Brewing Trouble or Transforming Nature? Making of Tea Plantation Environments in Assam, 1830s-1930s

A Thesis Submitted
in Partial Fulfilment of the Requirements for the Degree of
Doctor of Philosophy

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18th February, 2021

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Declaration

I hereby declare that this thesis titled "**Brewing Trouble or Transforming Nature? Making of Tea Plantations' Environments in Assam, 1830s-1930s**", is the outcome of my own research carried out in the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, India, under the supervision of Arupjyoti Saikia, Professor of History, in the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, India.

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Certificate

This is to certify that the thesis titled "**Brewing Trouble or Transforming Nature? Making of Tea Plantations Environments in Assam, 1830s-1930s**", submitted for the Degree of Doctor of Philosophy by Ms. Namrata Borkotoky, student at the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, embodies research work carried out under my supervision. The present thesis or any part thereof has not been submitted anywhere else for award of any degree or diploma.

Arupjyoti Saikia

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18. 02. 2021

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Abbreviations

ASA	Assam State Archives
EIC	East India Company
FRI	Forest Research Institute
GOI	Government of India
ITA	Indian Tea Association
NAI	National Archives of India
OUP	Oxford University Press
RF	Reserve Forest
TRA	Tea Research Association
WW I	World War One
WW II	World War Two

Glossary

Bigha	A traditional unit of measurement of land, equivalent to 0.33 acres
Jhum	Shifting cultivation
Anna	A monetary unit, equivalent to one sixth of a rupee.
Teela	Hillocks
Kala-Azar	Black fever
Maund	A variable unit of weight, generally equivalent to 36 kg in Bengal
Matak	Also known as the Moamorias. They were adherents of the Moamora *sattra*
Tokopat	*Livistonia jenkinsiana.* Assam fan palm
Bheels	Peatlands
Sau	Shade. Mostly refers to the shade trees in the tea plantations
Mati-kalai	Black lentil
Arhar	Pigeon peas
Boga Medeloa	*Tephrosia candida*.A type of shrub mostly used for soil improvement and control of erosion
Dhaincha	*Sesbania aculeate.* It is primarily grown as a green manuring crop
Jat	Variety
Ulu	*Imperata arundinacea.* A type of grass used for forage and pasture
Daes	Midwives

Acknowledgment

This dissertation is a result of a six year long journey which would not have been possible without the guidance and support of many people and institutions. First and foremost, I would like to extend my sincere gratitude to my supervisor, Arupjyoti Saikia for his untiring efforts towards bettering this dissertation. The encouragements, insights and critical appraisals from Prof. Saikia were crucial in the making of this dissertation. I also greatly appreciate the members of my doctoral committee, John Thomas, Debarshi Das and Amarjyoti Mahanta for always reading my work and providing crucial insights. At times when I felt lost, their comments and feedbacks helped me streamline my research and kept me on track. A special thanks is also due to Dr. Daksha Parmar for taking the time to read one of my chapters and steering me in the right direction.

I would also take this opportunity to acknowledge the support, both infrastructural and financial, of the Indian Institute of Technology Guwahati (IITG) and the Department of Humanities and Social Sciences (HSS) which aided this journey. The HSS office staff, Durga da, Parag da, Bandana baideo, Rubul and Mala, were always willing to help and made tedious administrative processes easier for which I shall always be grateful.

I am grateful to the Director, Assam State Archives (ASA) and its officials, where I spent the most time collecting archival materials, for providing access and facilitating my research. ASA's immense collections of archival materials and valuable books and reports have been pivotal in helping me write my dissertation. I extend my appreciation for the staff at the ASA for their support over the years and especially Nabin da, for always trying their best to respond to my demands. I also thank the Tocklai Tea Research Institute, Jorhat for allowing me to use their valuable library collection time and again. At Tocklai, Dr. Lakhi Bhuyan was kind enough to help me out when I needed to procure important books and Dhrubajyoti da

always assisted me in procuring necessary permissions. I also thank the library staff at Tocklai for all their assistance whenever I visited. I also owe a special thanks to the staff at the National Archives of India, New Delhi for their prompt delivery of archival materials during the two months that I spent there.

The love and support of friends and family were paramount in keeping me motivated and happy during the years of writing this dissertation. My colleagues at IITG, specially Biswajit, Abhilasha and Prarthana ba, were all very helpful in providing their unfailing support and encouragement throughout the years. I am extremely grateful for my wonderful friends at IITG, Konku ba, Halim da, Chandana, Taposh da, Tripti ba, and Snigdha, for always providing company and warmth. Jimmy da and Prerona have been constant companions throughout the years, always ready to listen, discuss and help. And thank you Anand for always being the pillar of support and putting things into perspective whenever I faltered. Lastly, acknowledging the unfailing support of my parents during the pursuance of my research work is hard to put into words. Their constant encouragement, love, support as well as sacrifice in providing a conducive environment at home to help continue my dissertation writing, especially last year when the pandemic halted normal life, inspired me to strive hard and complete this thesis.

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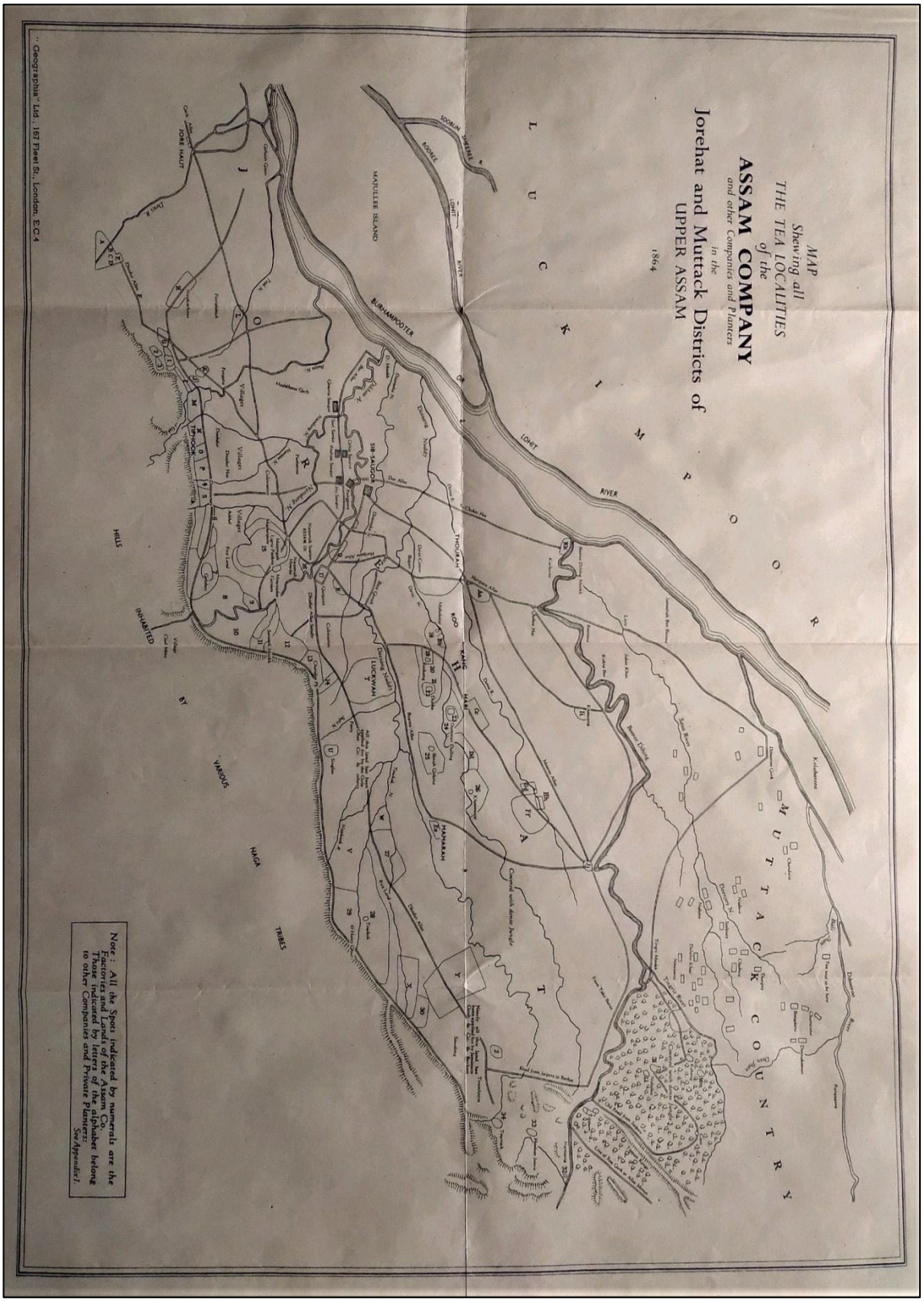
Abstract

Tea plantations in Assam brought about significant modifications in the physical environment along with the well-documented socio-economic and political transformations. The thesis explores the making and un-making of tea plantations' environments in colonial Assam, India from 1830s to the 1930s. The emergence of tea as an industry in Assam coincided with the simultaneous initiation, growth and influx of intellectual or scientific discourses which included agricultural expertise, practical "on-field" expertise, and various scientific and technological researches. Built around the narrative of tea cultivation prevalent among this colonial tea "expertise", who implicitly dictated how the environment in these plantations would be manipulated, the thesis explores a common thread that binds the themes under study- deforestation, soil degradation, pest occurrences and the corporeal degeneration of its labourers. This study endeavours to explore the inter-connectedness between human actions in the tea environs and its unforeseen and long-lasting consequences in the plantation environments.

