and more prolific, malaria killed more people and played a significant, although underemphasised and often misunderstood role in the history of the province. The reasons for the

disconnect between the social perceptions and the biological realities of the two diseases are reflected in the various institutions and practices in colonial Assam. These defined the effects of the diseases whether or not historical actors were fully aware of what was happening.

Setting the Scene: Public Health in Assam Between in 1874 and 1897

Between 1874 and 1897, the priority of health and medicine in colonial Assam was to support colonial enterprises, specifically the tea industry. This highlights the fact that during the last quarter of the nineteenth century in Assam, public health campaigns paid little attention to malaria as it affected the general public outside of tea plantations. This almost exclusive focus on plantations distinguished Assam from other provinces of British India. There were, however, several changes in the province's approach to malaria and fevers between 1874 and 1897. Though public health in colonial Assam was still defined by its major industry (tea), dialogue among medical officers elevated the importance of research as research on 'Fevers' in the province increased. However, as is demonstrated later, the transition of this research into sanitary practice remained limited.

Eighteen-seventy-four was a significant year in the history of colonial Assam. It was the year in which Assam was separated from Bengal and made a province of British India in its own right. However, Assam and Bengal were already distinct in many ways. Though there were some similarities, they had different cultural practices, languages, and traditions. Assam had successfully avoided Mughal invasion centuries prior and, as described in the previous chapter, remained isolated from outsiders until the early nineteenth century. Assam and Bengal also had different economic structures. Both Bengal and Assam had tea plantations and a tea industry, but tea plantations in Bengal were far smaller than their counterparts in Assam and the Bengal

economy was more diverse.[200] Assam's geographic remoteness also left it relatively isolated with travel to and from Calcutta a lengthy and difficult endeavour for most of the nineteenth century. There is a continuous history of colonial Assam and a unique culture that existed before Assam and Bengal were separated. Despite these differences, Assam's separation from Bengal was still significant and a major break from the past. The establishment of Assam as an independent province ushered in a new era of governance and politics that allowed Assam to develop a unique, local approach to public health. This new approach should not be interpreted as better or more equitable, as the politics, process, and structure of public health were still influenced by colonial imperatives. But the issues that dominated questions of public health and sanitation often focused more specifically on concerns relevant to the governance of Assam rather than Bengal.

Governing Assam presented several challenges different from its neighbour, Bengal. Independence from Bengal came with the establishment of Assam's own provincial government and its own public health institutions. Provincial government institutions, notably including the Assam Sanitary Department, began a continuous, annual collection of data on disease. The advantage of a provincial Sanitary Department was clear, it allowed officials to focus their efforts on the diseases that they believed to be of primary concern to Assam specifically. The perspectives on sanitation during these early stages set the tone for the future of public health in Assam in the following decades.

In February of 1874, Colonel Keatinge took charge of Assam as the Chief Commissioner.[201] At first, the government declared that medical and sanitary matters were to 'be treated as before the construction of a separate administration for the Province of Assam', and

[200] Bhattacharya, 'The Logic of Location', p. 184.
[201] 'Assam Proceedings 1874, Home Department, February, No. 1', BL, IOR/P/1.

there was already a small foundation of work on government sanitation in Assam reflected in the Sanitary Report and Dispensary Report for Shillong made in 1873.[202] In July of 1874, in the Assam Proceedings for Sanitation, local commissioners were told not to communicate directly with the Sanitary Commissioner of Bengal.[203] Instead, they were to direct all communication to the Sanitary Commissioner of Assam which further distinguished the activities of the new provincial government from the past. The Assam Sanitary Department became one of several provincial sanitary departments across India and the provincial government received fairly regular updates on the sanitary work in the other provinces. In 1875, Assam received a copy of the Sanitary Report of the Hydrabad [sic] Assigned Districts for the year 1873.[204] In 1878, the province received copies of the Punjab Sanitary Report for 1875, British Burma Sanitary Report for 1875, and the Madras Sanitary Report for 1875.[205] Despite their awareness of the sanitary operations in other provinces, the priorities of the new department were distinctive.

When examining the Sanitary Reports from Assam, it is evident that in this early stage the administration had two primary motivations. The first was establishing, maintaining, and developing the network of hospitals and medical care in the province. In short, expanding the system of and access to medical treatment in colonial Assam. The second priority was disease prevention through sanitation, which mostly took the form of addressing the impacts of disease on the tea industry. In the Sanitary Report of 1876, malarial fevers were identified as the chief cause of illness and death, but it was believed that,

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[202] 'Assam Proceedings 1874, Home Department, Tabular Statements, February, Nos. 57 and 62', BL, IOR/P/1.
[203] 'Assam Proceedings 1874, Sanitation, July, Nos. 6 & 7', BL, IOR/P/1.
[204] 'Assam Proceedings 1875, Misc., Tabular Statements, March, Nos. 310 & 311', BL, IOR/P/1.
[205] 'Assam Proceedings 1878, Misc., Tabular Statements, January, Nos 16 & 17', BL, IOR/P/1131.

> the physical geography and meteorological conditions of the province furnish natural causes for the prevalence of the disease. Heavy rainfall, swamps and rivers formed by the watershed of numerous hills, and the very large and disproportionate area of jungle and swamps to cleared and cultivated land, provide sources of production of malaria.[206]

In other words, the environment was believed to be the cause of malaria. The clearing of jungles for tea cultivation, however, was believed to have a positive effect on the health of an area; in some cases, by 'reducing the mortality amongst imported garden coolies to one half in the second year'. Sanitary efforts regarding malaria in Assam were directly related to the tea industry and at this point in time did not extend much to the population of Assam outside of the plantations. Despite the limited scope of sanitary policies in Assam, the reduction of malaria in the tea industry was still crucial. After observing some of the improvements in reducing malaria through sanitation, Sanitary Commissioner of Assam in 1876 W. H. Adley wrote,

> The mortality in the early years of the tea industry was proportionately so high, that the undertaking was looked upon as a penal employment or forlorn hope, -the originators of gardens, if resident owners, seldom surviving to reap the fruits of their labour. In Lakhimpur and Cachar, except in more distant gardens skirting the terai, the average health of Europeans is now in no degree inferior to that of planters in the indigo districts of Bengal or Behar. With extended clearances and as a natural consequence diminished rainfall, sanitary prospects are likely to further improve.[207]

The modus operandi of the Sanitary Department in Assam also extended to other diseases. Cholera was the considered the second highest cause of mortality in Assam in 1876, but medical officers claimed that the disease was 'usually confined to congregations of garden coolies'.[208] The provincial government's management of disease prevention and sanitation in the 1870s was defined by improving the health of those living on/traveling to tea plantations. With this in mind, it is important to note that the general population of Assam had their own approaches to disease and that the sanitary plans of the government at did not extend into the community at large

[206] Adley, *ASRPA 1876,* p. 48.
[207] Ibid., p. 48.
[208] Ibid., p. 49.

beyond some drainage works in the cities of Guwahati and Shillong. Diseases like ‘Fevers’ were believed to be endemic to Assam and only became the concern of the government when cases and deaths threatened colonial enterprises. This was a defining characteristic of the Sanitary Department and shaped public health in colonial Assam in the following decades.

The fact that the government was mostly preoccupied with the health of tea plantations and not the general public meant that the Assam Sanitary Department was viewed by other medical officers in India as a unique colonial outpost where those in charge of sanitation had only a limited sphere of influence. This led to the perception that disease prevention and sanitation in Assam was a colonial backwater and that those practicing medicine were outside of major public health discourse in India. Issues of public health in colonial India (then referred to as issues of sanitation) and debates over medical theories of disease were steeped in political battles that reinforced these associations. In the 1870s, many medical professionals lacked a precise understanding of the aetiology and pathology of several diseases in addition to malaria. Theories of disease aetiology and pathology undergird public health campaigns and debates over both medical theories and public health policies were often fierce. Different researchers and medical officers competed to promote specific theories and the corresponding public health policies. Medical officers in British India who did not align with dominant norms were sometimes silenced by being reassigned to positions in Assam where the outcomes of sanitary policy were politically insignificant.

A. C. C. DeRenzy was a medical officer who was silenced in this manner. As the Sanitary Commissioner of the Punjab, DeRenzy was engaged in a long-lasting sanitary debate with the Sanitary Commissioner of India, J. M. Cuningham. DeRenzy was a supporter of the idea that cholera was transmitted through water, called the waterborne theory. Though the waterborne theory of cholera was originally developed by John Snow in the 1840s, the theory was not

universally accepted and remained unpopular in India until the 1880s.[209] Cuningham rejected this theory of cholera transmission; he was a noted 'anti-contagionist' and believed that cholera was spread through other means such as climatic conditions, not through water.[210] Though based in scientific rhetoric, in many ways the crux of the dispute was political. Addressing cholera as a waterborne problem required costly (i.e., water-works, etc) and often disruptive sanitary measures. If cholera was instead caused by climatic conditions and not contagious from person to person, the corresponding sanitary measures would be less disruptive to people's lives. DeRenzy and Cuningham's public and professional dispute over the cause of cholera took many forms including conflicting scientific articles, differing calls for sanitary studies and policy, and impassioned dialogue, and the topic has been covered extensively in modern historiography with notable historical works from David Arnold and Mark Harrison published in the early 1990s.[211]

At the conclusion of the years-long debate, DeRenzy was reassigned from the Punjab to Assam where he became the Sanitary Commissioner from 1877 to 1879.[212] This transfer was at the behest of Cuningham and akin to banishment.[213] Though DeRenzy was able to continue his work in Assam, the Government of India was confident that DeRenzy's sanitary recommendations would be constrained by local issues in Assam. Cholera was a concern for people in Assam as it was for millions in India, but medical officers in Assam were more devoted to addressing the issue among tea plantation labourers, specifically immigrant labourers in transit,

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[209] A. C. C. DeRenzy, 'Sanitary Improvement in India.' *The British Medical Journal* 2/616 (1872), p. 436.
[210] Arnold, *Colonizing the Body*, p. 192.
[211] See Arnold, *Colonizing the Body*, p. 192, and Harrison, *Public Health in British*, pp. 102-5, 110, 231.
[212] DeRenzy, *ASRPA 1877.*, A. C. C. DeRenzy, *Annual Sanitary Report of the Province of Assam 1878* (Shillong 1879)., A. C. C. DeRenzy, *Annual Sanitary Report of the Province of Assam 1880* (Shillong 1891).
[213] J. C. Hume Jr., 'Colonialism and Sanitary Medicine: The Development of Preventive Health Policy in the Punjab, 1860 to 1900.', *Modern Asian Studies* 20/4 (1986), p. 717.

than the general public. Therefore, DeRenzy's sanitary recommendations would be less likely to lead to social unrest in Assam where the policies were limited to the tea industry. Within these pursuits, the provincial government had a larger ability to implement changes without the same pushback in other parts of India and even other parts of Assam where the response of the general public to sanitary measures was sometimes more volatile.

DeRenzy continued his work in Assam and, though it was considered controversial by some, it was considered ground-breaking and positive by others. In the Memorandum by the Army Sanitary Commission on the Assam Sanitary Report for 1877 in the Assam Proceedings of 1879, it was noted that DeRenzy's work provided the most comprehensive and practical assessment of health in Assam to date. This was an issue of particular importance to the army which often suffered heavily from deaths due to disease. The heading of 'Fevers' was highlighted as a particularly problematic category, but DeRenzy and the Army Sanitary Commission believed that malarial fevers caused the largest number of deaths in the province. According to DeRenzy and the Army Sanitary Commission, the problem with developing and implementing effective sanitary policies in colonial Assam was that most of the information on the province was limited to the tea plantations. There were calls to increase the collection of vital occurrences in the province by improving the measures in which locals across Assam, not just on tea plantations, reported deaths. In the opinion of the Army Sanitary Commission and DeRenzy, more information would help disambiguate the category of fevers and help both the general population of Assam and the development of the tea industry. As a result, it was recommended that tea-planters should help to pay for sanitation in Assam; a reflection of the close ties between tea and public health in the province both in the 1870s and long after.[214]

[214] 'Assam Proceedings 1879, Home Department, April, No. 61', BL, IOR/P/1271.

Historian Arnab Dey outlines the specifics of DeRenzy's recommendations and the impact on cholera within the province. Like many other historians of medicine, Dey notes that cholera was a political disease, but DeRenzy's work on cholera highlights 'additional semantic burdens-namely legal, economic, and structural', that were all specific to Assam and shaped cholera policy.[215] Dey argues that DeRenzy's influence on cholera in Assam was short lived, and the evidence for this claim is supported by the fact that DeRenzy left Assam without creating lasting sanitary recommendations. Dey notes that J. J. Clarke, Sanitary Commissioner of Assam in 1883, argued for policies that were shaped by Pettenkofer's theory of cholera rather than the waterborne theory espoused by medical officers such as DeRenzy.[216] Ultimately, it was not until Robert Koch's discovery of the cholera bacillus in 1884 that public health in India as a whole began to use the waterborne theory of cholera to undergird sanitary campaigns.[217] Nevertheless, DeRenzy's posting in Assam is representative of the very early stages of sanitation in the province and the development of public health in future decades. Though DeRenzy failed to make lasting changes to cholera policy in colonial Assam, his advocacy of a more comprehensive collection of vital occurrences in the province was echoed by other members of government and had a lasting legacy for public health in Assam particularly regarding 'Fevers' and malaria.

DeRenzy's reassignment to Assam is significant because it reflects how disease prevention in Assam was situated within India and the British empire. A major point to consider is the fact that DeRenzy's reassignment to Assam was a punishment. It was assumed that

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[215] Dey, 'Diseased Plantations', p. 568.
[216] Dey, 'Diseased Plantations', pp. 660-661.
[217] This transition, however, was not immediate and there was still some resistance to the waterborne theory of cholera even after the discovery of the cholera bacillus. C. Macnamara, 'A Lecture on Asiatic Cholera Delivered at the Westminster Hospital, March 4th, 1884 by C. Macnamara, F.R.C.S., Surgeon to the Hospital.' *The British Medical Journal* 1/1211 (1884), p. 504.

DeRenzy would not be able to have the same impact on public health discourse in Assam as he would have had as the Sanitary Commissioner of the Punjab.[218] Assam was relatively remote, as previously discussed the intended recipients of sanitary policy were less resistant to intrusive or radical sanitary policies (they were mostly tea plantation labourers), and restrictive sanitary initiatives were less likely to threaten the political stability that the Government of India strove for. Second, as Dey claims, Assam was situated in a unique landscape of public health. Assam's own economic, social, and political burdens provided certain constraints on the actions of medical officers stationed in the province. Together, these points support the argument that Assam was located outside of dominant dialogue of public health in India because of its peripheral status and its geographic and political landscape of public health.

Sanitation in Assam was not considered important or worth paying much attention to in other provinces in India and examining these attitudes towards disease treatment and prevention in colonial Assam is an essential yet underexplored component in the history of public health in British India. Though DeRenzy's time in Assam reveals the peripheral political position of public health in colonial Assam, the story underscores the argument that Assam developed a unique approach to sanitation during the final quarter of the nineteenth century. Assam's public health practices may have been considered less important or influential by the Government of India at the time, but the actions of the medical officers in Assam still affected the lives of the millions of people who lived in the province. Studying the history of disease in Assam during this period informs approaches to the history of medicine on the peripheries of empires, the general history of malaria, and the history of colonial Assam.

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[218] Hume Jr., 'Colonialism and Sanitary Medicine', p. 717.

A lot changed in colonial Assam between 1874 and 1897. In 1897, portions of Assam were relatively easier to travel to and from due to the development of the railway network, and the medical officers were more involved in all-India discourse on disease than when DeRenzy was transferred to the province over twenty years prior. In 1874, there was a relatively poor understanding of the presence of diseases and most of the efforts to decrease mortality and morbidity were dedicated to keeping tea plantations healthy, not necessarily to keep the general population healthy. Maintaining tea plantations was still a priority that guided sanitary policies in Assam in 1897, but at this point there was a better understanding of the general presence of disease in the province as a whole. Many of these changes occurred as a result of the challenges faced in the problem of 'Fevers'. Researchers were sent into the province to study 'Fevers' and there were efforts to connect the findings in Assam to diseases in other parts of India and around the world.

1897 was also a watershed year for the history of malaria and for the history of kala-azar. Sir Ronald Ross made his landmark discovery in 1897: that mosquitoes were the vector of malaria. After that point, the role of mosquitoes was a factor in conversations of public health and the aetiology of malaria was slowly uncovered.[219] 1897 was an important transition in the history of kala-azar in Assam. Leonard Rogers, I.M.S., published a comprehensive report on kala-azar. As will become clear in this chapter, Rogers mistakenly argued that kala-azar was a form of malarial fever though they are now understood to be two completely separate diseases. Nevertheless, his work elevated the issue of kala-azar beyond Assam and gave the province a sense of confidence in the belief that they could successfully prevent the disease. Though some of

[219] There were limitations to the influence of Ross' discovery on policies in Assam that are discussed in the next chapter.

his suggestions were ultimately incorrect and the aetiology of kala-azar continued to elude researchers for several more years,[220] the efforts were a positive step in developing public health policies that addressed 'Fevers' and malaria. This was a major shift in Assam which had previously been resigned to tolerate the annual toll fevers took on the province with limited public health support.

Malaria, or 'Fevers', became an issue of greater concern among both medical officers and the general public during the last quarter of the nineteenth century in colonial Assam. This was because 'Fevers' were *perceived* to be an issue of increasing concern. This did not mean that 'Fevers' actually grew in intensity during this time period. In fact, they remained relatively stable. The average number of deaths attributed to fevers as a percentage of total deaths was 53%, and the median percentage was 55%.[221] 'Fevers' were the primary cause of disease related death in Assam, but they were interpreted by the governors in Assam as a regular part of life, although a particularly deleterious one. Nevertheless, the perception that malaria was an issue of concern was not completely unwarranted and kala-azar played a significant role in the development of this narrative.

The previous chapter focused on the presence of 'Fevers', likely malaria, in Assam in a somewhat abstract way because the total numbers of cases and deaths are impossible to accurately quantify. With the collection of mortality and morbidity statistics that began in Assam in the 1870s, it is possible to gain a data-driven approximation of the presence of malaria. The collection of the statistics is also evidence of the interest of the Sanitary Department in gaining a numerical understanding of the impact of a range of diseases. During this period, malaria went

[220] It was not until 1903/4 that the parasite that caused kala-azar was discovered and several more years until it was understood it was spread through the bite of a sandfly.
[221] See Annual Sanitary Reports of Assam between 1874 and 1897.

from an obscure problem to an acute issue. Though the issue of malarial fevers had existed for generations, it was not taken seriously until the last quarter of the nineteenth century. The reason for this change in the perceived threat of 'Fevers' to the province, however, was actually because of another disease, kala-azar, not malaria.

Kala-azar, or visceral leishmaniasis, was likely present in Assam before the colonial period, but the disease was first named and described during the last quarter of the nineteenth century. Kala-azar, as it was known in Assam, is caused by an infection of the *Leishmania donovani* parasite that is spread through the bite of a sandfly. It is important to note that not all Leishmania donovani infections will induce symptoms, but when symptoms are present death was highly likely and medical intervention in the nineteenth century was unable to provide appropriate treatment. Kala-azar had a higher case fatality rate than malaria but malaria killed more people in Assam and the total mortality from malaria was likely higher. These facts, however, were not known for the duration of the nineteenth century.

Outbreaks of kala-azar were noticeably different from malaria. Though both were endemic diseases, malaria was ever present and residents of Assam were used to living with the effects of the disease. Kala-azar, however, appeared in distinct outbreaks that struck fear into the hearts of the population- particularly in the 1880s. These outbreaks encouraged researchers to try to understand what kala-azar was and what was causing such an uproar among the locals. Many of these initial investigations were prompted by the tea companies which saw unrest in their labour force.

Modern knowledge of kala-azar from disease historians in 1981 allows one to better understand trends of kala-azar and therefore distinguish the disease from malaria. Kala-azar was widely believed to be endemic to Assam, the first known cases epidemiologically recorded were in the Garo Hills in 1870. The disease was also widely believed to be spread along the

Brahmaputra River due to its alluvial soil. P. K Bhattacharyya's work has a much more epidemiological focus rather than a historical one, but Bhattacharyya notes that kala-azar had a peculiar pattern: it would be somewhat moderate for years and then break out in epidemic intensity abruptly.[222] In light of what modern research has revealed about the spread of the disease, historians have done little to use this point to explore kala-azar as a biological actor in colonial Assam.

Unlike international campaigns to address other diseases that had a global presence, for example cholera, efforts to address kala-azar were unique to Assam because the disease was then unknown in other parts of the globe.[223] In this sense, kala-azar and the development of public health practices in Assam regarding fever took on a unique form. This practice extended to malaria as the trends and policies were distinct from other parts of India. Medical officers sought to address the problem of 'Fevers' because of their fear of kala-azar. This fact must be considered alongside the argument that it was actually malaria, not kala-azar, that contributed to the bulk of 'Fever' deaths, and that the province's attention on kala-azar defined a relationship with malaria different from other provinces in the Raj.

Historiography

Much of the written scholarship on disease in colonial Assam focuses primarily on social perceptions of diseases and how they relate to structures, institutions, or specific peoples. This form of analysis has provided useful insights: the economic structure of colonial Assam was dominated by tea and other exports, and the province's relative position on the periphery of the

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[222] P. K. Bhattcharyya, 'Distribution of Kala-Azar in India', *Transactions of the Royal Society of Tropical Medicine,* 75/2, (1981) p. 333.

[223] It should be noted that visceral leishmaniasis, the disease commonly called kala-azar, was present in other parts of the world, but this fact was unknown to contemporary medical officers in Assam who approached the disease as if it was unique to the province.

British Empire fostered unique dynamics between the organization of society and its relationship to disease. In *Waste Land Settlement in the Brahmaputra Valley of Assam (1838 to 1921),* A. Goswami focuses on the development of the Brahmaputra Valley in Assam and explores kala-azar in its relationship with Assam's colonial development. The Brahmaputra River is the main waterway of Assam and Goswami argues that many of the attributes of the river are linked to various diseases including malaria and kala-azar. The river's alluvial soil provides ideal breeding grounds for both mosquitos (the vector of malaria) and sandflies (the vector of kala-azar). Goswami acknowledges that diseases such as kala-azar are endemic to Assam and even claims that outbreaks of the disease during the beginning of the 19th century combined with the Burmese invasion caused severe depopulation prior to the colonial period.[224] According to Goswami, it was the colonial time period and the importation of labourers from other parts of India to suit needs of the new economic structure in Assam that shaped the demographics. This fundamental claim is key to Goswami's approach to malaria, kala-azar, and disease in Assam during the colonial period. Goswami argues that western capitalists and planters viewed the climate of Assam as detrimental to the cultivation of their crops. According to Goswami, many labourers, especially those imported from parts of India with a drastically different climate to Assam, suffered from malaria and kala-azar which was a severe financial burden to planters.[225] As a result, there was a push to recruit and favour labourers from populations with a believed inbuilt resistance to the tropical diseases of Assam.[226] Goswami also makes the fundamental claim that the push to combat diseases in Assam like malaria and kala-azar sparked an improvement of the

[224] A. Goswami, *Waste Land Settlement in the Brahmaputra Valley of Assam (1838 to 1921),* (Gauhati, 2001), p. 67.
[225] Ibid., p. 106.
[226] Ibid., p. 110.

medical facilities.[227] These assertions rely on the fundamental connection made between the death of labourers, the planter's loss of money, and therefore a concerted effort to improve the health of the population in Assam as a result.

Goswami's emphasis on labour when exploring diseases such as malaria and kala-azar is fundamental to understanding the broader structures in colonial Assam, but his assertion only focuses on one side of history: how disease affects labour and wider societal organization. There can be no denying that a loss in revenue on plantations from labourers out sick or dead was a cause for concern, but Goswami is approaching the history of disease by only acknowledging contemporary perceptions. The interactions between the plantations and diseases helped define both malaria and kala-azar just as much as the existence of malaria and kala-azar defined life on and the management of plantations. For Goswami, diseases such as malaria and kala-azar do not need to be defined in such hard terms because his work is not historical epidemiology, but neglecting the role labour, colonial development, and economic structures in Assam affected the ways malaria and kala-azar were understood and viewed is a mistake. A reflexive relationship acknowledging both the social and biological aspects of disease must be added to discussions on the history of disease and of Assam.

Kala-azar and malaria are both endemic to Assam, but they operated in different ways with different rhythms. Although cases of malaria fluctuated based on the month and dominant weather trends, there was a consistent presence of the disease that repeated itself roughly on an annual pattern. Increases or decreases in mortality and morbidity did not deviate from the usual trends. Likely because of its predictable patterns, endemicity, and acquired or innate immunity, malaria was not viewed as a life-threatening cause for immediate alarm, rather a normal, albeit

[227] Ibid., p. 154.

taxing, part of life. Perhaps due to its behaviour as an endemic, predictable disease, some contemporary researchers in Assam did not even consider malaria contagious, although it should be noted that debates were quickly mounting with evidence that malaria was in fact contagious.[228] Early yet imprecise attempts to differentiate malaria and kala-azar came from the belief that kala-azar was likely contagious, and malaria was thought not to be.

Even as modern scholarship has expanded to add valuable insights into the history of infectious disease in colonial Assam, failure to acknowledge the reflexive relationship between disease and other aspects of life continued in modern historiography. In his 2018 chapter 'Tracking kala-azar The East Indian Experience and Experiments', Achintya Kumar Dutta discusses the place of kala-azar in the medical historiography of British India. Dutta supports the idea that during colonial rule, colonial policies, structures, and attitudes are often responsible for the outbreak and severity of epidemics.[229] This idea is not a new one and is closely connected to other arguments from historians such as Ira Klein on the influence of colonial rule on disease. Kala-azar is different from other diseases such as malaria, however, because there is no proven connection between the spread of kala-azar and the climate. There is, however, an environmental connection because of the sand-fly vector. The presence of sand-flies could not be the direct result of British interference in Assam because sand-flies existed in the area long before the British. Dutta argues that black fever, another term for kala-azar, increased as the direct result of the expansion of the tea industry in Assam and other commercial enterprises during the late

[228] G. M. Giles, *A Report of an Investigation into the Causes of the Diseases Known in Assam as Kala-azar and Beri-Beri* (Shillong, 1890), p. 40.
[229] A. K. Dutta, 'Tracking Kala-Azar The East Indian Experience and Experiments', in Biswamoy Pati and Mark Harrison (eds.), *Society, Medicine and Politics in Colonial India* (London, 2018), p. 291.

nineteenth century.[230] This assessment is consistent with the opinion of researchers in colonial Assam; Leonard Rogers argued that the disease spread as a result of infected tea-garden workers moving from one location to another.[231]

Dutta focuses primarily on the perception of kala-azar and his conclusions must be refined to include a new, more informed interpretation of epidemiological data. He assumes that the kala-azar mentioned in contemporary reports is the same kala-azar as it is understood biologically in the twenty-first century. Dutta notes that the assumed mortality rate was about 95 per cent, a key feature of kala-azar.[232] According to Dutta, 'the mortality from kala-azar was so serious in Assam that it was difficult to gain any exact idea of the absolute number of deaths it had caused. Depopulation and desertion caused by kala-azar adversely affected cultivation and land had lost its value. The decrease of cultivation also resulted in a corresponding loss of revenue.'[233] He argues that the affect kala-azar had on tea populations was the first sign that alarmed the government. Deaths from fever, including kala-azar, did affect tea plantations in many ways, but it would be wrong to assume that it was only kala-azar at work, and easy to over-emphasize the influence of kala-azar.

Kala-azar was cited as the reason for changes in the society of Assam, but this is an example of the disease viewed as a singular social phenomenon and a limited conclusion that does not acknowledge the role of malaria. Claims like Dutta's must be broken down and understood within their historical context. Kala-azar was a name given to a social phenomenon in colonial Assam. Many individuals died with fever as a primary symptom, but it was extremely difficult to tell the difference between kala-azar and malaria for much of the nineteenth century,

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[230] Ibid., p. 293.
[231] Ibid., p. 293.
[232] Ibid., p. 295.
[233] Ibid., p. 296.

and there was plenty of confusion. Blackening of skin, the symptom from which kala-azar got its name, was present in only some cases, and though kala-azar is much more lethal than malaria, methods of differentiating the diseases were too imprecise to draw concrete conclusions. In reality, malaria was also a factor with an unexplored and underemphasised impact on life.

Dutta describes the epidemic of kala-azar in Assam as a holocaust and argues that it was this fear that inspired the action of the Assam government to successfully combat the disease. Fear of kala-azar did spur an increased emphasis on combatting fever related deaths, but it was fear of the social construct of kala-azar, not kala-azar as a biological phenomenon, that was the true source of the changes. Dutta claims that kala-azar was more prevalent in Assam than malaria until 1930.[234] This claim is impossible to substantiate, likely false, and completely ignores the effects and presence of malaria. It is true, malaria and kala-azar mortality and morbidity were both categorized under the heading of 'Fevers', but malaria affected and killed a much larger portion of the population of Assam than kala-azar. Data from the second quarter of the twentieth century, when epidemiologists were able to more accurately track malaria, reveals a pattern that is consistent throughout every year epidemiological statistics were recorded on fevers in Assam. This pattern indicates a continuous presence of malaria in Assam that remains unaltered in its seasonal regularity even during years when incidences of kala-azar were reduced and malaria increased.

Dutta spends a large amount of time exploring the impact of colonial health policy on Indian society. In general, opinions among historians are divided. Many scholars, including Radhika Ramasubban, Poonam Bala, Anil Kumar, Kabita Ray, V. R. Muraleedharan, Chittabrata Palit, Deepak Kumar and others argue that the primary motivation for health policy was the needs

[234] Ibid., p. 299.

of the Europeans, not an ethically driven desire to help the general population of India. Other historians, such as Mark Harrison, argue that this perspective is too simplistic.[235] One ought to be sceptical of colonial claims, however one can't entirely dismiss the fact that many colonial officials believed they were acting in the best interests of Indians. In other words, it came from a sense of their 'civilising mission' – a kind of paternalism. If this isn't acknowledged, then one cannot fully understand why people acted as they did. One also needs to acknowledge that there were different views within the colonial administration about what sanitary/medical intervention could achieve. Society in colonial Assam was built to prioritize colonial activities and the structures established traditions that defined all manner of phenomena, including disease. Though paternalistic and complicated by imperial motivations, Assam's relationship with malaria is not straightforward.

Dutta spends a lot of time looking at why exactly many of the efforts to combat kala-azar failed. He attributes this failure largely to the apathetic attitude of the government, exemplified by researchers in colonial Assam such as Ross on malaria, Haffkine on cholera and by the Bhore Committee (a health survey in India in the 1940s).[236] 'Medical research in India did not receive priority, and it was secondary to political and economic imperialism.' He also argues that, 'These colonial medical institutes had undoubtedly contributed to the extension of medical knowledge in British India, and it is hard to deny their contributions even in post-independence India. But the development of medical science and the public health system in British India was not an organic one.' 'The government seems to have been reluctant to provide requisite funds for kala-azar

[235] Ibid., p. 294.
[236] Ibid., p. 304.

research in India.' One of the main questions Dutta struggles with is that 'arguably, western medicine had the efficacy to successfully fight against it [kala-azar]'.[237] So what stopped them?

Colonial governance in Assam and institutions such as the provincial Sanitary Department viewed disease through a particular lens. Historians often speak of the 'politics of profit' that dominated perspectives in colonial Assam. Historian Arnab Dey argues, 'ideas of mortality, death, and well-being exceeded-indeed, had to exceed-instrumental logics of scientific objectivity, imperial sanitary policy, vector identification, and preventive cure in the estates. It was shaped by the expedient exegesis of medical knowledge, law, commercial interest, and idioms of corporeality'.[238] Dey's work breaks down the social history of colonial Assam, and he notes that the medical history of colonial Assam is tied to all other aspects of society.[239] This chapter attempts to further support Dey's perspective and approach and highlights the unknown actors at play in colonial Assam. Identifying these unknown agents is important in understanding reactions, one should not simply view disease as social phenomena. The relationship between all the actors in the history of colonial Assam can help inform why certain decisions were made and better understand the social structures that define their actions.

The Recorded Origin of Kala-azar

The actual origin of kala-azar is difficult to determine. As a biological entity, the disease likely existed in Assam long before the nineteenth century, but first accounts of the disease in colonial reports do not appear until the 1860s in the Garo Hills (a district of Assam), and these accounts referred to problems with the government securing revenue in the affected areas- they

[237] Ibid., p. 306.
[238] Dey, 'Diseased Plantations', p. 681.
[239] Ibid., p. 680.

were not medical in nature.[240] Locals living in the region described periods of epidemic intensity varying between 3 and 30 years. Colonial administrators at the time believed the disease was linked to malaria, a suspicion based on the environmental characteristics of the localities where outbreaks occurred. 'The disease is most intense, where the low, densely-wooded Garo Hills join on to the low-lying Central Assam plain, a position par excellence the most favourable for malarial developments'.[241] Contemporary administrators stated that the disease 'decimated' and 'depopulated' many areas across the Garo Hills, stark descriptors for society's reaction to a disease. For roughly the following twenty years from these incidents in the 1860s, the disease failed to make an impression across the wider landscape of Assam and was confined mostly to the Garo Hills. Being a relatively localised disease, it was probably of little interest to colonial administrators outside the Garo Hills.

The first descriptions of the symptoms of kala-azar were published in 1882 because 'the hill tracts of Khasi and Jainta and the station of Tura were first brought under the system in 1882 only'.[242] Attention to the disease came from fear that kala-azar was depopulating large tracts of the Garo Hills and that it might spread. Locals in the Garo Hills believed kala-azar was a form of malarial sickness, naming it after the blackened colour skin turns in severe cases, and considered the disease highly contagious. It was not uncommon for locals to separate those ill from everyone around them in an attempt to mitigate the spread of the disease.[243] Mr. McNaught, the medical officer at Tura, was the first to detail what was believed to be the primary symptoms of kala-azar.

> It begins with a high temperature, severe pains in the head and body, loss of appetite, and other symptoms of a general febrile condition: fever sometimes of anguish form and

[240] J. J., Clarke, *Annual Sanitary Report of the Province of Assam for the Year 1882* (Shillong, 1883), p. Appendix A.
[241] Ibid., p. Appendix A.
[242] Eteson, *ASRPA 1884*, p. 1.
[243] Clarke, *ASRPA 1882*, p. 21.

> sometimes fever without remission for many days together. The spleen and the liver enlarge, the skin becomes gradually darkened, and in advanced cases there often is haemorrhage from the nose and gums; oedema of the feet, or general dropsy, is likewise common, and life ends by a combination of disordered functions known as malarial cachexia.[244]

The most notable of the symptoms McNaught listed were fever, swelling of the spleen and liver, and oedema.

Though kala-azar was commonly discussed among the locals and colonial administrators in the Garo Hills, the disease drew wider attention in the Sanitary Reports because of a peculiar trend in deaths from fever. By 1882, in Assam as a whole, rates of deaths by fever were at the expected level for the area. Deaths were high, of course, but the perspective on fever expressed a sense of realistic acceptance. The report states that 'fever mortality is a constant quantity with which we have to reckon throughout the year.'[245] Malaria was believed to be the cause of the vast majority of fever deaths and was linked to a number of phenomena: 'Dense jungles, decomposing vegetation, a water-logged soil, obstructed drainage, areas in many districts for months under water, poor habitations, are among some of the conditions under which people live, and, therefore, we may always look for a high mortality from malarial cases.'[246] These factors were present across Assam, leaving little room for administrators to distinguish fever deaths between regions. The Garo Hills was no exception in its ecology and the lifestyle of the inhabitants, but deaths by fevers exhibited peculiar trends. These, coupled with the local awareness of kala-azar, pushed the disease into the spotlight.

The presence of kala-azar in the Garo Hills was also noted in the Assam Proceedings of 1882. One of the major issues highlighted in the Resolution of the Garo Hills Administration

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[244] Ibid., p. 21.
[245] Ibid., p. 21.
[246] Ibid., p. 21.

Report for 1882-1883 was the fact that the cultivated lands in the temporarily settled areas did not yield the same increase as in other locations in Assam. The largest contribution to 'this unsatisfactory result' was attributed by the Deputy-Commissioner as caused by 'the ravages of kala-azar'.[247] Unfortunately, very little was known about kala-azar and McNaught's enquiry into the disease was the only medical study. The Garos themselves were often hesitant to seek western medical attention, and the Sanitary Commissioner suggested that little could be done other than moving villages to the highest sites possible away from jungles and waterlogged areas; if possible, the Sanitary Commissioner recommended that the waterlogged areas should be drained. Overall, the approach to kala-azar in the Garo Hills was the same as the approach to malaria elsewhere, as kala-azar and malaria were considered related. 'Of these causes, the prevalence of kala-azar is incapable of remedy by the action of Government; it may be hoped that, as the margin of cultivation and cleared land advances into the jungle, it will expel the malaria.'[248]

Research at the time linked kala-azar to malaria and described it loosely as a particularly intense form of malaria. 'At present more cannot be said than that from the cases recorded: the opinion has been arrived at that kala-azar is a cachexia produced by malarial fever, deriving its peculiar characteristics from the nature of the region where it prevails, and having a singular tendency to run rapidly into the cachexial stage'.[249] The relationship administrators drew between kala-azar and malaria by 1882 was formed by a similarity in symptoms, particularly those outlined by McNaught in the Garo Hills. Another key factor was the locality of the disease. Locals believed kala-azar was contagious and acted accordingly. This conflicted with opinions on

[247] 'Assam Proceedings 1883, Home Department, July 1883, Garo Hills Administration Report for 1882-1883, No. 2', BL, IOR/P/1985.
[248] 'Assam Proceedings 1883, Home Department, July 1883, Garo Hills Administration Report for 1882-1883, No. 2', BL, IOR/P/1985.
[249] Clarke, *ASRPA 1882,* p. Appendix A.

malaria at the time, which was often associated strongly with environmental factors. Ultimately, it was quantitative trends in fever that set kala-azar apart from malaria, and researchers attempted to differentiate kala-azar from malaria based on the symptoms of the two diseases.

Attempts to Differentiate Malaria and Kala-Azar Based on Symptoms

In the Assam Sanitary Report of 1884, administrators were arguing that the 'Fevers' category was convoluted; in short, too many diseases could fit under the heading of 'Fevers'.[250] Administrators had a difficult time disambiguating any fever data, let alone trusting the reliability of the statistics.[251] According to the Sanitary Report,

> The body of registrars name fever as a cause of death simply because there has been a symptomatic increased temperature sensible to an ignorant observer. Nearly half the Province are put down to fevers. Perhaps one-third of these are climatic or malarial and due to natural causes under which the people must live and die for generations to come; a third are probably due to the habits of the people, their insufficient clothing and bedding, their exposure, their food, and privations; and the remaining one-third would, under a more perfect system of registration, be entered under other classes of disease.[252]

There was an intense desire to differentiate and distinguish between all of the diseases within the 'Fevers' category, but challenges collecting accurate epidemiological data, lack of finances, and even challenges traveling and communicating with groups throughout Assam made it difficult.

A. Eteson M.D., Sanitary Commissioner of Assam in 1884, called for special attention to be given to kala-azar in the Garo Hills and the Goalpara district based on the increase in fever deaths from 1882 to 1884. Eteson noted an increase in Goalpara while other districts remained relatively constant. It is difficult to know exactly whether fever deaths increased in Gaolpara between 1882 and 1884, there was a difficulty compiling accurate statistics and the district lacked

[250] Eteson, *ASRPA 1884*, p. 21.
[251] Ibid., p. 20.
[252] Ibid., p. 21.

a hospital, but the general attention local administrators paid to fever deaths and the paranoia surrounding kala-azar was enough to bring the state of affairs to the attention of the Sanitary Commissioner.[253] While the statistics were notably unreliable, local police officials in Goalpara kept coming across deserted villages caused by natives fleeing at any possible sign of kala-azar.[254] Eteson hoped that if a hospital was built, patients suffering from kala-azar could be treated at the central location and the general distress might ease.

> It has been one of the most unfortunate aspects of this epidemic that the disease was commonly believed to be hopelessly fatal and contagious; with the result that villages were abandoned if a single death took place, and that among the Garos the sufferers were not merely shunned, but actually removed to the jungle and left to die of starvation or wild animals.[255]

The Chief Commissioner of Assam supported the call for a dedicated researcher to be sent to Assam, but the Government of India could not afford to spare a special medical officer. Instead, the Government of India entrusted the work to Surgeon E. Dobson, who was to carry out the research in kala-azar alongside his normal duties in charge of civil medicine in Goalpara.[256]

In 1884, knowledge of kala-azar was very limited. McNaught's description of the symptoms from 1882 was well known, but by 1884 he was transferred to Nowgong due to 'ill health', and his knowledge of the disease as well as his ability to communicate with the native people in the Garo Hills and Goalpara could no longer be an asset to kala-azar researchers in the area.[257] Administrators were questioning how prevalent kala-azar was, whether it was a 'special or local type of fever', whether the rate of infection was increasing or decreasing, and particularly

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[253] The establishment of a hospital in the Garo Hills was requested for but denied by the Chief Commissioners due to 'present financial pressure'. 'Assam Proceedings, Home Department, Tabular Statements, September 1885, Medical and Sanitation, Nos. 58 & 59', BL, IOR/P/2427.
[254] Eteson, *ASRPA 1884,* p. 82.
[255] Ibid., p. 82.
[256] Ibid., p. 82.
[257] Ibid., p. 84.

whether the disease could spread to other districts.[258] Dobson's task was to look into each of those factors and break down kala-azar to satisfy each of those questions.

Dobson, his assistant Babu Srish Chandra Sarkar, M.B., and four hospital-assistants established a new hospital in Darangiri, a large village on Trunk Road. The village was devastated by kala-azar and Trunk Road was the road on which many police officers had discovered abandoned villages.[259] The Gaonburas, heads of villages in Goalpara, submitted the names of the villages which had kala-azar cases, and Dr. Dobson and his team looked into each village. These surveys combined with data from the hospital contributed to a series of conclusions on kala-azar. From this work, Dr. Dobson asserted the following:

> (a) That kala-azar is no new disease
> (b) That it is only a local name for malarial fever and its consequences
> (c) That it is essentially chronic in its nature, originating in ordinary fever and continued relapses
> (d) That its most noticeable and constant complication is hypertrophy of the spleen, commonly known as ague-cake
> (e) That darkening of the skin which has been given the name locally, far from being invariable not at all common. In only three patients was pigmentation found inside the mouth none could it be positively asserted of the outer skin
> (f) There is not a particle of reliable evidence that kala-azar is contagious[260]

In light of the previous description of kala-azar put forward by McNaught, it may not come as a surprise that Dobson concluded kala-azar was not a new disease and that it was just a local name for malaria.

Dobson reached his conclusions on kala-azar based largely on the appearance of two symptoms in particular. From July to December of 1884, 5,000 individuals in Goalpara sought help from Dobson and his team for what many of them believed was kala-azar. There were 2,712

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[258] Ibid., p. 82.
[259] Ibid., p. 82.
[260] Ibid., p. 82.

with an enlarged spleen and 1,479 cases of 'malarial fever'.[261] For Dobson and his team, these symptoms alone were not enough to distinguish kala-azar from malaria. In the eyes of the locals, however, kala-azar was a separate disease of particular concern. Locals believed the disease was contagious and often went to great lengths to distance themselves from individuals exhibiting symptoms or even remove the diseased all together. This attitude conflicted directly with Dobson's assertion that kala-azar was not contagious.