Through this exploration, the thesis seeks to situate the rapidly transforming plantation environment within the tea expertise's discussions and debates surrounding a few of the biggest concerns of planters of colonial Assam, i.e. declining soil productivity, rise of pests and the ill-health of the plantation labourers. The study brings to the forefront how the cycle of human actions and consequent environmental repercussions continuously changed the tea expertise's opinions and strategies in managing these troubles.

Map 1: Map Showing the Localities of the Assam Company 1864



Source: H.A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957).

Map 2: The Estates of The Assam Co., Ltd. 1945

Source: H.A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957).

INTRODUCTION

The pursuit for tea in Assam began after a British East India Company officer stumbled upon indigenous wild tea trees growing abundantly in the eastern-most belt of Assam in the 1830s. Correspondences between British officers stationed at Assam and their superintendents or colleagues stationed in other parts of British India regarding the discovery of tea plants began to escalate and within a decade, producing tea within a plantation scenario was envisioned and established.[1] The history of Assam tea plantations is essentially an account of sweeping transformations of the geographical terrain and topography of vast areas of the colonial province. Yet most historical studies pertaining to these plantations do not address how the tea plantations reshaped the environment and conversely the role of the environment in shaping the course of the Assam tea plantation's history.[2]

The establishment of tea plantations in Assam brought about great changes in the physical environment of the province along with the often discussed socio-economic and political transformations. They also coincided with a simultaneous development of extensive intellectual capital which included agricultural expertise, practical first-hand knowledge, influx and development of scientific and technological researches which implicitly dictated to a large extent how the environment in these plantations would be manipulated. The thesis's narrative is heavily dependent on the discussions of this "tea expertise" whose recommendations were instrumental in re-structuring the tea environment. I define this

[1] 'Correspondence Regarding the Discovery of Tea Plant of Assam.' *Agricultural Society of India Proceedings* (Calcutta: Star Press, 1841).

[2] Important historical studies on the Assam tea plantations provides crucial accounts of various aspects of the Assam tea plantations, yet the environmental aspect of these plantations has been largely absent. These works include- Amalendu Guha, *Planter-Raj to Swaraj: Freedom Struggle and Electoral Politics in Assam 1826-1947* (New Delhi: Indian Council of Historical Research, 1977); Jayeeta Sharma, *Empire's Garden: Assam and the Making of India* (Durham: Duke University Press, 2011); Rana Pratap Behal, *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam* (Delhi: Tulika Books, 2014); Nitin Varma, *Coolies of Capitalism: Assam Tea and the Making of Coolie Labour* (Berlin ; Boston : De Gruyter Oldenbourg, 2017); etc.

expertise as those engaged in envisioning, recommending, commissioning, and analysing these environmental transformations in the Assam tea plantations. This expertise, which unwittingly reveals the environmental transformations and their after-effects in the Assam tea plantations during the period under study, was neither always unanimous nor disseminated through a fixed hierarchy but was a trial and error exercise at best. I would acknowledge here that this study was not able to incorporate the voices of indigenous experts of the late nineteenth and early twentieth century. The sheer volume of colonial documents vis-à-vis the lack of sources to document the opinions of the indigenous populations in this fairly new and exclusive endeavour of tea planting had hindered the exploration of this angle. However, for the chapter on the labourers, anthropological and sociological studies, coupled with contemporary literature produced by the tea garden labour tribes and their folk songs have been used to an extent.

Examining the physical transformations in large stretches of land marked for tea in the province in the first chapter, the rest of the three chapters talks about how these landscape alterations aided in eroding soil productivity, increasing pests among the tea bushes and kept the labour force perennially in a diseased state. This thesis strives to address the larger question of the interplay between humans and tea environments in the Assam tea plantations by tracing a series of interconnected transformations in the plantation environments.

The thesis spans from the 1830s-the beginning of tea plantations in Assam till 1939-the start of the Second World War. The reason for excluding the last few years of the colonial period is because the archives point to various rapid changes that took place during this war which I believe warrants an independent study. Although the First World War also brought in disruptions primarily in areas of shipping and recruitment of planters for war services, yet the tea industry carried on without much effect in the larger themes under study in the thesis. The Second World War had much bigger repercussions on Assam tea. The war led to a shortage

of coal supplies to the tea gardens which prompted the use of wood in the place of coal and in some instances even shade trees in these gardens were cut down to meet fuel needs of the plantations and the situation almost went on till the 1945.[3] All these shall require in-depth examination to understand how the method of exploitation of timber and other forest resources within the tea plantations differed from the prior peace time trend of exploitation that has been discussed at length in the first chapter.

Similarly, the Second World War saw a drastic change in the usage of fertilisers and insecticides on a global level, and not only limited to tea. The war made fertilisers and insecticides a more urgent requirement primarily for food grains. Shortages of nitrogenous fertilizers was an important feature during and more so after the war and the government rationed the amount of sulphate of ammonia to the tea gardens during the 1940s as the priority of the government was to make these fertilisers available for cultivating essential food crops during war times.[4] With increased war time demands for tea, even more pressure in plucking tea was encouraged and the absence or scarcity of fertilisers and insecticides would surely have had effects on the tea environments. Research works at the Tocklai Experimental Station established in the early 20th century for carrying out research on various aspects of tea, also came to a halt due to the war, especially on soils and tea pests, and instead the scientists were engaged in examining ways to purify contaminated water and make clean water available to the soldiers stationed in eastern India.[5]

And finally, with the tea garden labourers already living a malnourished life, the war which siphoned off a large chunk of the tea labour for military projects, also led to increasing concerns of lack of food grains to feed the plantation labourers in Assam, especially with the

[3] Percival Joseph Griffiths, *The History of the Indian Tea Industry* (London: Weidenfeld & Nicolson, 1967), pp. 208-209.

[4] Ibid., pp. 208-210; 'Manuring of Tea in War Time', *The Assam Review and Tea News*. Vol. XXVIII, No. VI. (February, 1943), pp. 275-276 & Vol. XXIX, No. I. (March, 1943), p. 5.

[5] Griffiths, *The History of the Indian Tea Industry*, pp. 451-452.

halt of imports of rice from Burma. According to the tea industry's own admission, malnutrition became widespread among the garden labourers during this period.[6] A scarcity of doctors and planters, as they were recruited for war efforts, as well as a shortage of insecticides also led to a slowing down of anti-malarial measures in the tea gardens. Additionally, a lack of medicines and hospital facilities along with a serious lack of nutritious food led to even more widespread malnutrition and higher deaths in tea districts, the aspects of which were covered most prominently in the Rege Report of 1944 and Lloyd Report of 1947. Moreover, the garden labourers' efforts in war time construction and their subsequent deaths and ill-health would require a different analysis as the purview of this thesis remains that of tea induced environments and its corporeal effects on the labourers.

Seeing that all the themes covered in this thesis witnessed significant transformations with the commencement of the war, the study ends at a junction which is ironically also one of the most visible junctures of human-induced environmental transformations and contamination in the world.[7] This thesis endeavours to provide a substantial background to this era of extremes in case of the tea plantations in Assam.

Situating Colonialism in Environmental History

> As Western empires spread around the globe, colonial economics displaced locally adapted agricultural systems. Typically, introduction of European methods replaced a diversity of crops with a focus on export crops like coffee, sugar, bananas, tobacco, or tea. In many regions, sustained cultivation of a single crop rapidly reduced soil fertility. In addition, northern European farming methods developed for

[6] Ibid., pp. 203-206; 'Assam Consolidated Tea: Difficult Conditions.' *The Times* (London, England), (Wednesday, Oct 18, 1944) Issue 49977, pg. 10; 'Assam Consolidated Tea: Labour Position.' *The Times* (London, England), (Wednesday, Oct 10, 1945) Issue 50269, pg. 9; Lizzie Collingham, *The Taste of War: World War II and the Battle for Food* (New York: The Penguin Press, 2012).

[7] Important works on this theme includes- Rachel Carson, *Silent Spring* (Boston : Houghton Mifflin, 2002); Simo Laakkonen, J. R. McNeill, Richard P. Tucker and Timo Vuorisalo (eds.) *The Resilient City in World War II: Urban Environmental Histories* (Switzerland: Palgrave Macmillan, 2019), etc.

> flat-lying fields shielded under snow in winter and watered by gentle summer rains led to severe erosion on steep slopes subject to intense tropical rainfall.[8]

Humans have transformed landscapes through intensive agricultural practices, industrialization and urbanization, which attained extraordinary intensity by the second half of the nineteenth century.[9] European colonialism from the end of the fifteenth century marks another such phenomenon with its capital-intensive and homogenising project that brought about fundamental transformations in human–environment interactions across large regions of the world which had colossal repercussions for the indigenous species of flora, fauna and the local human population.[10] Colonial enterprises "placed tremendous pressures on long-standing anthropogenic landscapes leading to significant modifications with the invasion of foreign species, the disruption of native habitats, the extermination of keystone species, and in some places, the loss of biodiversity."[11] Environmental history written about the imperial rule has connected European history with the history of many regions of South Asia, Latin America, Africa and Australia.[12] In the majority of writings under this theme, emphasis was mainly directed towards the insatiable greed of the colonizers for natural resources and disregard to indigenous ecosystems and alternative forms of knowledge.

The phenomenal work by Alfred Crosby, *Ecological Imperialism: The Biological Expansion of Europe, 900-1900,* first published in 1986 opened up a new vista of historical research

[8] David R. Montgomery, *Dirt: The Erosion of Civilizations* (Berkeley and Los Angeles, California: University of California Press, 2007), p. 110.

[9] Vaclav Smil, *Harvesting the Biosphere: What We Have Taken from Nature* (Cambridge: MIT Press, 2012), pp. preface, vii; David Grigg, 'The Industrial Revolution and Land Transformation' in M. G. Wolman and F. G. A. Fournier (eds.) *Land Transformation in Agriculture* (Chichester and New York: John Wiley & Sons, 1987).

[10] Alfred W. Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492* (Connecticut: Greenwood Press, 1972); Jose A. Padua, 'The Theoretical Foundations of Environmental History.' *Estudos Avancados*, 24 (68), (2010), p. 83; Ramchandra Guha, *Environmentalism: A Global History* (New Delhi: Oxford University Press, 2000), p. 3.

[11] Kent G Lightfoot, Lee M Panich, Tsim D Schneider, Sara L Gonzalez, 'European Colonialism and the Anthropocene: A View from the Pacific Coast of North America' *Anthropocene* 4 (2013), pp. 101–115.

[12] J. R. McNeil, 'Observations on the Nature and Culture of Environmental History.' *History and Theory.*Vol. 42, No. 4, Theme Issue 42: Environment and History (Dec., 2003), p. 21.

which engaged with this alternative discussion on European colonialism. [13] While most prior works on colonialism focused primarily on the military might, adventurous zeal and superior nautical skills while accounting for the success of the large scale colonisation projects undertaken by the British, Crosby looks at a completely different set of biological aspects that, he argued, aided this imperial design. This work takes a large time-frame under consideration and argues that till 1492, human societies were "materially incapable of achieving world hegemony."[14] But with the aid of three most deadly weapons- weeds, domesticated animals and pathogens, the Western European colonizers subordinated and sometimes obliterated the native population and exploited the ecosystems of its colonies. In another work by Crosby on more or less the same area, *The Columbian Exchange: Biological and Cultural Consequences of 1492*, he explores the above theme in the context of the Americas and argues that the most important changes brought about by Columbus's voyages were in fact biological in nature.[15] The European people, animals, plants, pathogens etc. were biologically dominant in comparison to the corresponding New World population which led to a widespread replacement of the natives, and their flora and fauna.

Crosby shows how the Old World and the New World were vastly different in terms of plants, animals as well as humans. The Native Americans developed their ways of life in nearly complete isolation and this not only checked the spread of their civilizations, but also weakened their defences against the major diseases brought along by the European colonisers and their African slaves. The Old World diseases, on their first contact with the Native Americans, induced bouts of epidemics as the indigenous population had no prior

[13] Alfred W. Crosby, *Ecological Imperialism: The Biological Expansion of Europe, 900-1900* (Cambridge: Cambridge University Press, 2004).

[14] Ibid., p. xviii.

[15] Alfred W. Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492* (Connecticut: Greenwood Press, 1972).

resistance.[16] This same idea about the spread of diseases was explored in the 1976 to a great extent by historian William McNeil.[17] The small pox was one such disease that affected a large percentage of the Native American population. He gives an example of how the Spaniards brought on a smallpox epidemic among the Incas and thus when the Spaniards ultimately attacked them, they could not put up a strong resistance as they almost lost half of their population to smallpox and weakened the rest.[18] In the same vein, J. R. McNeil's work on the ecological changes in the Greater Caribbean portrays how such changes affected explorations, wars, revolution and the empire between 1620 to 1914.[19] Focussing specifically on the two most deadly mosquito-borne diseases, yellow fever and malaria, that pervaded the Caribbean, McNeil contends that ecological changes provided a well-disposed environment for the proliferation of these mosquitoes. The geopolitical struggles that took place in the Greater Caribbean mainly took place in landscapes that were in the process of environmental change like deforestation, soil erosion and establishment of commercial plantations of crops like sugar and rice. With the establishment of sugar plantations, the Europeans brought in African labour force and along came the *Anopheles* and the *Ades*, the deadly virus-carrying mosquitoes. The environment as well as the increase in population, a by-product of the plantation economy, made sure that the mosquitoes play a key role in shaping the geopolitical outcomes of early modern Atlantic world, making them important historical actors.

In the case of South Asia, and particularly in India, colonization also emerged initially as the most important theme in the writings of environmental history. Indian historians' engagement with environmental history has been pervaded mainly by their concerns regarding access to resources and concepts revolving around conservation as well as destruction of natural

[16] Ibid., p. 39.

[17] William H. McNeill, *Plagues and Peoples* (New York: Anchor Press/Doubleday, 1976).

[18] Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492*, p. 39.

[19] J. R. McNeill, *Mosquito Empires: Ecology and War in the Greater Caribbean, 1620-1914* (Cambridge: Cambridge University Press, 2010).

resources, with special emphasis on the colonial rule and its aftermath.[20] Important contributions to the area of environmental history has come from insightful works by Indian scholars like Mahesh Rangarajan, Ramachandra Guha, Madhav Gadgil, K. Sivaramakrishnan, Rohan D'Souza, Arupjyoti Saikia among others.[21] These scholars have contributed detailed works on forests, rivers, dams, laws, policies and colonialism in relation to the environment.

On Expertise and "Improvement"

The discussion on colonialism and environment inevitably also leads us to the topic of the influx of a specific form of expertise primarily in the fields of agriculture, science, technology, medicine and their tremendous impact on the environment. The environment also did influence in deciding what form of science and technology a certain colony would invite. David Arnold claimed that till a long period of time, we see discussions on merely "transfer" of western science, technology, and medicine into its colonies which scholars did not necessarily problematize mainly because they did not seem to be overtly designed to sustain imperial hegemony.[22] However, there has been an increasing number of substantial works that focuses on the interconnectedness of science, technology, medical science and how they

[20] Kathleen D. Morrison, 'Conceiving Ecology and Stopping the Clock' in Mahesh Rangarajan and K. Sivaramakrishnan, (eds.) *Shifting Ground: People, Animals, and Mobility in India's Environmental History* (New Delhi: Oxford University Press. 2014); McNeill, 'Observations on the Nature and Culture of Environmental History', p. 21.

[21] Some of the important works include- Mahesh Rangarajan and K. Sivaramakrishnan (eds.) *Shifting Ground: People, Animals, and Mobility in India's Environmental History* (New Delhi: Oxford University Press. 2014); Mahesh Rangarajan, *Fencing the Forest: Conservation and Ecological Change in India's Central Provinces, 1860-1914* (New York: Oxford University Press, 1996); Mahesh Rangarajan, *Nature and Nature: Essays on Environmental History* (New Delhi: Permanent Black, 2015); Ramachandra Guha and David Arnold (eds.) *Nature, Culture, Imperialism: Essays on the Environmental History of South Asia* (Delhi: Oxford University Press, 1995); Madhav Gadgil and Ramachandra Guha, *This Fissured Land: An Ecological History of India* (Delhi: Oxford University Press, 1992); K. Sivaramakrishnan, *Modern Forests: Statemaking and Environmental Change in Colonial Eastern India* (Stanford, CA: Stanford University Press, 1999); Rohan D'Souza, *Drowned and Dammed: Colonial Capitalism and Flood Control in Eastern India* (Oxford: Oxford University Press. 2006); Arupjyoti Saikia, *Forests and Ecological History of Assam, 1826-2000* (New Delhi: Oxford University Press. 2011); Arupjyoti Saikia, *The Unquiet River: A Biography of the Brahmaputra* (New Delhi, Oxford University Press, 2019) etc.

[22] David Arnold, *Science, Technology and Medicine in Colonial India* (Cambridge: Cambridge University Press, 2004), p. 2.

were efficiently wielded by the colonisers. Although there was undeniable passion in some of these experts- scientists, botanists, geologists, etc.- for their disciplines with increasing numbers of research endeavours beginning to emerge in the colonies yet the primary motivation of such activities was ultimately to secure more revenue and control to the colonial state. It has also been argued by historian Richard Tucker that the system of extracting tropical crops, like tea, too began to intensify with advancements in science and technology.[23]

Focussing on plant sciences and how its proliferation benefitted imperial designs, Richard Drayton argues that "the sciences of collection and comparison-among which we may include botany, zoology, anthropology, and geology- depended on Europeans becoming exposed to the planet's physical and organic diversity, and often to the scientific traditions of non-European people."[24] Since the sixteenth century itself, Europe undertook the process of collection and research of indigenous plants in different parts of the world which Drayton asserts shaped the pattern of imperial expansion by revealing the most efficient way of extracting natural resources. By examining the founding and development of the Royal Botanic Gardens at Kew, Drayton reveals how science gained political patronage over the centuries that made such knowledge acquiring institutes an ally of imperial designs. Later by the eighteenth century, through the concept of "improvement" colonisers claimed that, for the interest of everyone, nature should be managed by those who understood it best. This brought about a greater degree of control and legitimacy to the imperial monopoly over the colonies' natural resources.[25] In a similar context, Stuart McCook writes about science, agriculture and

[23] Richard P. Tucker, *Insatiable Appetite: The United States and the Ecological Degradation of the Tropical World* (Berkley, Los Angeles, London: University of California Press, 2000), p. 422.