There was a great disconnect between the colonial administrators in Assam and the locals in Goalpara and the Garo Hills. When Dobson announced he had medicine to treat those suffering from kala-azar, many of the locals travelled to see him. Without seeing immediate results, however, interest in Western medicine used to treat kala-azar dwindled.[262] There was, in fact, no way for Western medical practitioners to reduce the swelling of a spleen in Assam in 1884, and without results it is understandable that locals would lose faith in Dobson's methods. Nevertheless, Dobson and the rest of the administrators thought negatively of the locals for having too high of an expectation. He claimed that the locals would sometimes be rude or even violent to medical officers when medications failed to achieve immediate results.[263] The interpretation medical officers had of the locals in Goalpara and the Garo Hills contributed to a suspicion of local attitudes towards kala-azar the suspicion that kala-azar was just malaria by another name.

Administrators' interest in the disease was sparked as a result of the increase in fever deaths. Colonial medical officers worked more closely with locals than ever before in Assam because of the need to explain the increase, but impenetrable jungles, few roads, and widely

[261] Ibid., p. 83.
[262] Ibid., pp. 82-83.
[263] Ibid., p. 82.

dispersed villages made any work in Goalpara notoriously difficult. Dobson and other administrators also complained of difficulty working with the local population. Even with local translators, officers had a hard time communicating with people in the Garo Hills and Goalpara.[264] There are many possible reasons for the communication challenges, particularly because in the 1880s administrators were not able to implement many promising medical treatments, but the challenge underscores a greater problem in understanding kala-azar and its relationship to malaria.

Colonial administrators first heard of kala-azar from the local populations in Goalpara and the Garo Hills and only focused on the disease because of an increase in fever deaths and the severe reaction from the locals. In Western circles, the disease was unknown. Administrators were keen to determine if the disease was a threat to the population of Assam and focused their efforts to answer the relevant questions. After looking into the symptoms and working with local individuals, the conclusion was that kala-azar was entirely a product of both the environment and the people of Goalpara and the Garo Hills.

The Assam Sanitary Department believed that there were certain characteristics that made locals in Goalpara and the Garo Hills predisposed to suffer from malaria and fever, and less able to recover than their counterparts in other parts of Assam. After Dobson's reports, Assam Sanitary Commissioner A. Eteson wrote, 'There is nothing peculiar about kala-azar beyond what can be plainly ascribed to periodic intensity of both general and local natural conditions, aggravated by the habits and the customs of the people'.[265] Eteson and his colleagues believed kala-azar was not a new disease; instead they believed it was linked to malaria, but the symptoms

[264] Ibid., p. 84.
[265] Ibid., p. 84.

locals described as kala-azar were nonetheless severe. The reason for the severity of the symptoms was argued to be the environmental conditions and actions of the people.[266] 'Habits' can be a very general term, but Eteson specifies that the negative habits that he believed contributed to failing to recover from a fever included wearing consistently wet clothes in the rainy climate, working with cattle in low-lying swamps and jungles, fishing or labouring in rice fields in wet conditions, eating putrid vegetables and meats, and poor community care for those who were ill.[267] He opined that he hoped that these circumstances could be changed for future generations. Advice to rid the districts of kala-azar involved improving general sanitation, changing these habits, and building the trust of the locals in western medical practices and the advice of colonial medical officers.[268] The prospect of accomplishing these goals, however, was slim. In 1882, provisions had been drawn up to improve the sanitary conditions of Goalpara and the Garo Hills, but a lack of provincial funds meant the plans could not be carried through.

Kala-azar was met with never-ending scepticism from authorities in Assam in the early 1880s, and a contributing factor to this scepticism was that the disease was local and only appeared to affect certain peoples. Though provincial sanitary department officials were curious about reported increases in fever deaths, many medical officers were aware that increases in mortality, particularly in the category of fevers, could increase for a variety of reasons.[269] The deserted villages could also theoretically be explained by fear of police, rather than being emptied by disease. In addition to these factors, medical officers did not trust local populations; Eteson proclaimed, 'their clownish ignorance is intense'.[270] This negative and in many ways

[266] Ibid., p. 84.
[267] Ibid., p. 84.
[268] Ibid., p. 84.
[269] Ibid., p. 84.
[270] Ibid., p. 84.

condescending attitude towards locals in Goalpara and the Garo Hills underscores an important theme in understanding kala-azar during the 1880s. The disease seemed to have originated among the local people and medical officers had a difficult time verifying if the disease was new and unique, if it was just a product of life in those districts, or if it was just another name for the almost omnipresent malaria.

Regardless of the opinions of medical officers at this point in time, the increase in fever mortality and the deserted villages in the area were warning signs that the government could not ignore and needed to investigate. Though the extensive work on kala-azar in 1884 fell mostly in line with early assumptions about the disease and did not cause much alarm, kala-azar was officially added to medical discourse in Assam. In subsequent editions of Sanitary Reports and Dispensary Reports in Assam, kala-azar would no longer appear in a special appendix but was included in general reports on the province.[271] Though administrators were sceptical of the full scope of kala-azar and the knowledge available on the disease, they understood further inquiries were necessary.

By 1886, efforts to combat kala-azar in Goalpara were underway but medical officers were hesitant to even use the term 'kala-azar'. Special relief efforts that began in 1884 were still in place, but officers were using terms such as 'local fever' and 'the sickness, which has its origins in widely-diffused natural causes and in the prejudices and habits of the people'.[272] Aversion to the term kala-azar was rooted in a belief held by many medical officers: that kala-azar was just another form of malaria and malaria and kala-azar were at the very least related. In many ways, treating kala-azar as a disease distinct from malaria came with its complications. Treating kala-azar in the same ways as the locals (contagious and a separate issue unrelated to

[271] Ibid., p. 85.
[272] A. Eteson, *Annual Sanitary Report of the Province of Assam for 1886* (Shillong, 1887), p. 32.

other causes of fevers) was antithetical to the general outlook on sanitation and medicine in the Assam Sanitary Department. In the 1880s, particularly in Assam, many diseases were believed to be connected to unsanitary conditions such as dirty water supplies and the poor hygienic habits peoples. According to the Sanitary Report of 1886, as a medical officer, 'Dr. Dobson dwells on the uniform polluted water-supply of the district as accounting for both the general sickness and epidemic outbreaks. The apathy of the people on this point is intense.' Regarding reliable diagnosis of disease, Dobson was sceptical:

> Two deaths, one from cholera and one from haemorrhage after childbirth, both of which the Hospital-Assistant had attended were returned as due to kala-azar and would have been so returned but for the medical subordinate's accidental presence. No sanitary works of any importance are being proposed; want of funds prevents them being undertaken. Meanwhile the total absence of village conservancy, the universal pollution of water, the intermittent floods, and the perpetual taint among the living of that which is dead, conduce to an oscillation of statistics between healthy and unhealthy years, which must of necessity accompany uncivilized areas.[273]

There was an emphasis on the importance of sanitation: 'A certain number of intermittent agues and enlarged spleens are treated, and some are cured, but the prevalence or severity of the local fever have not been adequately combated, and their cost is out of all proportion to the results.'[274]

From a public health standpoint, the provincial Sanitary Department had little ability to affect change and was pushing for a restructuring of the department. In 1887, other than the high rates of fever deaths in Goalpara, many districts in Assam were relatively consistent in pattern.[275] The attention paid to Goalpara was unique, but there was no progress in attempts to reduce fever deaths. The Army Sanitary Commission performed an independent review of Goalpoara and concluded that the problems of the district were 'mainly due to waterlogged (village) sites, and

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[273] Ibid., p. 21.
[274] Ibid., p. 40.
[275] A. Eteson, *Annual Sanitary Report of the Province of Assam for the Year 1887* (Shillong, 1888), p. 17.

consequent dampness of dwellings.'[276] The options suggested by the Army Sanitary Commission were either to improve the sanitary conditions of the district or remove the people. These options were viewed by the Assam Sanitary Department as equally impractical and ridiculous. A. Eteson, Sanitary Commissioner in 1887, suggested that the supply of affordable quinine pills to the district be increased, but financial constraints and other issues prevented this.[277] The scope of the Assam Sanitary Department was limited to improving the hygiene and general cleanliness of districts in Assam. Its perspective reflected the belief that most diseases were the result of impure water supplies, putrefaction, and generally unsanitary conditions. Poor sanitation was a broad category with many debates over the influence of certain factors and conditions, but Eteson seems to have believed that the department was ill equipped to solve the problems that confronted it.

Eteson argued that the Sanitary Commissioner should not be a medical officer, the Sanitary Commissioner should instead be a civil servant and engineer with the ability to affect public policy.[278] According to Eteson, the exact person 'would be a well-qualified sanitary engineer invested with executive duties, and with whom would rest the disposal of an annual budget grant of Provincial and local funds, and whose advice would influence the authorities as to the amount necessary to effect each permanent improvement'.[279] This reflects a belief many people seemed to have with engineering as a panacea for fevers because waterlogging was often seen as the underlying problem. Eteson's main concern was protecting the productive capacity of Assam. 'Epidemics come and go unmitigated and uncontrolled; the maintenance of the health of

[276] Ibid., p. 23.
[277] Ibid., p. 23.
[278] Ibid., p. 29.
[279] Ibid., p. 29.

the rural population is dependent on ignorance and prejudice, the prosperity of the country is doubly hampered, first, by excess mortality reducing labour and produce, and, secondly, by lapse of cultivated areas developing further disease'.[280]

According to the Sanitary Department, fever deaths increased in the Garo Hills and then Goalpara in the early 1880s, a trend unique to those districts in Assam. By 1888, fever deaths across the province increased in most districts, except notably Goalpara.[281] 'As regards the cause of malarious or marsh fever', Sanitary Commissioner in 1888 C. P. Costello wrote, 'the Province is, as a rule, a vast laboratory for its production as all the factors which go to form it are omnipresent, excepting, perhaps, some few well-sanitated sadr stations and towns'.[282] Costello needed to explain the increase in the recorded fever deaths and concluded that the increase was not due to a spread of kala-azar or even malaria. Costello and other researchers in Assam believed the factors that created malaria were rife across Assam, and he also distinctly believed that neither malaria nor kala-azar were contagious. According to Costello, kala-azar was only distinguishable from malaria in that it was considered to be neglected form of malaria that was particularly fatal. What some people interpreted as kala-azar spreading was, in Costello's opinion, simply greater attention being paid to the particular form of fever kala-azar was and an increase in the registration of cases and deaths along those lines.[283]

It was difficult to distinguish kala-azar and malarial fever based simply on symptoms alone in the nineteenth century.[284] In fact, in 1888, Dr. P. M. Gupta, M.B., Civil Medical Officer

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[280] Ibid., p. 29.
[281] C. P. Costello, *Annual Sanitary Report of the Province of Assam for the Year 1888* (Shillong, 1889), p. 16.
[282] Ibid., p. 17.
[283] Ibid., p. 17.
[284] Ibid., p. 17.

Garo Hills, plainly stated that it was impossible to distinguish between kala-azar and malarial fever through either physical symptoms or post-mortem analysis.[285] He argued that in the eyes of locals in Assam, particularly those helping record mortality statistics, many victims were suffering from malarial fever but when they were past the point of recovery they were said to be suffering from kala-azar.[286] This breakdown of the struggle to distinguish between kala-azar and malarial fever would explain the increase in kala-azar deaths reported in the province, but it was an opinion held by the Sanitary Department and government officials rather than the general public.

The attitude of the general public and particularly those who were not colonial officials is indicative of varying opinions of kala-azar. In the mindset of many government officials, particularly those in the Sanitary Department, kala-azar was nothing more than severe malarial fever. Therefore, according to opinions on malaria at the time, the disease was not contagious and was best addressed with general sanitary improvements across the province. Government officials could explain away cases in specific locations by arguing that it was the local conditions, not a contagious disease, that caused more than one individual to get sick and poor sanitation and hygiene that caused severe symptoms.[287] In the eyes of locals, however, kala-azar was so contagious that rumours of its arrival were enough to empty villages and general panic was a sensible reaction to a dangerous issue. By 1889, colonial officers were concerned with increasing fever mortality and believed the increases was due to two factors: more accurate registration covering more people across the population and kala-azar.[288] Though opinions on kala-azar

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[285] Ibid., p. 39.
[286] Ibid., p. 40.
[287] Ibid., p. 39.
[288] C. P. Costello, *Annual Sanitary Report of the Province of Assam for the Year 1889* (Shillong, 1890), p. 16.

varied across the province, medical officers could not ignore the effects of the fear that broke out with a suspected case of kala-azar and the social reactions to the disease were nonetheless real. Colonial officials needed to respond to the reactions of the people:

> However, the opinion of the most experienced district officers, who in travelling through their districts have many opportunities of seeing this "kala-azar," is that it is not alone contagious, but that it is spreading upwards towards Nowgong, &c. So many thousands die annually from this disease that this mortality must eventually affect the revenue. I recommend that the Government of India be asked to detail a special officer of tried scientific attainments to proceed to the affected districts next cold weather, and, with the help of the Civil Surgeons, to inquire thoroughly into its cause, with the view of stopping its ravages and spread.[289]

At the time, there was no consensus on what was actually causing the increase in fevers in specific locations in Assam like Goalpara or the Garo Hills. Looking back, evidence suggests that it may have been malaria, not kala-azar, that was causing a large portion of illness and death. Nevertheless, contemporary medical offers were perplexed.

Calls for Further Research in Colonial Assam

Though they had always been high, deaths categorised under the heading of 'Fevers' became an issue of greater concern in colonial Assam because of the belief that kala-azar was spreading. This contradicted the longstanding belief that malaria, though understood as the deadliest disease in the province, was thought to be tied to natural environmental conditions and not capable of spreading in the same way as other diseases. The provincial government of Assam sought the help of medical officers from the Government of India to address the issue of kala-azar within Assam. Officials from Assam were eventually successful in their request, and the Raj sent specialised researcher G. M. Giles, I. M. S., to the province in 1889 to investigate the disease. At the conclusion of his research in colonial Assam, Giles claimed that kala-azar and

[289] Costello, ASRPA *1888*, p. 18.

beri-beri were both related to anchylostomum duodenale [sic] (hookworm). Giles' assessment was wrong and completely dismissed within a few years, but his work was a significant break from previous conceptions of kala-azar and the first attempt of medical officers to claim that the disease was separate from malaria. Ultimately, Giles' inquiry is indicative of a few themes regarding public health and malaria in colonial Assam. The reception of his work highlights the unique political setting in colonial Assam and the relationship between the development of disease theory and public health policies. Both were in the shadow of the tea industry. The second major theme is the unique position of malaria in public health dialogue. Though Giles was researching kala-azar, his inquiry was also a reflection of contemporary perceptions of malaria, and his attempt to decouple the diseases was a challenge to the long-established status-quo on 'Fevers'. These themes must be examined within the context that kala-azar was difficult to differentiate from malaria and, as previously argued in this section, many of the deaths attributed to kala-azar were due to malaria. As a corollary, malaria was a prominent figure in Giles' research.

Research into kala-azar was originally a secondary priority when officials in Assam requested a medical specialist to be sent to the province. Giles was sent to Assam because the Chief Commissioner of Assam argued that more research on beri-beri was needed; kala-azar was added on as another focus of the inquiry later on, though still before Giles arrived in the province.[290] Beri-beri worried tea planters in Assam because of a relatively high presence of anaemia among 'coolies'. This fear was stoked even more in 1887 when the provincial government received letters from the Government of India on Cornelis Andranus Pekelharing's

[290] 'Assam Proceedings 1889, Home Department, Misc, July, No. 9', BL, IOR/P/3348.

inquiry into the disease.[291] Professor Pekelharing was a Dutch researcher who examined beri-beri in Dutch Java in the 1880s. Giles was aware of Pekelharing's study and keen to research the subject in Assam.[292]

Ultimately, the social problems caused by kala-azar required an increased amount of attention by the late 1880s and kala-azar was included in Giles' inquiry because C. P. Costello, the Sanitary Commissioner in 1889, argued that medical officers in Assam were already too busy with their duties and could not devote the appropriate amount of time to research the disease.[293] It was hoped that if Giles could finally breakdown and understand kala-azar, Assam would be able to address the increased fear among the pubic and the potential loss in revenue among planters associated with the disease. Before arriving in Assam, Giles was aware of the economic concerns of the province; diseases were a threat to the peace and, by extension, a threat to maintaining an able-bodied and willing workforce. Giles was particularly concerned with abandoned tea gardens and imported labourers who were thought to be bringing the diseases into the province. There were several instances in Assam when tea gardens were deserted because of a disease, notably either kala-azar or, separately, anchylostomum (now Ancylostoma duodenale or hookworm), and Giles believed anchylostomum was related to both kala-azar and beri-beri.

In the modern context, the relationship between kala-azar, beri-beri, and hookworm may seem preposterous, and modern readers may be confused that in his efforts to clearly differentiate beri-beri and kala-azar from malaria Giles called for beri-beri and kala-azar to be relabelled anchylostomiasis (parasitic anaemia).[294] Modern medicine classifies each of these diseases as

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[291] 'Assam Proceedings 1887, Home Department, Tabular Statements, October, Medical and Sanitation, No. 53', BL, IOR/P/2878.
[292] G. H. Fink, 'The So-Called Kala-Azar of Assam', *Indian Medical Gazette,* 32/8, (July, 1897), p. 245.
[293] 'Assam Proceedings 1889, Home Department, Misc, July, No. 19', BL, IOR/P/3348.
[294] Giles, *A Report of an Investigation,* p. 7.

entirely different; beri-beri or thiamine deficiency is caused by a vitamin B1 deficiency, anchylostomiasis is a hookworm disease, and kala-azar (visceral leishmaniasis) is a complication due to the presence of a parasite transmitted by sandflies. Despite his mistake, it is important for historians to understand why Giles was incorrect in his assessment of the three diseases.

Claims that kala-azar and beri-beri were caused by the presence of anchylostomum duodenale and that the diseases were all related were not as unbelievable at the time as the theory had its origins in contemporary medical research. In 1887, a pamphlet on beri-beri (called in the pamphlet 'anaemia of coolies') was published by the Government of Ceylon. The pamphlet gained popularity among medical officers in Assam who believed that a local disease in Assam called 'anaemia and dropsy' was the same phenomenon as beri-beri in Ceylon. It was believed at the time that the cause of the disease was connected to malaria cachexia and associated with climate- specifically bad drainage and 'exposure'. Despite these beliefs, post-mortem analysis revealed that many of those who had died also had an intestinal parasite- the Anchylostomum duodenale. As a result, a connection was drawn between beri-beri and 'bad water' or drinking from stagnant pools. Dr. Ruddock investigated the disease near Nowgong, Assam and declared that it was the anchylostomum parasite that was the cause of beri-beri. The pamphlets published from the report were then distributed among Civil Surgeons in Assam. The Sanitary Commissioner of Assam in 1887 hoped that the discovery would link to kala-azar but remained sceptical assuming kala-azar was instead malaria.[295]

Giles began his investigation into kala-azar in 1889 already believing that kala-azar and beri-beri were the same disease and that they were caused by anchylostomomum. One of the goals of his inquiry was to determine conclusively that kala-azar and malaria were in fact

[295] Eteson, *ASRPA 1887*, p. 31.

separate diseases. Upon first arriving in Assam, Giles performed post-mortem analysis of victims of 'chronic malarial disease' in Gauhati. He searched for a bacterial cause for the deaths and discovered the presence of anchylostoma. Based on this initial assessment, Giles commented that it was not surprising that kala-azar was confused with malaria because malaria was so common and anchylostomiasis had a condition of profound anaemia which was very similar to that of malaria.[296] Giles then visited a number of dispensaries and other medical facilities across Assam and in the process came across many patients who were thought to be suffering from kala-azar. Giles was frustrated with the fact that, as he claimed, 'everywhere in India, nearly all disease is ascribed by natives to "fever", and it is only by the most patient enquiries as to the exact symptoms actually experienced that one can get any other history for nine diseases out of ten'.[297] Giles became somewhat discouraged during his research and faced many hurdles. At this point in time, there was still plenty of confusion concerning malaria and kala-azar, and many researchers believed they were the same disease or at the very least related. Giles, on the other hand, remained steadfast in his conviction that 'malarial symptoms were quite inadequate to account for the gravity of mischief' caused by kala-azar.[298] Nevertheless, Giles found it difficult to study kala-azar in villages across Assam. According to Giles, many residents in Assam were resistant to visiting medical dispensaries themselves and also refused medicine even if it was brought to them. This resistance was not the case with every disease, but uniquely it was with kala-azar. Giles believed that the public had 'such a firm belief in the incurability of the malady, that they are free to confess that even charms and sacrifices to the gods are quite unveiling'.[299]

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[296] 'Assam Proceedings 1890, Home Department, July, No. 117', BL, IOR/P/3570.
[297] Giles, *A Report of an Investigation,* p. 10.
[298] Ibid., p. 10.
[299] Ibid., p. 13.

Kala-azar researchers across Assam were befuddled. Amid the confusing claims and distinct epidemiological trends were assertions that kala-azar rarely affected Europeans. Giles claimed that were 'no recorded or even hearsay instances of a European becoming infected. Europeans, of course, suffer much less than natives from malarial cachexia, but they nevertheless enjoy no complete immunity from it'.[300] Giles' statement highlights two themes that are important for historians to pay attention to when studying kala-azar in Assam during the end of the nineteenth century. First is that medical officers were attempting to figure out who was most affected by kala-azar. Second is that there was a presumed relationship between kala-azar and malaria. As is evident from the previous sections of this chapter, Giles' inquiry was not the first study of kala-azar, but his work was a landmark moment in the history of the disease because it stands at the point kala-azar was fully incorporated into the medical discourse of colonial Assam and a concern for the Government of India. Previous studies were unable to adequately explain the disease or produce an effective public health approach. Giles' work was also ultimately unable to accomplish these goals, but his work elevated the disease from a local issue of Assam to a malady possibly connected to other diseases and requiring professional medical attention. Prior to this study, the issue of 'Fevers' in Assam had never been taken that seriously by medical officers.

Giles was acutely aware that a number of diseases were mislabelled and misidentified, and epidemics and outbreaks were attributed to specific diseases on loose grounds. According to Giles, part of this problem stemmed from inadequate efforts from scientists and medical practitioners to correlate an outbreak in one area of the world with another outbreak that occurred in another locality or even country. In 1890, both kala-azar and beri-beri were widely used terms

[300] Ibid., p. 41.

in Assam but their aetiologies were imprecisely understood.[301] Giles also had a problem with the words beri-beri and kala-azar, he thought the terms led to inappropriate responses to epidemics specifically because of their popularity and attribution to epidemics without sound reasoning. Popular names for diseases struck a certain amount of fear into the hearts of medical practitioners, epidemiologists, and even patients. Giles was concerned that if diseases were misidentified the responses would be grossly inadequate. At the core, the purpose of Giles' work was to further epidemiological efforts in Assam by breaking down the aetiology and develop corresponding sanitary responses to kala-azar and beri-beri.

Recorded in the Assam Proceedings of 1890, Sanitary Commissioner Costello supported Giles' claim to the provincial government that 'under the two names of beri beri and kala-azar anchylostomiasis has now such a hold over the whole of Assam.'[302] Giles' insights were used to inform certain policies that were applied in Assam to help reduce cases of kala-azar. In 1891, the Sanitary Commissioner of Assam Surgeon-Colonel C. P. Costello issued the following sanitary policy:

> I advise that for all villages in the (1) Goalpara, (2) Kamrup, (3) Nowgong, and (4) the Mangaldai sub-division of the Darrang district [especially in (2), (3), and (4)] village sanitation as defined in sub paragraphs (a), (b), and (c) of paragraph 3 of Appendix B of this report should be carried out with the addition of each village of-
>
> (d) a clearance of jungle, &c., for 200 feet from the nearest habitations;
> (e) one or more protected tube or pucca wells in each village on high ground unlikely to be polluted;
> (f) disinfection or migration in extreme cases, when these are necessary and predictable;
> (g) insistence on the inhabitants of each village resorting to one, or at the most two places only for purposes of nature, which should be outside the village and so situated as not to be likely to pollute the drinking water; and I would make the gaonburas, &c., of each village responsible for this being strictly carried out, the

[301] Ibid., p. 1.
[302] 'Assam Proceedings 1890, Home Department, July, Surgeon Giles Report on Anaemia of Coolies, No. 1', BL, IOR/P/3570.

> Civil surgeon reporting to the Deputy Commissioner whenever any failure to carry out this order was proved.[303]

On the back of these policies, Costello expressed a strong sense of doubt about the possibility of implementing any more specific measures than those outlined. This was largely due to a level of prejudice against the locals and his belief that they would not be receptive more direct action. Costello wrote, 'Considering what we know of the habits of the natives of Assam, I consider it would be impossible to get more done than the above at present, but I think that a serious attempt to carry out these recommendations should be made.'[304] These were the recommendations put in place for towns that were relatively remote and lacked the sanitary infrastructure of larger, more established towns. In the smaller towns, Costello recommended Lieutenant-Colonel G. F. Young's advice to cremate nightsoil rather than bury it as described in Young's work *Notes on Sanitation in India*. This method was also recommended for tea plantations. In larger towns such as Gauhati and Nowgong, Costello recommended a more advanced sanitary system, 'a perfect conservancy system and good protected wells being provided wherever now wanting.'[305] It is difficult to determine the overall impact these recommendations had on malaria or kala-azar in colonial Assam. While policies such as clearing jungle may have had some effect on the presence of mosquitoes and sandflies, the actual impact would be difficult to measure in acute circumstances. The other policies would likely have had little to no effect on cases of malaria or kala-azar as they were designed around inaccurate conceptions of the disease.

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[303] C. P., Costello, *Annual Sanitary Report of the Province of Assam for the Year 1891* (Shillong, 1892), p. 21
[304] Ibid., p. 21
[305] Ibid., p. 21

One of the major issues relating to kala-azar at the time was the difficult of accurately determining the exact prevalence of the disease in Assam, but the feared increase of the disease in tea plantations was enough to cause greater concern among government officials. Giles' work was condensed by Costello and translated into Assamese by Dr. Borah, a medical officer and Assamese scholar, to be distributed free to districts across Assam. Nevertheless, medical officers were aware of the gaps in their knowledge. Costello wrote, 'no matter what the reason cause of kala-azar may be, the above sanitary measures cannot fail to be most useful in retarding the progress of the disease.'[306]

Rejection of Giles' Work

Before 1890 most medical researchers in Assam were convinced that kala-azar and malaria were related. Though Giles was able to change some minds, many medical officers remained steadfast in their beliefs. Dr. Edwin F. H. Dobson was a Civil Surgeon in Assam and as already noted had completed a smaller inquiry into kala-azar prior to Giles' research and study. Throughout the duration of Giles' inquiry, Dobson maintained that kala-azar was a complication of malaria, not an instance of anchylostomiasis.[307] Dobson was perhaps the most prominent of several medical officers who disagreed with Giles' findings. This created a tension between Giles and Dobson that is briefly touched upon in modern researcher of tropical medicine, parasites, and malaria Robert S. Desowitz's work *The Malaria Capers.* In *The Malaria Capers,* Desowitz quickly delves into the struggle to differentiate between malaria and kala-azar in Assam. Providing a brief overview of kala-azar in Assam, Desowitz claims that Giles and Dr. Dobson differed in opinion over the root cause of kala-azar. According to Desowitz, Giles arrived in

[306] C. P., Costello, *Annual Sanitary Report of the Province of Assam for the Year 1892* (Shillong, 1893), p. 23.
[307] Giles, *A Report of an Investigation,* p. 42.

Assam with the belief that anchylostomiasis was the cause of kala-azar and this perspective informed Giles' decision to study the faeces of the inhabitants of Assam. Dobson, who was already performing research in Assam, argued that malaria was the root cause of kala-azar, not hookworm. While hookworm could cause anaemia, it did not cause an enlarged spleen which was believed to be a key symptom of kala-azar. Desowitz argues that Giles was ultimately defeated in his arguments by epidemiologists who claimed that anchylostomiasis was beyond prevalent in Assam, but cases of kala-azar were not.[308]

Desowitz's brief overview of the argument between Giles and Dobson serves the purposes of *The Malaria Capers'* narrative which is to explore the reasons why tropical medicine and laboratory science did not always produce grand sweeping changes to populations that people once thought it did, but Desowitz's exploration of the ideas do not go far enough to shed light on life in Assam and the greater context of what malaria and kala-azar were. Notably, Dobson and Giles were arguing over the prevalence, importance, and connections of certain symptoms with certain diseases. Desowitz's narrative goes on to discuss how Dobson won the argument between him and Giles when, in 1896, many researchers agreed that kala-azar was in fact related to malaria and not anchylostomiasis, but the 'wisest' researchers of all believed that kala-azar was caused by some yet unknown agent.[309] This language paints the struggle to define kala-azar in a somewhat straightforward format, when in reality the task was much more nuanced and a reflection of public health in colonial Assam. Implementing the changes that Giles recommended faced significant hurdles from a lack of finances to an unwillingness to disrupt the productivity of

[308] R. S. Desowitz, *The Malaria Capers: More Tales of Parasites and People, Research and Reality* (New York, 1991), p. 43.
[309] Ibid., p. 44.

the tea industry, and the disagreement over the implementation of public health policy between Giles and medical officers like Dobson expressed a different understanding of life in Assam.

From the perspective of a historian, Giles should not be completely dismissed or understood as a lesser player in history for his study even though he was wrong. Giles examined a much more important trend that eventually led to a better understanding of kala-azar- the idea that kala-azar was spreading but social perceptions of disease were misleading contemporary medical officers. Giles wrote, 'the irregular and apparently capricious distribution of the centres of epidemic intensity in any given neighbourhood also exactly recall what was found to be the case on the distribution of kala azar, and is an additional proof of the identity of the maladies known under the two names.'[310] Giles' drive to understand kala-azar was motivated by the larger need to distinguish the disease from malaria, and the basis for this research was the noted difference in outbreaks between malaria and kala-azar. Giles had an acute sense that social perceptions of diseases like beri-beri and kala-azar could differ from the biological reality. Though his conclusions were ultimately incorrect, his work stands as an example of the reflexive relationship between the social perceptions of disease and the biological realities that existed regarding 'Fevers' in colonial Assam. Social perceptions of disease (mainly a fear that 'Fever' deaths were increasing, and kala-azar was spreading) combined with the actual high mortality from malaria in colonial Assam (which was an unknown fact for contemporary researchers) are the reasons that Giles was sent to the province. At the time, it was almost impossible to know what was happening, but looking back it is clear that biological actors like malaria, kala-azar, and even anchylostomiasis were present and were all factors in the social reactions to 'Fevers' at the time but in ways that those in the past could not understand.

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[310] Giles, *A Report of an Investigation,* p. 145.

To understand these points, it is important to situate Giles' analysis within the wider struggle in Assam. Giles was attempting to assert a new way of understanding and interpreting kala-azar, beri-beri, and anchlyostomiasis. This was a shock to the province which had already developed a system for handling certain endemic diseases like malaria. Though beri-beri was perceived as a new threat to the province, kala-azar was associated with older conceptions of malaria and 'Fevers'. A large motivation for Giles' work was to help differentiate 'Fevers' in the province and therefore redefine the relationship the province had with kala-azar while maintaining the existing relationship with malaria. Figures under the heading of "Fevers" increased dramatically in 1889, and the Sanitary Commissioner believed the increase was due mostly to kala-azar. With a presumed connection between Anchylostomum duodenale and kala-azar, researchers searched for a reason for the increase in "Fevers". The provincial government paid particular attention to immigrant labourers who entered Assam to be able to work on tea plantations. It was unknown if anchylostomum were imported into Assam or if the related disease was native to the province.[311] Though some in Assam did accept his conclusions initially, Giles' research faced challenges in the transition into sanitary policies. This was due to two facts: one, that many medical officers disagreed with Giles' finding scientifically, and two, that some of the suggestions proved disruptive to the tea industry.

The Sanitary Commissioner of Assam, Costello, had supported Giles' argument when it was published, but some of Giles' recommendations for sanitation policy were met with resistance from other medical officers who saw them as unnecessary and problematic. In January of 1890, Giles recommended that immigrant labourers coming into Assam be detained for a few days and inspected by medical officers to prevent cases of anchylostomiasis (and by extension

[311] Costello, *ASRPA 1889,* p. 8.

beri-beri and kala-azar) from being brought into tea gardens.[312] In April of 1890, Surgeon Dobson, the Civil Surgeon of Dhubri where many migrants passed through on their way to tea plantations, sent a letter to Costello arguing that there was no benefit of detaining immigrant labourers because any cases of anchylostomiasis found could be adequately treated on tea gardens. Additionally, detaining labourers with anchylostomiasis would ultimately require housing both the infected individuals and their families for indefinite periods of time, an overall costly measure. The way that immigration to Assam was structured for work on tea plantations also made the detention of labourers ineffective. According to Dobson, on humanitarian grounds only fit travels were allowed to pass medical inspection and head towards their contracted positions in on a tea plantation. They were only stopped if the journey would harm them specifically or if they had cholera or smallpox. Travellers with anchylostomum were usually reasonably healthy and capable of travel, but if they were detained at the medical checkpoint their contract with the tea garden were voided, which meant that ultimately, they would then be free to travel anywhere else in Assam. This means that detentions would be ineffective and enable the spread of the diseases (anchylostomiasis, possibly beri-beri and kala-azar) throughout Assam, rather than anchylostomiasis simply being treated on the tea garden.[313]

The issue of immigration to Assam and the spread of disease was a primary concern for medical officers, but most in power were in favour of continuing immigration rather than placing further restrictions as Giles' recommended. In 1892 Sanitary Commissioner Costello continued to make claims that one of the most important ways to prevent diseases from entering Assam was to

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[312] 'Assam Proceedings 1890, Home Department, July, No. 114, Deputation of Dr. Giles to Assam for Kala-azar and Beri-Beri Enquiry', BL, IOR/P/3570.
[313] 'Assam Proceedings 1890, Home Department, July, No 8. Surgeon E. Dobson, Civil Surgeon, Dhubri to the Deputy-Surgeon-General', BL, IOR/P/ 3570.

have a more careful selection of labourers in recruiting districts.[314] The Secretary to the Chief Commissioner of Assam even communicated with Secretary to the Government of Bengal, the neighbouring province where many of the immigrant labourers in Assam came from, to recommend that measures should be taken to prevent the importation of anchylostomiasis to Assam.[315] These notions were quickly defeated. The Army Sanitary Commission in Assam wrote in 1892 that they could not see any connection between kala-azar and transmission from immigrant labourers.[316] R. McLeod, Superintendent of Emigration, Calcutta, wrote to the Secretary of the Government of Bengal to argue that Dr. J. F. P. McConnel, the Medical Inspector of Inland Emigrants, was consulted and argued that there was probably no disease that anchylostomiasis could be applied to and that no preventive measures could be derived because the pathology of kala-azar still remained a mystery.[317] McConnel even stated that Giles' argument regarding kala-azar was 'premature, and, in my opinion, rests on insufficient data'. Therefore, any restrictions on emigration regarding anchylostomum would be unnecessary and should not be carried out, though McConnel was careful to also point out that medical officers inspecting immigrant recruited immigrant labourers were still useful in providing a healthy workforce. Cases like kala-azar were unknown in Bengal, but the government still had an interest in preventing those suffering from cholera and smallpox from entering Assam.[318]

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[314] 'Assam Proceedings 1892, Home Department, September, No. 21', BL, IOR/P/4031.
[315] 'Assam Proceedings 1894 January – June, Home Department, January, No. 161', BL, IOR/P/4471.
[316] 'Assam Proceedings 1892, Home Department, December, No. 52, Memorandum by the Army Sanitary Commission on the Assam Sanitary Report for 1890', BL, IOR/P/4031.
[317] 'Assam Proceedings 1894 January – June, Home Department, January, No. 166', BL, IOR/P/4471.
[318] 'Assam Proceedings 1894 January – June, Home Department, January, No. 167', Bl, IOR/P/4471.

Dobson was one of several medical officers in Assam who were sceptical of sanitary policies based on a presumed link between kala-azar and beri-beri, and immigration was only one of many issues. Surgeon-Major S. Borah, M.B., was the Civil Surgeon of Kamrup (a district in Assam). In 1888, Kamrup had a total of 17,828 deaths and 14,147 (79%) of those deaths were from fever. Borah believed that most of these fever deaths were due to some type of malarial fever, 'which occurred in an endemic and in some places in an epidemic form' according to Borah.[319] Infectious diseases including fevers, cholera, and bowel-complaints were common in Kamrup, a phenomenon Borah thought was due to the fat that much of the country and many village sites were under water for a large part of the year and decomposing vegetation and refuse were prevalent. When detailing the symptoms of many of the patients suffering from fevers in Kamrup, Borah noted the similarities to the cases of kala-azar that were believed to be connected to beri-beri. 'There was 'anaemia, enlargement of liver, loss of appetite, emaciation, aedema of the feet, diarrhoea, ascites, and in very few cases, cancrum oris (due to poverty of blood), also enlarged spleen and phthisis pulmonalis.'[320] Baroah remarked that the locals thought of the fever as contagious, but medical proof for the fact was lacking. During his efforts to treat many of the cases, Baroah, aware of the previous research linking kala-azar to beri-beri and anchylostoma duodenale, administered thymol; thymol was the drug recommended to treat anaemia or beri-beri of Ceylon. Baroah did not have any success with the treatments, and in post-mortem analysis he did not discover any anchylostoma duodenale. In light of his experiences, Baroah claimed that kala-azar was distinct from beri-beri and anchylostoma, and argued that kala-azar was not new, it was 'simply malarial'.[321] In 1892, Borah along with Dobson, McNaught, Surgeon-Major

[319] Costello, *ASRPA 1888*, p. 39.
[320] Ibid., p. 39.
[321] Ibid., p. 39.

Mullane, and Surgeon-Major R. N. Campbell were called upon for their opinions on Dr. Giles' work.[322]

Giles' claims faced a mixed and mostly negative response in India. An article published in the *Indian Medical Gazette* in 1892 did support his argument, but rapidly medical officers in Assam began to distance themselves from Giles' claims.[323] In 1892, about two years after Giles published his report, districts across Assam made special inquiries into the prevalence of kala-azar in their specific settings. Dr. Ruddock of the district of Meesa wrote that there were no cases of kala-azar reported from tea gardens, however several of the Assamese labourers believed they were suffering from kala-azar and were being treated for their fevers. In the district of Kamrup, Drs. Campbell, Macnamara, and Dobson all found cases that they suspected to be kala-azar. With the news, the Chief Sanitary Officer, Costello, wrote that 'my opinion is that kala-azar has begun, although as yet in a very limited degree, to show itself in tea gardens, and amongst the settled immigrants outside such gardens.'[324]

In the 1892, Costello believed that an increase in 'Fevers' over the previous year was due to a relationship between rainfall, water accumulation, and the jungle. This perceived link was used to explain greater mortality from fevers in uncultivated parts of Assam where jungles were widespread as compared to 'the more open and more cultivated plains of the Upper Assam Valley', in other words areas that had been cleared of jungles to create tea plantations.[325] The overall health of tea plantations was a paramount concern for the Assam Sanitary Department. Looking for a different approach to kala-azar than the one Giles offered, Costello quickly

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[322] 'Assam Proceedings 1892, Home Department, September, No. 21 to 27', BL, IOR/P/4031.
[323] 'Kala-Azar and Beri-Beri in Assam', *Indian Medical Gazette,* 27/2 (Feb, 1892), p. 312.
[324] Costello, *ASRPA 1892,* p. 22.
[325] Ibid., p. 20.

changed course. Costello called for a new specialist 'who should be a fully competent pathologist and bacteriologist' from the Government of India, one who would be able to perform post-mortem analysis and help advise on the appropriate sanitary policy in the wake of Giles' work.[326]

By 1893, doubt over Giles' claims spread rapidly to those outside of the medical setting. The Nowgong Branch of the Indian Tea Association commissioned an inquiry in Nowgong from the Sanitary Commissioner of Assam to follow up on Giles' report at the end of 1892.[327] Surgeon-Colonel W. P. Warburton, the new Sanitary Commissioner of Assam in 1893 published his response following the Nowgong inquiry into kala-azar in the Sanitary Report of 1893. Warburton claimed that kala-azar exhibited separate symptoms from beri-beri and that in many cases dochmius duodenalis (or anchylostomum duodenale) were not present at any stage.[328] Though previously some medical officers petitioned to place kala-azar deaths in a separate category from 'Fevers', in 1894 kala-azar deaths were still under the heading of 'Fevers'. Surgeon-Colonel A. Stephen, the Sanitary Commissioner of Assam in 1894, argued that malarial fevers included kala-azar and in this short timespan Giles' arguments were completely dismissed in Assam.[329]

Though Giles' conclusions on kala-azar were rejected, medical officers had no concrete conclusions about the disease other than descriptions of the symptoms in patients they believed were suffering from kala-azar. Stephen wrote to the Assam Branch of the Indian Tea Association for input on devising a method of kala-azar control in Assam and had to come up with a new plan

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[326] Ibid., p. 21.
[327] 'Assam Proceedings 1893, Home Department B., Tabular Statements, April, No. 1094 to 1098', BL, IOR/P/4266
[328] W. P. Warburton, *Annual Sanitary Report of the Province of Assam for the Year 1893* (Shillong, 1894), p. 19.
[329] A. Stephen, *Annual Sanitary Report of the Province of Assam for the Year 1894* (Shillong, 1895), p. 22.

in the wake of Giles' work.[330] Building off of Costello's recommendation in 1892, in 1896 the provincial government in Assam was able to convince the Government of India to send a new medical officer who was a specialist in disease pathology and laboratory research to Assam to study kala-azar and continue the investigation of Dr. Giles.[331]

Sir Leonard Rogers on Kala-Azar

In 1896, Surgeon-Captain Leonard Rogers, M.B., F.R.C.S., was sent to Assam to investigate kala-azar.[332] After his arrival in April 1896, Rogers quickly visited locations across Assam where kala-azar was common and other locations in Assam where the government was worried cases would quickly increase.[333] The relationship between disease and sanitary policy in Assam revolved around tea plantations, and the Government of India's attention was piqued when the vitality of the plantations were threatened. Though fevers were commonplace in Assam, it was not until kala-azar began to destabilise the productivity of tea production that the Government of India got involved. Giles' work was an attempt to address concerns among the plantations, but his conclusions failed to win over other medical officers, government officers, and industry members. Rogers' efforts were an attempt to address this issue and organise the province in the best way to prevent the spread and damage of kala-azar.

Leonard Rogers published his findings in 1897. In his report, he detailed the history of research on kala-azar in colonial Assam. Rogers claimed that though kala-azar had likely existed

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[330] Ibid., p.. 25.
[331] 'Assam Proceedings 1896 January – June, Home Department, February, No. 182', BL, IOR/P/4872.
[332] 'Assam Proceedings 1896 July – December, Home Department, July, No. 14', BL, IOR/P/4873.
[333] A. Stephen, *Annual Sanitary Report of the Province of Assam for the Year 1896* (Shillong, 1897), p. 32.

in Assam for decades, it was not until 1882 that medical officers first took note of the disease. To make this claim, Rogers referenced McNaught's description of the disease and his basic breakdown of the symptoms of kala-azar. Locals believed the disease was contagious but medical officers were not similarly convinced.[334] The reason Rogers traced the history of kala-azar was to open a discussion on the relationship between kala-azar and malaria. Kala-azar and malaria have a linked history in colonial Assam, and Rogers noted the fact that medical officers originally were convinced that kala-azar was the same as malaria, albeit possibly in extreme form. This idea persisted for the next few years until in 1887 medical practitioners in tea plantations began to note cases of anchylostoma, beri beri, and anemia among labourers.