[24] Richard Drayton, *Nature's Government. Science, Imperial Britain, and the "Improvement" of the World* (New Delhi: Orient Longman, 2005), pp. xiv-xv.

[25] Ibid. This rhetoric of "improvement" in remaking Assam into an empire's garden by establishing tea plantations is discussed by Jayeeta Sharma in *Empire's Garden: Assam and the Making of India.*

the environment in the Spanish Caribbean.[26] He shows how even after the Caribbean (primarily Venezuela, Costa Rica, Cuba, Puerto Rico, and Colombia) attained independence from Spain, their nation building incorporated measures "to regulate, standardize, and subjugate" its wildlife and landscape.[27] Through state-funded research institutes specializing in agricultural and botanical sciences, the Caribbean hoped to overcome environmental problems but still maintain economic profitability from their export crops, preserving parts of the legacy of their colonial past. A quote by historian Donald Worster amply sums up the situation-

> In the long transition to the corporate agriculture mode, systematized, ordered, and unitary biological landscapes replaced complex and diverse communities of plants and animals. The greatest change-turning the land itself into a mere instrument of production-was largely a product of the twentieth century and the emergence of the technological efficiency associated with agribusiness.[28]

The tea plantations of Assam situated within this very context of colonialism expanded under the aegis of the colonisers since the mid-nineteenth century. And the gradual influx of agricultural and scientific expertise aided such systematic resource extraction. Financial and intellectual capital combined together began to induce unprecedented changes in the province's plantations. And these conditions, as we shall see in the thesis, were crucial in setting the trajectory of the narrative concerning the plantation environment.

Understanding Plantation Environments

Most colonial plantations were characteristically a large scale endeavour, typically mono-cropped with perennials, export oriented with an inflow of foreign capital and hinged on

[26] Stuart McCook, *States of Nature: Science, Agriculture, and Environment in the Spanish Caribbean, 1760-1940* (Austin: University of Texas Press, 2002).

[27] Ibid., p. 2.

[28] Donald Worster, *The Wealth of Nature: Environmental History and the Ecological Imagination* (Oxford: Oxford University Press, 1993), p. 55.

exploitative labour.[29] The French historian Ferdinand Braudel, in his celebrated work on the Mediterranean, published in 1949, accepted that world economies are intrinsically entwined with the environment. Braudel acknowledged that by establishing monocultures, the imperialist almost irrevocably altered land, labour as well as cultural relations in their colonies.[30] Although Braudel does not dwell in detail about these transformations, his ideas did open up new areas of interest to the environmental historians of posterity.

In many instances of plantations imposed on colonies by imperialists, plants were transported from other regions and cultivated for the fulfilment of capitalistic pursuits by the colonisers. Most of the times, these exchanges were intentional, but at other times they were not. The infamous Columbian exchange, that we had discussed previously, facilitated such phenomena of exchange, not just of plants but also of diseases, food and ideas.[31] The New World benefitted the Old World by providing various metals and different types of staple crops like potatoes, maize, cassava, sweet potatoes, etc. which greatly altered the diet of people all over the globe. However, there were also some crops which had greater commercial value that caught the fancy of the colonisers. These crops included sugar, coffee, rubber, tea etc. and in most colonies large tracts of land were transformed into plantations which altered not only the land relations, labour relations and the general economy of those regions but also effected

[29] Alfred E. Hartemink, 'Plantation Agriculture in the Tropics: Environmental Issues', *Outlook on Agriculture.* Vol 34, No 1, (2005), pp 11–21; Frank Uekötter (ed.), *Comparing Apples, Oranges, and Cotton: Environmental Histories of the Global Plantation* (Frankfurt and New York, NY: Campus Verlag, 2014), pp. 8, 13.

[30] Ferdinand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II.* Vol I (Berkeley, Los Angeles, London: University of California Press, 1995); Jason W. Moore, "Capitalism as World Ecology: Braudel and Marx on Environmental History." *Organization & Environment*, Vol. 16 No. 4 (December 2003), pp. 431-458.

[31] Nathan Nunn and Nancy Qian, "The Columbian Exchange: A History of Disease, Food, and Ideas." *Journal of Economic Perspectives*. Volume 24, Number 2 (Spring 2010), pp. 163–188; Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492;* Crosby, *Ecological Imperialism: The Biological Expansion of Europe, 900-1900*.

long-lasting environmental changes which are now evident through recent scholarship of environmental history.[32]

The discussion so far highlights how colonialism along with their capitalistic fervour has brought about tremendous environmental changes, directly and sometimes indirectly, all over the world. The plantation economy was part of this very system which was instrumental in making these transformations more visible and intensified, mostly in the colonies. It is important here to acknowledge the inflow of capital into such ventures and how the capital influx interacted with the other factors of production and the environment. Investing in ventures of interregional maritime trade, Western Europe's market requirements dictated the natural resource extraction on a global scale since the 15th-16th century onwards.[33] Historian Richard Grove writes, "By the mid seventeenth century the colonial plantation investments made by the European trading companies (especially the Dutch, English and French East India companies) were instrumental… in bringing about rates of soil erosion and deforestation on Caribbean and Atlantic islands that were unprecedented in Europe."[34]

Just like tea, other commodities like sugarcane, coffee, banana, cotton, tobacco etc. also operated in a similar plantation scenario. With the proliferation of the labouring class post the industrial revolution, commodities like tea and sugar, which were previously the luxuries enjoyed by the rich, gradually became the necessities of the poor, labouring in the mines and

[32] Uekötter (ed.), *Comparing Apples, Oranges, and Cotton: Environmental Histories of the Global Plantation;* John Soluri, *Banana Cultures: Agriculture, Consumption and Environmental Change in Honduras and the United States* (Austin: University of Texas Press, 2005); Corey Ross, *Ecology and Power in the Age of Empire: Europe and the Transformation of the Tropical World* (Oxford: OUP, 2017), etc.

[33] John F. Richards, *The Unending Frontier: An Environmental History of the Early Modern World* (Berkeley and Los Angeles, California: University of California Press, 2003) p. 18; E. Damsgaard Hansen, *European Economic History: From Mercantilism to Maastricht and Beyond* (Denmark: Copenhagen Business School Press, 2001).

[34] Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Islands Edens and the Origins of Environmentalism, 1600-1860* (Cambridge: Cambridge University Press, 1995), p. 52.

factories, with the intent of keeping them alert and rejuvenated.[35] Since the sixteenth century in the Caribbean islands, driven by pursuits of mercantilist expansion, European colonisers favoured cleared and cultivable lands which in addition to making these lands economically productive also aided in displacing the local peasants whose livelihoods depended on these forested lands.[36] Clearing forests for timber to aid their fuel needs, for construction and repair of their ships, to grow food to feed their growing population along with greater pressure on the fauna as a result of hunting also began to affect the Caribbean forest ecology. However, this did not compare to the damage that the sugarcane plantations incurred to the forests in the Caribbean.[37] Sugarcane plantations transformed the Caribbean landscape to a great extent. The earlier prevalence of a diversified agriculture with mixed husbandry was displaced with sugar monocultures which led to deforestation and soil erosion.[38] By clearing forests to make way for the plantations, habitats of insects, birds and mammals were disrupted. The surrounding woodlands too were utilized to procure firewood for boiling the cane juice and other purposes relevant to the functioning of the plantations. Roads and railways too gradually developed for the convenience of the planters and in the process created access to these previously inaccessible regions and assimilated them into the global market. Millions of African slaves that were brought into the Americas to work in the sugarcane plantations

[35] Sidney W. Mintz, *Sweetness and Power: The Place of Sugar in Modern History* (USA: Penguin Books, 1986), p. 61; Anthony N. Penna, *The Human Footprint: A Global Environmental History* (United Kingdom: John Wiley& Sons, Inc., 2015), p. 249.

[36] Lizabeth Paravisini-Gebert, 'Deforestation and the Yearning for Lost Landscapes in Caribbean Literatures', in Elizabeth DeLoughrey and George B. Handley (eds.) *Postcolonial Ecologies: Literatures of the Environment* (USA: Oxford University Press, 2011), pp. 101, 105.

[37] Ibid., p. 102; Richard S. Dunn, *Sugar and Slaves: The Rise of the Planter Class in the English West Indies, 1624-1713* (Chapel Hill, London: University of North Carolina Press, 1972).

[38] Penna, *The Human Footprint: A Global Environmental History*, p. 252.

found it extremely difficult to survive and as a result death rates exceeded far more than birth rates which resulted in increased influx of labourers to sustain these plantations.[39]

Similarly, the importance of coffee also grew at about the same time as tea, when the industrial workers required beverages that would keep them active. Coffee plantations too showed signs of environmental degradation with declining soil nutrition, use of large amounts of petroleum-based chemical fertilizers and extremely heavy usage of pesticides.[40] Generally, coffee plantations were replete with shade trees that provided living spaces for numerous species of birds which also consumed insects and pests that plagued the coffee plants. However, in an ensuing debate whether shade trees are beneficial or not, since 1920s an estimated 70 percent of Central and South American coffee plantations saw a widespread destruction of its shade trees which contributed towards a decline of bird population leading to further environmental degradation.[41] The production process of coffee was also highly damaging to the ecology; it included discarding the outer shell of the coffee beans which, when disposed in water bodies, led to widespread pollution as it depleted the water of its oxygen, killing plants and aquatic animals.[42] However, newer methods of production do take notice of these negative impacts and newer, improved ways have been devised to mitigate such effects on the environment. Along with environmental changes, colonial coffee plantations in the Indian context also disturbed the largely self-sufficient traditional tribal economy which included collecting forest produce and traditional cultivation since the 19th century.[43] The entry of the imperial as well as non-tribal planters led to a loss of hereditary

[39] Ibid., p. 253; Dunn, *Sugar and Slaves: The Rise of the Planter Class in the English West Indies, 1624-1713*, pp. 300-334.

[40] Penna, *The Human Footprint: A Global Environmental History*, p. 257; Stuart McCook, 'Environmental History of Coffee in Latin America' *Oxford Research Encyclopedia of Latin American History*. (27 Jul. 2017) Accessed 31 Jan. 2021. https://oxfordre.com/latinamericanhistory/view/10.1093/acrefore/9780199366439.001.0001/acrefore-9780199366439-e-440.

[41] Ibid.

[42] Penna, Anthony N. *The Human Footprint: A Global Environmental History*, p. 257.

[43] Velayutham Saravanan, 'Colonialism and Coffee Plantations: Decline of Environment and Tribals in Madras Presidency during the Nineteenth Century.' *Indian Economic and Social History Review*, 41(4): 465–88, (2004), pp. 465, 468; Vinodan

land rights of the tribal population as new land legislations were established which favoured land acquisitions by the planters and the imperial government accelerated the land alienation process, forcing the local population to engage as plantation labour for survival.[44]

The plantation systems of various crops all over the globe share many similarities ranging from mass forest clearances, soil exhaustion, emergence of pests and plant diseases, changing biodiversity of a region to transforming the relationship of the local inhabitants with their environment. However, different plantations affects the environment to a different degree on account of the diverse nature of the geography, climatic conditions, labouring class, socio-economic-cultural background of planters, uses of pesticides and fertilisers, amongst a host of different reasons. A range of essays on the environmental histories of plantations all over the globe in Frank Uekotter's edited volume titled *Comparing Apples, Oranges, and Cotton,* have revealed a few larger themes that connected plantations in different parts of the world which Uekotter calls a "transnational phenomenon that one might call the global plantation".[45] This construct of the global plantation has been imagined as a way to discuss and compare common environmental challenges of plantations worldwide. Dubbing plantations as "eminently unnatural places of production", this volume unveils common characteristics of plantations- a specific environmental imagination, biological unification of the world through pests and plant diseases, conflicts over "space", a some-what complicated relationship between hands on expertise and scientific expertise, connections between the producers and consumers as well as questions of sustainability of plantations.[46] My thesis is

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Navath, 'Politics of Environment in a Colony and After: The Kerala Case.' *Proceedings of the Indian History Congress*, Vol. 73 (2012), p. 1315.

[44] Ibid., pp. 473, 475.

[45] Frank Uekötter (ed.), *Comparing Apples, Oranges, and Cotton: Environmental Histories of the Global Plantation* (Frankfurt and New York, NY: Campus Verlag, 2014), p. 10.

[46] Ibid., pp. 7-25.

situated within the niche of this very global plantation construct and, as the chapters shall reveal, the environmental repercussions too had striking similarities.

Locating Assam and its Tea Plantations within the Domain of Environmental History

Before delving into the historiography of tea plantations in Assam, it would be crucial to briefly discuss some of the works that have been done in the field of environmental history in colonial Assam which aids our understanding of the ecology of the province. Gunnel Cederlof's work on the 18th-19th century Barak and Arupjyoti Saikia's works on pre and post-colonial forests of Assam and his in depth biography of the river Brahmaputra in Assam are important contributions in this field.

Cederlof's work deals with five decades of the initial British Raj in the North-East region of Bengal and its neighbouring kingdoms, with particular emphasis on Sylhet, Cachar, Manipur and Tripura. Cederlof emphasizes the need to critically re-imagine the entire process of colonial penetration and their attempt to impose a uniform administrative system in the whole of India. This re-imagination is particularly crucial, she opines, because the North Eastern Frontier was a categorically different region whose polity and economy were shaped by its climate, geography, continuously shifting courses of rivers and tributaries as well as the different kinds of reigning tribal kingdoms. The colonial administrators failed to realize that an understanding of the fluid geographical boundaries, the role of climate and ecology in affecting people's livelihood and sustenance, complex patterns of loyalties to different chiefs etc. were in fact crucial to discern a more effective way to administer the region. Armed with such misinformed notions of the geography and polity, revenue administrative policies began to be introduced within geographical boundaries identified by the EIC officials. As a consequence, it became extremely tough for the EIC officials to establish relationships with

the new subjects as well as discern which lands to tax.[47] Cederlof's work provides an insight into this region's encounter with colonial forces as well as how they negotiated and interacted with the environment of the region.[48]

Before the possibility of tea even emerged, the British East India Company officers were already eyeing Assam for prospects of trade and natural resource extraction from as early as the eighteenth century. Officers collected plant specimens, mapped resource rich areas and established trade relations with Assam and its neighbouring regions. In the year 1771, the Company established trading relations with Assam, but even earlier than that, an attempt to trade was initiated under the patronage of the Society of Trade established by Lord Clive in 1765.[49] The increasing prospects of extracting petroleum, coal, timber, rubber and tea piqued their interest in the region and this made the annexation of the region even more lucrative. Some scholars even argue that the discovery of tea prompted the colonizers to formally discredit the legitimacy of the Ahom king Purander Singha's rule in eastern Assam which rendered an excuse for complete takeover.[50]

Geological explorations as well as a quest for profitable botanical specimen in Assam was initiated in the 1820s itself.[51] Interest in coal and petroleum facilitated the entry of British

[47] Gunnel Cederlof, *Founding an Empire on India's North-Eastern Frontiers, 1790-1840: Climate, Commerce, Polity* (New Delhi: Oxford University Press, 2014).

[48] Ibid.

[49] S. K. Bhuyan, *Anglo-Assamese Relations, 1771-1826* (Guwahati: Dept. of Historical and Antiquarian Studies in Assam, 1949).

[50] H. Gohain, 'Origins of the Assamese Middle Class'. *Social Scientist*, Vol. 2, No. 1 (Aug., 1973), pp. 11-26; Behal, *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam*, p. 30.

[51] S. F. Hannay, 'Further Observations on the Quality, &c. of some of the Forest Trees growing in the Vicinity of Jeypore, Upper Assam.' *The Journal of The Agricultural and Horticultural Society of India.* Vol. VI. Part I (Calcutta: Bishop's College Press, 1848); Aparajita Majumdar, 'The Colonial State and Resource Frontiers: Tracing the Politics of Appropriating Rubber in the Northeastern Frontier of British India, 1810-84.' *Indian Historical Review*. 43(I) 25-41 (2016), pp. 26-29; Arupjyoti Saikia, 'Imperialism, Geology and Petroleum: History of Oil in Colonial Assam.' *Economic and Political Weekly*. Vol XLVI, No. 12. (March 19, 2011); Arupjyoti Saikia, 'Coal in Colonial Assam: Exploration, Trade and

enterprise and capital into Assam and these resources proved to be of crucial importance, directly or indirectly, in aiding the pursuit of tea.[52] Perusal of correspondences and reports show that the Company officials played a major role in identifying species of plants, locating commercially viable resources, sending samples to the Agricultural and Horticultural Society in Calcutta as well as observing its usage by the local people.[53] Interestingly, wild tea growing in Assam too was similarly chanced upon by a Company official.

Within this context, by the late nineteenth century, various resource extraction projects in the province were gradually gaining ground. Tea plantations and the newly established Forest Department in the 1860s were treading on a similar path in Assam in terms of competing for forest lands and the rights over its resources. Historian Arupjyoti Saikia's *Forests and Ecological History of Assam, 1826-2000* provides a detailed account of the transformations of Assam's forests by the taking almost a 200 years timespan.[54] This work highlights the process of the gradual transformation of a largely forested region into a new landscape with re-defined control over these forests, the natural resources therein as well as the neighbouring villages. Towards the second half of the nineteenth century, such transformations of forest lands were undertaken by the Forest Department with exclusive control of timber extraction and other forest products of the province, although their authority in doing so did not go unchallenged. This story of systematic extraction of resources and transformation of the landscape is also closely related to the history of tea plantations. The tea-planters emerged as

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Environmental Consequences' in Kuntala Lahiri-Dutt (ed.). *The Coal Nation: Histories, Ecologies and Politics of Coal in India* (England and USA: Ashgate Publishing Limited, 2014).

[52] Saikia, 'Imperialism, Geology and Petroleum: History of Oil in Colonial Assam'; Saikia, 'Coal in Colonial Assam: Exploration, Trade and Environmental Consequences'.

[53] Hannay, 'Further observations on the quality, &c. of some of the forest trees growing in the vicinity of Jeypore, Upper Assam'.