The combination of anchylostoma, beri beri and anemia among labourers with the new threat of kala-azar that was emptying out villages in Assam and threatening tea plantations was, according to Rogers in his report, the reason Assam asked for G. M. Giles to be sent to the province to investigate kala-azar.[335] Giles' work was significant because Giles was the first medical officer in Assam to claim that kala-azar and malaria were not related. Many locals in Assam, however, had been convinced that malaria and kala-azar were separate diseases for years. Rogers disagreed with Giles' conclusions on many points. Rogers wrote,

> Since September 1891, deaths have been returned under the heading anchylostomiasis, which is further subdivided into (a) anaemia or beri-beri of Ceylon, and (b) kala-azar. Nothing could illustrate better the hopeless state of confusion which ensued on the publication of Dr. Giles' report than his extraordinary nomenclature; for apart altogether from the absurdity of expecting the ignorant village headmen who register the deaths to differentiate between these diseases, which have been such a source of controversy for so many years and the subject of two special investigations, it will not be evident from the facts recorded in this report that two or more totally distinct cases have been returned under one heading, while as Dr. Giles himself pointed out, true beri-beri does not occur in Assam, although, unfortunately, he used the term on the title page of his report. […] the fact that kala-azar is nothing but an intense form of malarial fever, which is not always

[334] L. Rogers, *Report of an Investigation of the Epidemic of Malarial Fever in Assam, or Kala-Azar*, (Shillong, 1897), p. 1.
[335] Ibid., p. 4.

> easily distinguishable from the ordinary type, even by an experienced medical man, will be sufficient reason for reverting to the previous arrangement whereby these cases were returned under the head of "fevers". The deaths from fevers (and also from kala-azar if the term is retained) in each mauza of the affected districts should be permanently recorded in the office of the Sanitary Commissioner, in order that the yearly progress of the epidemic may be easily and accurately followed in the future.[336]

Ultimately, Rogers made the fundamental point that kala-azar and malaria were biologically related and dismissed Giles' claim that they were not.

Rogers' work was well received by the Assam Sanitary Department. One of the main reasons the Sanitary Department was pleased with his findings was because quinine, the drug used to prevent and treat malarial fever, could therefore be used to prevent and treat cases of kala-azar. In 1894, Stephen, the Sanitary Commissioner of Assam, stated that quinine was not useful in treating advanced cases of malaria.[337] Rogers argued that in 1894, when Stephen made this insight, medical officers suspected that kala-azar and malaria were unrelated. In 1897, the distribution of quinine to address the prevalent problem of fevers was underway and Stephen was excited that the total amount sold through post offices in the Surma Valley was increasing.[338] It was hoped that this would decrease mortality and morbidity from all malarial fevers, including kala-azar.

Rogers made several recommendations on how to address kala-azar in Assam. First, he set out to determine whether the disease was communicable or not. He claimed that it was difficult to trace the spread of the disease because it took some time, usually at least a year, for cases in any village or tea garden to be recognised. Nevertheless, the disease on appearance

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[336] Ibid., p. 216.
[337] Ibid., p. 18.
[338] A. Stephen, *Annual Sanitary Report of the Province of Assam for the Year 1897* (Shillong, 1898), p. 30.

seems to spread along 'the lines of traffic or human intercourse'.[339] In his travels across Assam, Rogers spoke to the heads of villages that had been riddled with cases of kala-azar. Many of the people Rogers spoke to traced the origins of the disease to visits to other villages or visiting villages who contracted fever and brought the malady home.[340] Kala-azar had perplexed tea planters because it was more likely that the labourers who had worked on a plantation for years were more likely to contract kala-azar as opposed to newly arrived immigrant labourers. Rogers claimed that this was because labourers who had lived in the area for many years were more likely to contract the disease by visiting neighbouring villages. This confused many medical officers at the time because it was believed that more seasoned labourers would have developed some form of resistance to malaria through 'acclimatisation'.[341] Rogers argued that kala-azar was communicable, but struggled with the fundamental question that had perplexed medical officers for some time: 'how then did a malarial fever get this power of communicability?'[342] The answer, according to Rogers, was in the origins of the epidemic.

Rogers drew a link between the phenomenon of kala-azar in Assam and Burdwan Fever in neighbouring Bengal. According to Rogers, the fact that kala-azar emerged from the Garo Hills was taken for granted, but Rogers believed that the disease had a different origin.[343] Rogers claims that,

> as the disease is only a very intense form of malaria, the Garo people for generations past, indeed, as long as the physical conformation of the country has been in its present state, must have died of chronic malarial disease indistinguishable, individually considered, from the subsequently called kala-azar, btu it does not follow that the disease has been present in an epidemic and communicable form all that time; in fact, Colonel Maxwell himself states that it was not formerly of so virulent a type.[344]

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[339] Rogers, *Report of an Investigation,* p. 147.
[340] Ibid., pp. 149-151.
[341] Ibid., p. 161.
[342] Ibid., p. 164.
[343] Ibid., p. 165.
[344] Ibid., p. 166.

This was claimed despite fact that, as Rogers admitted, 'the Garos themselves called the disease "Sirkari disease," or "Saheb's disease," not because the Europeans suffered from it, for up to that time they had entirely escaped, but because they said the disease was unknown among them until after the Sahebs took over their country.'[345] Rogers found evidence in 1875 that administrators had trouble collecting revenue from the Garos because of an outbreak of something the locals called 'kala-azar', but the issue was unknown to medical officers in Assam at the time. This outbreak was then related to a neighbouring outbreak that occurred at the same time, 'Burdwan Fever'.[346]

The validity of Rogers' claims that kala-azar actually originated as Burdwan Fever in Bengal rather than in the Garo Hills in Assam is difficult to substantiate from a biological standpoint, but it is significant for a few reasons. First, Rogers is committed to the idea that kala-azar was a form of malarial fever and also made that claim that this form of malarial fever, at the very least, was somehow communicable. Second, Rogers attempted to further dismiss Giles' claims that kala-azar is related to hookworm. Connecting kala-azar to Burdwan fever was essentially an argument that kala-azar was related to malaria but kala-azar was somehow unique in the sense that other forms of malarial fever were believed to not be communicable.

To advocate for his specific forms of kala-azar control, Rogers claimed that, above all, kala-azar was 'an epidemic of malarial fever'.[347] According to Rogers,

> This view involves the following propositions: (1) that malarial fever may, under exceptional circumstances, become intensified to such a degree as to attain the epidemic properties; (2) that malarial fever when it has become sufficiently intensified and is introduced into a suitable soil, may spread in an epidemic form over considerable areas, and cause an exceptionally great mortality, int eh absence of any changes in the physical

[345] Ibid., p. 166.
[346] Ibid., p. 169.
[347] Ibid., p. 194.

> or sanitary condition of the paces affected; and (3) that the germs of the disease must in some way be able to get out of one person into another, either directly or indirectly, after passage through the soil, which is obviously necessitated by the conditions of the second proposition.[348]

Rogers believed that malarial fevers were capable of at least 'indirect infection'[349], and in the wake of Dr. Patrick Manson and Surgeon-Major Ronald Ross' independent research on the relationship between mosquitoes and malaria, argued that it was possible that some pathogenic germ could pass through animals and intensify; a phenomenon that occurred in test tubes that Rogers argued could also occur in 'Nature's laboratory'.[350] Rogers was willing to accept that some forms of malaria could be possibly transmitted via mosquitoes, but was unwilling to accept that kala-azar could be transmitted in this way because the 'crescent-shaped bodies' that characterised malaria in studies were not found in kala-azar. This insight was important in distinguishing malaria from kala-azar. Though malaria and kala-azar are actually different diseases, Rogers was arguing that they were related. Nevertheless, malaria and kala-azar were still somehow different. Rogers believed that both could be communicable but was unwilling to accept that kala-azar and malaria were communicated in the same way.

Rogers believed that kala-azar was on pace to inevitably spread throughout the entire province of Assam and that none of the sanitary measures that were in place prior to his arrival were sufficient to stop its progress. According to Rogers, building dispensaries would help minimise suffering to a small degree, but no sanitary work short of 'an entire alteration of the soil of the whole valley into one which is unfavourable to the development of the malarial organism' would be enough to avoid the inevitable omnipresence of kala-azar.[351] In proposing his new

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[348] Ibid., p. 194.
[349] Ibid., p. 197.
[350] Ibid., p. 197.
[351] Ibid., p. 203.

policies, Rogers wholeheartedly believed that locals in Assam would be overwhelmingly receptive and active in instituting any measures to ease the suffering of such a horrible disease.[352] Roger wrote,

> I propose then to take advantage of this attitude of the people, and to assist them to help themselves int eh following two ways: (1) By writing a pamphlet, to be translated into Assamese, Kachari, and any other languages that may be thought advisable, setting forth in the simplest words the methods in which the disease is commonly spread, and the precautionary measures which should be taken in order to avoid the introduction of the disease into previously unaffected villages, and the best measures to adopt to prevent its spread through a village when once it has begun, etc.
> (2) To give facilities to those villages which are already severely affected by the disease to move from the infected sites to new ones a short distance off, while still retaining the land which they are cultivating, which will prevent their going to a distance and so running a risk of carrying the infection to new places. The move should be made during the dry cold-weather months, from December to February[353] or the middle of March, being the most favourable ones.[354]

For tea gardens, Rogers stated that the biggest issue was early detection, and to aid with this he provided a detailed list of the recognisable symptoms.[355] With this information, Rogers hoped that plantations would be able to not only get a quick diagnosis, but also tell labourers to avoid visiting neighbouring villages if cases of kala-azar occurred.[356] If cases of kala-azar, or fever in general, increased at a particular tea plantation, Rogers argued that the living quarters of the labourers should be destroyed and the site moved to another location. To argue for this measure, Rogers cited a plantation in Kamrup that followed these procedures and successfully ended an epidemic in the garden.[357]

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[352] Ibid., p. 205.
[353] December to February were the months when fever deaths were at their lowest, consistent with overall trends in malaria in the province.
[354] Ibid., p. 206.
[355] Ibid., p. 217.
[356] Ibid., p. 218.
[357] Ibid., p. 221.

Rogers' work stood at an important moment in the history of malaria. It was published in 1897, the same year that Ross discovered that mosquitoes were the vector of malaria. This was briefly discussed in his inquiry into kala-azar, but Rogers' work was one of the last that argued for a biological connection between kala-azar and malaria. The eventual decoupling of kala-azar and malaria is discussed more in depth in the next chapter, but Rogers' assertions that kala-azar and malaria were similar were nonetheless important for Assam. His sanitary recommendations were much more palatable for the province and fit into the work that was already being done to control malaria in Assam.

Sanitation, Drainage, and Quinine- the Future of Malaria Control in Assam

This section provides a brief overview of the anti-malarial work in colonial Assam that occurred alongside but often separate from the inquiries into kala-azar. As an endemic disease, the presence of malaria was often understood as a normal part of life even though it was believed to be the deadliest disease in the province. The clearing of jungles and the spread of cultivation in Assam was still thought to be an effective way to reduce malaria in the province, but new efforts to control malaria can be placed into three separate categories. The first was a renewed and reenergised approach to sanitation in Assam, particularly conservancy measures and drainage. The second was a massive increase in the spread of the sale of quinine. The third was a more systematised approach to record epidemic incidences and improve the collection of vital occurrences in the province. The most significant fact about these measures is that they aspired to reach villages across Assam, not just major cities such as Guahati or Shillong and tea plantations. Though these measures faced some hurdles including administrative challenges, financial limitations, and mixed reactions from locals, the momentum of these measures would carry into

the following decades and help establish the tone of future malaria control entirely separate from kala-azar.

For decades, jungles had been interpreted as a major health hazard and large tracts of land were deforested in an effort to decrease the total cases of fever within Assam. In 1894, the Sanitary Commissioner of Assam A. Stephen compared the health of the Brahmaputra Valley and the Surma Valley, both in Assam. Stephen argued that both valleys had 'swampage' and large areas that would flood during the rainy season; two factors Stephen closely associated with catching malaria. The Surma Valley had fewer cases of fever than the Brahmaputra Valley, and the Surma Valley had much more land under cultivation than the Brahmaputra Valley which had larger tracts of jungle and uncultivated land. Stephen argued that this gave the Surma Valley 'comparative immunity'[358] from malarial fevers, and he believed that cutting down the jungles in the Brahmaputra valley and cultivating more land would improve the health of the Brahmaputra Valley in the long run, though an initial spike in cases while the work was being done would be expected.[359]

There was a great need to increase the standards of sanitation on tea plantations and in the general public, and many of these plans were related to Giles' plans. On the one hand, these plans involved traditional methods of drainage which were thought to help reduce cases of malaria or 'Fevers'. On the other, in specific reference to Giles' work, was the necessity for the better management of nightsoil. In the Memorandum of the Army Sanitary Commission on the Assam Sanitary Report for 1890 as presented in the Assam Proceedings of 1892, the Army Sanitary

[358] It is important to note that this conception of immunity was not the same as immunity is considered today. Instead of referencing a biological resistance to disease in human beings, Warburton is arguing that ecological conditions made it more difficult for humans to suffer from malarial fever.
[359] Stephen, *ASRA 1894,* p. 23.

Commission concluded that Giles' calls for a cleaner water supply on tea plantations and villages would help reduce kala-azar and that tea plantation managers would see their investment in such measures pay off highly with a healthier workforce.[360] In January of 1892, Secretary to the Chief Commissioner of Assam Edward A. Gait wrote that the government would increase grants for village sanitation to develop improved water management.[361] Lack of financial support was a limiting factor in many of the recommendations of the Assam Sanitary Department in Assam, in 1891 calls to increase drainage to hopefully decrease cases of malaria in villages suffered from an extreme lack of funds. At that point, the workers who had already completed several sanitary works remained unpaid. Without payment nor the promise that more monies could be devoted to sanitation, civil officials and workers were hesitant to take on any new projects.[362] Giles' work, though ultimately wrong, was able to encourage more government money to be spent on public health in Assam and several grants were eventually created.[363] Some of these grants came from the Government of India.[364] Officials in Assam also urged tea planters to invest money in improving sanitation saying that there could only be a benefit.[365] Despite the newfound enthusiasm for improving sanitation in villages across Assam, localities still struggled to afford the changes and often needed to perform expensive surveys to breakdown the costs and apply for

[360] 'Assam Proceedings 1891, Home Department, September, No. 27', BL, IOR/P/3804.
[361] 'Assam Proceedings 1891, Home Department, September, No. 23', BL, IOR/P/3804.
[362] 'Assam Proceedings 1891, Home Department, January, No. 123', BL, IOR/P/3804.
[363] 'Assam Proceedings 1892, Home Department, September, No. 23', BL, IOR/P/4031.
[364] 'Assam Proceedings 1894 January - December, Home Department, September, No. 170', BL, IOR/P/4668.
[365] 'Assam Proceedings 1892, Home Department, December, No. 52, Memorandum by the Army Sanitary Commission on the Assam Sanitary Report for 1890', BL, IOR/P/4031.

grants- this was the case with Nowgong which was eventually given a grant but the district spent a lot of time and money preparing the grant application.[366]

In addition to policies advocating for the improvement of sanitation through conservancy measures and drainage, the government of Assam also rapidly scaled up their programme to distribute quinine. In 1893 the Government of India received information from Sir Horace Rumbold that Dr. Glagner, the physician serving under the Government of Batavia, had successfully treated patients suffering from beri-beri with quinine.[367] Glagner had thought to try the idea because of the many similarities between beri-beri and malaria, specifically the animalculer amoeba 'which infects the circulation.[368] Based on this information, in 1893 before he left the office as the Sanitary Commissioner of Assam, Costello wrote to the Secretary of the Chief Commissioner of Assam that,

> In view of the spread of kala-azar specially, and to the widespread belief amongst the medical officers who have experience of it that its basis, at least is malarious, I would urge Dr. McNaught's suggestion on the favourable consideration of the Chief Commissioner. Besides, for kala-azar it would be most useful to supply the people with quinine this way, but which it could be easily obtained by every villager; and, as Assam acknowledged to be about the most malarious province in the Indian Empire, the advantage of the proposed arrangement to health of the people would be incalculably great.[369]

McNaught had previously recommended that packets of quinine be sold through post offices throughout Assam so that the public could reliably and cheaply access the drug.[370] The

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[366] 'Assam Proceedings 1894 January – June, Home Department, January, No. 116 to 130', BL, IOR/P/4471.
[367] 'Assam Proceedings 1894 July – December, Home Department, October, No. 14', BL, IOR/P/4472.
[368] 'Assam Proceedings 1894 July – December, Home Department, October, No 15', BL, IOR/P/4472.
[369] 'Assam Proceedings 1894 July – December, Home Department, October, No 15', BL, IOR/P/4472.
[370] 'Assam Proceedings 1894 July – December, Home Department, October, No 17', BL, IOR/P/4472.

Chief Commissioner of Assam advocated the policy and 'arranged for the sale of quinine, manufactured by Government, as low prices, to the rural population, through the agency of the post office.[371] In 1893, Wilkington, the Deputy Postmaster General of Assam, agreed to the scheme and even contributed to the most secure methods of storing and transporting quinine.[372] The scheme was not new, it had recently begun in Bengal, but officials from other provinces in Assam were excited to see the results. J. A. Bourdillon, the Secretary to the Government of Bengal, wrote to the Chief Commissioner of Assam sanctioning the sale of quinine from Bengal to Assam and took great interest in the results.[373] Instructions were sent to the post offices throughout Assam with how to store and sell the quinine which they were supposed to procure from jails in Calcutta that manufactured the drug.[374] The sale of quinine in Assam was doubly attractive; it could help residents prevent and treat both malaria and kala-azar.

The Assam Sanitary Department was in charge of issues of public health in Assam, but widespread and remote villages and tea plantations meant that there needed to be medical practitioners across Assam. On 30th October 1894, medical practitioners form the tea gardens gathered at Kokilamukh along with officers from the Sanitary Department and Civil Surgeons to discuss the issue of kala-azar.[375] The result of the discussions were sent to the Chief commissioner. The gathering of medical practitioners and other sanitary officials is a mark of how difficult it was to coordinate efforts against the disease. The work, however, is important in elevating the importance of the issue. The legitimacy of kala-azar as a problem was elevated

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[371] Stephen, *ASRPA 1894*, p. 23.
[372] 'Assam Proceedings 1894 July – December, Home Department, October, No 17 to 18', BL, IOR/P/4472.
[373] 'Assam Proceedings 1894 July – December, Home Department, October, No 24', BL, IOR/P/4472.
[374] 'Assam Proceedings 1894 July – December, Home Department, October, No 49', BL, IOR/P/4472.
[375] Stephen, *ASRPA 1894*, p. 25.

through this effort because the disease was interpreted as a problem for tea plantations farmers. In response, the Chief Commissioner sought special help from the Government of India.

One of the biggest hurdles preventing medical officers in Assam from providing a better anti-malarial programme was somewhat poor and unreliable information from villages in the provinces outside of major cities or tea plantations. In March of 1895, provincial officials agreed that a better system was needed to record vital statistics in the province.[376] By May of 1895, Medical Officers devised a new Village Sanitary Inspection Book, published in English and local languages, in which officials could systematically record facts about villages as they related to sanitation including the drainage systems in place, what railways were in the province, population numbers, and meteorological data.[377] Notably, the Sanitary Inspection Book was designed for the use of villages where there were no systems for inspection; municipalities and towns for tea gardens were not expected to use the book because systems for sanitary inspection already existed.[378] These calls for improved sanitary inspections were couples with urges to improve the registration of vital statistics, including having more accurate mortality data.[379]

Overall, these three measures formed a new, comprehensive approach to malaria control in Assam that, combined with Rogers' conclusions on kala-azar, were meant to reduce deaths from fevers both on tea plantations and in the general public. At the time, the success of the programmes was difficult to measure. For example, quinine had already been given to sufferers in Nowgong for free and because the government traced the success of the scheme based on the

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[376] 'Assam Proceedings 1895 January – June, Home Department, March, No. 161', BL, IOR/P/4667.
[377] The whole of the village inspection book can be viewed in the Assam Proceedings of 1895. 'Assam Proceedings 1895 January – June, Home Department, May, No. 14', BL, IOR/P/4667.
[378] 'Assam Proceedings 1895 January – June, Home Department, May, No. 15', BL, IOR/P/4667.
[379] 'Assam Proceedings 1895 January – June, Home Department, May, No. 119', BL, IOR/P/4667.

amount of quinine sold, the sale of quinine in districts like Nowgong therefore provided misleading data. Nevertheless, Medical Officers like Macnamara believed that success could still be made if the benefits of quinine were made better known to the public.[380] Over the next few years, the systems were continuously refined. In 1897, quinine was sold by both post offices and vaccinators and in the following decades the government carefully considered the best ways to attract more residents to procure the antimalarial drug.[381] As colonial Assam entered the twentieth century, these approaches formed the backbone of the province's anti-malarial measures but many debates over whether mosquito control could be reasonably added to these anti-malarial measures defined the anti-malarial measures in the province for the future.

Conclusion

Malaria was a constant presence for much of colonial Assam's history, but the prevailing opinions of the disease in Western medical circles meant that relatively little could be done to stop the annual death toll. It was not until the emergence of kala-azar as a social phenomenon that government officials in Assam began to take malaria seriously and investigate the problem of 'Fevers'. Though historical sources note concern over kala-azar, it is likely that, from a biological perspective, malaria was the cause of the majority of 'Fever' cases in colonial Assam. This chapter has argued that historians must consider malaria as one of the major actors during discussions of public health and medical research in the province.

Medical officers in Assam had a difficult time differentiating malaria from kala-azar. From the outset, locals in the Garo Hills noted the severity of the disease. While their concerns

[380] 'Assam Proceedings 1896 January - June, Home Department, May, No. 114', BL, IOR/P/4872.
[381] 'Assam Proceedings 1897 January – June, Home Department, January, No. 15 to 21', BL, IOR/P/5092.

were acknowledged, their assessment of the disease as both communicable and a separate entity form malaria was dismissed. Between 1874 and 1897, the Assam Sanitary Department grew from a relatively remote and underrecognized institution of public health to a department closely associated with research on malaria and 'Fevers'.

Fever research in Assam began to incorporate the work of medical officers from the Government of India who were determined to situate fevers in the province within the larger network of fevers in the British Empire. G. M. Giles' efforts to classify kala-azar as distinct from malaria was in line with his larger efforts to address beri-beri and anchylostomiasis (hookworm) in other parts of the province. Leonard Rogers, along with other medical officers from the Assam Sanitary Department, dismissed Giles' conclusions and asserted that malaria and kala-azar were biologically related diseases. In his writings, Rogers noted a possible difference between malaria and kala-azar in the wake of Patrick Manson and Ronald Ross's preliminary research on mosquito transmission (specifically the fact that kala-azar could not be spread along the same lines as malaria) but ultimately Rogers remained steadfast in this belief.

During the last quarter of the nineteenth century in Assam, quinine distribution was slowly growing and in the beginning of the next century quinine took centre stage as a prominent anti-malarial measure alongside debates over mosquito eradication. Together, malaria and kala-azar encouraged the province to address fevers, but, in reality, it was a complex reflexive relationship between the actual outplay of disease in Assam (which was unknown to contemporaries) and the social perceptions of disease that drove this transition within the province.

Ultimately, sanitation, research, and policy in colonial Assam were still bound by constraints outside of medicine. It was only once fevers began to truly threaten the stability of tea plantations that both malaria and kala-azar were taken seriously. This was in the face of the fact

that, on average, 1.5% of the population died from fevers every year.[382] This framework situated sanitation/public health in Assam for the beginning of the next century as well, as discussed in the following chapter, but the increase in attention paid to fevers created policies that would affect the lives of residents across Assam on and off tea plantations.

Assam was a unique landscape for public health. Though research into diseases, particularly on 'Fevers', increased in Assam between 1874 and 1897, there were still several hurdles that affected the transition of medical theories to public health praxis. In 1897, Surgeon-Major E. F. H. Dobson became the Superintendent of Emigration and Protector of Emigrants.[383] This is not necessarily an indication of a corrupt system where medical officers who disputed policies restricting emigration to Assam were rewarded, Giles was wrong in his assessment of kala-azar after all. Ultimately, Dobson's promotion reflected the balance medical officers in colonial Assam were trying to strike. Theories on diseases abounded, but the priority of medical officers was to maintain the colonial systems in place in Assam, notably the tea industry. Many of these decisions were paternalistic and sustained an industry that took advantage of millions in the province, but one thing is certain: malaria was a pivotal actor in this process. Focusing on the disease sheds a new perspective on the history of the province and life on the periphery of the British Empire.

[382] See: ASRPA 1874-1897.
[383] 'Assam Proceedings 1897 January – June, Home Department, Tabular Statements, No. 308 to 310', BL, IOR/P/5092.

Chapter 3: The Turn of the Twentieth Century - Malaria in Assam Between 1897 – 1919

Introduction

> There is probably no part of India where sanitary regulations are more strictly enforced than they are in regard to the immigrant populations of Assam. The circumstances of the indigenous population are, however, entirely different, and call for no similar measures; Assam is a very sparsely-populated province, and full of hills and jungle, and though it is undoubtedly an unhealthy part of India, this is due to causes which could not be remedied by the provisions of any Sanitary Regulation. So far as Mr. Cotton [the Chief Commissioner of Assam] can judge, the only practical result of the enforcement of such a Regulation would be the harassment of remote villages inhabited by an ignorant peasantry, and he is not prepared to take any steps for furthering its enactment.[384]

Sanitary policies in colonial Assam were often limited to monitoring and managing the health of the workers in the province's various industries - most notably tea but by the late nineteenth and early twentieth centuries also railways, coal, and oil among others. As explored in the previous chapter, from the province's inception in 1874, government medical officers called for an expansion of the scope of the Sanitary Department so that regulations could address members of the public outside of these industries. There were always those who disagreed with these calls; as is evident from the quotation above, even in 1897 the Chief Commissioner of Assam was hesitant about expanding the purview of sanitary policies. Despite such reservations, the period between 1897 to 1919 saw an expansion of colonial Assam's ambition to reduce malaria both on and off tea plantations. Policies that began in the 1890s such as the widespread distribution of quinine for sale, a revised approach to the collection of vital statistics, and

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[384] Sir Henry John Stedman Cotton was the Chief Commissioner of Assam between 1896 and 1902 and the above quotation is from the 'Resolution' section of the Sanitary Report of Assam in 1897; it was written by the Secretary to the Chief Commissioner of Assam as a representation of the provincial government's interpretation of the work and future plans of the Sanitary Department. (F. J. Monahan, 'Resolution on the Sanitary Report of Assam for 1897', in A. Stephen, *Annual Sanitary Report of the Province of Assam for the Year 1897* (Shillong, 1898), p 5.)

continuing reliance on traditional approaches to drainage and sanitation matured during this period. Alongside existing approaches came brand-new calls for anti-malarial schemes to address the vectors of malaria – Anopheles mosquitoes. Unfortunately for the residents of colonial Assam, medical officers struggled to create and implement effective anti-malarial strategies and severe financial constraints further inhibited their ability to tackle malaria. 'Fever' mortality and morbidity data show that there was no substantial reduction in deaths from malaria between 1897 and 1919. 59% of the total deaths in colonial Assam were attributed to 'Fevers' in 1897, and 58% of the total deaths in the same category in 1917.[385]

There are many factors that influence malaria mortality and morbidity, and in Assam, as elsewhere, the relationship between human beings, malaria-causing plasmodium parasites, and anopheline mosquitoes was unique. Despite increasing knowledge of the behaviour of parasites and vectors, the specific factors that influenced the presence of malaria varied from location to location and, in the early twentieth century, often remained unknown. For example, each strain of parasite produces a different reaction within the host. Falciparum malaria causes symptoms within a few days; vivax caused initial symptoms like those of falciparum but tended to relapse, unlike falciparum. Additionally, different species of anopheles have different breeding and feeding patterns, and this affects the seasonal prevalence of malaria, and the time-of-day humans are most likely to be bitten. If the factors that contribute to malaria are unknown, then general anti-malarial measures (anti-larval measures, mosquito nets, etc.) are often unable to adapt to each unique setting.

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[385] Though the timeline of this chapter ends at 1919, the statistics on 'Fevers' in 1918 and 1919 were affected by the 1918-1920 Influenza Pandemic, and it is unlikely that these years accurately indicate deaths from malaria and other causes typical in Assam. Therefore, 1917 is used as the last year representative of the general malarial and 'Fever' trends in the province. (Stephen, *ASRPA 1897*. T. C. McCombie Young, *Annual Sanitary Report of the Province of Assam for the Year 1917* (Shillong, 1918).

To better understand the relationship between humans, parasites, mosquitoes and the environment in the provinces most affected by malaria, the Government of India commissioned anti-malarial studies of various types and sizes. The turn of the twentieth century marked a new era in malaria research and anti-malarial strategies around the world. Italy, for example, implemented ultimately successful strategies that greatly reduced the presence of malaria within the country. Italian approaches to domestic quinine distribution and sanitary engineering were even idealised in colonial Assam.[386] Despite international discourse and the success achieved in places like Italy, the northeast of India suffered from disagreement between medical officers over which anti-malarial measures would be effective and feasible. The debate over anti-malarial methods reflects the multidirectional influences that affected both medical theories and the practice of public health/sanitation. At the core, medical officers struggled to determine which anti-malarial measure would be optimal for Assam.

This chapter analyses the developing perspectives of medical officials, the practical approaches to malaria control, and the outcomes of various anti-malarial campaigns in colonial Assam between 1897 and 1919. It begins by detailing the way in which malaria and kala-azar were finally differentiated. Efforts to combat kala-azar continued in colonial Assam, but the remainder of the chapter focuses primarily on malaria. Though multifaceted and nuanced, efforts

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[386] It should be noted, however, that many specific approaches were not viewed as universally adaptable and were often not utilised outside of Italy. Italian public health efforts were often mentioned in international discourse as a positive example of anti-malaria measures. Some examples in the context of this project include the 1909 Malaria Conference at Simla (specifically in reference to drainage and other issues) and in the sanitary report for the province of East Bengal and Assam in 1910 on the topic of distributing quinine to children. It must be noted that in these contexts, Italian anti-malarial measures were often mentioned as being successful, though usually not applicable to other localities mostly because of environmental and financial reasons. *Proceedings of the Imperial Malaria Conference Held at Simla in October 1909* (Simla, 1910), p 106. & E. C. Hare, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1910* (Shillong, 1911), p. 18.

to reduce malaria in the province revolved around three approaches: increasing the distribution of quinine for sale as a malaria prophylactic and treatment, reducing the presence of anopheline mosquitoes, and implementing traditional methods of sanitation and drainage. Each of these approaches had their supporters and detractors, but the ability to prove one or the other as effective rested on the provincial government's efforts to increase the accuracy of vital statistics. With accurate vital statistics, the provincial government thought they would be able to better understand the true presence of malaria and determine the efficacy of each measure so that funding could be allocated appropriately. Though sound in theory, the collection of vital statistics in colonial Assam remained less than accurate. Nevertheless, vital statistics were used to help determine anti-malarial measures. This highlights a tension between scientific expertise and government action that is important for historians to note because it shows that knowledge of malaria did not always translate into public health practice. The reasons for this reflected the nature of society in colonial Assam and the creation of medial knowledge itself. The last section of this chapter focuses on the impact of World War I. During the war, the momentum behind anti-malarial measures was lost as both financial resources and medical experts were reallocated to the war effort.

Between 1897 and 1919, Assam ultimately relied on quinine distribution as the primary anti-malarial method and invested only a small amount in mosquito eradication programmes, but malaria was finally recognised as a significant problem in the province. This change should be recognised as a significant transition in anti-malarial efforts within the province. Though large parts of the world and India relied on quinine, approaches to malaria in Assam were unique due to the province's own political and environmental landscape. This chapter serves as an indication of the relationship between the development of medical knowledge on malaria in colonial Assam and the implementation of anti-malarial schemes on the periphery of the empire. Statistics on

malaria mortality and morbidity are obscure, but in this chapter the real effects of these efforts are explored using modern knowledge to understand malaria and produce insights that researchers during the colonial period were not capable of making due to their limited knowledge. There are many possible explanations for the failures (and occasional successes) of the anti-malarial measures, but the result remained the same: developments in medical science and some practical experiments did not reduce malaria mortality and morbidity. Explaining this phenomenon contributes to important themes in the history of malaria and the history of Assam.

Colonial Assam Between 1897 and 1919

The time period between 1897 and 1919 was significant for both the history of malaria and of colonial Assam. 1897 is the beginning point for this chapter for several reasons. By 1897, the practice of sanitation had matured and medical officials in Assam were better connected with other colonial and international discourse on malaria control. Leonard Rogers' work on kala-azar discussed in the previous chapter was a far cry from conceptions of Assam in the 1870s, in which the province was deemed a colonial backwater suitable for the banishment of defiant medical officers such as A. C. C. DeRenzy. Additionally, though there were a few breakthroughs in malaria research that occurred throughout the 1890s, Sir Ronald Ross' discovery of mosquitoes as the vector of malaria marks 1897 as a new age for malaria research.

Ross' discovery and, separately, William Boog Leishman and Charles Donovan's 1903 discovery of the *Leishmania donovani* parasite's role in causing kala-azar reenergised and reoriented efforts to address the overwhelming problem of 'Fevers' in colonial Assam. These studies offered new insights and fuelled conversations on sanitation and public health, but they did not spark an immediate revolution in anti-malarial methods in the province. Some historians have argued that Ross' discovery had a minimal impact on public health in Assam and the current

scholarly conversation on public health and sanitation during this timeline focuses overwhelmingly on kala-azar. Historian Arupjyoti Saikia notes that much of the revenue for sanitary schemes still went to combating kala-azar, especially on tea plantations.[387] The government was more acutely focused on kala-azar than malaria between 1897 and 1919, but historians should recognise that this phenomenon was the result of Assam's history with 'Fevers' and the belief that kala-azar was a new, threatening, and contagious disease in comparison to malaria which had previously been viewed as endemic and caused by the local climate. The government prioritising anti-kala-azar efforts was not a reflection of which disease was more deadly. Malaria was an ever-present and overwhelming threat to life, but medical officers became more attuned to malaria once malaria and kala-azar were finally differentiated.

During this timeline, existing anti-malaria programmes and newly introduced mosquito eradication campaigns received increased scientific attention, financial backing, and government scrutiny. Medical officers engaged actively in local and international dialogues on anti-malarial measures. Studies were commissioned, experimental schemes were implemented, and over time approaches to malaria rapidly developed with a level of attention noticeably higher than previous decades when questions of kala-azar dominated conversations on 'Fevers' in Assam. These changes can be observed in the writings of medical officers in colonial Assam who reassessed their understanding of 'Fevers'.

The roughly two-decade period between 1897 and 1919 was also one of great political change for Assam. In 1905, an eastern portion of Bengal was partitioned and combined with Assam to form the province of Eastern Bengal and Assam with its new capital in Dacca (modern day Dhaka). The province was short-lived; in 1912 the eastern Bengal portions were reunited

[387] Saikia, *The Unquiet River*, p. 316.

with western Bengal and Assam was made an independent province within India once again. Readers must take note of the fact that any analysis of malaria between 1905 and 1912 will include information on both the eastern Bengal and Assam portions of the province.

Separate statistics from the province of Eastern Bengal and Assam between 1905 and 1912 complicate the analysis of government documents, especially when considering the question of the continuity of malaria mortality and morbidity numbers in the province of Assam, then the province of Eastern Bengal and Assam, and then the province of Assam once again. A significant issue contributing to the problem of analysing these statistics over a longer timeframe beyond 1905 and 1912 was the massive increase in the population of the province of Eastern Bengal and Assam when Assam's population total was combined with that of Eastern Bengal. This is in contract to central Bengal which saw a decrease in population. There are also many differences between Eastern Bengal and Assam. Aside from social, religious, and economic differences, the malaria trends were distinct from each other. For example, the species of anopheline mosquitoes present in Eastern Bengal bit more frequently in the winter months as opposed to the summer months in Assam. Contemporary researchers were aware of this difference, and Deputy Sanitary Commissioner T. C. McCombie Young made the point in 1912. The anopheline mosquitoes found by McCombie Young included *A. Fuliginosus, A. Nigerrimus, A. Barbirostres,* and *A. Rossi*.[388] The distribution and level of public use of quinine also differed between Eastern Bengal and Assam. Eastern Bengal eventually received nearly double the quinine and much larger sales than Assam. During this time period, the many tea plantations that

[388] T. C. McCombie Young, 'Report on the Result of the Larvicidal Experiments in Ramna (Dacca)', in E. C. Hare (eds.), *Supplement to the Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1911* (Calcutta, 1912), p. 6.

dominated the cultivated landscape of Assam distributed quinine freely to their workers.[389] With the role of tea plantations and their distribution of quinine in mind, the difference in quinine sales between Assam and Eastern Bengal is placed into its appropriate context, but overall this fact indicates that the sizeable portion of Assam's population that lived on the tea plantations were subjected to different standards of health and protection than other residents of Assam. In short, both the landscape of disease and the pathways to public health were different in each region. These aspects are discussed in detail in this chapter, but here they indicate the difficulty when studying government documents from the province of East Bengal and Assam. The combination of Assam's population and fever mortality and morbidity rates with that of Eastern Bengal between 1905 and 1911 complicated the efforts of contemporary medical officers and modern historians to assess both the immediate and long-lasting effects of anti-malarial measures.

During the short-lived union, Eastern Bengal received more attention from medical officers than Assam. The Eastern Bengal portion of the province was the host of the two mosquito eradication measures around 1909 and 1910. Additionally, malaria surveys that discovered the main mosquito species carrying malaria in the province were conducted on in Eastern Bengal and not Assam. Both of these incidences will be explored further on in this chapter, but it is clear that most of the research on malaria within the province between 1905 and 1912 was carried out in Eastern Bengal. As a result, Assam was behind both Eastern Bengal and other provinces in the Raj where mosquito control measures were not necessarily popular nor universally implemented during the 1910s, but new studies on medical entomology and anti-malarial measures that targeted species-specific sanitation were being done. Despite this broader

[389] E. Wilkinson, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1909* (Shillong, 1910), p. 21.

trend, the baseline studies on identifying the specific malaria-carrying mosquitoes and ecological conditions were not performed in Assam until much later. Shortly after Eastern Bengal and Assam was partitioned, the beginning of World War I reshaped sanitary efforts.

The landscape of public health changed dramatically again in 1914. Though there were no battles fought in Assam, the First World War stalled much of the development of anti-malarial measures in the province. Government monies and many medical experts were no longer dedicated to addressing diseases in the remote province of Assam- they were instead supporting soldiers around the world. By 1919, perspectives on malaria control had changed. An example of this shift is a change in attitude towards quinine; medical officers during the war began to downplay the drug's ability to act as a malaria prophylactic.[390] Additionally, the momentous political changes brought on by the Great War mark the period after 1919 as another new era of malaria control, and this is the focus of the next chapter of this project.

Historiography

The analysis of malaria in this chapter combined with the work of other historians of medicine focusing on British India and other parts of the world helps situate colonial Assam within wider historical discourse. The perspectives of medical officials and the biological realities of the disease reveal the relationship between malaria and society in Assam. Though underexplored, historians have touched on the influence of malaria in colonial Assam during this timeline.

In the wake of Ronal Ross' discovery of mosquitoes as the malaria vector, different locations around the world introduced varying measures of malaria control. Historian J. M.

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[390] M. Harrison, *The Medical War: British Military Medicine in the First World War* (Oxford, 2010), p. 233.

Oluwasegun argues that between 1902 and 1928 the government in colonial Lagos responded by segregating Africans from Europeans with the primary motivation being safeguarding the lives of Europeans.[391] There were some attempts to clear swamps in Lagos between 1901 and 1904 headed by Governor William MacGregor, but these were quickly relegated to the background until mosquito control measures were implemented beginning in the late 1920s and early 1930s. In his discussion of disease, ecology, and politics, historian J. R. McNeill wrote about the experiences addressing yellow fever and malaria, both diseases transmitted by mosquitoes, in the Caribbean and notes the success Americans had implementing mosquito control measures in Panama by 1906.[392] G. Majori argues that the work from the Italian School of Malariology, which included figures such as Giovanni Battista Grassi who discovered that only female anopheline mosquitoes transmitted malaria, was pivotal in encouraging the Parliament of the Italian Kingdom to support mosquito control measures relatively quickly with anti-larval measures beginning in the 1910s and hitting their stride in the 1920s with the help of the Rockefeller Foundation.[393] Despite the fact that Ross made his landmark discovery in India, anti-malarial measures within the Raj that featured mosquito eradication methods failed to gain traction in the immediate years after 1897.

Ross' work did not produce a universal approach to anti-malarial campaigns. Historian Michael Worboys explores some of the complications surrounding the application of Ross' discovery on malaria control within colonial medicine by emphasising the tensions between the

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[391] J. M. Oluwasegun, 'The British Mosquito Eradication Campaign in Colonial Lagos, 1902 – 1950', *Canadian Journal of African Studies* 51/2 (2017), p. 221.
[392] J. R. McNeill, *Mosquito Empires: Ecology and War in the Greater Caribbean, 1620-1914* (Cambridge 2010), p. 311.
[393] G. Majori, 'Short History of malaria and its Eradication in Italy with Short Notes on the Fight Against the Infection in the Mediterranean Basin', *Mediterranean Journal of Hematology and Infectious Diseases* 4/1 (2012), p. 2.

London School of Hygiene and Tropical Medicine and the Liverpool School of Tropical Medicine in shaping the application of Ross' work and broader public health.[394] In his work *Public Health in British India,* historian Mark Harrison expands on Worboys's breakdown of the two different approaches to tropical medicine, that of the Liverpool school (emphasising holistic approaches to sanitation) and the London school (emphasising laboratory research and post-graduate teaching), by arguing that similar differences can be seen in debates over malaria prevention in India. Prior to Ross's discovery, there were two primary methods of malaria eradication in India, drainage and general avoidance of swampy (or unsanitary) areas, and prophylaxis from cinchona preparations (most often quinine). There were several debates over the optimal path forward, but Harrison noted that Ross was unable to convince the government to fully embrace mosquito eradication. He 'left India in 1899 a disgruntled and bitter man'.[395] Despite the fact that not all medical officers in India fully embraced mosquito control techniques in the late 1890s and early 1900s, there were some experiments that embraced the method.

One pivotal mosquito control experiment often cited by historians was the work done at Mian Mir in the Punjab. Historian W. F. Bynum's article 'An Experiment that Failed: Malaria Control at Mian Mir' highlights the fact that the Mian Mir experiment, which was criticised by Ronald Ross as under-funded and badly planned, was influential in shaping anti-malarial programmes throughout India which afterward relied largely on quinine.[396] Similar experiments were held in the province of Eastern Bengal and Assam that suffered from similar setbacks and fundamentally produced the same result- wariness towards mosquito control methods.

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[394] Worboys, 'Manson, Ross and Colonial Medical Policy', p. 21.
[395] Harrison, *Public Health in British India,* p. 158.
[396] W. F. Bynum, 'An Experiment that Failed: Malaria Control at Mian Mir', *Parassitologia*, 36/1-2 (1994), p. 107.

Ultimately, quinine was used as the primary method of malaria control throughout India during this time period, including Assam between 1897 and 1919.

The primary method of malaria control in India began to change with the introduction of species-specific sanitation rather than blanket mosquito eradication methods. Historian D. J. Bradley argues that it was not until the work of individuals such as Malcolm Watson in Malaysia or N. H. Swellengrebel in Indonesia that anti-malarial methods began to embrace medical entomology. India, however, was slower to adopt these measures than south-east Asia.[397] The likes of Watson and Swellengrebel were joined by other medical officers who embraced medical entomology, including researchers G. C. Ramsay, C. Strickland, S. R. Chirstophers, C. A. Bentely, and M. O. T. Iyengar. This approach, however, arrived relatively late in Assam and did not really take off until the late 1920s and early 1930s, with very few studies occurring beforehand.