[54] Saikia, *Forests and Ecological History of Assam, 1826-2000.*

tough competitors in the race to acquire land and natural resources, along with railway companies and individual landholders also claiming shares of these resources.

Saikia's second monograph, *The Unquiet River: A Biography of the Brahmaputra* follows "the river's long lineage and its centrality in Assam's environment."[55] The river Brahmaputra, flowing through the heart of the province had complex interconnections with almost every aspect of Assam's history as well as its present. The book comfortably spans a long period of history and weaves a narrative of its origin, its floodplains environment and the human inhabitants; the river's usage and centrality in various trading pursuits; the boats and steamers that made these fluvial journeys possible; to the subject of floods and consequent attempts at reining the river. His work while meticulously addressing all these aspects also dedicates a chapter to the centrality of the river in affecting the history of tea plantations in the province.[56] Touching on many of the concerns that have been addressed at length in this thesis, Saikia's section on tea is an account of the ecological distortions brought about by the plantations in relation to the river Brahmaputra. Although the river played an indispensable role in facilitating the entry of planters, labourers, machinery, as well as acted as a channel to export the manufactured tea to a global market, yet these plantations were of unfavourable consequence to the ecology of the province as well as to the hydrological system of the Brahmaputra. This thesis discusses in detail many of the concerns fleetingly appearing in Saikia's monograph such as the connections between forest clearances, soil exhaustion, pest occurrences and human ill-health as a consequence of tea in the Assam province.

[55] Saikia, *The Unquiet River: A Biography of the Brahmaputra*, p. xxxii.

[56] Ibid., pp. 298-326.

Tea Plantations in Assam- The Story so Far

The history of the Assam tea plantations have been quite extensively and competently recorded by historians like Amalendu Guha, Jayeeta Sharma, Rana Behal, Nitin Verma and others, however these texts do not specifically address the emerging tea plantations' connection in transforming the plantation environment. One of the earliest and amongst the most authoritative texts on the subject of tea plantations of Assam is that of Amalendu Guha's *Planter-Raj to Swaraj: Freedom Struggle and Electoral Politics in Assam 1826-1947.* Guha highlights the influx of British capital into Assam, specifically into the emerging tea plantations in the nineteenth century and the accompanying emergence of newer transport systems, communication channels and the prevalence of English education.[57] This aided the emergence of a regional, politically active, bourgeois class who eventually launched a successful campaign against the colonial forces. With a primary focus on the role of tea in the rise of Assamese nationalism, this remains a classic work on the Assam tea plantation, although the aspect of the environment is altogether absent from this narrative.[58] Jayeeta Sharma's work on the Assam tea plantations is another important contribution which intertwines the tea plant with a larger history of the people, language and ideologies in Assam.[59] Identifying the influx of the large numbers of labourers, Bengali clerical officers and others into the province's tea gardens as a turning point, Sharma argues that this phenomenon infused a sense of identity crisis among the English-educated Assamese gentry. Associating this very attitude to the emergence of a new Assamese identity, Sharma shows how this gentry class strove to identify themselves with the larger (and racially "superior") Indo Aryan community and prove the supposed Aryan origin of the Assamese language. This work provides an interesting reflection on the growing regionalism of Assam and how the tea

[57] Guha, *Planter-Raj to Swaraj: Freedom Struggle and Electoral Politics in Assam 1826-1947*, p. 16.

[58] Arnab Dey, *Of Planters, Ecology, and Labour: Plantation Worlds, Human History and Nonhuman Actors in Eastern India (Assam), 1840-1910* (Unpublished Phd. Dissertation , The University of Chicago. 2012), p. 8.

[59] Sharma, *Empire's Garden: Assam and the Making of India*.

gardens were inadvertently a crucial part of this process. These works have integrated the region's political and social history with that of the emerging tea plantations and provides important insights into how a seemingly dissociated colonial endeavour impacted the region's socio-economic and political history.

Moreover, the history of labour in the Assam tea plantations have also been quite extensively researched by scholars like Rana Behal, Sharit Bhowmik, Rajanikanta Das, Dwarkanath Ganguly, Nitin Varma, Prabhu Mohapatra, Piya Chatterjee and others.[60] These scholars have contributed immensely to understanding various aspects of the tea plantations in Assam, such as- the repressive labour regime beginning with the indenture system of recruitment, legislative aspect of labour control in the plantations, physical conditions of the labourers and their standard of living, plantations as social systems, emerging labour politics, trade unions, gender dimension of the plantations and so on.

Inching closer to the theme under study in this thesis, a very crucial study has been done by historian Arnab Dey in the field of tea environments and plantation cultures.[61] It provides a welcome deviation from the usual discourse of scrutinising tea plantations through an examination of its "working class history, regional political fallout and ethno-social impacts".[62] Dey devises a framework in which he states that the tea enterprise with all its expertise and overlapping ideological, scientific and legal stakes brought about agro-

[60] Some of their selected works are- Behal, *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam*; Rajanikanta Das, *Plantation Labour in India* (Calcutta: R Chatterjee, 1930); Dwarkanath Ganguly, *Slavery in British Dominion* (Calcutta: Ananda Press & Publications (P.) Ltd, 1959); Piya Chatterjee, *A Time for Tea: Women, Labour, and Post/Colonial Politics on an Indian Plantation* (Durham, N.C.: Duke University Press, 2001); Rana P. Behal and Prabhu P. Mohapatra, 'Tea and Money versus Human Life: The Rise and Fall of the Indenture System in the Assam Tea Plantations 1840-1908', *The Journal of Peasant Studies.* Volume 19, Issue 3-4 (1992); Nitin Varma, *Producing Tea Coolies?: Work, Life and Protest in the Colonial Tea Plantations of Assam, 1830s- 1920s.* (Unpublished Phd. Dissertation: Humboldt University of Berlin, 2011); Varma, *Coolies of Capitalism: Assam Tea and the Making of Coolie Labour*; etc.

[61] Arnab Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India* (United Kingdom: Cambridge University Press, 2018)

[62] Ibid., p. 4.

economic, social and ecological mishaps. His study works towards establishing this disorderly nexus as the prime mover behind these mishaps and ironically also the reason behind the success of the tea enterprise. Dey explores how the built environment of tea plantations conspired with elements of nature like pests, climate and rainfall to affect the overall production process of the beverage while operating within this disorderly nexus. Overriding scientific know-hows and legal bounds to suit specific needs were also not uncommon in extracting the provinces' forest resources by the two major stakeholders, the forest department and the tea planters who simultaneously shared a relationship of competition and co-dependence with one another. Similarly, to better understand the state of ill-health of the labourers in these gardens and other aspects of the "culture of commerce" operating in plantations contributing towards their impoverishment, Dey compels us to look at underlying roles of "pathogenicity, profiteering, and legality simultaneously".[63] By his own admission, Dey strives to answer these "seemingly unrelated questions" by arguing that "a syncretic look at the legal, environmental and agronomic aspects of tea production help us better understand why human and natural reordering in the region had overlapping, and invisible agendas."[64] This thesis acknowledges Dey's heuristic and analytical framework of the disarray and tries to unearth and trace the actual transformations of the physical environment within the plantations through an examination of the interplay between human agency/expertise (in the context of agricultural, scientific and medical discourses) and the plantation environment comprising of forests, soil, tea pests and labouring human bodies.

Earlier scholarships on Assam's forests, the tea environs, and labour ill-health in the plantations have touched upon the themes that are under study in this thesis and have shaped the understanding of the environmental history of tea plantations in Assam. And my thesis

[63] Ibid., p. 33.

[64] Ibid., p. 6.

builds on precisely this historiography to fill the gap of an empirical study in the history of the Assam tea plantation environments.

My thesis explores the making and un-making of tea plantations' environments in colonial Assam. Built around the narrative of tea cultivation prevalent among the colonial tea "expertise", the thesis explores a common thread that binds the themes under study- deforestation, soil degradation, pest occurrences and the corporeal degeneration of its labourers, in that order. This study endeavours to explore the inter-connectedness between human actions in the tea environs and its unforeseen and long-lasting consequences in the plantation environments. These consequences and new adversaries were often followed by newer human strategies and this seemingly unending cycle of experimentation and seeking solution by trial and error, both to ameliorate environmental concerns as well to sooth labourers' ill-health, is at the core of the thesis.

From calculating an approximate scale of timber loss, connecting soil health with that of emerging debates around replenishing plantation soils and its consequent impacts on pest occurrences, to locating labourers' diseased state of existence within the altered environmental landscape of the plantations, the thesis brings out newer areas and connections to the forefront. The novelty of this research, in addition to providing a descriptive account of the larger changing environmental landscape and specifically the micro-environment, is also in its attempt to understand the gradual acceptance among the expertise regarding the usage of manures and pesticides to manage or ameliorate such changes within the context of the environmental changes induced by the plantations. Moreover, locating the corporeal conditions of the labourers within the context of this manufactured landscape brings out newer insights connecting the environment with the labour regime, malnutrition, discourses on race as well as gender. Such developments, in turn, make the interplay between the tea environs and human actions more apparent.

The larger question that this thesis poses is- how do we situate the rapidly transforming plantation environment within the tea expertise's discussions and debates surrounding a few of the biggest concerns of planters of colonial Assam, i.e. declining soil productivity, rise of pests and the ill-health of the plantation labourers. The study brings to the forefront how the cycle of human actions and consequent environmental repercussions continuously changed the tea expertise's opinions and strategies in managing these troubles.

The thesis endeavours to detail such transformations through the reading of mostly colonial texts which help us decipher how exactly such transformations were imagined, their attitudes towards such transformations and how these discussions hold the key to understanding the environmental concerns on these plantations that became visible since the late nineteenth century onwards.

A Brief Note on Sources

This historical study relies on a number of primary and secondary sources. Sources ranging from planters' biographies, forest reports, scientific reports by the Indian Tea Association, labour immigration reports, sanitary reports, tea reports and journals form the major bulk of the study. These archival materials have been collected over the period of five years from the Assam State Archives, National Archives of India and the Tocklai Tea Research Association, in addition to making liberal use of online library and archival platforms to supplement these sources.

Some of the major sources that have aided this study are the treatises by experts, mostly written in the late nineteenth century and twentieth century by chemists, entomologists and agricultural experts, employed specifically to aid the tea enterprise of the province. Some of these seminal works include accounts by Kelway M. Bamber, G. D. Hope, Harold H. Mann, George Watt, E.A. Andrews, P. H. Carpenter and others. Official histories of tea companies

like H.A. Antrobus's *A History of the Assam Company, 1839–1953* and *A History of the Jorehaut Tea Company Ltd. 1859-1946* in addition to P. J. Griffiths' *The History of the Indian Tea Industry* are important accounts that this study refers to for their statistics and other important observations. Along with these, the tea planters themselves also wrote on various aspects of tea cultivation which have also been liberally used to re-imagine the changes effected on the environment of these plantations. Such first-hand experiences and analyses of the plantation environment have been generously aided by the archival records and the library collection of the Assam State Archives and the National Archives. The landscape transformations effected by the plantations discussed in Chapter 1 has benefitted from the wasteland grant files, *Progress Reports of Forest Administration*, along with reports that depict conflict of interests in terms of resources in the province. Scientific journals published quarterly by the Indian Tea Association, journals, reports and memorandums published by the Tocklai Experimental Station, established in the early 20th century for carrying out research on tea (now known as Tocklai Tea Research Association), mostly procured from the Tocklai library, have been crucial in building the narrative of Chapter 2 and Chapter 3 which explores the changes in the micro-environment of the plantations. The final chapter, Chapter 4, which engages with the bodily deterioration of the plantation labourers within this changing environment, have been aided by archival records, mostly Government of Bengal papers, which record their journeys into the plantations and an extensive reading of *Reports on Labour Immigration into Assam* and *Annual Sanitary Reports of the Province of Assam* that details their maladies.

Considering that these sources were mostly produced by "experts" or by people who commanded some form of authority, either by their experience on the ground or through their professional training, the environmental repercussions as forewarned or understood by this expertise has been the focus of the thesis. In saying so, it is also acknowledged that these

were mostly colonial sources and the voices of indigenous populations, labourers, Indian "experts", and scientists are lacking. Caught between the sheer volume of these colonial documents and the simultaneous lack of sources to document the indigenous voices, it remains a gap in this study that have to be filled through further research. However, for the last chapter on the labourers, anthropological and sociological studies, coupled with contemporary literature produced by the tea garden labour tribes and their folk songs have been used to an extent to supplement the colonial sources.

Thesis Organisation

The thesis consists of an introduction, four core chapters and a conclusion. A brief summary of the chapter organisation and its contents are as follows.

Chapter 1, titled *Laying the Groundwork: Transforming Forests*, details the initial exercise of establishing tea plantations in Assam since the 1830s which leads us to explore colonial perceptions on nature and how they shaped the trajectory of manipulation and exploitation of natural resources in Britain's colonies. How did the prospective planters encounter Assam's landscape, often impenetrable with wild vegetation? How did the tea enterprise transform Assam's environment and how did it affect the local population and wildlife? The chapter manoeuvres between re-imagining the physical transformation of the landscape by the plantations through accounts of planters and other experts involved with tea, at the same time trying to discern contending views on such transformations by another stakeholder of the province's timber- the forest department.

Alongside the distinctly visible changes in the landscape as discussed in Chapter 1, many other crucial changes were also inconspicuously creeping in. Inside the gardens, there were hindrances in sustaining stable production of tea as a consequence of such transformations. Gradually, concerns began to emerge within the planting circle- one was regarding the

problem of declining productivity of tea lands, which led to an examination of the soil in the plantations which forms the topic under study in Chapter 2, *Perceiving Degeneration: The Soil*, and the second was the issue of rising incidences of pests, blights and plant diseases inside the plantations which has been taken up in Chapter 3.

With increasing human-induced modifications of the wild tea plant to suit the needs of perpetual production- like excessive plucking, pruning, hoeing and digging, tremendous pressure was placed on the plantation soil which led to its exhaustion and degradation. The chapter addresses the relationship of the changing nature of the soil in connection with the declining productivity of tea which has been teased out from discussions and debates among the planting experts.

Simultaneous discussions also prevailed regarding the rising incidences of insects within the gardens. Chapter 3, *Invading the Gardens: The Pests*, follows the trajectory of how this altered environment of tea plantations prompted a huge surge of pest population in these gardens and the consequent deliberation and endeavours undertaken to resolve this trouble. Following from the previous chapters, we see that plantation specific characteristics like- soil exhaustion due to constant extraction of nutrients by the perennial plants, inadequate nourishment of the plants due to faulty cultivation techniques- were acknowledged to be some of the primary causes that brought on the menace of unrelenting pest attacks in the Assam plantations.

The final chapter of the thesis, Chapter 4, *Plantation Environment and Labouring Bodies*, situates the millions of labourers involved in the tea plantations of Assam within this altered environmental landscape. With the intensification of the colonisers' pursuit for tea, the effect of deterioration on the human bodies of the labouring class was quite evident. When low wages, malnutrition and wretched working conditions were added to the mix, the mortality

rates rose tremendously. Bodily deterioration and general un-healthiness of the labouring class is a colonial legacy in the Assam plantations which relentlessly torments this class to this day. We seek to understand colonial perceptions which at times sought to explain ill-health through inherent environmental flaws of the region and at times emphasised inherent socio-economic-corporeal conditions which I argue was enabled by the plantation environment itself.

Chapter I

Laying the Groundwork: Transforming Forests

Introduction

Since the late nineteenth century, resource extraction projects of the colonial enterprise, especially tea, in addition to petroleum, coal, timber and rubber exacerbated competition for resources leading to a gradual depletion of forest lands in Assam.[1] The landscape of Assam began to witness major reorientation probably right from the moment transplanting the wild tea trees from the vicinity of the rivers of the province to the uplands was considered and orderly rows of tea were fantasized by the Company officials since the first half of the nineteenth century.[2] With legislations encouraging Europeans to take up large amounts of lands for tea cultivation, to virtually unchecked appropriation of forest resources both from within and even outside the tea land grants, led to clearances of large areas since the 1830s. These clearances were further amplified when tea plantations were established assuming that freshly cleared forest lands had the best tea producing potential. Moreover, the perennial influx of over a million labourers recruited into these plantations between the mid-nineteenth century to the 1920s also led to increased activities in neighbouring forests which aided in

[1] S. F. Hannay, 'Further Observations on the Quality, &c. of some of the Forest Trees Growing in the Vicinity of Jeypore, Upper Assam', *The Journal of The Agricultural and Horticultural Society of India.* Vol. VI. Part I. (Calcutta: Bishop's College Press, 1848); Aparajita Majumdar, 'The Colonial State and Resource Frontiers: Tracing the Politics of Appropriating Rubber in the Northeastern Frontier of British India, 1810-84', *Indian Historical Review*. 43(I) 25-41. (2016), pp. 26-29; Arupjyoti Saikia, 'Imperialism, Geology and Petroleum: History of Oil in Colonial Assam', *Economic and Political Weekly*. Vol XLVI, No. 12. (March 19, 2011); Arupjyoti Saikia, 'Coal in Colonial Assam: Exploration, Trade and Environmental Consequences', in Kuntala Lahiri-Dutt (ed.). *The Coal Nation: Histories, Ecologies and Politics of Coal in India* (England and USA: Ashgate Publishing Limited, 2014).

[2] Arupjyoti Saikia, *The Unquiet River: A Biography of the Brahmaputra* (New Delhi: Oxford University Press, 2019), p. 289; *The Tea Cyclopaedia: Articles on Tea, Tea Science, Blights, Soils and Manures, Cultivation, Buildings, Manufacture Etc., With Tea Statistics* (London, 1882), pp. 68-69.

their gradual degradation.[3] Subsequently, along with tea, closely affiliated services like establishment of saw mills, tea chest making factories, construction of new railways, bridges, and roads, either directly or indirectly, began to broaden the effects of landscape transformation of the plantations to a much wider geographical space. This was not an isolated event but was also the story in other tea growing regions like Kerala and Ceylon-present day Sri Lanka, where forests were replaced by tea. It has been estimated that in Ceylon by the end of 1880s, approximately 6,00,000 acres of forests were felled to facilitate tea plantations.[4] While according to another estimate by a tea planter, approximately 9,00,000 acres of jungle were felled by the year 1900 to make way for tea plantations in India and Ceylon combined.[5]

While delving into the extent and repercussions of such forest clearances, a few compelling questions arise. How did the prospective planters encounter Assam's landscape, often impenetrable with wild vegetation? How did the cultivation of tea transform its immediate landscape and how did it alter the relationship of dependence on natural resources of the local population? How did such encounters guide or determine the course of the tea enterprise? In an endeavour to document and reimagine such transformations, this chapter shall first unpack colonial perceptions on nature and juxtapose these notions with the prevailing relationships of the local population with their environment. Moving forward, the chapter seeks to investigate the actual process of transformation of the "jungles" which, as we shall see in the later chapters, had ensuing repercussions in altering the environment of these plantations.