The narrative of anti-malarial efforts in Assam is not too dissimilar to other provinces in India or other parts of the world. In general, mosquito eradication measures failed to be adopted and quinine was chosen as the primary method of malaria control. It was not until the 1910s that malariologists and governments began to embrace mosquito control methods, but these were adapted from Ross' original methods to include species-specific sanitation. As India slowly began to embrace these species-sanitation measures by implementing malaria surveys, Assam was held back. Assam did conduct some early mosquito eradication experiments very soon after Ross' discovery, but these were plagued with problems and failed to receive much support. Between 1905 and 1912, most of the resources on malaria control went to Eastern Bengal, and Assam relied largely on quinine with few other measures. By 1914 and the advent of World War

[397] D. J. Bradley, 'Watson, Swellengrebel and Species Sanitation: Environmental and Ecological Aspects', *Parassitologia,* 36/1-2 (Aug 1994), p. 137.

I, most public health momentum was interrupted. Assam was not necessarily an outlier from the rest of India between 1897 and 1919, and indeed malaria began to gain much more attention in the province than in previous decades. Nevertheless, exploring the reasons anti-malarial measures developed the way they did in Assam contributes to the history of a deeply transformative time for malaria and malaria research.

Differentiated from Kala-Azar, a New Emphasis on Malaria

This section provides a brief overview of the period in which medical officers in Assam began to understand kala-azar and malaria as two separate diseases. During the last few decades of the nineteenth century, kala-azar was understood as a distinct threat to life in Assam. Though from a biological standpoint it is likely the disease had existed in the province long before British rule, the perception that kala-azar was both a new disease and contagious spread across the province and attracted the attention of the provincial government and the Government of India. As discussed in the previous chapter, medical officers in Assam believed that malaria and kala-azar were related. In their attempts to study and understand the disease, the issue of malarial fevers was viewed with a new level of focus and urgency by government officials. Campaigns to address malaria and kala-azar separated during the first few years of the twentieth century, and malaria was taken more and more seriously.

The previous chapter concluded with Leonard Rogers' 1897 work on kala-azar in which he outlined new measures to combat the spread of kala-azar and claimed that kala-azar was a complication of malaria. Rogers' recommendations for public health measures regarding kala-azar were invasive and expensive, but they had the support of the Chief Commissioner of Assam. In a 1900 letter from the Secretary to the Chief Commissioner of Assam to the Commissioner of the Assam Valley districts, the Secretary wrote that 'every effort should be made to spread

among the inhabitants of that part of the district a knowledge of the nature of the disease and of the means by which its spread may be checked.'[398] Additionally, Rogers' pamphlet 'Note on the Spread of Kala-azar and how to Check it' was translated into Assamese and copies were distributed to literate residents in Assam Valley neighbourhoods.[399] The Assamese copies were translated by Assistant Surgeon Lakshmi Prasad Chailibi who was paid Rs. 32 for the work.[400] In 1901, copies of Rogers' pamphlet were translated into Bengali by Surgeon Shushil Chandra Bhattacharya and distributed widely.[401] While Rogers' sanitation recommendations received support from the government, some medical officers were not willing to accept his conclusions on the pathology of the disease.

Rogers had found *Plasmodium malariae* in many of the advanced cases of what was perceived as kala-azar. Commenting on his conclusion in 1897, Sanitary Commissioner of Assam Surgeon-Colonel A. Stephen argued that simply finding the malaria parasite in patients was not enough to determine a connection between malaria and kala-azar. According to Stephen, Rogers was unable to complete the 'bacteriological portion' of his study, and Stephen argued that Rogers was unable to prove that there was not also some other microorganism that could be the cause of kala-azar.[402] Strong evidence of a conclusive link establishing a connection between kala-azar and malaria, or contrarily evidence separating the two diseases as different diagnostic categories,

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[398] 'Assam Proceedings 1898 July – December, Home Department, July, No. 14', BL, IOR/P/5332.
[399] 'Assam Proceedings 1898 July – December, Home Department, July, No. 14', BL, IOR/P/5332.
[400] 'Assam Proceedings 1898 July – December, Home Department, Tabular Statements, September, No. 547 to 566', BL, IOR/P/5332.
[401] 'Assam Proceedings 1901 January – June, Home Department, Tabular Statements, May, No. 586 to 592', BL, IOR/P/6028.
[402] A. Stephen, 'Appendix C.- Principal Medical Officer and Sanitary Commissioner's Note on Surgeon-Captain Rogers' Report on Kala-azar No. 836S., dated Shillong, the 16th July 1897', in A. Stephen, *Annual Sanitary Report of the Province of Assam for the Year 1897* (Shillong, 1898). p. XXIX.

had remained elusive for decades and was the subject of much scientific debate on the topic. Past attempts to study the diseases had also involved research on microorganisms. As discussed in the previous chapter, G. M. Giles mistakenly believed kala-azar was linked to *Anchylostomum duodenale*, or hookworm. Conclusions from research on microorganisms often had a tenuous relationship to public health and did not always determine sanitary regulations, but Stephen nevertheless advanced calls for more laboratory research.

In 1899, sanitary officials were still struggling to grasp the full effects of malaria and kala-azar, but many medical officers believed that kala-azar in Assam was in decline. Colonel C. W. Carr-Calthrop, Stephen's successor as the Sanitary Commissioner of Assam, agreed with his predecessors' suspicions of kala-azar death rates in government records as 'hopelessly inaccurate'. Carr-Calthrop believed that the presence of malaria was probably larger than exemplified in the number of deaths in specific districts and certainly larger than kala-azar.[403] In the Memorandum by the Army Sanitary Commission on the Report of the Sanitary Commissioner of Assam for 1898 published in the Assam Proceedings in September of 1900, the Army Sanitary Commission drew parallels between the disappearance of kala-azar in Assam and the Burdwan Fever epidemic in Bengal that was also in decline.[404]

The real impact of Rogers' recommendations and their ability to actually reduce kala-azar is difficult to determine and further complicated by the fact that medical officers believed kala-azar in Assam was on average declining but still spreading to regions of the province without any recorded history of the disease. One of these districts was Sylhet which lacked any medical

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[403] C. W. Carr-Calthrop, *Annual Sanitary Report of the Province of Assam for the Year 1898* (Shillong, 1899), p. 23.
[404] 'Assam Proceedings 1900 July – December, Home Department, September, No. 4', BL, IOR/P/5791.

officers with personal experience of kala-azar. In 1901, the Sanitary Commissioner of Assam requested that Leonard Rogers return to Assam to investigate the disease in Sylhet and further his research.[405] The Secretary to the Chief Commissioner of Assam responded by saying that Rogers could not return to Assam from Bengal, and due to an unusually large influx of 'coolie traffic', particularly railway labourers, few medical officers could be spared. The only one who could be reassigned was Assistant Surgeon Bipin Behari Bora. The medical officer deployed, however, ended up being First-Grade Hospital Assistant Kailash Chandra Das.[406] Chandra Das worked closely with the general population of Assam over the course of the year to circulate Leonard Rogers' advice to the general public in local languages. [407] Carr-Calthrop noted that Chandra Das was able to gain the confidence of the people and successfully implement measures to help locals across the province understand cases of fever presumed to be kala-azar.[408] Research into kala-azar continued in this manner in Assam and sanitary measures for incidences of the disease, believed to be decreasing in most parts of the province, were designed based on Rogers' recommendations. Smaller enquiries were made by medical officers already stationed in Assam rather than experts sent from the Government of India.

As the management of kala-azar became more routine after Rogers' report and less pressing, medical officers in colonial Assam began to pay closer attention to malaria. Though evidence had not yet been provided that proved kala-azar and malaria were two separate diseases,

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[405] 'Assam Proceedings 1901 January – June, Home Department, January, No. 107', BL, IOR/P/6028.
[406] 'Assam Proceedings 1901 January – June, Home Department, January, No. 109 to 111', BL, IOR/P/6028.
[407] F. C. Henniker, 'Resolution on the Sanitary Report of Assam for 1901', in C. W. Carr-Calthrop, *Annual Sanitary Report of the Province of Assam for the Year 1901* (Shillong, 1902), p. 1.
[408] C. W. Carr-Calthrop, *Annual Sanitary Report of the Province of Assam for the Year 1901* (Shillong, 1902), p. 8.

interest in reducing mosquito populations grew. Rogers did not believe that mosquitoes transmitted kala-azar as they did malaria, and mosquito eradication methods of malaria control were seen as separate from attempts to reduce kala-azar in the province.[409] Several publications were purchased by the Government of Assam on the connection between mosquitoes and malaria. These included 12 copies of Dr Giles' *Hand-book of Gnats of Mosquitoes* in 1900,[410] 2 copies of *Mosquito Brigades and How to Organize them* by Ronald Ross in 1902,[411] and 22 copies of Ross' 'Memoir on malarial fever' in 1903.[412] Additionally, the need to reduce malaria mortality and morbidity became an issue of growing concern. Despite kala-azar deaths falling, in 1901 medical officers believed that malaria deaths were increasing; a phenomenon the Sanitary Department blamed on an increase in malarial infections, not kala-azar.[413]

With the perceived increase in malaria, the Sanitary Department established new schemes in an effort to combat malaria. A notable early example of this was an effort, beginning in 1901, to use mosquito brigades. However, these mosquito brigades failed to gain popular approval. Both local and European residents of Assam were often unwilling to pay for them: a phenomenon Carr-Calthrop believed was likely due to apathy towards malaria among residents both local and European. [414] This indicates that the prevalence and impact of these early mosquito brigades across Assam was likely very limited. The particulars regarding the development of these mosquito brigades are discussed in further detail in the next section of the chapter, but it is worth

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[409] Rogers, *Report of an Investigation*, p. 197.
[410] 'Assam Proceedings 1900 July – December, Home Department, Tabular Statements, October, No. 456 to 461', BL, IOR/P/5791.
[411] 'Assam Proceedings 1902 July – December, Home Department, Tabular Statements, August 1903, No. 239 to 241', BL, IOR/P/6267.
[412] 'Assam Proceedings 1903 January – June, Home Department, Tabular Statements, March, No. 838 to 842', BL, IOR/P/6499.
[413] Carr-Calthrop, *ASRPA 1901*, p. 8.
[414] Ibid., p. 12.

noting in this discussion that between 1897 and 1903 efforts to address kala-azar remained consistent and unchallenged, making room for anti-malarial efforts separate from efforts to address kala-azar. Up to this point, aside from traditional methods of drainage jungle clearing, most of the efforts to reduce 'Fevers' in Assam had been dedicated to studying and combating kala-azar. In this sense, the discovery of mosquitoes as the malaria vector represents a major stride in the development of malaria public health campaigns in Assam. Major Wood who was carrying out an enquiry into kala-azar in Sylhet in 1903 stated,

> If kala-azar is nothing, but a malarial fever, there should be no need for burning down houses; and none for the evacuation of villages, provided that quininization and measures against mosquitoes can be carried out. Under the direction of Koch experiments on a large scale have been made in Europe and Africa, which are considered to show that malaria can be eradicated from a denied area by thorough quininization. On the other hand, there is some evidence to show that, as a matter of fact the burning of houses and the evacuation of villages has been of use; and that it may be advisable to let the instructions regarding the adoption of these measures as they are until more is known about the real causation of the disease. Jungle cutting may be carried out with discretion, on ordinary grounds; but none can be sure that it would do any good, as far as kala-azar goes.[415]

By far the biggest breakthrough in kala-azar research, and in Assam the most decisive discovery that helped distinguish between the two major 'Fevers', was the discovery of the kala-azar parasite *Leishmania donovani* in 1903 by Leishman, Donovan, and Marchand in China. Dr. Charles A. Bentley, a medical officer who was working on the Borjuli tea garden in colonial Assam, had discovered some parasitic bodies in a splenic puncture that were similar to those Major Donovan of Madras had described in cases of kala-azar. Bentley sent his sample to Donovan who confirmed that the parasite was the kala-azar parasitic body. With this information, Bentley set out to prove the presence of the parasite in cases of kala-azar in Assam. Working alongside Assistant Surgeon Atul Chandra Ray who was well respected for his work in kala-azar,

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[415] 'Assam Proceedings 1904 January – June, Home Department, April, No. 36', BL, IOR/P/6728.

Bentley performed a splenic puncture on a patient Chandra Ray believed to be suffering from kala-azar. Bentley demonstrated the presence of the parasitic bodies in the sample in front of experts at the medical school in Dibrugarh. Colonel David Wilkie, Principal Medical Officer and Sanitary Commissioner of Assam, heralded the discovery as a 'fresh basis for research into the nature and causation of kala-azar and chronic fevers in general.'[416]

In January of 1904, Bentley sent Ronald Ross and Sir Patrick Manson separate telegrams announcing that he had discovered Leishman's bodies in cases of kala-azar by splenic puncture. Bentley also promised to send Manson specimens in the mail.[417] Ross publicised Bentley's discovery in the *British Medical Journal* published on 16 January 1904.[418] The Assam Proceedings of 1904 reprinted a copy of the article in the *British Medical Journal* in which Ross commented on Dr. Donovan's work on kala-azar and argued that the microorganisms were separate from those that caused malaria:

> The subject of kala-azar is a most important one from a practical, as well as from a scientific point of view, as the disease is the cause of a vast amount of suffering and death among the natives in Assam. The prevention of this disease is a question of exact knowledge as to its causation. It is within the province of the Indian Government to promote and actively assist research on the subject by every means in its power, and it is to be hoped that public opinion will not allow it to neglect this clear duty.[419]

Bentley had examined 1,200 blood samples from cases of kala-azar in total. In those cases, he found the malaria parasite in only 4% of samples. In a letter to the Sanitary Commissioner of Assam in January 1904, Bentley stated that 'the vast majority of cases suffering

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[416] D. Wilkie, *Annual Sanitary Report of the Province of Assam for the Year 1903* (Shillong, 1904), p. 8.
[417] 'Assam Proceedings 1904 January – June, Home Department, May, No. 255', BL, IOR/P/6728
[418] R. Ross, 'Leishmania Donovani found in Kala-Azar', *British Medical Journal* 1 (1904), p. 160.
[419] 'Assam Proceedings 1904 January – June, Home Department, May, No. 255', BL, IOR/P/6728.

from kala-azar were old residents, who at no time exhibited malarial infection.' He continued, 'These facts, which correspond closely with the results reported by Major R. Ross I.M.S., in his report upon the nature of kala-azar, 1899, appear to prove conclusively that the disease is not a malarial infection.'[420] These discussions on kala-azar among medical professionals emphasise the influence medical research in Assam had on medical knowledge. Individuals such as Patrick Manson were able to share discoveries such as these in volumes such as Manson's Tropical Diseases which were well referenced guides for medical professionals around the world.

This newfound method of diagnosing kala-azar upended previous perceptions of the presence of the disease among both sanitary officials and the general public. In the wake of Bentley's work, sanitary officials insisted that kala-azar was much more widespread than thought only in the last few years. In 1904, Captain James, I.M.S., was specially appointed to Assam by the Government of India to investigate kala-azar using the knowledge gained from the detection of the *Leishmania donovani* in Assam.[421] Wilkie, the Sanitary Commissioner of Assam, argued that James should work alongside Bentley and Major Hare because of Bentley's association with the tea industry. Writing to the Secretary to the Chief Commissioner of Assam, Wilkie wrote,

> Dr. Bentley is a well known enthusiast in research, who has already worked independently on this very subject, and like Major Hare, he knows the land of the disease Not only garden doctors, but their employers, are vitally interested in the matter of kala-aar. Such a [sic] appointment would, I think, be regarded as a complement by tea garden doctors, and might lead to further co-operation.[422]

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[420] 'Assam Proceedings 1904 January – June, Home Department, May, No. 260', BL, IOR/P/6728.
[421] 'Assam Proceedings 1904 January – June, Home Department, May, No. 253', BL, IOR/P/6728.
[422] 'Assam Proceedings 1904 January – June, Home Department, May, No. 253', BL, IOR/P/6728.

After his enquiry, James argued that there was a large presence of kala-azar in Assam, a view the Sanitary Commissioner of the Government of India supported. [423] Major Hall, I.M.S., was then sent to Assam to investigate the prevalence of kala-azar. Through splenic samples, Hall recorded the presence of the parasite in villages throughout South Sylhet. With this information, Hall argued that kala-azar should no longer be considered a disease only causing intense symptoms. According to Hall, cases of kala-azar varied in intensity and included chronic cases as well as those of 'isolated causes of more acute type'. [424] In a massive reversal of his previous opinion, Leonard Rogers admitted that it was possible now to tell kala-azar and malaria apart through a splenic puncture and microscopical examination and that malaria and kala-azar were two completely separate diseases. As a caveat however, he warned that clinical observation alone, without laboratory evidence, was often too fallible to make this distinction.[425]

In reality, identifying *leishmania* parasites in the population of Assam could have only gone so far in explaining the presence of kala-azar. Unknown to medical professionals at the time, only a small fraction of individuals with *leishmania* parasites in their bodies will develop symptoms of kala-azar, even without medical treatment. Though rates of mortality are high upon the onset of symptoms, the presence of a *leishmania* parasite alone does not adequately explain the mortality and morbidity of kala-azar. The immediate conclusions of those in the past regarding the prevalence of the disease should be taken with some reservation. There was some acknowledgement of this phenomenon and particularly of the gradation of kala-azar cases from severe to 'less strongly marked', but it is far more likely that clinical observation continued to

[423] D. Wilkie, *Annual Sanitary Report of the Province of Assam for the Year 1904* (Shillong, 1905), p. 7.
[424] Ibid., p. 7.
[425] Ibid., p. 7.

confuse malaria and kala-azar.[426] Additionally, the village leaders who reported deaths remained unable to note the difference between the two diseases. Nevertheless, the major shift in Assam's understanding of the relationship between malaria and kala-azar was realised and public health efforts in the province evolved.

A diagnosis of kala-azar was difficult to determine for medical officers at the time even with the scientific discovery of the leishmania parasite, but kala-azar and malaria were reasonably differentiated and different paths of public health intervention began to develop. In Captain James' special inquiry into kala-azar in 1905, malaria and kala-azar were symptomatically differentiated with the help of laboratory research (though the ability to do so required advanced medical knowledge and extremely careful monitoring of symptoms, skills not possessed by the general public or many of the people who reported the causes of death in provincial statistics).[427] James also concluded that the development of immunity by locals in Assam to malaria meant that individuals with malaria could often work even while suffering from some symptoms of malaria; a key difference from kala-azar. Ultimately, kala-azar was presented as a serious disease that lacked the seasonal trends malaria often exhibited, had a higher range in average fever temperature fluctuation in sufferers, and had a much lower survival rate than malaria. In an obvious slight to G. M. Giles' conclusions that were made about a decade prior, James was quoted in the Assam Sanitary report of 1905 stating confidently 'that kala-azar has no more connection with the malarial parasites than it has with the ankylostoma duodenale [sic]'.[428]

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[426] Ibid., p. 7.
[427] S. P. James, *Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India on Kala Azar, Malaria and Malarial Cachexia* (Calcutta, 1905), p. 1.
[428] E. C. Hare, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1905* (Shillong, 1906), p. 9.

Kala-azar continued to be an issue for colonial Assam, but previous effort spent on kala-azar slowly transitioned to work on malaria. Even though modern historians doubt the effects of mosquito eradication on malaria in colonial India as a whole, it is important to recognise that fresh perspectives in colonial Assam were embraced without the constraints of kala-azar from previous decades. The increase in medical knowledge of kala-azar and malaria during this time was a significant development. Malaria research, treatment, and initiatives went ahead and slowly, although not completely, shed their perceived associations with kala-azar. Additionally, as diagnosis of the two diseases became more accurate, confidence in the potential effectiveness of schemes grew. The vague category of 'Fevers' continued to be problematic in provincial statistics, but malaria moved into the spotlight and medical officials believed they could actually make a difference.

The complicated history of malaria's relationship with kala-azar in colonial Assam makes the province unique in colonial India as much of the time, effort, and money spent addressing 'Fevers' in previous decades was focused on kala-azar. Other provinces had similar experiences, Bengal had to address Burdwan Fever because the epidemic became a political concern, but different origins of the epidemics and local perceptions of the diseases prompted different responses. Overall, the individual characteristics of every province indicate unique relationships were formed with 'Fevers' including all of the diseases categorised under that heading.

Doubling Down on Quinine

Kala-azar and malaria were finally differentiated in 1904, and the focus of the remainder of this chapter is on contemporary efforts to address malaria. Alongside jungle-clearing and traditional campaigns to improve drainage that continued in the province as they had for decades, medical officers debated which of two additional anti-malarial measures should receive the most

attention and limited financial support from the government. This section discusses the tension between calls to build upon efforts that placed quinine at the centre of anti-malarial measures in Assam and calls to invest heavily in mosquito-eradication schemes. During this period in Assam, the tension was not structured around two different groups of medical officers debating the efficaciousness of each anti-malarial measure. It was the political and economic structure of Assam combined with the limited purview of the province's Sanitary Department (which focused more so on maintaining the health of industry workers) that were additional factors that influenced the primary anti-malaria measures in Assam. For the full period between 1897 and 1919, quinine was relied upon most by the government as the preferred method of reducing malaria mortality.

Cinchona preparations, most notably quinine, were a longstanding component in malaria prophylaxis and treatment. Medical officers in colonial Assam believed, like many others across the world, that regularly taking doses of quinine would provide one with some protection against malaria and that taking quinine would help treat malarial infection. Quinine had been available in Assam for decades, but during the 1890s government officials across India tried to improve access to the drug by increasing the distribution of quinine for sale. A system was implemented in many provinces across the Raj and utilised post offices; it made every post office a place where anyone could purchase quinine at an affordable price. The scheme was first implemented in Madras in 1890, in Bengal in 1892, in Burma and in the Chhattisgarah and Nagpur divisions of the Central Provinces in 1893, in the Punjab, Bombay, and Assam in 1894, in the Hyderabad Assigned Districts in 1895, and in the United Provinces in 1896.[429] The sale of quinine in Assam

[429] 'Assam Proceedings 1905 January – April, Home Department, March, No. 1', BL, IOR/P/6965.

rose from an initial 46,424 packets in 1894 to 383,500 packets sold in 1898, but sales slowly declined in the following years until 1905.[430] The reason for the decrease in sales was unknown, but other provinces faced their own challenges of selling quinine, and though some in India rejected the use of quinine, those who wanted it faced challenges accessing the drug. For example, quinine in Madras, Bombay, the United Provinces, the Central Provinces, and the Hyderabad Assign Districts was sold at a fixed price of 2 pies, but 2 pies was, according to a government report, a 'sum made up of coins which are hardly anywhere in common use'.[431]

The Assam Sanitary Department tried to increase the use of quinine in a myriad of ways. Instructions on use were written by S. P. James and translated into local languages, government subsidies were issued, the number of retail agents was increased, and the overall approach was continuously refined. Alongside the work of medical officers, missionaries in Assam (many of them part of the long-standing contingent of Welsh missionaries) promoted quinine and increased its use and acceptance among their followers.[432] Additionally, quinine was also distributed on many tea plantations for workers. Quinine was used as both a prophylactic and a treatment. The efficacy of quinine as a malaria prophylactic is now doubted among medical experts and its use in modern times has largely subsided, but at the turn of the twentieth century many adherents advocated the use of quinine.

Often discussed in this project, the difficulty of accurately measuring 'Fevers' was a continuing problem for medical officers in colonial Assam. Quinine, more significantly its sale,

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[430] 'Assam Proceedings 1905 January – April, Home Department, March, No. 1', BL, IOR/P/6965.
[431] 'Assam Proceedings 1905 January – April, Home Department, March, No. 1', BL, IOR/P/6965.
[432] L. J. Kershaw, 'Resolution on the Sanitary Report of Assam for 1899', in C. W. Carr-Calthrop, *Annual Sanitary Report of the Province of Assam for the Year 1898* (Shillong, 1899), p. 4.

distribution, and general usage, became a shorthand for officials to gauge the presence of fevers in the province and in many ways the general healthiness of the population. This measure was viewed by medical officers as particularly useful when comparing one district in Assam to another. In 1899, C. W. Carr-Calthrop, Sanitary Commissioner of Assam, wrote, 'as might have been expected, owing to the improved general health, the sale of packages of quinine through the agency of the vaccination and post office staff fell off considerably'.[433] The emphasis on quinine and its relationship to 'Fevers' and health was yet another factor in contemporary medical work. The focus on quinine influenced perceptions of malaria in colonial Assam.

Historian Rohan Deb Roy has written extensively on the role cinchona extracts played in the history of malaria. His work *Malarial Subjects* explores the usage of these preparations, most often quinine, as an object of natural medical knowledge. Deb Roy contends that the relationship between quinine and malaria is a useful point at which to observe the 'co-construction' of malaria and its potential cure.[434] This perspective is useful when exploring the history of malaria in colonial Assam where quinine was often advocated by many, but it is important not to overemphasise the role of quinine in this narrative or believe that quinine was the only anti-malarial measure or the main way of determining the malarial nature of fevers.

The actual efficacy of quinine (which was limited) in preventing and treating malaria is discussed in further detail in the next chapter, and though quinine was widely advocated for use in colonial Assam and the co-conceptualising of malaria alongside prophylactic/treatment measures did occur, prophylactic measures included other approaches in addition to quinine. Though not universally applied, a similar phenomenon of the co-conceptualising of the disease is

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[433] C. W. Carr-Calthrop, *Annual Sanitary Report of the Province of Assam for the Year 1899* (Shillong, 1900), p. 37.
[434] Deb Roy, *Malarial Subjects',* p. 3.

observable with the province's implementation of mosquito eradication measures. Ultimately, perceptions of the efficacy of quinine and perceptions of the success of mosquito control programs among medical officials contributed to public health schemes influenced the province's relationship with malaria.

On the 16th December 1901, W. S. Marris, the Upper-Secretary to the Government of India, reached out to the Chief Commissioner of Assam regarding the 'organisation by private enterprise of agencies for the destruction of Mosquitoes in India'.[435] Marris stated that all medical officers in Assam should be made aware of Ronald Ross' arguments for mosquito control, specifically the fact that Ross' measures ensured 'immunity from malarial fevers'.[436] Marris wrote that the Government of India was aware

> that the sphere of operations must be restricted by practical considerations. The success of the suggested measures will depend largely on the qualities of the persons selected to carry them out. The practical conduct of the operations should be in the hands of persons who not only have some knowledge of the theory on which they are based, but also bring the experiment due measures of enthusiasm and tact.[437]

Additionally, Marris wrote,

> The Government of India consider that to secure systematic and thorough operations in a few selected places would be better than to attempt to deal with areas too extended. Definite success in a few selected places would, it is hoped, bring home to the people the ease with which they can secure comparative immunity from malarial fevers, whereas the non-success of partial an incontiguous efforts would bring the remedy into dispute. [438]

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[435] 'Assam Proceedings 1904 January – June, Home Department, January, No. 159', BL, IOR/P/6728.
[436] 'Assam Proceedings 1904 January – June, Home Department, January, No. 159', BL, IOR/P/6728.
[437] 'Assam Proceedings 1904 January – June, Home Department, January, No. 159', BL, IOR/P/6728.
[438] 'Assam Proceedings 1904 January – June, Home Department, January, No. 159', BL, IOR/P/6728.

The Government of India provided Assam with copies of Ross' work that outlined effective methods of structuring and implementing mosquito brigades, but ultimately left the task to the discretion of the medical officers in Assam.[439]

In his 7th March 1902 response to the Chief Commissioner of Assam, the Sanitary Commissioner of Assam, Carr-Calthrop, detailed the various ways medical officers in districts across Assam went about making the public aware of Ross' work and come about methods of organising mosquito brigades. The ability of districts across Assam to organise mosquito brigades was mixed. Some, including the Civil Surgeons and the deputy Commissioners of Sylhet, Tezpur, and Sibsagar, argued that in their local districts any pursuit to fill up tanks and treat stagnant water were too impractical; most surfaces in the districts were covered in stagnant water.[440] The district of Lakhimpur could not provide funds for the project, but the Deputy Commissioner stated that individual planters were attempting to implement measures in their own gardens.[441] Dhubri and Kohima both set up local subscriptions to raise money and distributed pamphlets on 'mosquitoes and malarial diseases' in local languages to try to garner support from the public. Carr-Calthrop was most hopeful that a mosquito brigade would be successful in Kohima because the natural landscape had dry soil and slopes well suited to drainage and mosquito control measures.[442] This was not an exhaustive list of the activities of districts in Assam, (some districts including Nowgong and Kamrup had failed to take any steps toward organising mosquito brigades by that stage), and as outlined by the Government of India

[439] 'Assam Proceedings 1904 January – June, Home Department, January, No. 161', BL, IOR/P/6728.
[440] 'Assam Proceedings 1904 January – June, Home Department, January, No. 163', BL, IOR/P/6728.
[441] 'Assam Proceedings 1904 January – June, Home Department, January, No. 163', BL, IOR/P/6728.
[442] 'Assam Proceedings 1904 January – June, Home Department, January, No. 163', BL, IOR/P/6728.

the purpose of the inquiry was to prove the viability of mosquito control projects in select locations in order to advocate for their use in other areas, but the structure of the inquiry is an example of a key fact during the early stages of mosquito eradication programmes in Assam. Attempts to implement measures were driven by local support, whether that was monetary support or simply the belief that such measures would be useful. In part, this hinged on convincing residents of Assam that mosquitoes were in fact the vector of malaria, but despite the hopes of the Government of India, even this was not enough to encourage the widespread implementation of mosquito brigades. Conceptions of malaria and effective anti-malarial measures were often local, and this is an important aspect to acknowledge alongside the co-conceptualising of malaria with quinine. Interest in the value of mosquito brigades lingered after these limited attempts to organise mosquito brigades and the province purchased copies of S. P. James' 'Causation and Prevention of Malarial Fevers'[443] and Major A. Buchanan's 'Malarial Fevers and Malarial Parasite in India',[444] but further mosquito brigades were not implemented in the province for several more years.

In 1904, Major Hall I.M.S., argued for the continued use of quinine in Assam.[445] This recommendation came alongside a call to revaluate drainage in Assam during Hall's inquiry into kala-azar. Quinine in many ways represented an older approach to 'Fevers' in Assam, one in which malaria and kala-azar were still connected. Though Hall recognised that the presence of the *leishmania* parasite in Assam was an indication malaria and kala-azar were separate diseases, quinine was viewed as an effective prophylactic and possible treatment for both. The government

[443] 'Assam Proceedings 1904 July – December, Home Department, July, No. 417 to 419', BL, IOR/P/6729.
[444] 'Assam Proceedings 1904 July – December, Home Department, July, No. 433 to 435', BL, IOR/P/6729.
[445] Wilkie, *ASRPA* 1904, p. 6.

of Assam responded favourably to Hall's calls. Sir Joseph Bampfylde Fuller, the Chief Commissioner of Assam, promoted quinine's positive effects as a tool in the struggle against both kala-azar and malaria. Fuller worked to make sure that, if necessary, quinine was to be distributed for free across Assam for those who needed it (though this was not implemented), and also ordered several engineers to survey the drainage of the province.[446] Fuller then became the Lieutenant Governor (equivalent of the Chief Commissioner) of the newly created province of Eastern Bengal and Assam in 1905 and ensured some consistency in the approach to quinine distribution in Assam.

Beginning in 1905, the government of the new province of Eastern Bengal and Assam supported calls to increase the use and distribution of quinine. There was minimal acceptance and usage of quinine in villages in Assam among residents who were not industry labourers. The Civil Surgeon of Sibsagar Captain A. Leventon, I.M.S., wrote to the Sanitary Commissioner of Assam in 1904 that vendors often returned packets to the government unsold. Leventon stated, 'In certain villages there is still some reluctance to use of European medicines but I think if medicines (especially those in dry form) were distributed gratis by a person of good caste and well-known in the village, it is possible that the prejudice may gradually disappear.'[447] In Assam alone, new trade depots were created at the offices of the Civil Surgeons in each district adding to the already existing depots in Tezpur, Shillong, and Sylhet. In an effort to incentivise local retail agents to increase their sales, the wholesale price of quinine was reduced so that more profits could be made by the vendors. Though the price would be the same for the consumer, it was believed that increased profits would encourage sellers to communicate the benefits of quinine to

[446] L. J. Kershaw, 'Resolution on the Sanitary Report of Assam for 1904', in D. Wilkie, *Annual Sanitary Report of the Province of Assam for the Year 1904* (Shillong, 1905), p. 2.
[447] 'Assam Proceedings 1905 January – April, Home Department, March, No. 25', BL, IOR/P/6965.

the public and boost the business overall. These retail agents included postmasters, village schoolmasters, mauzaders, and gaonburas (the latter two were village leaders in some, usually remote, areas of Assam). Anticipating much greater demand for the drug and hoping to avoid delays in procuring supplies from Calcutta, the province sought to establish a large, central depot in the province. Eastern Bengal lagged behind Assam in its capability to distribute quinine, and new plans were drawn up to scale up there as well.[448]

These measures were not implemented smoothly, nor were the initial effects on mortality and morbidity (if there were any) noted by officials. Fuller advocated strongly for the use of quinine as a prophylactic and treatment and hoped that the Sanitary Commissioner of the Government of India would take notice of East Bengal and Assam's efforts and offer help. Despite these efforts, it quickly became difficult to obtain adequate amounts of quinine.[449] Nevertheless, major strides were made, and medical officers waited to see if any of the measures would have an effect on malaria mortality and morbidity. If cases of and deaths from malaria decreased, there would be plenty of reasons for continuing the efforts.

Initially at least, medical officers believed progress was being made. The sale of quinine in Assam between 1903 and 1905 had been decreasing, but the trend reversed in 1906 with what was described as 'a considerable increase'.[450] The results were interpreted as encouraging, and with new financial backing, sanitary officials doubled down on their efforts to distribute quinine.

Increasing the supply and improving the distribution of quinine came at a considerable cost to the government. Losses in 1906 from the subsidised sale of quinine were estimated to be

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[448] Hare, *ASRPEBA 1905*, p. 13.
[449] L. J. Kershaw, 'Resolution on the Sanitary Report for 1905', in E. C. Hare (eds.), *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1905* (Shillong, 1906), p. 3.
[450] E. C. Hare, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1906* (Shillong, 1907), p. 20.

around Rs. 11,000. Two proposals were made to potentially reduce these losses: opening a cinchona plantation in a hill district of the Assam valley and/or compounding drugs at a jail in Assam rather than purchasing then already compounded from the Alipur Jail in Bengal. Lieutenant-Colonel E. C. Hare, I.M.S., Sanitary Commissioner of Eastern Bengal and Assam, believed neither of these proposals would materialise and referenced a failed attempt from 40 years previously that had attempted to establish a cinchona plantation in Assam.[451] In 1867, plans were made to develop chinchona plantations in the Khasi Hills and Kamrup- these regions in Assam were chosen for their elevation (between 800 and 4,800 feet). The plantations were abandoned before any cinchona was mature enough to extract quinine, however, because the investors believed that the supervision required from European managers and the manual labourers (who were scarce and expensive at the time) made the entire enterprise too costly. Unsuccessful in 1867, investment and expertise shifted focus to chinchona plantations outside of Assam, in Sikkim.[452]

The plans to expand cinchona plantations in Assam were part of an emerging trend in the 1860s to expand the industry, and a number of new plantations were funded by private enterprise. Deb Roy wrote about a developing industry that was far from stable; many of the plantations were considered experiments rather than sure-fire investments. The financial success or failure of such experiments often dictated whether a plantation would thrive or be abandoned completely and quickly. As Dey describes, increasing competition from other industries, such as tea in Assam, placed pressure on the protection of cinchona plantations.[453] Additionally, as historian Jayeeta Sharma observed, problems developed in Assam with an unstable (and unfair) reliance on

[451] Ibid., p. 20.
[452] Ibid., p. 20.
[453] Dey, 'Diseased Plantations', p. 53.

Europeans managing ‘coolie’ labourers. Preconceived notions of ‘lazy coolies’ and necessary yet expensive western managers limited the development of plantations in Assam during the middle of the nineteenth century. These preconceived notions of who should be a labourer and who should be a manager along with the other previously noted complications were enough to put off investors from the mass cultivation of cinchona in Assam and persisted at least until migrant labour was introduced to Assam.[454] Cinchona plantations had been squeezed out, and it was the tea industry that ushered in these changes and limited the cultivation of other crops. The lack of success in establishing cinchona plantations in Assam during the 1860s was a complicated issue, and despite some changes in the economy of the province, it was enough to make government officials in the early twentieth century doubtful of any major changes that might reintroduce cinchona.

Medical officers were attempting to boost the use of quinine while attempting to minimise government losses. In 1906, the Civil Surgeon of Jalpaiguri Captain Ritchie, I.M.S., distributed sugar-coated quinine tablets that were purchased by the District Board with the hope that the sugar-coated tablets would be more appealing to the masses than powder and therefore taken more frequently. Dr. Mead, the Medical Missionary at Faridpur, called for the distribution of leaflets to the general public that would both describe malaria and encourage the use of quinine.[455]

Though financial constraints limited the distribution of the drug, encouraging the use of quinine as a malaria prophylactic and treatment was much cheaper and easier than improving access to formal hospital treatment. As Ritchie was conducting his experiment on sugar-coated

[454] Sharma, ‘”Lazy” Natives’, p. 1288.
[455] Hare, *ASRPEBA 1906,* p. 20.

quinine, the Civil Surgeon of Dinajpur Captain Gidney, I.M.S., noticed a peculiar trend in mortality and morbidity in his district. In Dinajpur, Gidney stated that there were 50,000 deaths from malarial fever[456] among 64,214 deaths due to 'Fevers' recorded in a population of 1,553,650.[457] In the neighbouring district of Bogra, 18,422 deaths were recorded from 'Fevers' (no official count given on malarial fever specifically) for a population of 843,335. [458] That is 4.1% of the population of Dinajpur died from fever in one year, compared to 2.2% in Bogra. Gidney noted that despite having nearly double the population of Bogra, Dinajpur was treating almost half as many patients for malaria; Bogra treated a total of 52,300 patients compared to Dinajpur's 24,781.[459] Ritchie made the argument to the district board of Dinajpur that treating more patients in Dinajpur was too far too expensive, insisting that there were other ways to reduce malaria morbidity at a lower cost. The best option from a financial standpoint was, according to Ritchie, to increase the amount of quinine that was distributed to the residents of Dinajpur. 'Anti-malarial measures on a large scale being impossible on account of the expense, he considered that the only way of lowering the mortality was by attacking the disease itself, by arranging that quinine should reach every house in the district'. The appeal was convincing; the price of quinine was lowered in Dinajpur, and five new dispensaries were created.[460]

Further measures were put in place to increase the distribution and use of quinine, and these programmes were expanded in both the Assam and Eastern Bengal portions of the province. By 1907, three years after the renewed calls for a rapid increase in quinine distribution, medical officers wanted to know if quinine was getting into the hands of the residents who needed it most.

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[456] Ibid., p. 20.
[457] Ibid., p. xii.
[458] Ibid., p. xii.
[459] Ibid., p. 20.
[460] Ibid., p. 21.

Within government reports, the numbers of pice-packets distributed (a pice-packet was a set amount of quinine offered at a set price of 1 pice, the smallest unit of currency) and the population numbers were displayed alongside the percentage of pice powder packets distributed to each population group in relation to the decennial ratio from fevers. This was done for each of the districts in the province of Eastern Bengal and Assam.[461] As one may expect, simply tracing the amount of quinine used in relation to the total amount of fever was not an adequate way to gauge the effectiveness of the drugs. Instead, officers used this measurement as a proxy to try to understand the needs of both supply and potential demand.

Identifying districts with lagging sales was simple but increasing both the supply of quinine and total sales was more complicated. In 1907, Hare the Sanitary Commissioner of Eastern Bengal and Assam, decided not to distribute pamphlets that recommended the use of quinine to the entire province as he believed that the advertisements were unlikely to reach the villagers they were intended for. Instead, Hare recommended that quinine 'should rather be advertised on more commercial principles.'[462] Under Hare's recommended programme, the government would hire individuals to travel to 'particularly malarious' areas during the fever season.[463] The result was intended to be a much more focused advertising campaign. Hare directed the Civil Surgeons of districts that reported 'a mortality of over 35 per mille [1,000] from fevers, to take special steps to advertise and give facilities for the sale of the drug in the affected villages.'[464] The quinine survey coupled with knowledge of each district reinforced the fact that the government was not alone in recommending quinine. While in Sibsagar, the Civil

[461] E. C. Hare, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1907* (Shillong, 1908), p. 14.
[462] Ibid., p. 15.
[463] Ibid., p. 15.
[464] Ibid., p. 15.

Surgeon's campaigns increased the sale of quinine, in the Khasi Hills, Welsh Presbyterian Missionaries regularly distributed the drug across the district increasing the overall usage.

Tracking the presence of malaria in districts across the province of Eastern Bengal and Assam was difficult for medical officers at the time because the two regions had distinctive environmental, social, and disease landscapes. In 1908, mortality was high in Assam because of the presence of tea plantations. Eastern Bengal, however, did not have nearly the same concentration of plantations. Medical officers were vigilant of the data coming out of these tea gardens. An increase in 1908 was blamed on a massive influx 'of immigrants from fever-stricken districts.'[465] Medical officers in Assam often viewed migrants as mobile reservoirs of pathogens, but the different priorities of medical officers in each part of the province reflects a different outlook on health and disease between Eastern Bengal and Assam. In Dinajpur, located in Eastern Bengal, the overall deathrate fell, and the Civil Surgeon reported that 'malarial fever was less prevalent than usual, owing to the deficient rainfall of the last 2 years.'[466] Additionally in Dinajpur, both deaths due to fevers and admissions to dispensaries fell by 3,866 and 7,000 respectively. Despite the declining deathrate, the problem of malaria in Eastern Bengal received more attention from the provincial government than Assam during the short-lived union. Eastern Bengal hosted several schemes medical officers used to test anti-malarial methods. In Assam, however, medical officers stuck to the traditional priority of monitoring migrants and labourers.

The provincial government drew up plans for new anti-malarial schemes in Dinajpur and Jalpaiguri in 1908 (both areas in Eastern Bengal). There were two primary motivations for the schemes. In Jalpaiguri, the Civil Surgeon Captain Ritchie stated that the plan was devised 'partly

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[465] E. C. Hare, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1908*, (Shillong, 1909), p. 4.
[466] Ibid., p. 8.

with the object of improving the health of the European quarter, and partly to demonstrate anti-malaria methods.' The region specified for the experiment was a localised area that included the Naga basti (where all the servants of the Civil Station lived), the police lines, and the European quarter.[467] In Dinajpur, the scheme was expanded to a much larger scale and far beyond just the European quarters and the quarters of their servants. The outline for the scheme was the same in both locations and involved three approaches: 'quinine disinfection' (distributing quinine freely between July and December as sugar-coated tablets for adults and quinine in chocolate for children), protection against mosquitoes (installing screen doors and wire gauze on windows), and the destruction of larval mosquitoes (cleaning and covering drains, deforesting the jungle, and filling pits, along with spraying kerosine oil where mosquitoes were thought to breed).[468]

The scheme began in January 1909, but progress in Jalpaiguri was slow. Captain Ritchie was transferred to another position early and his post was not filled until December. Despite the setback, quinine was still distributed and some of the drains were cleared. In contrast, progress in Dinajpur was not impeded by staffing concerns. The Civil Surgeon and the local committee managed to recruit several individuals including an Assistant Surgeon and manual labourers who were hired to clean, clear brush, and spray kerosine. The newly appointed Hospital Assistant was instructed to be a 'Quinine Missionary' and make it 'his business to preach the use of the drug and distribute it.'[469] Officers were aware of how long it might take any results of the anti-malarial schemes to appear and were prepared to maintain the experiment for however long it took until results could be known.

[467] Ibid., p. 9.
[468] Ibid., p. 9.
[469] Ibid., p. 9.

As the anti-malarial schemes were taking place in Jalpaiguri and Dinajpur, the focus in the rest of Eastern Bengal transitioned away from general malarial fever and towards black-water fever. In modern medicine, black-water fever is understood as a serious complication of malaria. During the early twentieth century medical officers in Assam believed there was a connection between the two and possibly to the consumption of quinine, but though any connection was only presumed and not a certainty, it was generally recognised that irregular treatment of quinine could worsen malaria symptoms.[470] An increase in cases in the first decade of the twentieth century, however, drove officials to act. Members of the Indian Tea Association and the Assam Branch of the British Medical Association appealed to the government to investigate the increase in cases in the Assam valley. [471] Other parts of the province, including Jalpaiguri and Duars, had previously completed an inquiry into black-water fever. Despite calls for an official inquiry in Assam, medical officers did not look into the slight increase in cases. Nevertheless, they remained sceptical of work that was done to reduce the presence of the disease, and they believed cases would not decrease in the near future. L. J. Kershaw, Secretary to the Government of Eastern Bengal and Assam, Financial Department on behalf of the Lieutenant-Governor stated:

> It has been found impossible to extend the investigation to Assam, where cases of black-water fever have unfortunately appeared, but when the second report is received the Lieutenant-Governor will consider the possibility of giving effect to the recommendations of the Commission through the agency of Civil Surgeons working under the control of the Sanitary commissioner.[472]

Officials continued to recommend both quinine and protection from mosquitoes, but they expected that cases would rise 'as the symptoms became more easily recognised.'[473]

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[470] Harrison, *Public Health,* p. 162.
[471] Hare, *ASRPEBA 1908,* p. 10.
[472] L. J. Kershaw, 'Resolution on the Sanitary Report for 1908', E. C. Hare, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1908* (Shillong, 1909), p. 2.
[473] Hare, *ASRPEBA 1908,* p. 10.

Though there were some mosquito brigades, most anti-malarial measures in Eastern Bengal and Assam still relied firmly on quinine. Medical officers tried to encourage the use of the drug in both the Eastern Bengal and Assam portions of the province and used private individuals in their propaganda campaigns. There were financial incentives in place that made it possible for some sales-agents to make their living by traveling around the country and selling quinine. To spread the word of the proposed benefits of the drug, village schoolmasters were taught the perceived values of quinine. Teachers were also advised to give a lesson that was prepared by the government on the dangers of malaria and the benefits of quinine. The lesson was placed into the textbooks of Class I Lower Primary schools, and charts with instructions and pictures were made and hung up in schools.[474] The effort to shore up the distribution and use of quinine as a malaria prophylactic and treatment was supported by the provincial government as well as the Sanitary Department.

Sir Lancelot Hare, the Lieutenant-Governor of Eastern Bengal and Assam between 1906 and 1911, wanted to support the Sanitary Department's efforts, but the opinions of officers in the Sanitary Department on quinine distribution schemes were not universally favourable or optimistic. Some officers remained sceptical and believed that a widespread quinine campaign would not make much difference. Their reservations, though, were focused on practical difficulties distributing the drug and encouraging its use and not strictly doubts of the efficacy of quinine. In response, Kershaw wrote:

> The Lieutenant-Governor has already stated that he will cheerfully accept the increased burden upon Provincial Revenues which extended distribution will involve, and although he realises that there is much force in the contention that haphazard distribution is not the most scientific or likely to be the most successful method of combating malaria, he considers that for the present it is of the first importance to encourage the use of quinine.[475]

[474] Ibid., p. 15.
[475] Kershaw, 'Resolution ASRPEBA 1908', p. 3.

There were many detractors, some of whom were worried about the practicalities (procurement, distribution, dosage, etc), but proponents of campaigns to support malaria prophylaxis and treatment through quinine were willing to adapt their approach. Quinine remained the primary anti-malaria prophylactic endorsed by the provincial government and received considerable financial backing.

The Imperial Malaria Conference held at Simla in October of 1909 in response to increases in malaria in India. It was significant because it was a point at which medical officers from across India gathered to discuss the future of anti-malarial measures. Malaria was a problem in many different provinces across India; it was reported at the conference that in the previous ten years (between 1899 and 1909) the average deaths from 'Fevers' was between 4 and 4.5 million per year and an estimated one-fourth to one-fifth of those deaths from 'Fevers' was believed to be malaria. Medical officers also believed that the number of malaria deaths in particular was thought to be rising.[476] One of the goals of the conference was to recognise the collaborative efforts needed between municipal and district boards and provincial governments by discussing the 'facts which demand the joint consideration of all local authorities and the joint acceptance of the plan of campaign it may be advisable to adopt.'[477] The other goal was to explore the best possible way to design anti-malaria schemes, with a particular focus on how best to transfer two different anti-malarial theories into practice. As the president stated:

> The Conference will have before it two important facts, Major Ross's discovery of the actual cause of malaria, and the evidence, which I think we may assume to be incontrovertible, that where quinine can be systematically administered as a prophylactic, a very general immunity from malaria will be the result. It will rest with the Conference to decide by what means the knowledge of these two great facts may best be utilised.[478]

Three individuals from the province of Eastern Bengal and Assam attended the conference: Major E. Wilkinson, F.R.C,S., I.M.S. (Officiating Sanitary Commissioner), Mr. R. Nathan, C.I.E., I.C,S., (Commissioner, Dacca Division), and The Hon'ble Maulvi Saiyid Nawab Ali Chaudhuri (Khan Bahadur, member of the legislative council), and the representatives promoted the efforts of Eastern Bengal and

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[476] *Proceedings of the Imperial Malaria Conference,* p. 2.
[477] Ibid., p. 1.
[478] Ibid., p. 3.

Assam to promote and distribute quinine. At the conference, Major Wilkinson presented his paper titled, 'A Scheme for the Distribution of Quinine'. In his paper, he described the province of Eastern Bengal and Assam as a leader in quinine distribution in India. Wilkinson's argument was based on the fact that sales of quinine in Eastern Bengal and Assam were larger than the rest of India. He attributed this phenomenon to two marks of progress: the early introduction of the pice packet system to distribute the drug (in 1892 in Bengal and 1894 in Assam) and the large profits of retailers that encouraged further sales of quinine.[479] The financial incentives in place in Eastern Bengal and Assam for retail agents that were designed to boost sales by allowing the salespersons to earn a higher commission were viewed as a positive approach to increasing quinine sales among other attendees of the conference. In the final resolutions of the conference, the procedure was included as an official recommendation for other provinces to adopt.[480]

Despite Eastern Bengal and Assam's position as a leader in organising quinine distribution in India, Wilkinson was clear that quinine did not seem to have a notable effect on malaria mortality and morbidity at population level. He stated, 'in spite of the large sales, statistics give no reason to believe that in the province of Eastern Bengal and Assam the distribution of quinine has made any appreciable impression upon malarial fevers.'[481] Wilkinson believed this problem was caused by the fact that quinine was 'sold in doses, and not treatments, and that those who suffer very rarely subject themselves to continuous treatment.'[482] Wilkinson's paper focused on quinine, and his points concerned the distribution of quinine and the its use as a treatment for malaria, not its use as a prophylactic.

Some attendees had concerns over the efficacy of quinine, and the issues were raised at the conference. Major S. P. James stated that very few studies had been made in India on the effectiveness of quinine. According to James, there was plenty of evidence from the use of the drug in hospitals that supported the idea that quinine was, at least to a degree, effective in helping patients who suffered from

[479] Ibid., p. 79.
[480] Ibid., p. 107.
[481] Ibid., p. 79.
[482] Ibid., p. 79.

malaria. On the other hand, there were several reported cases, particularly among British soldiers, that quinine did not prevent the onset of malaria.[483] In other words, James doubted the efficacy of quinine as a prophylactic. James was, however, still in favour of the use of quinine. He believed that practical experiences verified that the drug was useful as a treatment for malaria, but he argued that medical officials did not understand how to use it properly.[484] Sceptical of any programme that relied too heavily on quinine because of the limited knowledge on how exactly the drug should best be used, James stated that several reports were being made of quinine's limitations as a malaria prophylactic,

> and there is no doubt that in the near future such reports will become increasingly numerous. Failures of this nature would be very detrimental to the success of an attempt to popularize the use of quinine in India and it is therefore necessary that we should be careful research ascertain the causes of failure and guard against them.[485]

Scepticism of the use of quinine was prevalent among many of the attendees of the conference, but the reasons varied. Colonel W. G. King, C.I.E, I.M.S., commenting on the state of malaria in Burma, stated his argument, 'that the people may ultimately use quinine largely for prophylactic purposes is a pious hope that has possibilities in it; but it stands to reason that so long as a population is free, this measure cannot be looked to for the extermination of malaria.'[486] King firmly believed that the correct approach to reducing malaria was through 'engineering efforts for sub-soil drainage, embankments, silting and other methods of bringing about correct control of surplus moisture on soil.'[487] King was officially reprimanded by the chairman for his report because it deviated too significantly from the central purpose of the conference: addressing mosquito control and quinine. In his official response to the criticism, King argued that addressing sub-soil conditions was going to reduce the number of mosquitoes and therefore malaria.[488]

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[483] Ibid., p. 68.
[484] Ibid., p. 69.
[485] Ibid., p. 68.
[486] Ibid., p. 49.
[487] Ibid., p. 50.
[488] Ibid., p. 63.

Opinions among medical officers at the conference did not reflect a consensus on the optimal anti-malarial measures. Within greater calls to control mosquitoes and further distribute quinine, the limitations of each approach quickly became clear. Nevertheless, general resolutions and recommendations were provided. According to Government of India, the provinces were to inquiry:

> (1) The distribution of malaria
> (2) The epidemiology and endemiological of malaria including
> (a) meteorological and physiographical conditions, and
> (b) the life history of malaria bearing mosquitoes
> (3) The physiological and therapeutical action of quinine and other remedies for malaria[489]

Acting on any of these recommendations would have inevitably involved facing significant hurdles, and though the goal of the conference was to provide an all-India approach to anti-malarial schemes, the different perspectives of the attendees and different characteristics (geographical, political, social, financial, etc) of the provinces meant that each locality would face its own struggles in translating the advice into practice. The most important takeaway for the provinces, even more important than the measures themselves, was the idea that accurate vital statistics were needed to justify and put in place anti-malarial measures. At the conference, the work of Captain S. R. Christophers in the Punjab was presented as a good model and accurate data was viewed as a necessity to properly understand both the presence of malaria and the effectiveness of the anti-malarial measures.[490] The importance of vital statistics was placed alongside calls for greater financial backing of schemes, both quinine and mosquito oriented.

> Each local government should be invited to make a special allotment of funds every year for the investigation of the problems connected with malaria and measures of prevention. The conference recognize that the amount of this allotment will depend upon the state of the provincial finances, but they would urge that the prevention of malaria has a strong claim upon all surpluses and increases of revenue.[491]

[489] Ibid., p. 105.
[490] Ibid., p. 105.
[491] Ibid., p. 107.

Officers were aware that anti-malaria schemes were expensive, especially those that tried to control mosquitoes, and it was hoped that through the practice provinces would be able to find affordable ways of accomplishing their goals.[492]

Finance was likely the issue of highest concern when choosing an anti-malarial measure for most provincial governments, and Eastern Bengal and Assam was no exception. This did not mean that provincial governments did not care about anti-malarial measures and were therefore committed to spending as little money as possible; rather, governments wanted to make sure that any anti-malarial measures were effective and therefore worth the investment of relatively limited funds. Hare, the Sanitary Commissioner of Assam, detailed the resolutions of the conference in the annual sanitary report for the province of Eastern Bengal and Assam after the conference in Simla. Hare focused his report on the 'extirpation of mosquitoes' (largely through drainage and petroleum based anti-larval measures), prophylaxis (primarily through quinine), the education of the sanitary staff, and finances. Hare also stated that,

> a malarial survey of the province is to be undertaken, maps are to be drawn, and tables. Of statistics are to be compiled, to illustrate and mark off the epidemic and endemic areas of the disease. To enable this to be done with accuracy, specially selected areas are to be first examined, to determine the "correction factor," by which figures representing the deaths from malaria can be separated from those representing the other causes of mortality, which are classified under the general term "fever."[493]

Additionally, systematic studies of the lifecycles of the parasites and their mosquito hosts were to be carried out. The past mosquito control schemes in Dinajpur and Jalpaiguri made medical officers like Hare wary of anti-larval methods. Hare was hopeful that species-specific mosquito sanitation would be useful, but he ultimately stated that he was unsure if the measures could have any effect within Eastern Bengal and Assam, 'where the possible breeding grounds are so innumerable and extensive, and where the movements of the population, a large percentage of whom harbour the parasite, are so continuous,

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[492] Ibid., p. 105.
[493] Hare, *ASRPEBA 1910,* p. 11.

antilarval measures can only be undertaken in small and isolated areas, and then only as an adjunct to personal prophylaxis and treatment by quinine.'[494]

The malaria survey was carried out in 1910 'based on the method employed by Major Christophers, I. M. S., in the Punjab,'- breaking down when malaria was most intense and comparing it to other diseases such as cholera, but it was only done in the Rajshahi division of the Province of Eastern Bengal and Assam. This region was somewhat large, but it was entirely within Eastern Bengal and did not encompasse any portion of Assam. The report found that the months of October, November, and December were the most malarious.[495] The following year, larvicidal experiments were carried out in Daca. These were based on species-specific malaria control and based off of malaria surveys. Overall, the results were a failure. McCombie Young who carried out the scheme believed this was because the area treated was too small and mosquitoes needed to be controlled in a wider berth to make a difference.[496] These surveys will be discussed in more detail in the next section, but it was clear Eastern Bengal was undertaking a new approach to malaria control. The progress made, however, was only applicable to Eastern Bengal and not Assam. Medical officers in Assam were still primarily concerned with kala-azar over malaria, and malaria surveys and species-specific mosquito control methods would not be employed for over a decade in Assam.

Members of the government outside of the Sanitary Department understood that malaria was a pertinent issue and were willing to contribute financial backing to the cause. They were not, however, willing to provide unconditional funding and allow the Sanitary Department to design any schemes without checks especially when several anti-malarial schemes were unproven, especially in Assam. The Secretary to the Lieutenant-Governor of Eastern Bengal and Assam, L. J Kershaw, argued that, though the

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[494] Ibid., p. 12.
[495] T. C. McCombie Young, 'A Note on Epidemic Malaria in the Rajshahi Division of the Province of Eastern Bengal and Assam, during 1905-1909', E. C. Hare (eds.), *Supplement to the Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1910* (Shillong, 1912), p. 59.
[496] McCombie Young, 'Report on the Result', p. 13.

recommendations from the malaria conference in Simla were immensely important and would likely have a large effect on malaria in the province, the most important aspect of the recommendation was to ensure that all vital statistics in the province were properly recorded and examined. The ability to accurately record the statistics was believed to be necessary to understand the effectiveness of schemes so that 'effort may not be ill-directed and money may not be wasted.'[497]

Vital Statistics

Vital statistics were considered of the upmost importance by the provincial government, and though they were not always as accurate as they were hoped to be, they played a significant role in determining malaria policy and anti-malarial measures in Assam. Medical officers in colonial Assam were willing to try several different methods to reduce malaria mortality and morbidity. Whether the approach involved distributing quinine or trying to prevent bites from anopheline mosquitoes, officers believed that an accurate record of mortality and morbidity of malaria (or 'Fevers') was necessary to fully understand the effects of each scheme. The importance of registering vital statistics was not new, the concept had been well understood and legally in force in 54 towns in the province of Eastern Bengal and Assam from the passing of Act IV (B.C.) in 1873.[498] Despite the history, by the early twentieth century there still were many issues concerning the collection of vital occurrences, and as a result, there was a tremendous amount of effort put in to improving the system of reporting accurate statistics across the province.

In 1909, the reliability of the statistics collected in Dinajpur was under increased scrutiny because of the extensive anti-malarial scheme that was underway. Consequently, the largest

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[497] L. J. Kershaw, 'Resolution on the Sanitary Report for 1909', in E. Wilkinson, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1909* (Shillong, 1910), p. 2.
[498] Wilkinson, *ASRPEBA 1909*, p. 5.

number of prosecutions to date were instituted in the town for failing to register vial occurrences. All these occurrences, 66 in total, sparked 'a systematic investigation into the causes of mortality made in connection with the antimalaria measures.'[499] The interest in vital statistics was similar across the province as a whole. The same year, the government planned on rewarding Gaonburas if they reported accurate statistics. Gaonburas were the leaders of gaons, or villages, in Assam, and for villages far away from major towns or cities, Gaonburas both held a position of relatively high local authority and importance to the provincial government; their compliance was necessary for the government to create accurate records in remote parts of the province. All statistics reported were supposed to be verified by Deputy Commissioners and Subdivisional Officers. Gaonburas were financially rewarded if their reports were accurate and financially punished if medical officers could not verify the reported results through personal enquiries.[500]

Medical officers were also still concerned of 'the inaccuracy of diagnosis covered by the term "fevers"'.[501] This dissertation has regularly touched on the problematic category of 'Fevers' in reference to colonial Assam, but this problem was widespread in India not unique to Assam. In Dinajpur, officers were interested in differentiating the category of 'Fevers' as far as possible to better understand the effects of the anti-malarial measures. Estimates from Dinajpur in 1909 state that of the 151 deaths due to fever, only 34 (about 26 per cent. of the total deaths) were believed to be caused by malaria. The remaining deaths 'were attributed to such causes as typhoid, carbuncle, pneumonia, small-pox, rheumatism, dysentery, cholera, puerperal fever, diarrhoea, respiratory disease, heart disease, etc.'[502] These estimates in Dinajpur only accounted for mortality and did not encompass morbidity. The imprecise 'Fevers' category also hindered efforts

[499] Ibid., p. 5.
[500] Ibid., p. 8.
[501] Ibid., p. 13.
[502] Ibid., p. 13.

made by medical officers to understand the impact of anti-malarial campaigns. Many of the diseases under the heading should have been recorded in their own categories, but misdiagnosis was common especially when those reporting the cause of death were often not medical experts. Nevertheless, in 1909 the seasonal distribution of fever was well noted.

There were several differences evident in the collection vital statistics between the Eastern Bengal and the Assam portions of the province of Eastern Bengal and Assam during the short-lived union, including a difference in the seasonal patterns of malaria.[503] It was thought that the data collected by Civil Surgeons in the Eastern Bengal portions of the province was less accurate than what could be achieved in Assam: 'Civil Surgeons are not as a rule able to exercise the same supervision over the verification of the registers as in the Assam districts, and their reports are not quite so detailed.'[504] The Sanitary Commissioner of Eastern Bengal and Assam E. C. Hare argued that there was plenty of progress in improving the collection of vital statistics in the eastern Bengal portions of the province, especially considering the province-wide emphasis in the pursuit, but admitted that 'many years must elapse before it approaches accuracy even in compulsory areas'.[505] The province of Eastern Bengal and Assam was dissolved in 1912, and it is likely that the Eastern Bengal portions of the province did not have enough time to match the accuracy of reported statistics in their neighbour, Assam, before the separation.

The problem of inaccurate statistics in the Eastern Bengal portion of the province was particularly disadvantageous for Assam. As mentioned previously, anti-malarial efforts required vital statistics in order to understand both the presence and impact of the disease and to lobby for funding for public health/sanitary programmes. Many of the experimental schemes to test the

[503] Ibid., p. 12.
[504] Hare, *ASRPEBA 1910,* p. 7.
[505] Ibid., p. 7.

implementation and effectiveness of anti-malarial measures including anti-larval and mosquito eradication programmes were done in Eastern Bengal and not Assam during this time. These schemes faced their own setbacks, but their success was difficult to evaluate without any accurate vital statistics tracking local mortality. Not only did Assam have a different ecological landscape and different rates of malaria, but the experimental schemes in Eastern Bengal did not produce sound and reliable information on the effectiveness of the tested anti-malarial measures.

Despite setbacks and often spotty, inaccurate data, the collection of vital statistics had an effect on the conceptualisation of malaria. For example, in 1910 a system was established to register vital occurrences on railways. Railways had become a fundamental feature of colonial Assam because, in addition to the expected cargo of goods and regular travellers, they transported large numbers of immigrant workers. In 1910 alone, there were 232 births and 515 deaths recorded on the railways.[506] The relationship between railways and disease was also well established by the beginning of the twentieth century, particularly in reference to diseases like cholera. But it was the work of Captain McCombie Young, then the Deputy Sanitary Commissioner of the province of Eastern Bengal and Assam, that highlighted the relationship between railways and malaria in Eastern Bengal and Assam. In 1910, McCombie Young investigated the history of malaria in the Rajshahi division (located in eastern Bengal) during the previous 7 years (1903-1910). He prepared maps and tracked the outbreaks of fever within the Malda district of Rajshahi division. According to McCombie Young, between 1905 and 1907, malaria was absent in epidemic from the Malda district though the disease was prevalent in the northern parts of the division. Between 1903 and 1907 a railway line was built from Kaithar and Godargari. There was then a period of epidemic intensity of malaria during the 3rd and 4th years

[506] Ibid., p. 6.

of the project (1906-1908) when 'there was a considerable "aggregation of coolie labour".[507] Noticeably, when the railway fully opened in 1908, the work ended, and the labour force left the area. Immediately following, McCombie Young stated that the epidemic forms of malaria subsided. The result of McCombie Young's study was an increased suspicion of the impact travelling labourers in Eastern Bengal and Assam could have on malaria and tensions within the Assam-Bengal Railway Company surrounding the development and corresponding health of railways and railway stations.[508] One of the outcomes of this increased attention was the decision made in conjunction with the Sanitary Department, the Agent of the Assam-Bengal Railway, and the Manager of the Eastern Bengal State Railway to allow station masters to sell quinine. Posters in Bengali illustrating the benefits of quinine on malaria were put up in railways in addition to post offices, thanas, and school in eastern Bengal districts.[509]

McCombie Young called for an overall increase in health provisions for railway construction in the future. Specifically, he argued that the high presence of malaria was related to 'unfavourable economic conditions throughout the whole district, in parts remote from the immediate vicinity of the line and its makers.'[510] In short, McCombie Young argued that there needed to be regulations to ensure that the 'coolie' labourers who were constructing the railways were provided with better housing and better sanitation in camps. This, McCombie Young pointed out, would be mutually beneficial to the companies building railways because fewer workers would be lost to illness.[511] McCombie Young's argument for improving general health and addressing malaria was in tune with other arguments for public schemes for malaria control

[507] Ibid., p. 10.
[508] Ibid., p. 11.
[509] Ibid., p. 18
[510] McCombie Young, 'A Note on Epidemic Malaria', p. 62.
[511] Ibid., p. 62.

across the province. Sanitary measures in colonial Assam were justified as a way of maintaining the health of the province's many migrants and labourers. Nevertheless, McCombie Young's arguments still focused on improving the health of the general population. This justification was more a useful tool to encourage more resources to be spent on health from the companies in the province.

With newfound determination, especially in the wake of the 1909 Malaria Conference in Simla, the province of Eastern Bengal and Assam worked to restructure its anti-malarial efforts. Quinine was still used as a malaria prophylactic and treatment, but the government wanted to conduct a number of surveys to gain an accurate sense of the geographical distribution of epidemic centres of malaria.[512] This was in line with the drive to create a more accurate system of registering vital occurrences and tracking the geographical spread of malaria would allow resources to be concentrated in the areas that needed it most. It would also provide a better picture of the ecological state of the province and possibly make it easier to implement mosquito eradication programmes, though this potential was viewed as highly unlikely. [513]

In 1910, Charles Bentley was sent to Eastern Bengal and Assam on special duty as the Deputy Sanitary Commissioner to help with anti-malarial efforts. Bentley had just finished working in Bombay on a similar project, and the results of his work in Bombay were published in the *Report of an Investigation into the Causes of Malaria in Bombay and the Measures Necessary for its Control*.[514] The province of Eastern Bengal and Assam wanted to expand its campaign against malaria and Bentley was sent in because Sanitary Commissioner Hare believed

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[512] Hare, *ASRPEBA 1910,* p. 11.
[513] Ibid., p. 11.
[514] C. A. Bentley, *Report of an Investigation into the Causes of Malaria in Bombay and the Measures Necessary for its Control*, (Bombay, 1911).

that the project was ‘of such magnitude and importance as to be beyond the scope of the regular staff of the Sanitary Department.’[515]

The plans for the new approach to malaria in the province of Eastern Bengal and Assam were organised in accordance with the provincial government and the Government of India. First, maps, tables, and statistics were to be compiled and made to identify any areas of the province that were particularly malarious and to determine whether the areas were suffering from either epidemic or endemic malaria. With this information, further studies were supposed to be conducted in specific areas to make sure it was in fact malaria that was causing the high mortality and morbidity rates from ‘Fevers’. According to Hare, ‘for accuracy, specially selected areas are to be first examined, to determine the “correction factor,” by which figures representing deaths from malaria can be separated from those representing the other causes of mortality, which are classified under the general term “fevers”’.[516] In addition to these surveys, mass experimental demonstration camps were formed. This was in an attempt to educate both medical staff and the mass population in the uses of quinine and other anti-malarial measures. Along with the demonstration camps, there were other plans to educate the public. ‘Sanitary text books’ were written and issued through the Educational Department of the province to teachers and schools. In these textbooks, there was a specific focus on malaria and quinine. Separate from the textbooks, other advertisements and pamphlets with the same material were published and distributed widely to the public. [517]

Noticeably in this 1910 anti-malarial campaign plan, there were no calls for larvicidal use or mosquito eradication. Medical officers in Eastern Bengal and Assam doubted the effectiveness

[515] Hare, *ASRPEBA 1910,* p. 11.
[516] Ibid., p. 11.
[517] Ibid., p. 11.

of these measures and cited the unsuccessful efforts in Dinajpur and Jalpaiguri. The anti-malarial measures in Dinajpur and Jalpaiguri had already been underway for 2 years by 1910, when this plan was made. According to Hare, 'it is evident that there is little practical advantage in attempting to exterminate mosquito larvae in general.'[518] The process was extremely expensive and laborious; overall, it was deemed not worth the cost. Despite their reservations, medical officers did not completely give up on the potential for a reduction in malaria through mosquito eradication. A comprehensive study was called for on the history of the malaria parasite and their hosts in relation to the province of Eastern Bengal and Assam.[519] Hare stated:

> It is possible later on in the campaign, after a study of the habits of the parasite and its hosts in a particular area have been made, that measures of this nature having reference to the destruction of some particular species of mosquito, whose breeding grounds are limited, may be found useful; but in this province, where the possible breeding grounds are so innumerable and extensive, and where the movements of the population, a large percentage of whom harbour the parasite, are so continuous, antilarval measures can only be undertaken in small and isolated areas, and then only as an adjunct to personal prophylaxis and treatment by quinine.[520]

In 1910, quinine was still by far the preferred method of malaria control within colonial Assam from the standpoint of the provincial government.

A major issue with structuring these anti-malaria efforts was balancing the needs of the Eastern Bengal and Assam portions of the province. This affected both the approach to quinine distribution and the potential for mosquito eradication campaigns. Notably, the sale of quinine in the Eastern Bengal districts fell by 287 pounds. In contrast, the sale of quinine in the Assam districts nearly doubled. Hare blamed the difference on problems with sales outposts. According to Hare, each post office in Eastern Bengal served too large an area of land for there to be an easy

[518] Ibid., p. 11.
[519] Ibid., p. 11.
[520] Ibid., p. 12.

access to quinine for the average resident.[521] Additionally, the experiments in Dinajpur and Jalpaiguri were failing to produce promising results. Despite a large mortality from malaria, the sale of quinine did not increase as the government expected. As a result, there was a large amount of attention paid to attempts to increase the sale of quinine in Eastern Bengal. Unlike similar malaria experiments in other parts of India, the experiments in Dinajpur and Jalpaiguri were unsuccessful in reducing malaria. The Government of Eastern Bengal and Assam therefore decided to 'abandon further operations in Jalpaiguri, and as regards Dinajpur to concentrate efforts on quinine prophylaxis and for the present at all events to abandon measures or the destruction of mosquitoes.'[522]

The new grand campaign was structured in a new way that was different to schemes that were previously underway in colonial Assam. A provincial malarial committee was created and composed of the Sanitary Board, the Inspector General of Civil Hospitals, and a working sub-committee to work closely with local committees in various districts across the Eastern Bengal and Assam. The purpose of the local committees, in contrast to the central provincial malarial committee, was to be in charge of communication with residents in each district. Local committees were tasked with educating the residents of each district on sanitary measures with a specific emphasis on the prevention and treatment of malaria. The model was borrowed from the successful campaign in the Punjab where local quinine societies formed the backbone of the anti-malarial campaign.[523]

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[521] Ibid., p. 18.
[522] W. J. Reid, 'Resolution on the Sanitary Report for 1910', in E. C. Hare, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1910'* (Shillong, 1911), p. 2.
[523] Hare, *ASRPEBA 1910,* p. 12.

By 1910, increased attention was paid to malaria, but there was still a lingering focus on kala-azar that outweighed malaria. Though the focus on malaria was increasing, Major S. R. Christophers, I.M.S., was sent by the Government of India to Eastern Bengal and Assam to study the history of the kala-azar. Christophers argued that kala-azar had spread initially from the district of Nowgong to neighbouring districts in Assam.[524] Noticeably, this did not have much of an effect on the malarial measures that were put in place in 1910 (other than utilising resources that could have otherwise been used on malaria). Christophers believed that kala-azar and malaria were completely distinct but took a tremendous amount of care to catalogue spleen enlargement during his time in Assam. It was still relatively difficult to tell kala-azar and malaria apart without specific medical knowledge or biological samples, but Christophers theorised that if splenic enlargement was different in size in comparison to splenic enlargement from malaria in the Punjab, where there was no kala-azar, then this new measure could be a useful mechanism one could use to differentiate the diseases.[525] At this point in time, the dominant belief in Assam was that kala-azar was caused by bed bugs and transferred from one individual to another through the insects. It is difficult to tell whether medical officers were referring to sand flies (the actual vector of kala-azar) or the insects traditionally labelled bed bugs, but this idea was unconfirmed and approached with an appropriate level of hesitation from medical officers in Assam.[526] Regardless of the accuracy of the theory, this idea was nevertheless a mark that the potential vector of kala-azar was completely different to the vector of malaria. Though there was a similar suspicion of

[524] Ibid., p. 12.
[525] S. R. Christophers, 'Report on an Outbreak of Kala-azar in the Golaghat Sub-division of the Sibsagar District', in E. C. Hare, *Supplement to the Sanitary Report of the Province of Eastern Bengal and Assam for the year 1910* (Shillong, 1912), pp. 9-10.
[526] Hare, *ASRPEBA 1910*, p. 12.

individuals travelling throughout Assam, primarily immigrant labourers, and the spread of both diseases, they were treated differently.

Many of the measures that had been proposed in 1910 were implemented in 1911, which demonstrates that there was some progress rather than unrealised momentum after the 1909 malaria conference in Simla. In reference to the issue with vital occurrences, two camps for a special enquiry into mortality returns were set up in the Keranigunj thana of the Dacca district and in the Nator thana of the Rajshahi district (both in Eastern Bengal). The project was overseen by Bentley who was the 'Special Malaria Officer' of the province. The specific purpose of the enquiry was to 'test the accuracy of the mortality returns under the heading "Fevers" and to ascertain the percentage which is due to malaria.'[527] In response to McCombie Young's work in the Malda district focusing on the epidemic caused by railroad construction, quinine was distributed freely through the district board. The anti-malarial operations were fully cancelled in Jalpaiguri, though they continued in a diminished capacity in Dinajpur. Malaria cases in children were recorded and kept with registrars; all children suffering from a fever or with an enlarged spleen were to be given a daily dose of quinine distributed by house-to-house visitation, and quinine was distributed to primary and secondary schools for children.[528] All antilarval and mosquito eradication programmes were cancelled, and, according to Eastern Bengal and Assam Sanitary Commissioner Hare, all 'operations are now confined to the distribution of quinine.'[529]

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[527] E. C. Hare, *Annual Sanitary Report of the Province of Eastern Bengal and Assam for the Year 1911* (Shillong, 1912), p 7.

[528] The increased attention paid to children was the result of Christophers' drive to index the enlargement of spleens from fever. As a result, there was a 'spleen census' made twice a year between 1909 and 1911. The size was recorded as between Jan and Feb 28.85 – 27.77 – 16.98 and between July and August as between 23.56 – 22.21 – 10.91.

[529] Hare, *ASRPEBA 1911*, p. 10.

Despite the near-total reliance on quinine as the dominant anti-malarial method in the province, there were still some experiments that involved the species elimination of mosquitoes. In 1911, McCombie Young carried out one of these experiments in Dacca. In the civil station near Dacca, where mosquitoes bit more frequently in the winter months as opposed to in neighbouring Assam, there was a campaign to eliminate mosquitoes and mosquito breeding sights beginning in November and carried on for 3 months. 'A gang of men under a pensionable havildar were enlisted to examine and treat all the possible breeding grounds within the area, including tanks and surface drains, and collections of stagnant water from hydrants, street drains, and private compounds.'[530] This was a campaign of a somewhat small-scale, it was only targeted at the civil station and not the entire city of Dacca. The result was mixed. While the campaign successfully reduced the number of mosquitoes breeding in the civil station, there were still numerous mosquitoes present in the civil station that had been carried there from the main city of Dacca by winds. According Sanitary Commissioner Hare,

> it was found that so long as the wind remained in the north-east quarter, in the direction opposite to that of the native city, the station remained comparatively free from mosquitoes; but whenever it changed to the south-west and blew from the city, especially if the breeze was a light one, the mosquitoes swarmed in nearly as great a multitude as before.[531]

Though the methods of species sanitation preventing certain mosquitoes from breeding in a specific area were proven successful by the experiment, the overall utility of the mosquito control was questioned. As mosquitoes could travel for miles, targeted anti-larval measures would not have too much of an effect.

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[530] Ibid., p. 11.
[531] Ibid., p. 11.

The major emphasis of anti-malarial measures was still placed on improving the accuracy of the recording of vital occurrences. Bentley headed a special investigation into vital occurrences in Dacca, but the process as a whole required several boots-on-the-ground medical professionals to conduct the enquiry.[532] The method was structured systematically. Every Sub-Assistant Surgeon in the area was told to make house-to-house visits in the villages, determine the reported causes of deaths, note omissions, and record every case of disease noted during the house-to-house visits.[533] Sub-Assistant Surgeons were also told to treat cases they observed. According to the guidance, 'each member of the staff is provided with a clinical thermometer and a stethoscope, a liberal supply of quinine tablets, Government treatments, and a few other simple medicines mostly in pill or tablet form; and it has been found possible in this way to combine definite remedial measures with a statistical enquiry.'[534] The purpose of this inquiry was to combine the information given to officials from each village about causes of death with the actual experience of medical professionals who would be able to witness the courses of infection first hand, and hopefully treat many of the affected individuals. To protect the medical officers, each was given a mosquito net for sleeping, prophylactic doses of quinine, and a text-book on malaria from the Government of India written by S. P. James. Each officer was also given an aluminium water bottle to carry boiled water to avoid infections from contaminated water supplies. Beginning on 1 September, 1911, by February of 1912, medical officers had 'investigated the causes of death in 2,914 cases, verified 3,951 births and recorded 22,399 cases of sickness of a large number of whom received treatment' in the Keraniganj thana of the Dacca district, the target area.[535]

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[532] Ibid., p. 11.
[533] Ibid., p. 12.
[534] Ibid., p. 12.
[535] Ibid., p. 12.

The results were promising. It was found that the discrepancy in deaths was largely the cause of reporting deaths under the wrong months, rather than not reporting deaths at all. The result was a total discrepancy of only around 2%, an acceptable margin of error for medical officers at the time. Additionally, there were 862 deaths recorded under the heading of 'Fevers', 556 were determined to be due to malaria, and the rest to other specific diseases.[536]

The inquiry into the accuracy of vital statistics in the Dacca district is a mark of the increased attention paid to malaria specifically, which was a new development at the turn of the twentieth century, but it is an example of the problem faced by the colonial Assam portion of the province. Both McCombie Young's experiment on mosquito eradication and the enquiry into the accuracy of vital occurrences occurred in the eastern Bengal portion of the province and their results would be of limited use to public health in Assam. As previously stated, Assam did not suffer from the same discrepancy in vital occurrences. Though there was ambiguity in the diseases categorised under the heading of 'Fevers', many of the districts were relatively consistent at reporting their statistics. Additionally, mosquitoes bit at different times of the year in Dacca than Assam.

Overall, the time period between 1904 and 1912, during the life of the short-lived province of Eastern Bengal, more attention was paid to malaria and the development of anti-malarial schemes. This was especially true in the wake of the 1909 malaria conference in Simla. More attention, however, was paid to malaria in Eastern Bengal than in Assam during this time period. There was of course some focus on Assam, but the concentration on Eastern Bengal time at the expense of colonial Assam characterised anti-malarial measures during this.

[536] Ibid., p. 13.

Much of the progress in medical research and public health measures in colonial Assam was made in efforts to reduce kala-azar. In 1911, there was a special investigation into an outbreak of kala-azar in Golgahat which was inside of the Assam portion of the province. A house-to-house survey of the villages were made, the homesteads of families where there were outbreaks of malaria were burned down (done in the belief that the disease was spread via bed bugs, new buildings were built at the expense of the government and clothes and cash were distributed for free), the sick were separated from the healthy, and a new special hospital was built at Khumtai in Golgahat.[537] Like the enquiry in Dacca, these measures required tremendous resources; both money and manpower.[538] In the case of eastern Bengal, this was spent on malaria and in the case of Assam, this was spent on kala-azar. It is true that there was tremendous financial support of the distribution of affordable quinine in Assam to prevent and treat malaria, but the specific projects that required specialised knowledge and large amounts of manpower were split along these lines.

Major efforts were made in providing quinine on railways and tea plantations. In 1911, Sanitary Commissioner of Eastern Bengal and Assam, E. C. Hare, noted that the Tea Garden Managers and Agents in Assam took a special and increasing interest in malarial prophylaxis through quinine. As a result, quinine was increasingly distributed to labourers on tea plantations in Assam. According to Hare, there were many reports of 'more efficient work'. 'It is coming to be realised that a day's labour from a healthy man is worth more in hard cash than a daily dose of quinine. A very interesting report on the effect of this treatment in diminishing the number of labourers on the sick list has been drawn up for me by Dr. McNamara, the Chief Medical Officer

[537] Ibid., p. 14.
[538] Special credit was given to the Khumtai Mauzadar Rai Sahib Dandadhar Barua and Assistant Surgeon Bidyananda Dutta for their work. Ibid., p. 14.

of the Assam Company.'[539] The popularity of quinine on tea plantations was so great that the Assam Tea Company imported a special machine to manufacture their own tablets of quinine.[540]

There were some planned developments in anti-malarial measures in Assam after it was separated from Eastern Bengal. Regarding vital occurrences however, not much changed. Assam was already providing statistics that were at an acceptable level of accuracy.

> Without recasting the whole system upon a new and expensive basis, the only remedies at present applicable are, (1) more energetic and constant checking of returns by the inspecting staff, (2) adequate punishment of defaulting chaukidars, (3) encouragement of good reporting by remissions of land revenue, and gifts of gold rings to gaonburas in districts, where the Assam system is in force.[541]

The issues in Assam were different from Eastern Bengal, and the relative reliability, at least in the eyes of contemporary medical officers, meant that the province focused on new objectives.

The politics of public health in Assam was heavily affected by the maxims that drove production and trade. The use of quinine was more popular in Assam than in the Eastern Bengal portion of the province, but the priorities that defined the focus of medical officers varied between the locations. This, however, changed in 1912 when the province of Eastern Bengal and Assam was dissolved, and Assam regained its status as an independent province within the Raj. As its own province, from 1912, Assam was able to concentrate its resources on anti-malarial measures to be used within its own borders. There was a drive to create surveys which were intended to provide an accurate understanding of disease across the landscape. In the past, several surveys were conducted on malaria in eastern Bengal with new sources of funding. These surveys could be conducted in Assam but in 1912 the attention was first paid to kala-azar. According to

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[539] Ibid., p. 20.
[540] Ibid., p. 21.
[541] R. N. Campbell, *Annual Sanitary Report of the Province of Assam for the Year 1912* (Shillong, 1913), p. 5.

the Sanitary Report, 'proposals for malaria investigation and anti-malarial work are kept pending the completion of the kala-azar survey of the province at present in progress, and the appointment of a special malarial research officer.'[542] As a proxy, the department utilised data from the splenic census to get a sense of the presence of malaria across the province.

The rough information that provided a sketch of malaria in colonial Assam in 1912 indicated that there was a difference in rates of malaria in 'developed' areas of Assam and 'undeveloped' or uncultivated areas, which were higher. Assam Sanitary Commissioner R. N. Campbell wrote, 'in open cultivated and more populous country, the prevalence of malaria among the indigenous population appears to be small.'[543] The accuracy of this claim is difficult to determine, but it furthered the long held belief in Assam that 'cultivated' land was safer and developing Assam was the key to reducing malaria mortality and morbidity. Assam Sanitary Commissioner R. N. Campbell said, 'From those figures one might hazard the suggestion that perhaps an increase of the population and more cultivation of the land might prove the best anti-malarial measure for Assam.'[544]

Despite the fact that limited attention was paid to anti-malarial schemes in Assam, there was one oft-cited, notable anti-malarial scheme in Assam. This was the scheme in Nongpoh, which was a halting stage on the road halfway between Gauhati and Shillong (two of Assam's largest cities and Shillong the capital of the province).[545] There were several cases of travellers along the road who spent the night in Nongpoh catching malaria. A survey produced the following results:

1. The pond did not breed any malaria-carrying mosquitoes

[542] Ibid., p. 8.
[543] Ibid., p. 10.
[544] Ibid., p. 10.
[545] Ibid., p. 10.

> 2. No anopheles of any description could be found sheltering in cow-houses, sheds or dwelling houses during the day,
> 3. In spite of this apparent absence of carrier-mosquitoes, 5 specimens of a malaria carrier, m. listoni, obtained entrance at night to the imperfectly adjusted net of the observer, who subsequently developed a mild attack of fever
> 4. That those mosquitoes were found to be breeding in hill streamlets and sheltering in jungle
> At the recommendation of the Sanitary Board, the jungle is being cleared for a considerable radius round the village, and orange groves will take the place of jungle and undergrowth.[546]

Two aspects of this anti-malarial scheme are important to note. The first is that there was a tremendous amount of attention paid to travellers in Assam catching malaria. Like the issues on the railways, travelling individuals and groups were closely associated with malaria. The second feature of this anti-malarial scheme is the fact that it focused its efforts on species specific mosquito control.

Previously, many anti-malarial methods revolved around quinine, whether it was increasing the sales of the drug or encouraging the use. In this instance, the medical officers in Assam, specifically at the behest of the Deputy Sanitary Commissioner McCombie Young, decided that addressing the problem of mosquitoes would be the most effective method of malaria control in Nongpoh. Even when mosquitoes could not be found breeding in the immediate vicinity of the halting place, knowledge that mosquitoes could travel miles from breeding sites for a blood-meal and therefore spread malaria played a key role in decision making. This was a distinct trend that developed in Assam in 1912 that was previously underemphasised.

A focus on mosquitoes and the potential benefits of mosquito eradication set the scene for further plans for anti-mosquito schemes across the province. With an acceptable system for reporting vital statistics and a relatively enthusiastic and successful (at least in overall sales)

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[546] Ibid., p. 10.

programme for quinine distribution, the government of Assam looked towards a plan of eliminating mosquitoes and clearing jungles. As previously mentioned, this method of malaria control was situated within rhetoric that a more cultivated province was a healthier province. These ideas were not confined only to medical officers. Commenting on the state of malaria using the splenic index, A. W. Botham wrote on the order of the Chief commissioner of Assam that:

> These indicate (what might also be deduced from the vital statistics) a comparatively low incidence of malaria in the Surma Valley, and they corroborate popular idea that this disease is most common in the jungly tracts at the foot of the lower hills. The prevalence of malaria in open and more populace country is low, and the Sanitary Commissioner is inclined to think that an increase of population and of cultivation may prove the best anti-malarial measure for Assam.[547]

Anti-malarial measures in Assam were informed by anti-malarial pursuits in other provinces in India. There were very few medical practitioners in Assam, but there was a push to encourage the existing medical ones to verify the statistics that were reported as vital occurrences. In 1913, there was a proposal for financial support from the government for this scheme. Similar to a system on trial in the United Provinces, the Sanitary Department of Assam requested that medical officers be paid to verify causes of death across the province.[548]

In relation to anti-malarial measures in Assam, 1913 is a year that defines unrealised promise and good intentions. In the wake of the separation from Eastern Bengal, the province of Assam began assessing its own state of malaria and proposing surveys that would have addressed the deadly disease. Assam Sanitary Commissioner H. E. Bantavala, I.M.S., summarised the state of malaria in Assam astutely in 1913:

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[547] A. W. Botham, 'Resolution on the Sanitary Report for the Year 1912', in R. N. Campbell, *Annual Sanitary Report of the Province of Assam for the Year 1912* (Shillong, 1913), p. 2.
[548] H. E. Banatvala, *Annual Sanitary Report of the Province of Assam for the Year 1913* (Shillong, 1914), p. 7.

> The conditions of Assam differ materially from those prevailing in the parts of India in which malaria has up to now received most attention. The moist climate, the abundant vegetation and sparse population of Assam sharply differentiate its malariology from that of countries with dry climates, which with a small rainfall, scanty vegetation and paucity of permanent collections of water are thickly populated by inhabitants, who tend to live in aggregated groups of villages and towns. In such dry countries epidemic malaria at times assumes very formidable proportions, and is productive of much morbidity. In Assam, on the one hand, the climatic and meteorological conditions and the sparse and unaggregated population do not appear to supply the factors necessary for the production of malaria in its intense epidemic form. On the other hand, it is probable that in certain places and under certain conditions the endemic prevalence is maintained at a constantly high level.[549]

The Sanitary Department theorised that there were three settings unique to Assam that would contribute to the problem of malaria within the province. First, there were the alluvial and riverain tracts, including the greater parts of the plains district, that would affect the locals nearby.[550] Second, there were the lover levels of the Khasi and Jaintai Hills, the Garo hills, and other 'terrai' tracts (well known for the epidemics of 'Fevers' believed to be caused by kala-azar and malaria).[551] In these areas, the Sanitary Department believed that the sparse distribution of the population combined with 'uncleared jungle' where mosquitoes were known to breed would cause high rates of malaria. Other than distributing quinine, the Sanitary Department believed they could do little to help; clearing jungles, which were believed to alleviate malaria at the time, were dependent on economic 'development' and out of the control of the Sanitary Department. The third setting was the tea estates.

By 1913, many tea plantations distributed quinine to their as a prophylactic for malaria, but they were seeking more opportunities to reduce the presence of malaria. The importance of preventing and treating malaria on tea plantations was commonly recognised because it was the

[549] Ibid., p. 10.
[550] Ibid., p. 11.
[551] Ibid., p. 11.

most common reason workers fell ill, and the Sanitary Department looked optimistically at the potential for further campaigns against malaria on the estates. 'The tea districts being for the most part free from the presence of kala-azar, and with a population controlled by educated Europeans and with a European medical staff fully conversant with its health problems, present a particularly favourable opportunity for malarial research.'[552] This was despite the fact that practically all of the tea plantations had radically altered their local environment (viewed favourably by the Sanitary Department but nevertheless a factor in malaria control) and had incredibly large amounts of labourers, 'all of them foreign to the soil and climate, of whom a more or less constant proportion are new comers and unacclimatised.'[553] The determined approach was a survey of tea plantations to determine the carrier mosquitoes present, determine the breeding grounds, and determine the financial cost of the labour involved in these mosquito eradication and anti-larval measures. In other parts of Assam (and in the province of eastern Bengal and Assam), mosquito eradication measures were found to be too expensive and not worth the cost, especially considering unreliable mortality and morbidity statistics from Eastern Bengal. Tea plantations, however, had far more funds for the pursuit and malaria surveys and mosquito eradication measures were 'a commercial proposition and not an unremunerative expense of a philanthropic nature. The opportunities for profitable malarial research work, and for a practical application for the conclusions derived from it are, therefore, unusually favourable in Assam.'[554] This prediction, unfortunately, was far from the reality of what was to come.

Malaria research and plans for anti-malarial campaigns faced a number of unexpected obstacles in the following decades and these are examined later in this dissertation, but in 1914

[552] Ibid., p. 11.
[553] Ibid., p. 11.
[554] Ibid., p. 11.

there was a tremendous setback. The outbreak of the First World War stripped Assam of financial resources and knowledgeable medical officers as the British Empire engaged in a global conflict. As a result, progress on anti-malarial measures stalled. Though some research on malaria was done between 1914 and 1919, the province was unable to undertake the planned changes. Combined with a diminished focus on malaria in Assam between 1905 and 1911, when Assam was combined with Eastern Bengal, anti-malarial pursuits in Assam effectively stalled between 1905 and 1919. During this time other provinces were able to conduct surveys on malaria and implement schemes that in many cases reduced malaria mortality and morbidity. Assam was thus at a unique disadvantage.

Malaria in Assam During the First World War

Assam was far from any of the battlefields of the First World War, but the international conflict had an effect on malaria in the province. Unlike the Second World War, in which Assam hosted several battles in the Allied attempt to push back Japanese troops who attempted to enter India through Burma, no battles were fought in Assam during WWI. Nevertheless, the scale and cost measured in both money and manpower set back attempts to mitigate malaria in the province. However, experience gained through the war redefined approaches to malaria control. High level medical officers and government finances were both diverted to the global war effort. There were several advances in preventing and treating malaria that were developed during this time period, but there were also a series of setbacks that meant that the expanding work on addressing malaria in colonial Assam stalled between 1914 and 1919.

In 1914, S. P. James was selected by the Government of India to undertake malaria research in Assam. War broke out not long after James took up his post. James was quickly

called away for military duty and his research was postponed.[555] James was already well established as a malariologist and had extensive entomological knowledge in addition to his medical training. In the immediate years prior to taking up his post in Assam, James was chosen to study yellow fever in the Americas and assess its potential spread to India.[556] His work in this area was published in the book *The Protection of India from Yellow Fever.*[557] Fever in Assam was relatively high in 1914, and the provincial government was disappointed that James was diverted from his work on malaria in Assam.[558]

Despite the recall of S. P. James, momentum from previous years pushed malaria research in Assam forward, but only in a limited capacity. James' work was attempted by other medical officers who wanted to understand the general 'malariousness' of the Lumding railway station. Work had previously been completed by Captain J. F. James, I.M.S., Dr. Murray, and other officers, and two surveys were produced based on this work. Additionally, Dr. A. B. Fry, the railway medical officer, surveyed mosquito breeding grounds at the end of the malarial season. Major T. C. McCombie Young, the newly promoted Sanitary Commissioner of Assam, used this information to work with a sanitary commissioner to develop a scheme that would address the breeding grounds of the species of anopheles mosquitoes that carried malaria. Larvicide was used and new drains were drawn to combat the breeding grounds of *A. Culicifacies, A. Listoni, A. Fulliginosus* and *A. Maculatus*. These findings contributed to growing work within medical entomology and offered great potential for species specific mosquito control and anti-malarial

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[555] H. E. Banatvala, *Annual Sanitary Report of the Province of Assam for the Year 1914* (Shillong, 1915), p. 12.
[556] 'Flies and Mosquitoes', *The Spectator*, 4477 (1914), p. 641.
[557] S. P. James, *The Protection of India from Yellow Fever* (Simla, 1913).
[558] A. W. Botham, 'Resolution on the Sanitary Report for the Year 1912', in H. E. Banatvala, *Annual Sanitary Report of the Province of Assam for the Year 1914* (Shillong, 1915), p. 1.

measures. The common breeding grounds were drains, an old brick-field, and the haru langpher river.[559] The cost of these measures was estimated at Rs. 1,68,429. Some of them were limited in scope. For example, it would have been impracticable to carry out major work on the river, so larvicide was recommended instead. The plans for work on the station at Lumding were sent off to the Assam-Bengal Railway Board after they were drawn up.[560] Though medical officers were able to carry on with their planned work in Lumding without the presence of S. P. James, they could not pursue work on malaria in other parts of Assam. This was due to both the recall of James and a massive lack of funds in the wake of the global conflict.

The provincial government of Assam was aware that financial restrictions would place a large amount of strain on public health officials. Implementing any sanitary regulations was a challenge and municipal officials often needed persuading to spend limited resources on improvements in sanitation. For malaria, no further work was completed beyond the study of the Lumding railway station and medical officers were asked to comment on what they thought was possible. Overall, the financial outlook was grim. In the Sanitary Report of 1915, the provincial government stated:

> The Chief Commissioner must warn municipalities that for the duration of the war and of the financial stringency resulting there from they must not look to the Government for the special grants which have been forthcoming of recent years. He trusts that Municipal Commissioners will look facts in the face, and where funds are insufficient will not hesitate to levy the enhanced taxation required to bring their towns into decent order.[561]

Without the financial support to bolster development, malaria research and schemes were bound to already established approaches.

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[559] T. C. McCombie Young, *Annual Sanitary Report of the Province of Assam for the Year 1915* (Shillong, 1916), p. 12.
[560] Ibid., p. 12.
[561] Ibid., p. 1.

Quinine was still a cornerstone of the anti-malarial campaigns in Assam. Though the study at the Lumding station in 1915 focused primarily on anti-mosquito measures, the lack of funds made expanding these programmes impossible. Sales of the drug remained high across the province, but government subsidies for quinine was cut significantly. By 1916, it became apparent that the war had caused an increase in the cost of quinine in the open market. Because the Government of Assam was already making a loss on quinine before the prices went up, studies were made to make sure that the heavily subsidised quinine was finding its way into the hands of those who needed it, not those taking advantage of the system such as individuals who would purchase the drug at a subsidies price and resell it.[562]

By 1916 limitations in government funding meant that the province could not afford any new anti-malarial measures:

> In absence of an officer who can give his time to the elucidation of the causes which lead the prevalence of malaria in the province, and in view of the financial stringency entailed by the war, the consideration of special measures aimed at the reduction of malaria has had to be abandoned for the present. The growth in the sale of Government quinine which is offered at rates which are much below those at which the drug is obtainable in the open market, is however an encouraging anti-malarial measure. [563]

The subsidised sale of quinine continued, but there were no new surveys or anti-malarial plans. The collection of vital statistics was determined to be satisfactory in both urban and rural areas[564] but unsatisfactory on tea estates.[565] Travelling dispensaries moved around Assam treating individuals suffering from kala-azar supervised by Assistant Surgeon Suresh Chandra Majumdar.[566] There was an outbreak of kala-azar in one of the tea gardens, believed to be

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[562] T. C. McCombie Young, *Annual Sanitary Report of the Province of Assam for the Year 1916* (Shillong, 1917), p. 16.
[563] Ibid., p. 10.
[564] Ibid., p. 7.
[565] Ibid., p. 6.
[566] Ibid., p. 11.

brought in from a nearby village, that was investigated by one of the travelling dispensaries. Under the prevailing advice on managing kala-azar at the time, those suffering from kala-azar were separated from their neighbours. To avoid the chaos from previous decades when labourers on tea plantations and people in villages would abandon their homes (and in a worst case scenario spread disease), the Sanitary Department recommended that the local authorities apply for special powers and support under the Imperial Epidemic Diseases act of 1897.[567] Many locals in Assam, however, were notably cooperative and willing to accept help from the government in the face of such a feared disease.[568] Assam was continuing the long-established campaign against kala-azar, but this came at the cost of both monies and manpower, preventing widespread anti-malarial measures from being undertaken.

During the First World War, some malaria surveys were conducted and anti-malarial measures implemented, but these were limited to specific locations and partially funded from industry. A prime example is the enquiry into malaria at Lumding, which was a heavily travelled railway junction and the district headquarters of the Assam-Bengal Railway. Dr. Francis, the Chief Medical Officer of the Railway, officially requested an enquiry from the Sanitary Department based on previous research done by Dr. Murray in 1914. The enquiry was only possible because of the work of Dr. Fry, the medical officer of the station, worked with advice from the Assam Sanitary Commissioner McCombie Young. [569] Without the dedicated medical officer for the station, the survey would not have been possible.

The findings from the investigation at Lumding focused on mosquitoes in a way that previous anti-malarial surveys did not. There was a determination that there was a high

[567] Ibid., p. 11.
[568] Ibid., p. 11.
[569] McCombie Young, *ASRPA 1917,* p. 10.

prevalence of malaria infections in Lumding, and there were many breeding grounds for mosquitoes that were potential carriers of malaria.[570] With the application of larvicides being deemed too expensive, plans for improved drainage were drawn up by the Assam Sanitary Engineer, Mr. A. T. Duguid, A.M. I.C.E. The plans were then sent to Major S. R. Christophers, C.I.E., I.M.S., who had previously worked in Assam and was a regarded expert on malaria, for comment.[571] With Christophers' support, the plans were implemented. The total cost of the scheme was Rs. 1,12,000 and was financed completely by the railway.[572] The progress was encouraging to the Sanitary Department, who believed that even with limited government resources, industries could accomplish malaria surveys and fund anti-malarial measures.

Unfortunately, in 1918 when many medical officers expected to see the results of the Lumding experiment and encourage other industries to engage in similar surveys, the influenza pandemic reached Assam and obscured any results by causing a massive increase in mortality under the category of 'Fevers'.[573] There was one documented enquiry into malaria in Assam, but this occurred at Pasighat which was a military outpost on the North-East Frontier. There, McCombie Young identified the malaria carrying mosquitoes and recommended jungle clearance, drainage, and oil drippers.[574] Other than this, the reach of the influenza pandemic was almost all-encompassing and disrupted life in Assam to a massive degree. In an atypical manner different from other government reports, McCombie Young wrote of the pandemic:

> Although Assam suffered less severely from influenza than many other parts of India and escaped with a death-rate only slightly higher than the least severely affected province (vide paragraph 2), yet the havoc wrought by the pandemic was such that to avoid lapses into emotionalism unbecoming in an official report, one seeks safety in a rigid adherence

[570] Ibid., p. 10.
[571] Ibid., p. 11.
[572] Ibid., p. 11.
[573] Ibid., p. 13.
[574] Ibid., p. 13.

> to facts and figures, eschewing all temptation to depict in detail the exceedingly moving picture of death, bereavement, sorrow and privation of which these facts form the barest outline. In four months more than one hundred thousand persons would appear to have died of influenza in Assam or nearly eighteen out of every thousand, and of these, the majority were vigorous people in the prime of life.[575]

Conclusion

The period between 1897 and 1919 saw an expansion of anti-malarial measures in Assam, both in scope and ambition. Throughout, mosquito eradication measures failed to gain popular support and distinguish themselves as reliable methods of malaria control. Quinine remained the anti-malarial method relied upon most by the government, but schemes to increase the distribution and use of the drug were continuously refined. Vital statistics became the main way that officials in Assam judged the efficacy of anti-malarial campaigns, but the process remained flawed and public health campaigns in Assam suffered from inappropriate attention and support between 1905 and 1912 when Assam was combined with eastern Bengal. Additionally, within Assam kala-azar took the lion's share of attention and resources that could have otherwise been provided to anti-malarial efforts. Following the onset of World War I, all public health measures in Assam were completely disrupted and most anti-malarial research and schemes stalled. Overall, the government failed to reduce malaria in the province.

One of the largest developments in anti-malarial measures in the province during this period was the introduction of species sanitation; in other words, malaria surveys that would determine which anopheline mosquitoes carried malaria within any specific region and recommend anti-malarial methods that targeted those specific mosquitoes. Species sanitation was increasingly regarded as more feasible than blanket mosquito eradication measures in certain conditions, but it was never applied widely across Assam. Medical entomology grew in

[575] Ibid., p. 7.

importance in relation to anti-malarial schemes and would eventually become the dominant method of malaria control in the following decades.

Chapter 4: The Interwar Years- Malaria in Assam 1919 - 1939

Introduction

> Former popular beliefs that dirty water and dense virgin jungle, hitherto called dank, rank, etc., were the sources of malaria in Assam have been shown to be erroneous, as also the idea that the pioneer who clears or drains is necessarily benefiting mankind. No longer will the phrase 'clearing the dense and virgin jungle' have about it a resounding note of pioneering heroism, as we now know that the anopheline mosquito, which transmits our malaria, does not breed under dense shade, or in water which appears to be noisome or revolting, but in clear water exposed or partially exposed to sunshine. In future the control of malaria in Assam will mean less interference with nature and a realization of the fact that the green beauty of vegetation covering rivers, streams, and swamps can be allowed to remain with improved health to mankind.[576]

> As Sir Ronald Ross has said, we have to educate the people who provide the money, and that is not an easy matter. I often think that most of my life has been spent, not in fighting the mosquito, but in fighting the men who were preventing me from fighting the mosquito. Perhaps nine-tenths of my effort has been spent in fighting man, not mosquitoes.[577]

Around 40% of the total population of colonial Assam had a bout of malaria in 1932; that equates to over 3,200,000 individuals who suffered from debilitating fever or chills in one year, and many did not survive.[578] This statistic is an official estimate from the Public Health Department, and the number emphasises a devastating malaria trend in the province during the interwar period. Between 1919 and 1939 in Assam, the total mortality from 'Fevers' (principally

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[576] Ramsay, 'The Principles and Methods', p. 792

[577] Sir Malcolm Watson (1873–1955) was an accomplished medical researcher, and this quotation is part of a report in which he comments on his experiences speaking with tea plantation owners while researching malaria in Assam during the early-mid 1920s. (Watson, 'Observations on Malaria Control', p. 159.)

[578] Dr. P. Gupta, Offg. Director of Public Health, Assam, estimated the statistic by using data from hospitals, mortality statistics, and the percentage survivability rate in Assam to construct the figure. (P. Gupta, *Annual Public Health Report of the Province of Assam for the Year 1932* (Shillong, 1933), p. 19.)

malaria) rose to above 100,000 in 1939; contrary to other provinces, malaria did not decrease in colonial Assam during the interwar period.[579]

Many factors contributed to the high prevalence of malaria within the province. Often discussed in this project, colonial 'development' created the optimal ecological conditions for malaria to thrive, and high rates of the disease had been commonplace for decades. By the interwar period, medical knowledge had advanced significantly and supported methods of malaria control that had proven successful in other locations in India. In colonial Assam, however, the Public Health Department (previously known as the Sanitary Department), powerful plantation owners, government officials, and sometimes members of the public in Assam failed to embrace and implement these new methods of malaria control quick enough.

After the end of the First World War, the government of Assam refocused its efforts to prevent and treat malaria. To address the high level of malaria mortality and morbidity, medical officers called for increased funding, embraced new research, and placed a new emphasis on local malaria surveys to implement mosquito control measures. Unfortunately for Assam, the new focus was not enough to prevent hundreds of thousands of deaths. Quinine remained a popular malaria prophylactic (despite increasing evidence suggesting otherwise), but through the duration of the interwar period, medical officers became less and less convinced the drug would be an effective method of reducing malaria mortality and morbidity. Some malaria surveys were performed, and species sanitation was implemented, but mosquito control measures were only applied in select locations and not across the entirety of the province. Overall, there was not a

[579] T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1929* (Shillong, 1930), p. 13. and T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1935* (Shillong, 1936), p. 14.

reduction of deaths due to 'Fevers' suggesting malaria remained a serious problem for residents of Assam.

The presence and handling of malaria in Assam was in many ways different to other provinces in the Raj even though, during the interwar period, many provinces, including Assam, had similar knowledge of public health. The most notable difference between Assam and other provinces within the Raj is that malaria did not decrease in Assam during the interwar period. India suffered dearly from malaria, but some historians argue that by the 1920s mortality and morbidity were in slow decline in several provinces.[580] Malaria trends in Assam diverge from the overall decline in India. Data shows that cases of malaria in hospital increased and deaths due to 'Fevers' in Assam did not decrease as they did in provinces like Bengal (Assam's neighbour) and the Punjab. Additionally, deaths due to 'Fevers' even increased slightly in the early 1930s when compared to the previous decade.[581] Like every province in the Raj, Assam had its own balance between social, economic, political, and environmental factors. To explore the unique setting, this chapter focuses on an approach that historian Nandini Bhattacharya has noted is insightful but often underutilised in modern historiography of malaria in India; to use her words, this chapter explores 'the trajectories of malaria research, anti-malarial policy and the role of the colonial state and private entrepreneurship in formulating and directing anti-malarial programmes.'[582]

The purpose of this chapter is to examine the presence of malaria in the province and to analyse contemporary efforts made to understand and manage the disease. The relationships between the complex network of actors, from medical officers to plantation labourers to

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[580] This idea will be explored further in the historiography section of this chapter, but for quick reference material on the topic may be found in Zurbrigg, 'Hunger and Epidemic', p. 2. and Klein, 'Malaria and Mortality', pp. 132-60.
[581] Gupta, *APHRPA 1932*, p. 15.
[582] Bhattacharya, 'The Logic of Location', p. 184.

anopheline mosquitoes, influenced the levels of malaria mortality and morbidity. Assam's malaria trends are distinct from other provinces in India, but this chapter it is not a comparison of policy, epidemiological practices, or malaria rates in these other locations. Insights are derived using reports and data from the Public Health Department, hospitals, police, and prisons as well as contemporary medical research, much of which was conducted in Assam, with a particular focus on medical entomology. The high presence of malaria in Assam shows the importance of understanding the actions of those involved in anti-malarial efforts, particularly as a method of explaining the difference from other provinces. The relationship between malaria, colonial governance, and the environment is more evident in this time period, and therefore this chapter, than any other explored in this dissertation. There are parallels that can be drawn between Assam and other provinces in the Raj such as Bengal, the Punjab, and Madras, but Assam remained thoroughly distinct during the interwar period. The tensions between powerful institutions shaped the way the medical officers responded to the malaria crisis in Assam. This is an entry point to further explore the relationship between disease and society in Assam.

This chapter briefly explores the methodologies used by historians to study the presence of malaria in India between 1919 and 1939; comments on several possible factors that contributed to the high prevalence of malaria in Assam; and examines the noticeable change in approach within the Public Health Department after the perceived intensification of the disease in the 1930s. This chapter argues that a change in approach toward malaria prevention occurred during the interwar period when compared to previous decades, and that efforts to control malaria gained even more support when mortality increased and plantation owners, government officials, and non-government research groups were convinced to supply funding, perform research, and enact anti-malarial measures. Medical officers developed mosquito control measures and performed malaria surveys in an effort to move away from the use of quinine as the primary

method of malaria control. The creation and implementation of these plans in colonial Assam were under close scrutiny by malaria experts in the hopes that they could inform broader anti-malarial campaigns in similar locations around the world, specifically those dominated by plantations and on the periphery of empires. Malaria researchers, particularly in the field of medical entomology, were a part of the same scientific networks and their work was informed by each other.[583] Altogether, the work in Assam was a part of a growing field of medical entomology largely dedicated to reducing diseases such as malaria. Just as anti-malarial efforts in Assam were influenced by these researchers, the relationship between public health measures and the local characteristics of the province came to define malaria in colonial Assam.

As the ultimate chapter of this dissertation, its contents touch on several themes that have been developed in earlier chapters. The actual cause of the high prevalence of malaria in Assam during the interwar period is unknown and difficult to determine conclusively, but it is evident that there were several factors at play. Public, private, and military administrators believed that individuals were not regularly taking prophylactic doses of medicine.[584] Government officials placed the blame on the economic depression and the presence of a large immigrant class.[585] Medical researchers increasingly argued that environmental conditions caused anopheline mosquito populations to rise and with them cases of malaria.[586] There was no consensus and this

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[583] Malcom Watson's work in the Malaya States and S. R. Christophers work in the Andaman Islands was cited as an influence on anti-malarial measures in Assam in the 1930s, but it is also important to remember that both Watson and Christophers had also done extensive research on malaria in Assam. G. C. Ramsay, 'Assam's Malaria Problems and Their Solution', *The Lancet*, 214/5548 (28 Dec. 1929), p. 1358.
[584] W. C. M. Dundas, *Report on the Police Administration in the Province of Assam for the Year 1924* (Shillong, 1925), p. 8.
[585] J. Savage, 'The Transmission of Malaria in Assam and the Neighbouring Hill Tracts' (Oxford Univ. D. M. Thesis, 1935), pp. 12-3.
[586] Watson, 'Observations on Malaria Control', p.150.

made it difficult to develop a concerted campaign against any possible cause. People across Assam possessed different understandings of malaria and disagreed on the possible methods of prevention. Nevertheless, there was a marked shift in anti-malaria projects proposed by medical officers during the interwar period. Two new ideas emerged: that quinine was less effective than previously thought, and that jungle clearing efforts, previously thought to reduce malaria, created the perfect breeding grounds for malaria-carrying anopheline mosquitoes.[587] Despite debates over the efficacy of quinine as a prophylactic, prophylactic quinine usage was still recommended among certain individuals within Assam through to 1939. Additionally, jungle clearing was regularly used in the province until around 1930 when medical entomology studies advocated its reversal (targeted rewilding, shading, and other measures).

Despite the numerous developments in medicine and public health during this time, one theme emerges clearly: between 1919 and 1939, medical officers were sufficiently motivated and theoretically capable of addressing malaria in Assam. In the process, they developed the understanding that reducing malaria required new knowledge of the disease, society, and local ecology to create a more harmonious relationship between humans and the environment. This was a major departure from the history of malaria in Assam; malaria was no longer associated with kala-azar, and a number of scientific breakthroughs had improved anti-malarial efforts. Malaria caused a higher number of deaths than any infectious disease in Assam and had beleaguered residents for generations, but during the interwar years it became apparent that the colonisation of Assam had redefined Assam's relationship with the disease. As contemporary

[587] See the works of M. O. T. Iyengar on this, including M. O. T. Iyengar, 'Regional Distribution of Anophelines and Malaria in Bengal', *Transactions 7th Congress Far Eastern Assoc. Trop. Med.,* 3 (1927), pp. 116-27. and M. O. T. Iyengar, 'The Distribution of *Anopheles Ludlowii* in Bengal and its Importance in Malarial Epidemiology', *Indian Journal of Medical Research,* 19/2 (1931), pp. 499-524.

malaria researcher G. C. Ramsay wrote, 'it is unfortunately easier to create malaria than to eradicate it.'[588]

Colonial Assam between 1919 and 1939

This section includes a breakdown of major events during the interwar period that are relevant to the history of malaria in Assam. It also provides a brief analysis of mortality in Assam, which supports the argument that malaria mortality did not decrease, and at some points even increased, between 1919 and 1939.

The time period examined in this chapter is bookended by the end of World War I and the beginning of the World War II. As discussed in the previous chapter, the concentration of resources necessary during the First World War curtailed many anti-malarial efforts in Assam. Additionally, medical lessons involving disease from the dramatic events of the First World War caused many to re-evaluate longstanding approaches to disease control. Prior to WWI, quinine was widely used as a malaria prophylactic and treatment. Military experiences in zones ravaged by malaria, however, convinced many medical officials of quinine's usefulness in malaria treatment yet inefficacy as a prophylactic.[589] In 1920, the Assam Sanitary Department was officially renamed the Public Health Department, and during the decade the province grappled with the challenge of re-igniting ambitions to reduce malaria and incorporate new medical knowledge on the subject. Unfortunately, by the 1930s the entirety of the British Empire was suffering from the wide-reaching effects of the Great Depression and colonial Assam was no exception. Medical officers in Assam in 1932 noted that financial difficulties placed tremendous

[588] Ramsay, 'Assam's Malaria Problems', p. 1358.
[589] G. D. Shanks, 'How World War 1 Changed Global Attitudes to War and Infectious Diseases', *The Lancet*, 384, no. 9955 (8 Nov. 2014), p. 1699.

strain on campaigns for sanitation and hygiene.[590] Attempts to address malaria were often shaped by local factors, but they were also heavily influenced by these global forces.

This chapter ends in 1939 with the advent of WWII. By 1939, new public health imperatives and social, political, and environmental changes were brought about as the province was transformed into an active battlefield. In 1944, the Battle of Imphal and the Battle of Kohima, commonly called the Stalingrad of the East, were turning points in the war as Allied troops pushed back Japanese forces. Throughout the northeast, the implications of total war and an altered global economy created a new medical prerogative that ushered in the widespread use of new drugs and chemicals for mosquito management to reduce malaria and aid in the war effort. These transitions interrupted the efforts of previous public health campaigns, and the priority of anti-malarial campaigns was redirected to the war.[591] This diverged from the past when the relationship between malaria and society was deeply rooted in colonial dynamics that continuously defined the disease in Assam. The twenty-year period between 1919 and 1939 stands as a distinct segment of history just before the events of the Second World War and subsequent Indian Independence pushed Assam's relationship with malaria in a new direction.

Mortality in Assam is an important component in understanding the disease. In 1920, deaths in Assam under the heading of 'Fevers' were uncharacteristically high and totalled 112,437.[592] This fact requires explanation. 'Fever', as mentioned before, was a category that encapsulated many diseases. In 1920, Assam and the rest of the world were undergoing the last of

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[590] Gupta, *APHRPA 1932*, p.12.
[591] S. P. Desai, 'Resolution of the Public Health Report for 1939', in A. M. V. Hesterlow, *Annual Public Health Report for the Province of Assam for the Year 1939* (Shillong, 1941), p. 2
[592] J. Taylor, *Annual Sanitary Report of the Province of Assam for the Year 1920* (Shillong, 1921), p. 10.

the influenza pandemic.[593] The same year, there were 234,412 admissions to hospital (this includes state-public, local funded, and private-aided dispensaries) for malaria in Assam.[594] This number is relatively low in comparison with future hospital admissions data on malaria. Though it is impossible to know with certainty how many deaths under the heading of 'Fevers' were from malaria, influenza, or deaths that involved comorbidities, deaths in this year were likely outliers from the usual trends. In 1924, 'Fever' deaths climbed to 113,198 despite having dropped slightly in the few years prior.[595] The same year, admissions to hospital from kala-azar, another disease where the deaths were categorised under 'Fevers', had reached a peak and plateaued.[596] The pain these epidemics caused should not be lost in the statistics, but historians should interpret the data on admissions to hospital due to malaria and malaria deaths as relatively low due to the prevalence of other diseases such as influenza and kala-azar during the first few years of the 1920s in comparison to other deaths due to 'Fevers'. By 1929, deaths due to 'Fevers' reached the lowest number for the interwar period, with 83,520 in number, although the deaths due to 'Fevers' as a percentage of total deaths remained relatively consistent at 58%.[597] The mortality and morbidity data on 'Fevers' in colonial Assam during the 1920s is characterised by the relatively quick reduction of influenza cases during the early part of the decade and decreases in incidences/stabilisation of kala-azar.[598] As is evident, data on 'Fevers' is not a perfect proxy for

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[593] Taylor, *ASRPA 1920,* p. 3.
[594] B. H. Deare, *Dispensary Returns of the Province of Assam for the Year 1920* (Shillong, 1921), pp. 33-45.
[595] J. B. Hannafin, *Annual Public Health Report of the Province of Assam for the Year 1924* (Shillong, 1925), p. 32.
[596] H. Innes, *Dispensary Returns of the Province of Assam for the Year 1924* (Shillong, 1926), pp. 16-9.
[597] Murison, ASRPA 1929, p. 13.
[598] G. Hutcheson, *Annual Report of the Civil Hospitals and Dispensaries of the Province of Assam for the year 1929* (Shillong, 1930), p. 16-9.

malaria, but as deaths from 'Fevers' did increase subtly and certainly did not fall during the 1930s; one should understand that many of these deaths were likely due to malaria and not the other diseases under the heading.

Deaths due to 'Fevers' were falling slightly during the 1920s, but by the 1930s a harrowing trend began. Admissions to hospitals due to malaria rose sharply alongside deaths from 'Fevers'. In 1930, there were 414,799 admissions to hospital for malaria;[599] by 1933 there were 737,721 with only a modest increase in the number of hospitals.[600] The high numbers of patients admitted to hospital for malaria continued through the decade, with most years reporting between 600,000 and 700,000 admissions to hospital for malaria, peaking during this timeline in 1939 with 827,190 admissions.[601] It is important to note that admissions to hospital for kala-azar remained relatively stable with only a few thousand reported patients receiving treatment per year.[602] Over the same period, deaths by 'Fevers' rose to over 100,000. Hospital admissions for malaria may have increased to some degree because of an increase in population due to immigration and a greater awareness of malaria as a treatable disease among the general public, but the deaths due to 'Fevers' in Assam as a percentage of total deaths had an average value of 61% between 1919 and 1939 with a median value of 62% indicating that deaths due to total 'Fevers' remained high despite the fact that deaths due to other diseases (not malaria) within the category of 'Fevers' including influenza and kala-azar decreased over this timeline. Malaria mortality and morbidity during the interwar period did not decrease, and though it is difficult to

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[599] J. P. Cameron, *Annual Report of the Civil Hospitals and Dispensaries of the Province of Assam for the Year 1930* (Shillong, 1931), p. 1.
[600] J. P. Cameron, *Annual Report on the Working of the Civil Hospitals and Dispensaries in the Province of Assam for the Year 1933* (Shillong, 1934), p. 2.
[601] I. A. P. Anderson, *Annual Report on the Working of the Civil Hospitals and Dispensaries in the Province of Assam for the year 1939* (Shillong, 1940), p. 2.
[602] Ibid., p. 2.

determine with precision how many deaths due to ‘Fevers’ were in due to malaria, it is very possible that malaria increased in Assam. This is a fact that bucks the trends in other provinces in the Raj where malaria was prevalent.

It is likely that these trends were consistent throughout Assam. A comparison between the deaths recorded under the heading of ‘Fevers’ per mille between districts in Assam supports the argument that malaria remained prevalent throughout the province with no individual districts demonstrating unique trends correlated to anti-malarial measures. This is likely because promising anti-malarial measures backed by up-to-date research were not employed until the 1930s, and when they were they were, they were only applied to specific areas. Even if these programmes produced results, they were too small in scope to reduce malaria across the whole of Assam.[603]

Historiography

This section examines the historiography of malaria between 1919 and 1939 in India. Due to the limited number of works on Assam, it primarily focuses on the work of historians who have researched malaria in other provinces. This provides a justification for the approach used in this chapter and highlights Assam’s distinctive relationship with malaria. Anti-malarial programmes in Assam were based on the efforts of medical experts who engaged in international dialogue on malaria, and many medical officers across India embraced similar theories on public health to create anti-malarial measures. Despite the similarities, anti-malarial efforts were also greatly shaped by local factors and characteristics within each province. Assam’s malaria mortality and morbidity trends were distinct and so were the applications of anti-malarial

[603] Deaths per mille were taken from the districts of Cachar, Sylhet, Goalpara, Kamrup, Darrang, Nowgong, Sibsagar, Lakhimpur between the years 1919 and 1939 from the Assam Public Health Reports between 1919 and 1939

measures. Focusing on malaria in Assam during the interwar period makes a valuable contribution to historiography and informs discussions on the relationship between public health knowledge and local settings.

There are a few parallels that can be drawn between Bengal and Assam. The impact the British had on the local ecology and immunity both played rolls in the spread of malaria and efforts to control the disease. Despite their provincial differences, Ira Klein's work on Bengal (Assam's neighbour) is an entry point for research on Assam. In 'Malaria and Mortality in Bengal, 1840-1920' (1972), Klein focuses on the impact of 'British modernising'; that modernisation projects in India often unintentionally increased the spread of disease. Klein specifically comments on malaria in Bengal and notes the decline in the prevalence of the disease during the interwar period. According to Klein, Charles A. Bentley (who was a former Sanitary Commissioner and Director of Public Health in Bengal during the early 20th century and has been previously mentioned in this project as an notable researcher in Assam) was the first to put forward a coherent argument on the effects of development that was well supported by evidence.[604] Placing specific emphasis on the impact of canal and embankment construction as one of the main contributing factors in the prevalence of malaria in Bengal, Klein highlights the role of development in unintentionally sparking malaria and the (limited) awareness some government officials had of the issue.[605] Klein's larger argument is clear, that 'malaria was facilitated by economic development', and that the decline in malaria in Bengal in the early 20th century is, to a degree, due to the awareness medical officers in the province had of the effects of

[604] Klein, 'Malaria and Mortality', pp. 135-6.
[605] Ibid., p. 136.

environmental modification. [606] Klein also notes the role of immunity, and according to Klein immunity had a tremendous impact on decreasing deaths due to malaria.[607]

The immunity levels of the population of Assam were possible contributing factors to the spread of malaria, echoing Klein's conclusions about Bengal. Klein argues that higher levels of human immunity by the interwar period, coupled with the schemes implemented by the Public Health Department, played the largest role in the decrease in malaria in Bengal.[608] In Assam, it is likely that some residents had either acquired or genetic immunity and that those lacking any resistance were often at a worse risk of infection. The influence of immunity on mortality is somewhat unclear as immigrants with high levels of immunity could also have acted as vessels for the spread of the disease even if the hosts themselves remained healthy and unaffected. In 1919, reduced resistance to disease was cited as one of the possible causes for the prevalence of malaria in the province.[609] In the early 1930s, J. de la M. Savage, of the Medical Research Society, wrote extensively on immigrant labourers in Assam. It was common for recruitment programmes to target labourers who were thought to possess some immunity to malaria for work in Assam. The realisation among those during the colonial period that malaria could potentially transmit to labourers who lacked resistance highlights the weight immunity carried in discussions on malaria.[610] One cannot assume that levels of immunity in Bengal were the same as in Assam, but resistance to malaria did play a role in the spread of the disease, for better or worse, in both provinces.

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[606] Ibid., p. 142.
[607] Ibid., p. 179.
[608] Ibid., p. 179.
[609] T. C. McCombie Young, *Annual Sanitary Report of the Province of Assam for the Year 1919* (Shillong, 1920), p. 10.
[610] Savage, 'The Transmission of Malaria', p.14.

Klein's work has been challenged, however. In 1999, Sheldon Watts argued that government officials were largely unaware of the impact British 'modernizing' in the 19th and 20th centuries had on malaria.[611] Watts did not dispute Klein's assertion that modernisation influenced the spread of malaria, however Klein had argued that the reduction of malaria deaths during the interwar period in Bengal were partially the result of Bentley and S. Christophers' respective findings.[612] Watts' article 'British Development Policies and Malaria in India 1897-c.1929' differs, suggesting Bentley and Christophers' findings were overlooked. According to Watts, the intense emphasis on financial growth and development encouraged investors and colonial administrators in London to ignore the wider medical impact of the British involvement in India.[613] The overwhelming desire for returns on investment coupled with India's large distance from many British officials and financiers in London meant that reports on the negative impact of British development often went unseen, unread, or unreported.[614] Watts' article focused directly on the creation of knowledge in British India, but it misses the fact that the 1908 epidemics were reported and the political implications were grasped immediately, leading to the imperial malaria conferences, the first of which was convened in Simla in 1909.[615] Though off base on some counts, Watts' hesitation toward the overall impact and reach of medical research in the Raj stands as an important warning for inquiry into Assam.

Watts may have missed the mark on some details, but it is important to remain critical of colonial officials, industrialists, and other powerful members within the British empire. Watts was highly critical of the capabilities, both morally and practically, of British government

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611 Watts, 'British Development Policies', p. 179.
612 Klein, 'Malaria and Mortality', p. 160.
613 Watts, 'British Development Policies', p. 150.
614 Ibid., pp. 146-7.
615 *Proceedings of the Imperial Malaria Conference*, p. 3.

officials to design and enact malaria policy that would actually benefit the population.[616] The knowledge economy of medicine in Assam consisted of competing motivations between planters, government officials, medical experts, and locals. The tension in Assam existed between plantation owners and medical officers, the two groups who possessed the largest share power and influence within the province on issues regarding disease. As a result, Assam was a unique landscape of malaria treatment and policy where those in power debated the management of both people and disease. The work of Arnab Dey, often referenced in this project, offers an interpretation of disease control in Assam that contextualises the dynamic between the medical, public, and private sectors prior to the interwar period. Dey comments on Assam's status in the British Empire's periphery and argues that commercial industries in Assam influenced the transition of medical knowledge from theory to praxis.[617]

In Bengal, the connection between economic 'modernisation' and the creation of conditions that foster malaria is commonly accepted among historians. Land-modification projects created the environmental conditions ripe for anopheline mosquito reproduction. In the article 'Indo-Gangetic River Systems, Monsoon and Malaria', Elizabeth Whitcombe established that the silting of the Ganges-Brahmaputra and Indus delta were contributing factors to the underlying, long-term problems of malaria, and were exacerbated by subsequent British development. [618] Whitcombe's article concentrates more so on Bengal than Assam, but the Brahmaputra River was the lifeblood of Assam, and her work offers a basis for further study into Assam during this time period.

[616] Watts, 'British Development Policies', p. 180.
[617] Dey, 'Diseased Plantations', p. 647.
[618] Whitcombe, 'Indo-Gangetic River Systems', p. 2216.

Another approach to the decrease in malaria in India during the interwar period focuses on nutrition. The link between nutrition and malaria is difficult to determine with some arguing that malnutrition can increase mortality while others argue that it is possible malnutrition can provide some protection against infection. In the article 'Hunger and Epidemic Malaria in Punjab, 1868- 1940' and the book *Malaria in Colonial South Asia: Uncoupling Disease and Destitution*, Sheila Zurbrigg examines the impact of nutrition on malaria in Punjab. According to Zurbrigg, nutritional deficiencies can affect susceptibility by affecting immunity and the body's ability to recover.[619] Malnutrition and hunger are often maligned in contemporary research on malaria, but Zurbrigg argues that the nutritional variable should not be removed from the equation.[620] During the early 20th century in Punjab, malaria mortality and morbidity decreased just as the availability of food stabilised at appropriate levels. Zurbrigg supports her argument by connecting the incidents of the Punjab and Bengal together and notes that the same phenomenon was evident in Bengal as well; incidences of malaria decreased during the 20th century until the Bengal famine in 1943.[621] Even though each province has its own epidemiological history, the larger issue of susceptibility and nutrition was, in Zurbrigg's consideration, universal.

Hunger and nutrition are difficult factors to isolate as contributors to the spread of malaria. In 'Famine and Mortality', Elizabeth Whitcombe argues that, though linked, famine and malaria are not causally related. Famine and nutritional deficiency are different, and Zurbrigg also notes this. The difficulties examining the supply of food as the independent variable during a period of malaria increase or decrease limits the ability of nutritional studies to become a part of dominant discourse. Whitcombe argues that in certain cases, such as in the Punjab in 1900-01,

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[619] Zurbrigg, 'Hunger and Epidemic Malaria', p. 2.
[620] Ibid., p. 3.
[621] Ibid., p. 16.

famine caused by drought coincided with low levels of malaria. Once the rainfall returned, deaths from malaria increased. According to Whitcombe's research, it is not the famine itself that caused changes in malaria deaths but the climatic character that caused the famine in the first place.[622] In the case of Assam, as opposed to the incidences in the Punjab, healthy levels of nutrition seemed to have little impact on the increase in malaria.

Nutrition as a factor influencing malaria is difficult to apply to Assam. The state of nutrition in Assam was mixed and some labourers on tea plantations were only provided with the bare minimum of rations, but generally famine and extreme hunger were uncommon in Assam during the interwar period. In Assam, the staple grain was rice. Fruit, vegetables, and spices were plentiful, and fish, eggs, and dairy were consumed when available.[623] One might expect the economic depression in the 1930s to reduce the overall nutrition levels in Assam, but the depression lowered the price of rice keeping it widely accessible. The Assam Public Health Department noted that the population remained unaffected by nutritional deficiencies due to the low price of rice.[624] Based on a preliminary study, the stability of nutrition in Assam on average is clear. Food was plentiful, but unlike in Bengal and the Punjab, malaria levels increased regardless. Zurbrigg is keen to note that malaria in British India should not be conceptualised as a series of exceptional epidemics, rather as a fact of life. To study malaria, Zurbrigg argues one must identify the various day-to-day characteristics of lifestyle that contributed to the disease; malaria is not just an entomological problem. The overarching purpose of Zurbrigg's work in

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[622] E. Whitcombe, 'Famine and Mortality', *Economic and Political Weekly,* 28/23 (5 June 1993), p. 1177.
[623] Savage, 'The Transmission of Malaria', p.12.
[624] The health of the population was based on the availability of the rice, and also inferred from the high birth-rate,
and general 'vitality'. (Gupta, *APHRPA 1932*, p.2.)

'Hunger and Epidemic Malaria in Punjab' was not simply to highlight the role hunger and nutritional deficiencies could play in malaria mortality and morbidity, but to argue that exposure to anopheline mosquitoes and the malaria virus alone could not possibly be the only explanation for malaria epidemics.[625] Elizabeth Whitcombe's analysis offers an ecological explanation for epidemic malaria.[626] On this, there is room for further study on nutrition and the myriad of factors that can influence malaria mortality and morbidity in Assam, but Assam's history with malaria is different from other provinces. It was not until the interwar period that sections of the province underwent mosquito surveys, and it is necessary to unpack these themes to inform further studies.

It is important for historians to note that the general anti-malarial policies in Assam were similar to other provinces in the Raj during the interwar period. V. R. Muraleedharen and D. Veeraaghaven explore malaria during the interwar period in Madras in their article 'Anti-Malarial Policy in the Madras Presidency: An Overview of the Early Decades of the Twentieth Century.' Muraleedharen and Veeraaghaven claim that anti-malarial efforts in Madras emphasised the development of an effective quinine policy (including a search for alternative drugs) and 'location-specific preventive measures based on a clear understanding of socio-economic conditions.'[627] This chapter highlights the fact that this was also the case in Assam. The broad strokes of malaria control did not differ between Madras and Assam, but the individual characteristics of each province did. For example, Muraleedharan and Veeraraghaven argue that Madras benefited from the relatively early application of anti-malarial measures which they believe was due to the high proportion of Europeans living in Madras, a claim they believe is

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[625] Zurbrigg, 'Hunger and Epidemic', p. 19.
[626] Whitcombe, 'Indo-Gangetic River Systems', p. 2217.
[627] V. R. Muraleedharan and D. Veeraraghavan, 'Anti-Malarial Policy in the Madras Presidency: An Overview of the Early Decades of the Twentieth Century', Medical History, 36 (1992), p. 291

strengthened by the fact that anti-malarial measures in rural areas where fewer Europeans lives were less common even though malaria was more severe.[628] Regardless of the reason for this discrepancy in Madras, it is evident that the unique circumstances of each province determined the development of anti-malarial measures even if by the interwar period provinces like Assam and Madras embraced similar theories on public health.

Between 1919 and 1939, a number of surveys on mosquitoes and malaria were performed in Assam to better understand the relationship between the disease, insects, and local lifestyle. These focused on the complex relationship between human society and the environment. In 'The Logic of Location: Malaria Research in Colonial India, Darjeeling and Duars, 1900-30', Nandini Bhattacharya explores 'the logic of location' as a concept that was understood and applied to tea plantations by public health officials in Bengal during the early part of the twentieth century. Bhattacharya claims that both the application of local-area surveys on mosquitoes and the attempts to regulate mosquito populations were greatly limited by the competing interests between the plantation economy and public health services. Bhattacharya, like Klein and Watts, highlights the writings of medical officers Christophers and Bentley who performed some of these surveys in Bengal, but she does so in a way that concentrates on the relationship between their work and the tea plantations in the province. These included numerous factors including the 'tropical aggregation of non-immune labour' and regional ecology.[629] Immigrant labour was a large part of the population in Bengal due to the tea industry, but the presence of malaria in the non-immune population led Christophers and Bentley to add the 'congregative bodies of labourers' as well as ecological conditions to the local factors that influenced malaria.[630] In

[628] Muraleedharan, 'Anti-Malarial Policy', pp. 292-93.
[629] Bhattacharya, 'The Logic of Location', p. 190.
[630] Ibid., p. 190.

Bengal, Christophers and Bentley were keen to implement various schemes that addressed these localised issues, but tensions between the public health department and the tea industry prevented the transition of their scientific research to local policy.[631]

The factors that defined malaria in Bengal may appear, at first glance, similar to Assam, but key differences distinguished the two provinces. Bhattacharya has set useful boundaries on her study. The article focuses on tea plantations in Bengal, and Bhattacharya notes that the tea plantations and immigrant labour classes were treated completely differently in Bengal in comparison to Assam. In Bengal, immigrant labourers were often free to move and the tea farms were relatively small, whereas in Assam, plantation owners utilised indentured labour systems on much larger plantations.[632] The consequences of hosting immigrant labourers, who came from different parts of India to Assam than their counterparts who went to Bengal, and the mass administration of medical care on larger plantations meant that medicine and malaria prevention in Assam was structured differently than in Bengal.[633] 'The significance of the location in malaria research and control supports the argument that Bengal and Assam must be approached individually. Each location had its own logic, and malaria in Assam during the interwar period should be treated as a phenomenon specific to conditions within the province.

Another historian who has explored the decline of malaria in India was Sumit Guha with the work 'Mortality Decline in Early-Twentieth-Century India: A Preliminary Enquiry'. Guha emphasises the impact of stable food prices and a general decrease in multiple diseases and dedicates much of his research to the environmental and social factors that contributed to these phenomena. Despite the overall trends noted in Guha's research, his conclusions are not

[631] Ibid., p. 200.
[632] Ibid., p. 199.
[633] Ibid., p. 199.

applicable to the whole of India. Building on insights offered by Zurbrigg, Guha argues that the population in India during the second quarter of the 20th century, roughly 1925 to 1950, lived a much healthier life because public health measures combatted disease, food production was stable and food was available, and, notably, environmental change improved mortality rates.[634] Guha's claim is broad and involves three factors, but he dedicates a significant portion of his writing to the increased stability of food grains due to rainfalls during the interwar period by arguing that it contributed to a reduction in mortality. 'This analysis depends on two general propositions: first, that immunity is weakened by a fall in food intake to below some minimum level; and second, that severity of illness is related to the intensity of exposure to the infection.'[635] Guha also references Christophers to argue that malaria infection can be wildly variable, causing fluctuating severity among malaria patients across time.[636] Summarising India in this manner can lead one to assume that public health campaigns in Assam were as successful as in Bengal. In Assam, the mortality trend itself is unmistakable even though the relative impact of Guha's three factors is not known. Guha argues that in Assam specifically, a decline in disease mortality during the interwar period was caused by stable agricultural production.[637] This stands in direct contrast to the data available on the subject because between 1919 and 1939 in Assam, fever (principally malaria) deaths did not decrease.[638]

Historians of medicine frequently overlook Assam. This oversight has resulted in a failure to recognize important dynamics of malaria inside of specific provinces and the false depiction of

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[634] S. Guha, 'Mortality Decline in Early-Twentieth-Century India: A Preliminary Enquiry', in idem, *Health and Population in South Asia from Earliest Times to the Present* (London, 2001), p.386.
[635] Ibid., p. 384.
[636] Ibid., p. 385.
[637] Ibid., p. 383.
[638] A. M. V. Hesterlow, *Annual Public Health Report of the Province of Assam for the Year 1937* (Shillong, 1939), p. 12.

malaria in the Raj. In her work on tea plantations in Assam, historian Jayeeta Sharma argues that, within general historiography, information that does not align with 'an undifferentiated India' is all-too commonly passed over for fear it may fracture the normative paradigm of the Indian narrative. During the colonial period, the British believed that the only utility Assam offered the empire were exports, from agricultural products such as tea and rice to raw materials including oil and various minerals. As a result, Assam was considered on the periphery of the periphery, far removed from the colonial metropoles of London and even Calcutta.[639] Despite the typical characterisation, the experience of life in Assam is deeply relevant to the complex history of India. Sharma argues that often data on Assam can either conflict or be simply too far removed from the normative paradigm to be included.[640] Malaria in Assam fits those concerns raised by Sharma. It remains under-researched despite the provoking data on the disease and the societal tensions mentioned in this study. No research that concentrates exclusively on malaria during the interwar period or any other period in colonial Assam's history has been published. Therefore, the historiographical arguments grounding this chapter have been taken from studies on other provinces. Noting the similarities and differences between malaria in different provinces will make an important contribution to the historiography of malaria in India and the history of Assam.

There is no overwhelming consensus on the reasons for the decrease in malaria between 1919 and 1939 in India, but discourse on the topic is noted for its contributions to understanding the state of malaria during a relatively healthy period of the Raj. The data on malaria in Assam during the interwar period contradicts the trends noted in most other provinces, which was that all

[639] Sharma, *Empire's Garden*, pp. 20-1.
[640] Ibid., pp. 20-1.

of British India experienced a reduction of epidemic malaria.[641] Assam's trends should be understood as a fundamental part of Indian and medical history; they contribute and in some cases support the claims made by modern historians but with the caveat that though there are common themes, every part of the country had its own unique relationship with the disease. An analysis of the increase in malaria in Assam between 1919 and 1939 contributes to a discussion on the history of malaria within what is ultimately an understudied region, one in which the few medical historians have focused on other diseases. The fact that Assam seems to have gone in a different direction from other parts of India makes room for further commentary on Assam and contributes to discussions on what may have caused some mortality reduction in India. Ultimately, the factors that contribute to malaria isolated in other studies do not fully explain the state of malaria (both increases and decreases) during the interwar period in Assam or the entirety of India.

Malaria and 'Development' in Assam

This section provides a brief history of the province and identifies certain ecological and social conditions in Assam that contributed to the spread of malaria. A large part of the first chapter of this project is dedicated to the relationship between Assam and its landscape during the early colonial years. From the outset, experts believed there was a connection between malaria and the local environment of Assam, but jungle clearing and colonial 'development' (shorthand for establishing more and more plantations and cultivation within the province) were viewed as a way to rid the landscape of its many 'Fevers'. These processes continued throughout the history of colonial Assam, and to understand the events during the interwar period, it is important to note

[641] Not all provinces suffered equally from malaria. The picture of malaria in Madras, for example, is less clear than in Bengal and Punjab. Increases and decreases in the disease do not appear to display a consistent pattern.

the extent of these ecological changes and redefine the relationship between 'development' and malaria in colonial Assam. 'Development' caused unintended consequences, one of which was the creation of an ecological landscape in which malaria-carrying anopheles mosquitoes thrived.

During the interwar period, the economy in Assam was based largely on agricultural produce (notably tea and rice), and material exports (oil and coal). To reach this economic state, individual investors and the Raj (the British East India Company prior to 1857) pressed province-wide economic and environmental transformations that began when Assam was annexed to Bengal in 1826. Bioprospectors discovered that Assam's climate was ideal for mass tea cultivation, and Indian-grown tea was a valuable commodity for purveyors looking for alternatives to Chinese-grown tea. In the 1820s, the British were involved in a trade war over tea with China. Jayeeta Sharma explores the totality of this transformation in Assam over the course of the 19th and early 20th centuries in her work *The Empire's Garden*; it was a process in which prospective planters 'tamed' the jungles of Assam and constructed plantations that turned the wilderness into the 'empire's carefully managed garden'.[642] Large portions of the province were deforested in the decades after annexation to establish British run tea plantations which unintentionally created the optimal breeding grounds for anopheline mosquitoes.

By the interwar period, surveys on malaria closely linked deforestation in Assam to increasing cases of malaria. In his 1924 report on malaria in Assam, Malcolm Watson argued that tea plantations often hosted malaria epidemics because the local ecology, caused by deforestation, created the conditions necessary to host notorious species of anopheles mosquitoes.[643] In the Assam Valley, where the largest segment of the population of Assam lived, the Brahmaputra River flows through two floodplains. Prior to the creation of the tea estates,

[642] Sharma, *Empire's Garden,* p. 14.
[643] Watson, 'Observations on Malaria', p. 151.

these floodplains were covered by jungle. Immigrant labourers were tasked with clearing away the jungle to plant rice and other crops, and Watson wrote 'in these places I found *A. maculatus* and *A. minimus* in abundance, and I was not surprised to find much malaria.'[644] These contemporary findings are consistent with modern research. A 2012 study on malaria in Assam claims that 'the adverse effect of deforestation includes increase in soil erosion and changing patterns of vector-borne diseases like malaria.'[645] Both contemporary and modern findings on the subject highlight the specific ecological factors that contributed to malaria in Assam and the long history of the effects of deforestation on malaria in the province. The conditions for malaria in Assam by 1919 were ripe, and the presence of the disease can in part be explained by the ecological conditions unintentionally created by deforestation and the expansion of the plantation system.

In addition to the ecological and environmental conditions, the movement of peoples to plantations in Assam contributed to malaria, and the recruitment and management of the labour force in the province as a whole was closely linked to the disease. The population of Assam grew consistently during the interwar period, in large part due to immigration from other parts of India. In 1921, the population was roughly 8,000,000. By 1931, the population had grown to over 9,300,000. Roughly 40% of the population was engaged in agriculture and lived in conditions that left many exposed to anopheline mosquitoes.[646] British rule and agriculture expanded in the northeast and massive plantations defined life for many in Assam. The plantations required workers, and Assam attracted millions of immigrant labourers with formal and informal schemes

[644] Ibid., p. 149.
[645] Nath, 'A Longitudinal Study', p. 79.
[646] Savage, 'The Transmission of Malaria', pp. 12-3.

to expand the workforce.[647] Immigrant labourers were often recruited from 'preferred' parts of India, notably areas with a high presence of malaria because it was assumed they would be better able to deal with the disease in Assam.[648]

The recruitment process itself was designed to encourage immigrant labourers to recruit from their own home communities, continuing the influx of labourers with similar constitutions regarding disease. The recruitment was regulated by the government of Assam. Immigrant labourers were sent home on short leave to encourage members of their home communities to move to the province. The deal offered to prospective labourers was relatively attractive. 'The recruited persons have all expenses paid for them to their destinations, and are housed, fed, clothed, and medically attended if necessary.' Labourers from regions that were highly malarious were believed to possess an inbuilt resistance to malaria, and immunity would obviously be advantageous in Assam.[649] The different portions of Assam favoured labourers from different areas of India. For example, in the 1920s plantations in the Assam Valley favoured recruiting labourers from Chota Nagpur in Bengal, and the workforce of plantations in the Surma Valley were composed largely of labourers from the United Provinces and from Behar.[650]

Though their labour was indispensable, opinions of immigrants were not always positive. Treating immigrants as mobile reservoirs of pathogens needing to be managed was dehumanising but also common in colonial Assam. J. de la Mare Savage, who was appointed the first Malaria

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[647] Ibid., pp. 12-3.
[648] These locations were primarily parts of Bengal, Central Provinces, Bihar, and Orissa, among others. (Ibid., p. 14.)
[649] Watson, 'Observations on Malaria', p.150.
[650] 'Exodus of Coolies from Assam (Tea Garden Strike), No. 5842-F, Shillong, the 19th July, 1921, from A. R. Edwarts, Esq., I.C.., Second Secretary to the Government of Assam, Finance, Department, to the Secretary to the Government of India, Home Department', BL, IOR/L/E7/1181, File 57.

Research Officer of the Assam Medical Research Society,[651] argued that immigrants from malarious tracts constantly reintroduced the parasite to the province and placed immigrant labourers who lacked immunity at tremendous risk. Savage did not believe that immigrants were the only factor in the spread of malaria in Assam, he was acutely aware that environmental and ecological conditions played their part.[652] Nevertheless, the presence of immigrant labourers complicated public health campaigns against malaria.

The state of medical care for labourers on plantations in colonial Assam was centred around medical facilities available at most tea gardens. This was different from tea gardens in other parts of India, even those near Assam such as in the Duars. In a report on the tea gardens in the Duars published in 1910, government officials were hoping that tea gardens in areas such the Duars would be able to adopt an approach to medical case modelled off plantations in Assam- one in which local doctors and compounders were posted at each garden rather than travelling physicians serving a network of tea plantations.[653]

During the 1920s, a number of tea garden strikes occurred in which labourers were protesting the conditions of tea plantations. An article sympathetic to the protestors published in the Bombay Chronicle noted the 'ghastly conditions of labour in these far-off and sheltered areas of exploitation' and described labour in Assam as 'over-exploited and under paid'.[654] In contrast, a correspondent of the 'Northing Whig' and the 'Daily Telegraph' described the tea garden protests as being perpetuated by lies, citing an example that 'agitators' convinced labourers that

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[651] The Assam Medical Research Society was headquartered at the Pasteur Institute in Shillong, Assam. (Savage, 'The Transmission of Malaria', p. 2.)
[652] Ibid., p. 14.
[653] 'Eastern Bengal and Assam Duars (Monahan) Committee 1910: Report (including evidence), Shillong, 1910, p. 29', BL, V/26/670/80.
[654] 'Exodus of Coolies from Assam (Tea Garden Strike), 'Planters' Dominion, Bombay Chronicle, Saturday, November 4, 1911', BL, IOR/L/E7/1181, File 57.

the free medicines at tea gardens actually contained plague and cholera germs rather than treating them.[655] The Government of Assam's report on the protests were similarly un-sympathetic to the protestors. The Government report stated that 'an industrious coolie and a healthy working family earn enough to keep themselves in robust health and even to afford a few luxuries' but that the 'tea industry will have no answer to criticism unless it can show that the labourer is paid a fair economic wage'.[656] The 1920s was a turbulent period for labourers on tea plantations with strikes common and connections drawn to the work of Mahatma Gandhi. These concepts are briefly explored in Nitin Varma's work *Coolies of Capitalism* and underscore a momentous period of transition across India.[657]

Though discussions of the treatment and living conditions of labourers on tea plantations were often at the forefront of many of the protests and there were some protests where large segments of the workforce on plantations either left or were forcibly removed and replaced, it is difficult to link these events with malaria. As previously noted in this chapter, admissions to hospital for malaria increased during the interwar period suggesting that even if some in Assam developed a hesitancy to using medical facilities on tea plantations for political reasons, these beliefs did not always extend to malaria. Additionally, regular influxes of immigrant labour to Assam were commonplace and had been for decades. Historian Arabinda Samanta argues that during the interwar period, widespread malaria affected both immigrant labourers and those who had been living on tea plantations for generations equally; according to Samanta, both parties

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[655] 'Exodus of Coolies from Assam (Tea Garden Strike), 'Indian Tea Gardens, Report on Labour Conditions, 'Northing Whig' and 'Daily Telegraph' Correspondent, 19th October, 1922', BL, IOR/L/E7/1181, File 57

[656] 'Exodus of Coolies from Assam (Tea Garden Strike), Report from the Government of Assam as to the adequacy of wages paid on Tea Gardens', BL, IOR/L/E7/1181, File 57

[657] Varma, *Coolies of Capitalism*, p. 223.

suffered repeated attacks of malaria fever throughout the year.[658] Samanta's analysis focuses primarily on labour days lost on tea gardens (up to 50% on some estates) and the activities of labourers, it is not strictly a work within the history of medicine/malaria, and his work does not convincingly provide a link between immigration labour and malaria as it may suggest. Nor does his work examine any of the available data on fever mortality and morbidity or rates of immigration. However, he does highlight the argument that the interwar period, malarial fevers remained a significant problem for the livelihood of tea garden labourers.[659] Nevertheless, the relationship between immigration and malaria should be explored further. The effect of immigration on malaria mortality in colonial Assam during the interwar period remains a realistic possible factor because there is no clear correlation with weather patterns.

By the second quarter of the twentieth century the colonial influence in the province had moulded the local ecology and shaped the population, and this unique disease landscape presented distinct challenges for its residents. The struggle to address malaria is entrenched within many different factors. Medical officers began to pay closer attention to the local ecology and the biological characteristics of the population than ever before. The history of the province until 1919, which was explored in in the previous chapters, defined anti-malarial measures up until the interwar period- malaria was considered a sad reality but public health measures were limited to quinine as medical officials were more concerned with other diseases. Between 1919 and 1939, all these conceptions of malaria in the province were challenged and the province attempted to reframe its approach to malaria in light of a new understanding of the landscape.

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[658] A. Samanta, 'Ailing Estates and Languishing Labours: Revisiting the Malarial Fever in Assam Tea Gardens, 1920s-1930s', *Vidyasagar University Journal of History*, 2 (2013-14), p. 56.
[659] Ibid., p. 50.

The Use of Quinine

By the interwar period the distribution and use of quinine in Assam had been commonplace for decades. In the 1890s, the Government of India began a scheme to sell quinine through post offices. The programme received tremendous support from the Government of Assam and medical officers and government officials within the province worked continuously to refine their approach. Quinine was the primary anti-malarial method within Assam prior to 1919, but several factors redefined the province's relationship to the drug. Financial constraints caused by the First World War made quinine more expensive and new medical interpretations of the drug's efficacy set the stage for the future of quinine after the conflict. The use of quinine in Assam was still common by 1939, but events between 1919 and 1939 reshaped the province's management of the drug, anti-malarial plans, and conception of malaria itself.

During the interwar period, quinine and other cinchona preparations were the foremost medications used for drug-based malaria prevention in Assam, but the effectiveness of these remedies was widely debated. [660] This section explores three aspects of the role quinine played in malaria prevention within the public health department of Assam and the medical conception of the disease in the province. The first aspect is how quinine's effectiveness during the interwar period was debated. Dialogue between Assam's police forces, jails and civic hospitals on the matter of quinine and used to illustrate these debates. The second aspect is discipline and the struggle to administer public health during the interwar period. The third aspect is the public health department's battle to secure a regular and affordable supply of quinine to the province.

Debates over the prophylactic use of quinine emerged during the First World War. The 'bitter dispute' featured proponents and opponents from eminent members of the medical

[660] Arnold, *Colonizing the Body*, p. 109.

community. Dr. J. W. W. Stephens and Dr. S. R. Christophers advocated the prophylactic benefits of quinine, while former devotees of Ross argued that alternative methods of malaria prevention would be significantly more effective.[661] Quinine did not work prophylactically because it is only effective when the parasite is in the blood stream, not when it is developing outside of the circulatory system such as inside the liver or the long dormant stage of vivax malaria. While this was not understood until some years after WWI, it was widely believed during and immediately after the war that quinine prophylaxis was not very effective even when applied in conditions of strict discipline.[662] There was no clear consensus in 1919, but when the fighting stopped the debate left the war rooms and battlefield hospitals and entered public health departments around the world.

In Assam, challenges to the medical and social efficacy of quinine distribution influenced the government's policies on quinine. Scientists and public officials questioned the clinical qualities of quinine prophylaxis, and wondered if quinine, or any suitable substitute, could be supplied and taken with enough regularity to produce prophylactic benefits. In the early 1920s, the drug was frequently banned from prophylactic use. Government departments in Assam, however, remained unconvinced that quinine prophylaxis was completely useless. Arguments against the effectiveness of quinine that relied on evidence from clinical trials and the practical use of quinine were often defeated by claims that the drug was not properly and regularly taken. This was the case in Assam's jails and police forces.

In 1921, Colonel R. Heard, Inspector General of Civil Hospitals, Assam, ordered an end to all prophylactic doses of quinine distributed within the police forces and jails. Inspector

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[661] Harrison, *The Medical War,* p. 229.
[662] Ibid., p. 233.

General Heard doubted the preventative qualities of quinine and ordered that the drug be reserved for malaria treatment instead.[663] In response to the Heard's orders, both of Assam's police forces (the Assam Rifles and the civil police) and Assam's jails promptly ended the distribution of quinine for the prevention of malaria.[664] The prisons and police forces were not without drug-based prophylaxis; Heard called for other cinchona preparations as substitutes. The effectiveness, availability, and actual application of these substitutes, however, were questionable.[665] The medical benefits of quinine in treating patients already infected with malaria was supported by scientific research and members of the government of Assam at the time, so restricting the drug's use to hospitals caused relatively little controversy. By 1921, quinine was administered to police officers and prisoners only as a treatment, not as a prophylactic.[666] This had disastrous results.

In Assam's jails in 1921, there were 256 cases of malaria recorded. The following year, 1922, there were 553 cases of malaria, over double the previous year.[667] In the civil police forces, admissions to hospital rose from 1,564 in 1921 to 2,095 in 1922; the major factors contributing to this increase were noted as outbreaks of influenza and malarial fever.[668] There were thirty deaths

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[663] 'Resolution', in C. H. Bensley, *Report on the Jail Administration of the Province of Assam for the Year 1923* (Shillong, 1924), p. 2.
[664] Assam's police force was composed of two distinct units. The Assam Rifles is a paramilitary force that was deployed both within (to engage strikes, riots, tribal violence, etc), and outside of (the precursor to the Assam Rifles fought in WWI) Assam. It was composed of Indian soldiers, but often led by members of the British military. The Civil Police operated as traditional, local, civic police force, and was composed largely of Indians who lived in their municipalities as civilian inhabitants. (W. C. M. Dundas, *Report on the Police Administration in the Province of Assam for the year 1921* (Shillong, 1922), p 3.)
[665] This seems to be different from other provinces, where cinchona febrifuges replaced quinine during the war years but were discontinued afterwards. (Ibid., p. 8.)
[666] J. Garvie, *Report on the Jail Administration of the Province of Assam for the year 1921* (Shillong, 1922), p. 11.
[667] C. H. Bensley, *Report on the Jail Administration of the Province of Assam for the year 1922* (Shillong, 1923), p. 10.
[668] W. C. M. Dundas, R*eport on the Police Administration in the Province of Assam for the year 1922* (Shillong, 1923), p. 7.

in 1922 in the Assam Rifles, half were attributed to malaria and pneumonia and the overall number admitted to hospital rose by over 15%.[669] In all three departments studied, the jails, civil police forces, and the Assam Rifles, the number of cases of malaria rose in this two-year period. In 1923, prophylactic doses of quinine were reintroduced into Assam's prisons.[670] In 1924 Colonel H. Innes, Officiating Inspector General of Civil Hospitals, Assam, facilitated the reinstitution of quinine among both the civil police forces and the Assam Rifles.[671] In both cases, the number admitted to hospital for malaria dropped substantially.

Opinions on quinine in Assam's prisons shifted as cases of malaria increased in the 1930s. In 1931, quinine prophylaxis was once again discontinued in jails and a new policy of 'ordinary anti-malarial measures' was set in place.[672] In 1932, the number of patients admitted to hospital for malaria increased from 264 in the previous year, to 527.[673] The increase was dramatic, but prison officials remained dedicated to new policies on malaria prevention that did not involve quinine.

> Our present policy is sound and should bring about a true and permanent reduction in malaria incidence in due course if carefully and conscientiously practiced. It consists in early diagnosis and curative treatment combined with commonsense anti-malarial measures.[674]

Over the next few years, the number of patients admitted to hospitals in Assam for malaria in prisons increased and decreased depending on the year without exhibiting any regular pattern

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[669] Ibid., p. 2.
[670] C. H. Bensley, *Report on the Jail Administration of the Province of Assam for the year 1923* (Shillong, 1924), p. 12.
[671] Dundas, *RPAPA 1924*, p. 8.
[672] These ordinary anti-malarial measures were anti-mosquito schemes in the cities where the prisons were located. (T. P. M. O'Callaghan, *Report on the Police Administration in the Province of Assam for the Year 1931* (Shillong, 1932), p. 14.)
[673] T. P. M. O'Callaghan, *Report on the Police Administration in the Province of Assam for the Year 1932* (Shillong, 1933), p. 7.
[674] O'Callaghan, *RPAPA 1932*, p. 16.

until 1936 when malaria cases began a rapid decline in Assam's prisons. The number of cases shrunk by half, from 489 to 253 in 1936 alone.[675] The number stayed relatively low, and in 1939 there were only 182 patients admitted to hospital for malaria.[676] The change was drastic, but the setting of a prison differs tremendously from the varied landscape and lifestyle in Assam outside of the prisons. As a result, the lessons learned in these settings were not perfectly transferable to other locations or institutions within the province.

Prisons offered relatively controlled populations ideal for the practical analysis of quinine prophylaxis. Historian David Arnold notes cases across British India where quinine prophylaxis was tested in prisons, specifically referencing the actions of the Inspector-General of Prisons in the Punjab in 1907. Arnold argues that prisons offered model settings to study the impact of drugs, quinine in particular.[677] The constant surveillance of prisoners and the ability to force regular doses of quinine constituted a different scientific approach as compared to the police forces. Ending the distribution of quinine in Assam's police forces and jails in the early 1920s seemed to indicate that when quinine when properly taken for prophylactic purposes the drug was effective. As the number of cases grew in the 1930s, however, the two government departments reacted differently. The prisons ended the distribution of prophylactic quinine, but the police forces continued to distribute the drug and rely on it for protection against infection.

The connections between the various government departments within Assam meant that medical knowledge was openly shared. In 1923, Colonel C. H. Bensley, I.M.S., was the

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[675] T. E. Furze, *Report on the Police Administration in the Province of Assam for the year 1936* (Shillong, 1937), p. 12.
[676] R. C. R. Cumming, *Report on the Police Administration in the Province of Assam for the year 1939* (Shillong, 1940), p. 14.
[677] Arnold, *Colonizing the Body*, p. 109.

Inspector-General of Prisons[678] and the Inspector-General of Civil Hospitals in Assam.[679] The decision to reintroduce prophylactic doses of quinine for both Assam's prisons and police forces was predicated on the conclusions drawn by government officials like Colonel C. H. Bensley. As the cases of malaria increased and the perception of malaria control shifted in the 1930s, the differences between Assam's prisons and the police forces meant that malaria prevention needed to address both unique populations independently. This localised approach to malaria was representative of the broader transition in public health in Assam, from the application of universal anti-malaria schemes to area-specific programmes of mosquito eradication.

Arguments about the merits of quinine as a prophylactic depended on the second aspect of quinine in Assam focused upon this dissertation: discipline and control individual bodies. Represented by the discipline required for quinine prophylaxis among the police forces and the strict control possible over prisoners, the argument over the use of quinine for prophylactic purposes in Assam during the interwar period was influenced by questions over discipline. Discipline ensured the efficient administration of the province, labour, and the cost of various malaria prevention schemes. Preventing the spread of malaria among the rank-and-file members of the police and making sure that soldiers adhered to the malaria prevention schemes, was an issue of discipline. In 1924, W. C. M. Dundas, Inspector General of Police, Assam, claimed that the previous doubts concerning the effectiveness of quinine were actually caused by the inability of every police officer to 'consume his daily dose'.[680] Measures undertaken in the Assam Rifles to mitigate disease and illness often involved administrative commands to ensure better hygiene. Soldiers were ordered to stick to a strict medical routine regarding malaria. Among the civil

[678] Bensley, *RJAPA 1923*, p. 1
[679] C. H. Bensley, *Dispensary Returns of the Province of Assam for the Year 1923* (Shillong, 1924)
[680] Dundas, *RPAPA 1924*, p. 8.

police forces, which were stationed permanently across Assam, mosquito nets and quinine were standard methods of malaria prevention used from 1919[681] to 1939, except for the brief period between 1921 and 1924.[112]

Preventing malaria among the police forces was motivated by the need to cut down on the number of sick days taken by police officers. Interpreting the negative effects of disease as limitations on bureaucracy and administration may seem callus, but the limit on manpower was viewed as a legitimate financial concern. Leaders placed an even greater emphasis on public health and campaigns against malaria when cases of the disease increased in the 1930s. By 1932, the Police Administration in Assam began calculating and commenting on the number of 'man-days lost by men being in hospital'. T. P. M. O'Callaghan, Inspector-General of Police, Assam, wrote,

> personally I am not inclined to rely with-out reservations on the value of these as an indication of man-days lost, but they give a starting point for the new view that sickness is a serious economic loss as well as a cause of inefficiency. I look for improvement henceforth with the more detailed maintenance of hospital records.[682]

Awareness of the 'man-days lost' continued through to 1939, when malaria was still cited as one of the primary diseases troubling the police forces.[683] The need for a prophylactic drug against malaria continued throughout the interwar period, and the popular belief among police force officials was that if proper discipline was maintained, drugs could prevent the spread of the disease.

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[681] A. A. Campbell, *Report on the Police Administration in the Province of Assam for the Year 1919* (Shillong, 1920), p. 6.
[682] O'Callaghan, *RPAPA 1932*, p. 7.
[683] A. M. V. Hesterlow, *Annual Public Health Report of the Province of Assam for the Year 1938* (Shillong, 1940) p. 17.

From an administrative point of view, controlling the spread of malaria necessitated control of either the anopheles mosquito population or the human body, and a reliance on quinine distribution for malaria control was a matter of discipline. The issue of discipline is highly important when ensuring effective drug use. Regular doses were necessary to achieve the optimal results, but guaranteeing regular use was often a challenge for medical administrators and officials. Assam's police forces were acutely aware of this fact, and so was the public health department. In 1938, Lt.-Colonel A. M. V. Hesterlow, Director of Public Health, Assam, wrote, 'it is much easier to free permanently at comparatively small cost extensive areas from risk of malaria infection than it is to persuade or force individuals (and with communities it is still more difficult) to swallow prophylactic doses of quinine regularly for the rest of their lives.'[684] The battle over the effectiveness of quinine as compared to alternative methods of malaria control that manipulated environments and attacked mosquitoes is emblematic of the much larger battle for control in British India. The direct control plantation owners had over the administration of drugs and general medical treatment to their labourers, as well as the cases in Assam's prisons and police forces, are worth exploring to better understand local settings and their relationship to quinine.

The battle over the bodies of individuals in Assam connects to the overall struggle to secure a stable source of quinine in Assam. From the standpoint of the government, both the high death toll and the number of manpower days lost from members of the population suffering and then recovering from the disease proved a problem for productivity, social stability, and the health of the empire. The economy depended heavily on agricultural products from large plantations and anything interrupting this process was detrimental to the financial outlook of the

[684] Ibid., p. 17.

province. While the high death toll diminished the overall number of citizens contributing to a productive society, a large number of individuals afflicted with malaria recovered from the disease. Even with a relatively low mortality rate, the sick days necessary for recuperation adversely affected the efficient administration of the province and strained resources. Prophylaxis influenced the health of Assam on two distinct, conceptual levels. Blocking the spread of malaria protects the health of individuals, and naturally medical institutions have a desire to curb suffering and death. Society, medical, government, and private institutions all have a vested interest in curbing malaria to limit the number of manpower days lost due the disease. For example, in the Public Health Report of 1922, McCombie Young, the Director of Public Health, Assam, wrote,

> It is not beyond the bounds of probability that if only a fraction of the money which is now spent in the prophylactic administration of quinine to the labour force were to be spent in abolishing or limiting the breeding grounds of carrier mosquitoes (did we but know them)- the expenditure would yield a handsome return in an increased efficiency of labour forces.[685]

Given the need to make smart financial choices, funding quinine was often a budgetary struggle.

During the early 1920s, quinine was sold 'through the agency postmasters, selected school-masters, selected shop-keepers and members of the vaccination staff'.[686] The numbers sold, however, were relatively low; in 1923 only 4,589 parcels were purchased.[687] In 1925, the price of quinine in Assam was purposely lowered to below market value, and the drug was marketed for both malaria prevention and treatment.[688] Even with local surveys of malaria, the

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[685] T. C. McCombie Young, *Annual Sanitary Report of the Province of Assam for the Year 1922* (Shillong, 1923), p. 11
[686] Taylor, *ASRPA 1920,* p. 14.
[687] G. E. Soames, 'Resolution on the Annual Public Health Report of the Province of Assam for the year 1923', in T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1923* (Shillong, 1924), p. 2.
[688] T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1925* (Shillong, 1926), p. 11.

Public Health Department still relied on the distribution of quinine for malaria prevention and treatment to some extent. Gupta, the Officiating Director of Public Health, Assam, in 1932, described the two methods of malaria prevention as 'mechanical' (mosquito control through environmental modification), and 'medical' (quinine prophylaxis). He remarked,

> The difficulties with the medical methods are much less. It consists in the systematic administration of quinine and other synthetic drugs both as preventive and as a cure. The only suitable anti-malaria measure for the province as a whole would seem to be to make quinine available as much as possible and as cheaply as possible to bring it within the reach of the indigent sufferers.[689]

The Public Health Department in Assam during the interwar period did not abandon quinine prophylaxis; in fact, its importance was expressed openly. With the increase in malaria in the 1930s, however, the distribution of the drug was accompanied with local surveys of malaria and species-specific anti-mosquito measures. By 1939, the two methods were utilised in tandem to reduce the overall cases of malaria.[690] Despite an emphasis on both approaches, the more significant shift in the Public Health Department of Assam during this time was the introduction and heightened value of local surveys on malaria, mosquito control programmes.

Quinine is an important indication of how those in the past conceptualised both anti-malarial schemes and malaria itself, but it is important not to overestimate the role of quinine and to acknowledge the limited effects the drug had on malaria. Medical histories have shown that focusing on quinine can complicate research on malaria. Quinine and malaria can be conceptualised as co-constitutive. Rohan Deb Roy's work on quinine and malaria explores the concepts within a political and medical context, and convincingly argues that the relationship between the two influenced the opinions of public officials on disease prevention and treatment.

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[689] Gupta, *APHRPA 1932*, p. 29.
[690] Desai, 'Resolution of the Public Health Report for 1939', p. 2.

Nevertheless, Deb Roy's work highlights the fact that the overall impact of quinine prophylaxis on the epidemiology of malaria is believed to be relatively low.[691] Mark Harrison's writing on the limitations of the drug's availability, undesirable symptoms, cost, and even debates of overall effectiveness highlight the limitations on the drug's desired impact within Indian society. But when there was a sudden severe shortage in quinine in areas where it had been previously available (as in Bengal in WWII) malaria deaths increased sharply. The famine and poor nutrition would have affected that too, but the lack of antimalarial drugs certainly played a part.[692] Historiography on quinine often centres on the Indian government's struggle to procure, distribute, and reap the benefits of the drug. In 'Quinine (Cinchona) and the Incurable Malaria: India c. 1900-1930s', V. R. Muraleedharan argues that provincial governments in India were very limited in their ability to control malaria with quinine, even if the quinine or alternative cinchona preparation was medically effective.[693] Patricia Barton notes in 'The Great Quinine Fraud', that colonial administrators faced extreme difficulties securing a large, stable supply of quality quinine.[694] Historiography focusing on the trouble creating effective administrative policy on quinine casts a large shadow over the role of the drug in the prevalence of malaria during the interwar period. In Assam, the debates over the effectiveness of quinine in the early 1920s mark the beginning of a time period when the distribution and overall role of quinine was problematic and possibly underwhelming. While the role of quinine in treatment was still important, the staggeringly low number of quinine parcels sold for prophylactic purposes, for example just

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[691] Deb Roy, *Malarial Subjects,* p. 3
[692] Harrison, *Public Health,* p. 158.
[693] V. R. Muraleedharan, 'Quinine (Cinchona) and the Incurable Malaria: India C. 1900-1930s', *Parassitologia,* 42/1-2 (June 2000), p. 99.
[694] P. Barton, '"The Great Quinine Fraud": Legality Issues in the "Non- Narcotic" Drug Trade in British India', *The Social History of Alcohol and Drugs,* 22/1 (Fall 2007), p. 7.

under 8,000 in 1934, pales in comparison to the estimated millions who suffered from malaria each year.[695]

Colonial Assam relied heavily on quinine and the drug played a significant role in the province's history. During the interwar period the use of the drug was under increased scrutiny as many medical officers doubted the prophylactic effectiveness of quinine against malaria. This approach to quinine differs tremendously from Assam's relationship with quinine presented in the previous chapter, but despite this difference quinine was relied upon alongside mosquito nets by the Public Health Department, police forces, and jails as useful methods of reducing malaria mortality.[696]

In colonial Assam, focusing on the medical understanding of quinine within the province provides some insight into the various institutions and groups that dealt with the disease. While many medical officers argued that there were far better alternatives to quinine, mass drug distribution was openly employed in tea plantations to prevent and malaria. The debate over the effectiveness of quinine in Assam underscores the tensions that characterise malaria in the province as a whole. To those who sought low-cost solutions to malaria with minimal interference, the use of quinine and other prophylactic drugs was appealing. To those who those who sought a more efficacious solution, the drug was subject to endless human error and an ineffective solution.

Mosquito Surveys and Medical Entomology

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[695] Quinine was, however, given out for free for treatment in hospitals. (T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1934* (Shillong, 1936), p. 21.)
[696] Quinine is derived from the cinchona plant. By the interwar period, many public health departments and other government divisions in India were implementing programmes that utilised other medications derived from the same plant in the hopes of discovering a more effective drug.

Alongside inquiries into quinine in Assam came mosquito surveys and a renewed focus on the effects of the natural environment. This section breaks down attempts to survey the local environment of Assam to develop new anti-malarial methods, many of which called for the species-specific control of mosquitoes. This differed tremendously from the previous decades when few malaria surveys of this kind were called for and mosquito eradication measures did not target individual species or specific locations. The research of medical officers on medical entomology outlined an approach to malaria within the province that offered a promising method of reducing the mortality of the deadly disease in Assam, particularly on tea plantations. These surveys even received international attention and pushed malaria control within Assam into the spotlight. Unfortunately for the province, these surveys did not produce wide-sweeping changes as many planters rejected the idea of incorporating measures that could place an additional strain on finances and reduce crop yields during the 1920s. It was not until the 1930s that some of these measures were embraced. The direct reactions of the planters are only lightly touched upon in this section, but the unique logic of colonial Assam is evident in the development of these anti-malarial plans during the two-decade timeline. The analysis reveals useful information about the state of the province during the interwar period, Assam's relationship with malaria, and the role of the disease in the lives of residents.

As discussed in the previous chapter, momentum for anti-malarial measures increased at the turn of the twentieth century. Malaria and kala-azar were differentiated during the first decade of the twentieth century, but kala-azar still attracted more attention and resources from medical officers even though malaria was more prevalent. This was due to the distinct history of kala-azar within Assam explored in previous chapters. Assam's efforts to reduce mortality from kala-azar in Assam that were finally realised during the early 1920s, though the disease did not disappear from the province completely. After the successful campaign, leftover financial and material

resources from anti-kala-azar schemes were diverted to malaria. Alongside the windfall of financial resources came a renewed confidence in the potential impact public health campaigns could have, particularly regarding 'Fever' related diseases.[697] Members of the Assam Public Health Department pushed for funding to be spent on environmental and entomological studies that were understood as useful and necessary considering the increase in malaria deaths in the early 1930s. Mosquito studies and malaria surveys were not a new development globally, but it was not until medical officers in Assam began to advocate for their importance and gained financial support that these surveys gained wider appeal within the province.

During the early part of the interwar period, the funding for anti-malaria campaigns was limited and the scope of the projects were generally restricted to whichever district or private company was willing to sponsor the campaigns. In 1919, preliminary anti-malarial measures were carried out at Pasighat, but this is noted as one of very few public health projects during the year. Separately and sponsored by private funds, the Assam-Bengal Railway carried out the largest anti-malaria campaign at that time in Assam.[698] Dr. Weldon was chosen to supervise the programme because of his knowledge on 'malariological techniques'. The Public Health Department in Assam described these techniques as successful and promising, but it is important to highlight the fact that these measures were being paid for and supervised by the Assam-Bengal Railway, not the Public Health Department itself.[699] The Public Health Department lacked specific knowledge on how to affectively eliminate anopheline mosquito populations and the funding to determine which species caused the most damage in specific locations.

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[697] Like malaria, deaths from kala azar were also categorized under the heading of 'Fevers'. As deaths from the disease decreased, funds from the campaign were diverted to combating malaria, and the mobile units used to treat kala azar in remote locations were repurposed. (Murison, *APHRPA 1929*, p. 13.)
[698] Assam-Bengal Railway was an incorporated railway company in British India.
[699] McCombie Young, *ASRPA 1919*, pp. 9-10.

During the early 1920s, the Public Health Department did not employ any malaria research officers to carry out anti-malaria schemes. The Director of Public Health in Assam T. C. McCombie Young wrote,

> Unlike larger and wealthier provinces, we have not in Assam had the guidance of a whole time Malaria Research Officer to help us in the consideration of antimalarial problems, and little precise scientific information has been available to as to the conditions which produce hyper-endemic prevalence of malaria in certain areas.[700]

Anti-malarial programmes in Assam were often linked to private companies such as the Assam-Bengal Railway as the Public Health Department often could not spare medical officers or resources without private funding. This phenomenon was not new, public health in Assam had been defined for decades by its relationship between medical experts and local industries. In 1921, Lieutenant Colonel S. R. Christophers was brought into Assam to advise on anti-malaria schemes on the Messrs. Bird and Co's Sugar Estates in Kamrup.[701] Christophers' work provided specific insight on the species of mosquitoes on the sugar estates in Kamrup. *A. Listoni, A. Maculatus, A. Culicifacies*, and *A. Rossi* were all identified as the mosquito species in the area, and their breeding patters were tracked throughout the year. This analysis provided guidelines for the removal of mosquitoes from the areas surveyed.[702] The survey was limited in scope and geographic range, and it is important to note that while these local surveys were completed in select locations, the recommendations to eliminate mosquito populations did not always result in corresponding public health measures.

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[700] The posts of Malaria Research Officer were introduced after the 1090 malaria conference in Simla and were normally given the rank of deputy sanitary commissioner. (T. C. McCombie Young, *Supplement to the Annual Public Health Report for Assam for the Year 1921* (Shillong, 1922), p. 1.)
[701] T. C. McCombie Young, *Annual Sanitary Report of the Province of Assam for the Year 1921* (Shillong, 1922), p. 8.
[702] Ibid., p. 3.

The 1921 report on malaria on the Messrs. Bird and Co's Sugar Estate in Kamrup did produce a detailed list of the local anopheline mosquito populations and the appropriate methods to eliminate them, but these guidelines were not followed. Dr. Challam, one of the supervisors on the project and a representative of the sugar estate, concluded that larvicidal measures in streams and swamps would be neither useful nor palatable. Instead, Challam argued that the only practical measure for malaria control would be moving the living quarters of the labourers to the centre of the estate and as far away from the mosquito populations as possible.[703] This recommendation was only a minor measure in the scope of Christophers' full recommendations of addressing the mosquitoes directly. Assam Director of Public Health McCombie Young agreed with Christophers and wrote,

> if, in a place of known hyper-endemic malarial prevalence, certain species of anopheles known elsewhere to be malaria carriers were found, and if the breeding grounds of these species were accurately determined by twelve months' observation of all possible breeding grounds, then considerable amelioration of malarial prevalence might be expected by abolishing these breeding grounds or by rendering them unsuitable for breeding.[704]

This perspective was a massive change from previous decades of public health measures in Assam during which many medical officers doubted the feasibility and usefulness of mosquito control measures. Reorganising the living quarters of the labourers on the estate was not a complete dismissal of the findings of the study, but it was a minimal change that ignored calls to control mosquitoes within the area. Nevertheless, Challam's approach was considered and there were reasons that justified his final recommendations. The first was limited funding and the second was to need to disrupt the sugar industry in Assam as little as possible. In the past, medical officers had reservations regarding of the overall impact of mosquito control methods.

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[703] McCombie Young, *APHRPA 1922,* p. 11.
[704] McCombie Young, *SAPHRPA 1921,* p. 1.

Though many did accept that mosquitoes were the vector of the disease, they believed that attempts to eradicate the insects even in select areas would be expensive, invasive, and close to impossible given the overwhelming presence of stagnant water in the province. With this doubt in mind, some medical experts decided that it was in the best interest of the province to avoid such measures. Additionally, the sugar industry in Assam was relatively new in the early 1920s. Reorganising the living quarters of labourers was a much less invasive method of malaria control.[705]

The study of the Messrs. Bird and Co's Sugar Estates in Kamrup was only a single study, but the general lack of funding meant that in 1921 there were no surveys on tea plantations in Assam that far and away dominated the cultivated landscape and employed the most individuals in the province.[706] Updating malaria control on tea plantations was long overdue in light of the new medical knowledge available in the twentieth century. McCombie Young stated,

> the most striking aspect of our ignorance of Assam malariology is to be found in the fact that notwithstanding the enormous sums of money invested in the tea industry and the size of its labour force, the efficiency of which depends very largely upon the standard of health which is maintained in it, no precise scientific observations have been made as to what are the conditions which at times and in places tend to produce an intensive prevalence of malaria on tea estates.[707]

Despite the need to reduce malaria on plantations, the tea estates on average did not pursue local studies of malaria.

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[705] McCombie Young, *APHRPA 1922,* p. 11.
[706] There were, however, some surveys along the railways sponsored by the Assam-Bengal Railway Company, such as the anti-malarial work that was done in Lumding, Pasighat, and new work planned in Haflong in 1922. These schemes involved both jungle clearing and oil spreading, and though they were half-funded by the Railway Company, they were still subjected to shortages of funds. (Ibid., p. 11.)
[707] Ibid., p. 11.

Some of the resistance to malaria surveys was supported by the perception that tea plantations were healthy relative to the rest of Assam. The Secretary to the Chief Commissioner of Assam wrote in the Resolution on the Annual Public Health Report of the Province of Assam for 1923, 'the fact that the death-rate on tea gardens in Assam was lower than the recorded death-rate of any province in India in 1923 proves the care which is now taken of the labour force and should dispel the illusion that the tea gardens in Assam are unhealthy.'[708] The Public Health Department struggled to ensure vital statistics were recorded from each region within Assam, but rural areas were notorious for poor reporting. In 1923, Kamrup was specifically noted as 'having the worst record.'[709] Control over these statistics was an important factor in determining the need for the appropriate distribution of resources and help from the Public Health Department. Even though tea plantations lacked any understanding of local anopheline mosquito populations, the general perception that plantations were healthy enabled plantation owners to dismiss calls for malaria surveys in many instances.

Finally, in 1924, Malcolm Watson published a report on malaria in the tea plantations in Assam. Watson argued that environmental conditions fostered anopheline mosquito populations (noticeably in tea plantations) and that the only effective prophylactic was 'a direct attack on the mosquito'.[710] The following year, Cyril Strickland, Professor of Medical Entomology, School of Tropical Medicine and Hygiene, Calcutta, published another mosquito and malaria survey. According to Strickland, the only effective method of combating malaria was mosquito control.[711] Watson and Strickland's separate surveys outlined the various species of mosquitoes

[708] Soames, 'Resolution on the Annual', p. 1
[709] Ibid., p. 1.
[710] Watson, 'Observations on Malaria', p. 150.
[711] C. Strickland, 'The Mosquito Factor in the Malaria of Assam Tea Gardens', *Indian Medical Gazette* 60/11 (Nov. 1925), p. 522.

present in their respective regions and researched and detailed the exact methods that would be most effective in reducing the mosquito populations.

Watson and Strickland's research was supported by the work of the Assam Public Health Department. In 1924, a former Director of Public Health in Assam, Colonel T. C. McCombie Young, identified *A. maculatus* as the chief carrier of malaria in Shillong, the capital of the colonial Assam. McCombie Young recommended drainage to eradicate the mosquitoes in the area. Rs. 2,277 was provided.[712] Though some research was being conducted, mosquito control only received limited financial support due to shortages in funds. Referencing the work of Strickland and McCombe Young, the Officiating Director of Public Health in Assam J. B. Hanafin wrote in 1924,

> Anti-malarial measures of any extent in Assam are at present prohibited by their cost. As campaign against the particular anopheles mosquito the carrier in the various districts is the only sound method of prevention. In absence of funds for this purpose, reliance must generally be placed on quinine.[713]

Encouraging the population of Assam to regularly take quinine to prevent or treat malarial infection remained a common anti-malarial measure during the 1920s. Assam continued to rely upon quinine to control malaria due to financial constraints, but, as explored in the previous section, many medical officers began to doubt the efficacy of the drug and its ability to reduce malaria. Watson argued that the prophylactic use of drugs including quinine and other cinchona preparations were ineffective in public health campaigns against malaria.[714] Additionally, Strickland wrote 'that for prophylaxis no amount of quinine is of any avail to stamp out the disease.'[715]

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[712] Hannafin, *APHRPA 1924*, p. 12.
[713] Ibid., p. 12.
[714] Watson, 'Observations on Malaria', p. 150.
[715] Strickland, 'The Mosquito Factor', p. 522.

Not only were there limited financial resources, public health initiatives in Assam also needed to avoid disrupting society on a massive scale, otherwise schemes would never receive public support let alone funding. Strickland understood that no progress would be made if anti-malarial work interrupted the productivity of plantations. Strickland argued that 'the cost of anti-malarial work should not affect the commission of the staff of an estate.' [...] 'If made to do so, the practice will act like a dead weight on all the efforts of those who are trying to do some good.'[716] Strickland's opinion was not new in 1925. The history of public health in Assam is filled with examples that demonstrate the need for public health campaigns to work cooperatively with planters and the language medical officers used to demonstrate the benefits of public health measures was often structured in a way to appeal to planters.

To raise money for his study, Watson undertook the difficult task of speaking to hundreds of people in the industry until he was finally able to convince planters that his methods were effective. In his report, Watson wrote, 'no progress can be made until the Indian is educated.'[717] On Watson's efforts, Ronald Ross wrote, 'it is one thing to kill the mosquitoes, but it is a much more difficult thing to get money out of the pockets of the planters, and that is what he had to do.'[718] Reading of Watson's experiences and considering the support needed for his own recommended approach, Strickland argued that education and propaganda were just as necessary as mosquito control. Plantation owners and immigrant labourers alike needed to be convinced of the need and effectiveness of mosquito control, and the parties able to fund anti-malaria campaigns needed to be made aware of the necessity. Scientific research did not directly

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[716] Ibid., pp. 522-3.
[717] This quotation is specifically referencing progress in reducing malaria deaths, and educating Indians on the most effective methods of disease control. (Watson, 'Observations on Malaria', p. 159.)
[718] Ibid., p. 154.

determine medical policy, public health studies and initiatives had to develop with commercial needs in mind. Coupled with the increase in malaria during the interwar period, these facts help one explore the history of malaria in colonial Assam.

Despite the work of Watson and Strickland, the cost of mosquito control programmes and the perception that plantations were relatively healthy, at least regarding malaria, meant that plantations did little to address malaria during latter half of the 1920s. In 1925, some anti-malaria measures were continued in Pasighat, Lumding, and in Haflong and carried out in conjunction with the Public Health Department and local industries. The work involved the spreading crude oil and castor oil on mosquito breeding sites and further deforestation. The companies that sponsored the efforts included the Dooma-Dooma Tea Company in Lakhimpur and the Assam-Bengal Railway Company.[719] By 1926, public health reports noted that 'no new anti-malaria measures [sic] of any magnitude was undertaken in Assam during the year'.[720] By 1927, medical officers were reasonably pleased with their efforts. Reflecting on the relative success of the specific, small anti-malarial schemes, the Director of Public Health T. D. Murison argued that Assam, 'has reached a stage at which any large reduction is unlikely and we are simply liable to annual variations due to general conditions and which obtain in all districts and areas.'[721] In 1928, the Secretary to the Chief Commissioner of Assam wrote about the existing anti-malarial measures in the province concentrated in Pasighat, Haflong, Kohima, and Lumding and stated, 'malaria is, however, of such widespread importance in Assam that these measures hardly touch

[719] Murison, *APHRPA 1925*, p. 12.
[720] T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1926* (Shillong, 1927), p. 12.
[721] T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1927* (Shillong, 1928), p. 15.

the fringe of the problem.'[722] There was faith that anti-malarial efforts such as oiling would work in some locations, but Assam as a whole was unlikely to experience an overall reduction in malaria.

In 1928, the prevalence of malaria slowly began to increase. While deaths due to fevers in 1928 (89,255) was slightly lower than in 1927 (89,324), S. L. Mitra the Officiating Assam Director of Public health wrote, 'the number of malaria cases treated during the year was more than double that of 1927.'[723] The slow yet continuous increase in malaria reignited the focus on local surveys and encouraged these surveys to be completed across the province, not just in select locations. In 1929 the kala-azar teams of Assistant Surgeons that travelled to villages and provided magic lantern demonstrations on kala-azar began giving presentations on malaria as well.[724] In the public health report of 1929, Assam Director of Public Health T. D. Murison wrote,

> There is urgent need for a much wider malaria investigation in the province. It will be undertaken as soon as funds which must necessarily be large, are forthcoming. All available Public Health Department resources have been utilised for some years past in measures designed against kala azar. This disease is now well under control and as funds are gradually released from this undertaking it will be recommended that they be diverted to measures aimed at the mitigation and prevention of malaria.[725]

The provincial government of Assam echoed Murison's concerns. The Secretary to the Chief Commissioner wrote in 1929,

> The most common and ubiquitous menace in life and health must be admitted to be malaria, which, while the toll it noticeably levies upon life may not be so striking as that taken by the diseases with a more rapid climax and more visible physical results, yet saps the energy and economic powers of the people as a whole more than any other. Public attention all over the world has been recently drawn to the possibilities of combating malaria on scientific lines adapted to local conditions, and remarkable work has already

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[722] H. G. Dennehy, 'Resolution on the Annual Public Health Report of the Province of Assam for the Year 1928', in S. L. Mitra, *Annual Public Health Report of the Province of Assam for the Year 1928* (Shillong, 1929), p. 2.
[723] S. L. Mitra, *Annual Public Health Report of the Province of Assam for the Year 1928* (Shillong, 1929), p. 12.
[724] Murison, *APHRPA 1929*, p. 13.
[725] Ibid., p. 14.

> been done in this province. Assam, which suffers so much from the ravages of this disease, cannot afford to ignore the teaching of the latest investigations, and Government, while recognising the value of the earnest efforts made with the means available to disseminate correct information about the disease, to make quinine generally available at cheap rates, and to tackle local problems, agree with the Director that there is urgent need for a much wider malarial investigation. It is becoming evident that without expert investigation expenditure upon anti-malarial measures may be worse than wasted. The Governor and his Minister have decided that the possibility of providing an investigation unit as a first step is deserving of the fullest examination and they are contemplating action in consultation with the employers of labour.[726]

The Secretary to the Chief Commissioner's words are significant for a number of reasons. There is, of course, the overall admission of the increased need to address malaria within the province and to do so with the help of accomplished malaria specialists who would be able to perform proper inquiries in Assam. Overall, however, the fact that the government was organising the process with the 'employers of labour' indicates the close relationship between public health in Assam and industry. In a 1929 review of C. Stickland and K. L. Chaudhury's *Abridged Report on Malaria in the Assam Tea Gardens* published in the *Indian Medical Gazette*, the review criticised the report for focusing too much on malaria and its relationship to tea plantations within Assam, arguing that the work in Assam was written more so for the planters than fellow scientists and malariologists. Nevertheless, the reviewer conceded that this was an unfortunate necessity to implement any anti-malarial measures within Assam.[727]

In connection with the calls from the province, malaria researcher and medical entomologist G. C Ramsay performed inquiries into malaria in Assam in 1929 and 1930 that contributed to species-specific malaria control programmes in the province. Through his work, Ramsay determined that *A. minimus* was likely the most widespread and efficient carrier of

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[726] H. G. Dennehy, 'Resolution on the Annual Public Health Report of the Province of Assam for the Year 1929', in T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1929* (Shillong, 1930), p. 2.
[727] 'Review, Abridged Report on Malaria in the Assam Tea Gardens', *The Indian Medical Gazette,* 63/5 (May 1928), p. 277

malaria in Assam and therefore the most responsible for cases throughout. With this information, Ramsay argued in 1930 that controlling *A. minimus* within the province would have the largest impact on reducing malaria. To accomplish this, the summer-breeding areas of *A. minimus* needed to be treated with anti-larval measures during those months, and the migrations patterns of *A. minimus* must be understood year-on-year based on the annual monsoon season. Based on his understanding of the various mosquito species in Assam, Ramsay also argued that anti-larval methods would produce some of the best results of malaria control.[728] Ramsay wrote,

> Until biological control can be restored, the cheapest and most effective method of controlling malaria is by larvicides, especially by oiling, but it has to be remembered that the control of malaria by oiling can only be compared to the control of hyperglycaemia of diabetes with insulin; as soon as treatment is discontinued the disease returns. Further, cessation of control may be attended with disastrous results, owing to an increase in the non-immune population during the controlled period.[729]

Ramsay argued for the use of larvicides, but his work was also greatly influential in helping determine the role colonial 'development' in Assam played regarding cases of malaria. Ramsay's entomological research on *A. minimus* within Assam broke down the optimal conditions for breeding- clear water that is either slow-running or stagnant.[730] Unfortunately, in Assam, the jungle clearing and drainage schemes that in the past were thought to reduce malaria actually had the opposite effect by removing shade and creating clear-water drains that were 'intensely malariogenic'.[731] Ramsay and J. De La M. Savage worked together and argued that anti-malarial measures could be viewed within two categories: temporary measures and permanent. Temporary measures involved utilizing anti-larval methods and spreading oils and

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[728] G. C. Ramsay, 'The Factors Which Determine the Varying Degrees of Malarial Incidence in Assam Tea estates and the Fundamental Principles Governing Mosquito control of Malaria in Assam', *Transactions of the royal Society of Tropical Medicine and Hygiene*, 23/5 (17 March 1930), pp. 511-518.
[729] Ramsay, 'Assam's Malaria Problems', p. 1358.
[730] Ibid., p. 1357.
[731] Ramsay, 'The Principles and Methods', p. 791.

Paris Green; Paris Green had the added benefit of not damaging crops. Permanent measures involved modifying the local environment to create natural shade and faster-running water where species such as *A. minimus* would not be able to breed as well. According to Ramsay and Savage, the temporary measures were the most possible in Assam because the permanent measures recommended could not be achieved in certain locations within embankments, bridges, or irrigation schemes that interrupted natural drainage, but where possible the permanent measures were the most important because they were less likely to fail due to human error and did not require regular upkeep.[732] Ramsay's work was presented in the 1929 conference on malaria prevention by the League of Nations as a model for other parts of the world.[733]

The increase in malaria coincided with the decrease in kala-azar, opening up funds for new programmes dedicated to malaria.[734] Previously, resources were tied up managing kala-azar. Emboldened by the decline in kala-azar, the Public Health Department shifted resources into malaria prevention.[735] In 1932, Gupta wrote, 'The victory over kala azar and the experience gained in the long fight extending over a period of over 20 years justify the hope that with adequate funds it is quite possible even in Assam to mitigate human sufferings and to prevent a large number of premature deaths from preventable causes.'[736] The money freed up from the successful conclusion of the programmes designed to combat kala-azar represented only one source of the overall funded needed and eventually provided.

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[732] Ibid., p. 791
[733] *Report of the Malaria Commission on its Study Tour in India: Malaria Commission* (Geneva, 1930) p. 1.
[734] T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1930* (Shillong, 1931), p. 14.
[735] Murison, *APHRPA 1929*, p. 14.
[736] Gupta, *APHRPA 1932*, p. 15.

The Assam Medical Research Society was formed in 1930, and its focus was set specifically on gathering more information on malaria. Murison wrote that much more information on malaria in Assam was needed before any genuine, province wide campaigns could begin.

> The closest co-operation between the society [Assam Medical Research Society] and the Public Health Department is necessary in the execution of any campaign against malaria. It is hoped in years to come, that funds will be made available by Government for the application of practical methods of eradication of the disease which will be based on the results of the researches of the society.[737]

The medical officers were aware that despite the (limited) anti-malaria campaigns carried out in the 1920s, 'malaria was on the increase.'[738] Anti-malaria campaigns were often difficult to enact. Mechanical methods such as drainage could not be put into effect in rice fields because the crops needed to be kept under water. Especially in vast landscapes, mosquito control programmes were viewed as cumbersome and too costly.[739]

In 1932, the Government of Assam initiated an ambitious scheme to provide greater access to mosquito control measures within the province. The Assam Medical Research Society and the Public Health Department were to provide medical officers, necessary appliances (including larvicides and medicines), and all materials and expertise necessary for malaria surveys for free to all local districts who requested them. This also included providing professionals to each local and municipal board regardless of size to draft a full budget for the mosquito control measures.[740] Unfortunately, while the Government was able to pay for the relevant training and expertise, it was unable to provide the funds to pay for the labour necessary

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[737] Murison, *APHRPA, 1930*, p. 14.
[738] T. D. Murison, *Annual Public Health Report of the Province of Assam for the Year 1931* (Shillong, 1932), p. 15.
[739] P. Gupta, *APHR 1932* (Shillong, 1933), p. 29.
[740] 'Anti-Malarial Work by Local Bodies, 1932, General Department, Branch Medical', ASA, xxxIx-85/32

to carry out the scheme. To take part in the scheme, Board Committees had to pay for the labourers needed to implement malaria control measures; this included primarily but not exclusively the spraying of larvicides in targeted areas across the landscape indefinitely. This aspect of the scheme was extremely expensive for local boards and in many cases cost-prohibitive for many cities and towns across Assam. Additionally, though mosquito control measures promised a reduction of malaria, they were also notoriously disruptive; in other words, despite their benefits, the cost of anti-malarial works included both financial and non-financial duties. The Director of Public Health T. D. Murison wrote in his release to all Chairmen, Local and Municipal Boards and of Small Town Committees in Assam, 'it is feared that no anti-malarial work can be undertaken unless the Board Committee is prepared to pay entirely the cost of the staff to be engaged by them for training.'[741] These financial constraints, particularly during the depressed economic climate of the 1930s, placed limitations on anti-malarial efforts even though medical officers were capable of designing effective mosquito control plans.

In 1933, malaria was called 'by far the largest scourge of the Province', and by this point in time some additional funds were allocated to researching the disease.[742] The Government of Assam provided Rs. 25,000 to the Assam Medical Research Society and the resulting study confirmed that the mosquito species *A. Minimus*, 'previously reported upon as being the principal vector in Assam gave the highest infectivity rate'. Additional research was completed on the potency of diluted Paris green, an insecticide, and the histories of *A. Minimus* and *A. Maculatus*. The government of Assam was determined not to let the results of this survey be ignored and provided an additional sum of Rs. 26,000 to the Provisional Advisory Malaria Committee which

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[741] 'Anti-Malarial Work by Local Bodies, 1932, General Department, Branch Medical', ASA, xxxIx-85/32

[742] Murison, *APHRPA, 1933*, p. 25.

would determine the anti-malaria schemes to be enacted and distribute funds accordingly.[743] Even with this financial support and the numerous groups involved, the funds were limited. Despite calls from officials, the Public Health Department faced numerous financial constraints that limited its ability to contribute to malaria management, but some surveys continued.[744]

Funding for malaria and mosquito surveys was growing mostly from the private sector prompting some support from the government. In 1934, C. Strickland and D. Gibson completed a survey on drainage to address the issues with alluvial soil and malaria in Sylhet.[745] Strickland and Gibson argued that it was essential that humans understand their natural environment when he described his particular method of drainage necessary in Sylhet, and that, 'Man, represented in this case by tea-garden labourers' were inadvertently creating anopheline mosquito breeding grounds when trying to create rice patties.[746] R. A. Murphy, a medical officer in South Sylhet, worked alongside Strickland in Sylhet to implement some mosquito control measures on tea plantations. The work was built off initial assessments from 1926 done by Strickland in conjunction with Messrs. Duncan Brothers of Calcutta, but little work was done on any other tea plantations until the 1930s when the Amo, Deundi, Chandpore, Teliapara, Luskerpore, and the Imperial Tea Companies began to implement species-specific mosquito control measures.[747] The measures implemented involved shading drainage and oiling periodically. Overall, Murphy believed the effects of the measures were a success although he claimed that it was difficult to

[743] Ibid., p. 26.
[744] Ibid., p. 30.
[745] Strickland, C., and D. Gibson, '"Backdoor Drainage", an Anti-Malarial Measure Designed to Meet a Particular Physiographical Situation in Sylhet District, Assam', *The Indian Medical Gazette,* (Aug, 1934), p. 437.
[746] Ibid., p. 437.
[747] R. A. Murphy, 'Anti-Malarial Work in South Sylhet', *Indian Medical Gazette,* 69/8 (Aug 1934), p. 438.

judge the impact of the measures, especially given that these plantations had a relatively small number of labourers. Murphy tracked infant mortality on the tea plantations as a way of judging the effects of the anti-malarial measures but said that other causes of infant mortality would skew the numbers given the small population. Additionally, influxes of immigrant labourers, often believed to worsen malaria, made it even more difficult to tell how successful the schemes were.[748] These methods were hindered by financial constraints, but by the middle of the 1930s many institutions from tea plantations to the provincial government were increasingly willing to hand over resources to anti-malarial efforts.[749] In 1935, the government was able to provide Rs. 24,500 specifically for anti-malarial measures.[750]

While funding during the 1930s was available for both malaria surveys and anti-malaria schemes, it is important to note that neither the money, nor the anti-malaria measures were distributed with geographical consistency throughout the province of Assam. In 1936, the government provided Rs. 25,189 for malaria prevention, but certain areas were neglected. The Sibsagar and Golaghat Municipal Boards ceased their contributions to the government of Assam for anti-malaria measures, and as a result, anti-larval measures on government land near the Moabund Tea Estate was stopped completely.[751] Even though some money was made available for anti-malaria measures, convincing individuals across Assam to contribute to the funds was still a problem. The 1936 Public Health Report does not note whether the municipal boards stopped contributing to the anti-malaria campaign due to a lack of funds or an unwillingness to

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[748] Ibid., p.. 438.
[749] Ibid., p. 439.
[750] Murison, *APHRPA, 1935*, p. 21.
[751] S. H. Paul, *Annual Public Health Report of the Province of Assam for the Year 1936* (Shillong, 1937), p. 18.

pay, but as a result it is clear that anti-malarial campaigns were not, and could not, be openly provided across the province in large part due to limited financial resources.

During this time of greater interest in anti-malaria campaigns and higher funding, cases of malaria were subtly increasing. In 1937, deaths from fevers increased by 12,135, from 97,240 to 109,375. These deaths were attributed largely to malaria, and the months of the greatest mortality followed the usual annual trends of epidemic malaria, highest in June and lowest in March.[752] In 1938, Lt.-Colonel A. M. V. Hesterlow, Director of Public Health, Assam, stated that malaria could only be controlled in two ways, 'attack on the malaria mosquito, and by the treatment of the patient. Both methods must be employed.'[753] Full faith was placed in environmental modification and mosquito control schemes, but the methods were not enough to make an impact across the province. Hesterlow stated that there were vast areas in every district without dispensaries and where quinine was not readily available making it difficult to control malaria throughout Assam. After some successful results in mosquito control measures, Hesterlow argued that distributing quinine and relying on the drug as a prophylactic and treatment was more difficult than mosquito control, and that mosquito control would be the most viable option moving forward. 'It is much easier to free permanently at comparatively small cost extensive areas from the risk of malaria infection than it is to persuade or force individuals (and with communities it is still more difficult) to swallow prophylactic doses of quinine regularly for the rest of their lives.'[754] Anti-malarial schemes in Assam continued to embrace mosquito control moving forward.

[752] Hesterlow, *APHRPA 1937*, p. 14.
[753] Hesterlow, *APHRPA 1938*, p. 17.
[754] Ibid., p. 17.

In 1939, Hesterlow estimated that roughly 30% of the population of Assam suffered from malaria during the year. The disease remained the greatest scourge of the province, and though anti-malarial schemes had proven successful in specific locations there were simply too many residents who lived in Assam away from anti-malarial schemes and without access to appropriate treatments. On the basis that 2.5 million individuals suffered from Assam, Hesterlow believed that around 1.5 million were left untreated.[755] Despite the poor reach of anti-malarial measures in colonial Assam, by 1939 entomological studies and species-specific mosquito control measures were the dominant method of malaria control within the province.[756]

In the same year, Malcom Watson wrote a piece reflecting on the nature of malaria control from the late nineteenth century- 'Malaria and Mosquitoes: Forty Years On'. In this work, Watson broke down malaria control into decade-long phases and provided a brief overview of anti-malarial measures in locations across the world. In India between 1900 and 1910, Watson argued that mosquito control efforts were a major disappointment, and due to the cliquey nature of public health officers in the Raj, mosquito control measures failed to take root.[757] Between 1910 and 1920 in India, Watson claimed that the intensification of malaria and blackwater fever, especially on tea estates in the Dooars and Northern Bengal, pushed the government to undertake further research into anti-malarial measures beginning with the 1909 Malaria Conference in Simla. According to Watson, the mosquito surveys that were produced as a result failed to translate into cohesive mosquito control measures, and virtually all momentum was lost during

[755] A. M. V. Hesterlow, *Annual Public Health Report of the Province of Assam for the Year 1939* (Shillong, 1941), p. 17.
[756] Ibid., p. 18.
[757] M. Watson, 'Malaria and Mosquitoes: Forty Years On', *Journal of the Royal Society of Arts* 87/4505 (24 March 1939), p. 484.

the First World War.[758] Then between 1920 and 1930, India embraced species-specific malaria control measures and sponsored research across the country, exemplified by Watson's own work in 1924 on the tea estates in Assam and G. C. Ramsay's follow up studies.[759] This may have been a victory for malariologists, but the reality for residents in locations like Assam was much different.

Despite the popularity of mosquito surveys that slowly began in the 1920s, many tea plantations in Assam waited until the 1930s to carry out anti-malarial measures and some areas in Assam did not at all due to financial constraints. Despite the momentum and relative success, these measures failed to reach the entirety of Assam and were restricted largely to tea plantations, railways, and other industry sites who could afford them. This meant that malaria did not reduce across the whole of the province.

The struggle to implement effective anti-malarial measures in colonial Assam was underscored by the loss of hundreds of thousands of Indian lives during the interwar period, but the future public health in Assam was meant to look strikingly different from previous decades, particularly in its relationship with malaria. In 1939, a scheme for the substantial expansion of the Public Health Department was submitted. Permanent institutions were to be placed in villages and rural areas, and the entire process of public health was to be improved and developed. The Secretary to the Chief Commissioner of Assam wrote in 1939 that 'apart from the treatment of epidemics as they arise the main function of the Department lies in a wide diffusion of health living.'[760] In the past, public health in Assam was dominated by conversations on diseases that exhibited an epidemic nature, but little was done about malaria which had a long and

[758] Ibid., p. 487.
[759] Ibid., p. 490.
[760] Desai, 'Resolution on the Annual', p. 2.

overwhelming presence within the province. Malaria was endemic and the effects, though devastating in number, were normalised. Species-specific mosquito control offered the most promising route forward in reducing deaths across the province, and having proven their success in select locations, medical officers were keen to spread the measures across the province. Unfortunately for Assam, in 1939 the threat of war loomed over the province. By the 1940s the knowledge of malaria and mosquito control was not lost, but the structure of anti-malarial measures and the very nature of life in colonial Assam was recast as the province and entire world were thrust into another global conflict.

Conclusion

This chapter has argued that unlike other provinces in British India, malaria did not decrease in Assam during the interwar period. As shown above, there is evidence that suggests malaria mortality and morbidity slightly increased between 1919 and 1939, particularly in the 1930s, but this is impossible to know with complete certainty, and the phenomenon could just reflect annual variations and epidemic intensity of malaria. There were several factors that contributed to the high prevalence of malaria in Assam: the disease was endemic, colonial 'development' inadvertently created the perfect breeding grounds for anopheline mosquitoes, and large numbers of immigrants with varying levels of immunities were present throughout the province. Additionally, anti-malarial efforts were neglected for decades. Public health measures that focused on diseases like kala-azar took up the lion's share of resources that could have been spent on malaria until the 1920s, and efforts to distribute quinine to prevent and treat malaria in Assam were the dominant anti-malarial method until the 1930s.

Perceptions of malaria and anti-malarial measures changed radically during the interwar period. During the First World War, the efficacy of quinine as a prophylactic was highly debated,

and though the drug was still recommended in Assam between 1919 and 1939, it was no longer the primary method of malaria control. Previously maligned local surveys of mosquitoes and ecological conditions were taken much more seriously, received better funding, and were practically implemented. These surveys were a part of the growing field of medical entomology and the mosquito control measures that were recommended were much more affordable, feasible, and welcomed than those in previous decades. Despite the promising results in some locations, these mosquito control measures were not implemented across the whole of the province and failed to make a measurable impact on malaria mortality and morbidity across Assam.

Statistics do not adequately reflect the deep social and emotional tolls of an epidemic, but historians should not lose sight of the fact that death and illness due to malaria, an endemic disease, were once thought of as an expected and normal part of life. Scientific discoveries and medical breakthroughs alone were not enough to convince everyone in Assam that these consequences could be managed and should not be tolerated. By the interwar period, even when there was a will to reduce malaria mortality and malaria and a reasonable method to do so, there were several factors that made the application of anti-malarial methods difficult. Anti-malaria measures in Assam required financial backing that in many cases only the major employers were able to afford. This meant that the major industries had greater amount of control over the implementation of anti-malarial schemes, and that anti-malarial measures were designed with the major industries in mind. The conclusion of this chapter reinforces the fact that malaria in Assam should be understood within its local context. The history of malaria and anti-malarial efforts touches upon the relationship between the creation of knowledge and of the society of Assam. The methods used to reduce the mortality rate of malaria were inherently connected to all aspects of life in the province.

Conclusion:

Fevers in the Garden sits at the intersection of colonial, environmental, and medical histories to explore the history of malaria in colonial Assam. It has examined the history of malaria between 1826 and 1939 and has argued that malaria played a pivotal role in the history of colonial Assam; that historians are able to gain some understanding of the presence and effects of the disease from contemporary data; and that the malaria situation was heavily influenced by colonial forces. In particular, there was a close relationship between colonial 'development' in Assam and the presence of malaria.

In the early 19th century, malaria was framed by the British as a danger to foreigners who entered the territory. When the British discovered tea, they began slowly to transform the ecology of certain localities in Assam. Jungles were cleared in an effort to make space for tea plantations and immigrant labourers were brought into Assam to work. Malaria was then reframed as a problem for industry, not just a danger to Europeans in the province. Clearing jungles and establishing tea plantations inadvertently created optimal breeding grounds for anopheline mosquitoes, and the workers on plantations frequently caught malaria. Unfortunately, the same cultivation that increased the presence of malaria in Assam was viewed as a panacea for the disease. It is difficult to quantify the presence of malaria in Assam prior to 1874, but it is possible to determine that the disease was present and deadly.

Assam became a province in 1874 and its government started recording statistics on mortality and morbidity. With this data, it has been possible to show that malaria was indeed present and prevalent throughout the province. Though malaria was widely regarded as the province's greatest scourge, it received relatively little attention from government officials and medical officers. One disease, however, attracted plenty of attention: kala-azar. Kala-azar was

thought to have emerged in the 1860s (although it is likely the disease existed within Assam long before) but government officials were not aware of kala-azar until the 1880s. One of the primary symptoms of kala-azar was a fever and, alongside malaria, deaths due to the disease were placed under the heading of 'Fevers' in vital statistics. Kala-azar attracted the attention of the government because the public in Assam often reacted drastically when a case was discovered in their community. Villagers abandoned their homes, and the sufferers of kala-azar were often isolated or even killed. This frightened government officials and leaders within the local industries; it threatened the peace of Assam and the ability to have a productive workforce. Medical officers within Assam believed that kala-azar was either another term for malaria or some form of malarial fever, not a separate disease altogether. Assam sought the attention of the Government of India and was able to eventually host two medical officers, G. M. Giles and later Leonard Rogers, who researched the disease within the province. In the early 1890s, Giles argued that kala-azar was not malaria, that kala-azar was in fact caused by hookworm. He was incorrect, and his conclusions were quickly dismissed. In 1897, Rogers completed his study of kala-azar in Assam and concluded that the disease was a form of malaria. Rogers was also wrong in his assessment of the disease, but his sanitary recommendations were embraced widely in the province.

When examining mortality and morbidity statistics on 'Fevers', it is possible to see that malaria had a much stronger presence in colonial Assam than kala-azar, and that much of the deaths that were attributed to kala-azar were in fact due to malaria. The period between 1874 and 1897 was one of transition for public health in colonial Assam. In the 1870s, medical officers in had a very limited purview – that is, maintaining the health of local labourers. Over the following two decades, medical research in the province was taken more seriously by medical officers and government officials, and much of this transition was ushered in by research on kala-azar. Kala-

azar was a more pressing concern than malaria partly because many of the deaths attributed to kala-azar were actually due to malaria; beyond that malaria was normalised in the province. Although deleterious, malarial fevers were an everyday part of life. Kala-azar, on the other hand, was perceived as new, dangerous, and disruptive. The motivation to address kala-azar over malaria contributes to discussions on the structure of public health and society in colonial Assam.

By the turn of the twentieth century, malaria in colonial Assam was taken more seriously. Ronald Ross' discovery of mosquitoes as the vector of malaria encouraged some schemes to eradicate mosquitoes in Assam in around 1900, but these failed to gain popularity or produce results. Mosquito eradication measures similarly failed to gain popularity in other locations in India as well. In 1905, Assam was combined with an eastern portion of Bengal to form the province of Eastern Bengal and Assam, though the province was dissolved in 1912 and Assam became its own province once again. Anti-malarial measures in British India progressed considerably between 1905 and 1912. The Malaria Conference in Simla was hosted in 1909 and attendees were recommended to continue distributing quinine and embrace new malaria surveys to employ species sanitation- targeting specific species rather than attempting to eradicate mosquitoes completely. Some malaria surveys were performed in the Eastern Bengal portion of the province, but the insights from these surveys could not be applied to Assam. Additionally, mosquito control measures previously performed in the Eastern Bengal portion of the province made medical officers wary of such schemes. Though more attention was paid to malaria in Assam than ever before, few malaria surveys were performed in Assam between 1897 and 1919. Quinine remained the dominant anti-malarial method in Assam as efforts to distribute the drug were refined during the twenty-year timeline.

It was not until the 1920s that malaria surveys were first performed on tea plantations within colonial Assam. There were a few malaria surveys in the province prior to the end of the

First World War, but these were done with the cooperation and partial funding of the Assam-Bengal Railway Company. Tea plantations were considered relatively healthy, but this perception was challenged during the late 1920s and early 1930s as cases of malaria remained high. During the 1920s and 1930, medical officers employed medical entomology to perform malaria surveys on tea plantations in Assam and recommend appropriate public health measures. Though these measures were successful on small scales, they were not applied to the province as a whole and deaths due to malaria did not decline in colonial Assam as they did in other provinces in the Raj. It is worth returning to the quotation used in the Introduction section of this project.

> It is unnecessary here to emphasize the importance of control of a disease which causes a greater amount of sickness, inefficiency, and mortality than any other disease in the world, and the ravages of which have formed one of the greatest obstacles to colonization and civilization. Malaria is undoubtedly Assam's greatest problem, and has cost the local Government and the industries many crores of rupees.[761]

These words were written by G. C. Ramsay and J. De La M. Savage, two medical entomologists working in Assam, in 1932. In their recommendations for malaria control in Assam, they believed it was unnecessary to justify why malaria needed to be reduced. Malaria was undoubtedly the greatest scourge in colonial Assam; it was the deadliest infectious disease in the province, but in reality, the disease received relatively little attention from government officials and medical officers. Even the general public was more afraid of kala-azar than malaria.

Additionally, there is a lingering question of Assam's exceptionalism; malaria mortality did not decline in Assam whereas it did in other parts of India. For a significant portion of the nineteenth century, malaria was perceived as a disease caused by environmental and climatic conditions. It would be incorrect to state that there were no anti-malarial measures, jungle clearing and cultivating the landscape was seen as a method of reducing the presence of malaria.

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[761] Ramsay, 'The Principles and Methods', p. 790.

Additionally, the government and medical officers did work to increase the supply of quinine to both prevent and treat malaria, and many of the labourers recruited to Assam were selected, at least in part, because of a presumed immunity to the disease. This dissertation has focused overwhelmingly on government and medical sources that have been written from a British perspective, and though this imposes certain limitations, it has been possible to show that the trajectory of malaria was shaped by colonial forces. 'Development' created the ecological conditions for malaria to spread, but efforts to combat malaria were mostly motivated by the maintenance of Assam's major industries, primarily tea. Ultimately, malaria became endemic in Assam and its effects, in one way or another, were normalised. Data on mortality and morbidity indicates that malaria sustained a strong presence in colonial Assam between 1826 and 1939. By presenting the narrative of malaria in colonial Assam, this project has highlighted some of the reasons how and why.

There is no overwhelming consensus on the reasons for the decrease in malaria between 1919 and 1939 in India, but work on the topic has contributed to understanding the state of malaria during a relatively healthy period of the Raj. The data on malaria in Assam during the interwar period differs from the trends noted in most other provinces, which show that most of British India experienced a reduction of in malaria mortality.[762] Assam's trends should be understood as a fundamental part of Indian and medical history; in some cases support the claims made by modern historians but with the caveat that though there are common themes, every part of the country had its own unique relationship with the disease. An analysis of the increase in malaria in Assam between 1919 and 1939 contributes to a discussion on the history of malaria

[762] Not all provinces suffered equally from malaria. The picture of malaria in Madras, for example, is less clear than in Bengal and Punjab. Increases and decreases in the disease do not appear to display a consistent pattern.

within what is ultimately an understudied region, one in which the few medical historians have focused on other diseases. The fact that Assam seems to have gone in a different direction from other parts of India makes room for further commentary on Assam and contributes to discussions on what may have caused some mortality reduction in India. Ultimately, the factors that contribute to malaria isolated in other studies do not fully explain the state of malaria (both increases and decreases) during the interwar period in Assam or the entirety of India.

Within this work, there are broader implications of this study for the historiography of Assam and for the historiography of public health in British India as a whole. Malaria has been only lightly touched upon within histories of colonial Assam. This project has shown that malaria was a significant actor in Assam's history; the mortality and morbidity rates alone demonstrate the overwhelming presence of the disease; but historical sources focusing on malaria are relatively limited, especially in comparison to other provinces in India. The limited perspectives on malaria highlight a tension between perceptions of malaria and the impact of mortality and morbidity of 'Fevers'. It is necessary for historians to reassess the analysis of diseases such as malaria and kala-azar in colonial Assam and recognise the relationship between social recognition of disease and the biological presence and impact.

This project has also contributed to the historiography of public health in British India by providing a narrative of malaria in colonial Assam and a depiction of a disease within a periphery of the empire. It has offered an interpretation on the role of colonial 'development' that supports the views of historians such as Ira Klein by viewing malaria not as an independent variable but one of many factors influenced by British modernising. [763] Additionally, this dissertation has added nuance to discussions on public health in British India. It has challenged historians such as

[763] Klein, 'Malaria and Mortality', p. 132.

Sheldon Watts who viewed public health works in British India sceptically and argued that little was done to minimise the negative effects of 'development'.[764] Though it is correct that public health measures did not always produce positive results, the creation of medical knowledge and its transition to efficacious policy was a complicated and nuanced process and there were many factors at play. Within colonial Assam, the primary desire to maintain a healthy workforce was separate from the desire to boost the health of every resident of the province, and this supports the argument that within British India, each location was unique.

The methods of historical inquiry used in this project were informed by the work of other historians, and the approach strengthens the practice of historical epidemiology and analysis of malaria. This dissertation draws attention between the relationship between perceptions of disease and the biological realities of disease. While it may not be possible to determine the exact number of malaria deaths and illnesses, analysing the data available and the relationship between mortality and morbidity still highlights broader trends in the epidemiological history of Assam and allows for in-depth analysis over long periods of time, even during periods when no epidemiological data was recorded.

Overall, the trajectory of malaria in Assam was heavily influenced by colonial rule, and this narrative of malaria in colonial Assam has explored attempts to create medical knowledge and transition that knowledge to public health praxis within a distinct historical environment.

[764] Watts, 'British Development Policies', p. 160.

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