[3] N. Lele, P. K. Joshi and S. P. Agarwal, 'Assessing Forest Fragmentation in North-eastern Region (NER) of India using Landscape Matrices', *Ecological Indicators*. Volume 8, Issue 5. (2008), pp. 657-663.

[4] Michael Williams, *Deforesting the Earth: From Prehistory to Global Crisis. An abridgement* (USA, The University of Chicago Press, 2006), p. 340.

[5] John Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life* (London: Quiller Press Ltd., 1986), p. 30.

Forest Resources and Colonial Perceptions on Nature

Tea plantations emerged as highly controlled, modified and orderly stretches of land, and the validation behind such modifications can perhaps be found in the ideology which prevailed in Europe after Enlightenment, where human intervention resulting in an ordered state of nature was celebrated.[6] Historian Donald Worster, while attempting to analyse eighteenth century European intellectual discourse, sheds light on how colonization, imperial management of natural resources in colonies, and other such imperial attitudes have been shaped by the prevalent perception of nature.[7] Lynn White's contentious essay in the 1960s pointedly identified Judeo-Christian attitudes as a major contributor of man's ascendency over nature, although not without objections.[8] Moreover, the industrial revolution that heightened the position of Europe from the rest of the world, alongside the prevailing dominant religious views, led to an increasing belief in the supremacy of human beings over natural resources.[9] Landscapes were thus deemed as self-conscious representation of virtues of a specific political, cultural or social community.[10] However, emerging new sensibilities by the seventeenth and eighteenth centuries which, to an extent, questioned the indiscriminate exploitation of plants and animals, the resultant idea of conservation of nature still retained anthropocentric residues. The American conservationist and naturalist, John Muir, celebrated as one of the pioneers of environmental conservation and nature writing, believed that in order to preserve wilderness, people needed to maintain their control over a landscape.[11] In

[6] Ellen J. Jenkins, Review of, Nathaniel Wolloch, *History and Nature in the Enlightenment*. H-Albion, H-Net Reviews. January, 2012; R G. Collingwood, *The Idea of Nature* (USA: Oxford University Press, 1960), p. 5; Keith Thomas, *Man and the Natural World* (London: Penguin Books, 1984).

[7] Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge: Cambridge University Press, 1994).

[8] Lynn White, 'The Historical Roots of our Ecologic Crisis', *Science*, 155(3767), (March, 1967); Emily Warde, 'Christianity and the Environment: The Lynn White Controversy', *Ex Post Facto*, Vol. XX (2011).

[9] Ibid., pp. 1203–1207; Worster, *Nature's Economy: A History of Ecological Ideas*, p. 27.

[10] Simon Schama, *Landscape and memory* (United States: Vintage Books, 1995); Thomas Greider and Lorraine Garkovich, 'Landscapes: The Social Construction of Nature and the Environment', *Rural Sociology*. 59(1), (1994), pp. 1-24.

[11] Ibid.

this regard, historian Thomas Keith remarked that the entire idea of conservation of nature, at its core, was an anthropocentric idea.[12] Therefore from Britain's colonies in Americas, Africa as well as India, a similar pattern of natural appropriation and domination can be discerned.

Historian Richard Drayton has argued that once the imperial governments engaged with the environments of its colonies and had garnered enough knowledge and formed perceptions about their natural resources, their claim to managing these natural resources for the "improvement" or "development" of the colonies became stronger.[13] This is a recurring trope in the accounts of Assam planters and administrators who lauded the enterprise of such brave men who ventured to "improve" the province by making unused lands commercially productive. In a correspondence concerning C. A. Bruce, brother of the "discoverer" of Assam tea Robert Bruce, whose efforts were instrumental in establishing the tea industry in Assam, such tropes are evident,

> ...in pursuit of this discovery, he traversed wild and jungly provinces never before trodden by the foot of a European; and that it was mainly through his instrumentality, and by his services rendered often at the risk of his life, that the whole of the waste and uncultivated lands in Assam, now so valuable, came into the possession of the govt.[14]

Worster also emphasized the impact of culture and society on the scientists or the "experts" that were directly engaged in the colonies and how their perception of ecology translated into the measures undertaken in their subsequent policies of ecological management.[15] In the case of Assam too, it is interesting to note that an important aspect of geological and botanical

[12] Keith Thomas, *Man and the Natural World*. (London: Penguin Books, 1984), p. 302.

[13] Richard Drayton, *Nature's Government. Science, Imperial Britain, and the "Improvement" of the World* (New Delhi: Orient Longman, 2005).

[14] Grant of Waste Land to Mr. Bruce in Assam in Acknowledgment of the Service rendered by him by the Discovery of Tea Plant in Assam. Department-Home, Branch-Revenue (March 31st 1864). Part A. File No. 18-22. National Archives of India (hereafter NAI).

[15] Worster, *Nature's Economy: A History of Ecological Ideas*.

explorations in the early colonial period was the crucial role played by the Infantry or Army General who perhaps assisted in exposing natural resources, situated even in interior locations, to the colonial gaze.[16] Even with the establishment of the Forest Department in Assam in 1868, the imperial government aided the dissemination of scientific tradition to its colonies by sending experts or 'scientific soldiers'.[17] With the emergence of tea companies since the 1840s, speculators began to acquire lands but the managers who were sent to manage the plantations were the ones that dealt with the environment. Apparently, these plantations did not attract a very sophisticated section, and the planters and managers who arrived were often deemed inferior by their counterparts in Europe.[18] It was often opined that people with no agricultural background were employed to manage these gardens and these planters "were a strange medley of retired or cashiered army, Navy officers, medical men, engineers, veterinary surgeons, steamer captains, shopkeepers, stable keepers, used up policemen, clerks."[19] However, as we shall see later in the chapters, a section of formally trained professionals began arriving in the province to advise the tea companies starting in the late nineteenth century.

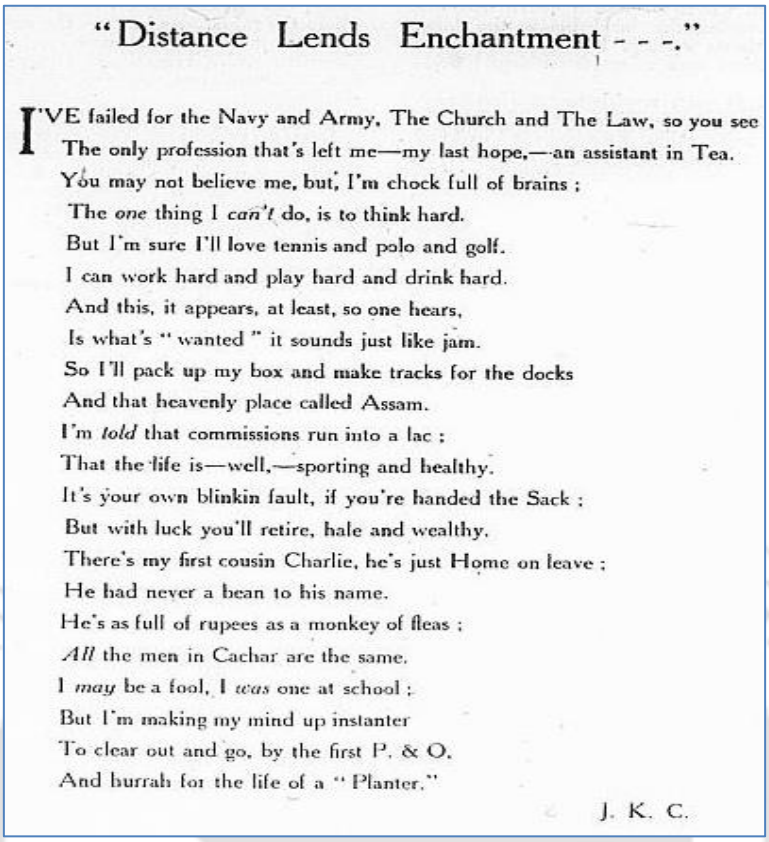
[16] Hannay, 'Further Observations on the Quality, &c. of some of the Forest Trees growing in the Vicinity of Jeypore, Upper Assam'.

[17] S. Ravi Rajan, *Modernizing Nature: Forestry and Imperial Eco-Development 1800-1950* (New York: OUP, 2006), pp. 10-11; Roy M. MacLeod, 'Scientific Advice for British India: Imperial Perceptions and Administrative Goals, 1898-1923', *Modern Asian Studies*, Vol. 9, No. 3 (1975), pp. 347-349.

[18] H.A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957), pp. 144-145.

[19] Ibid.

Fig 1: A Poem titled 'Distance Lends Enchantment'



"Distance Lends Enchantment - - -."

I'VE failed for the Navy and Army, The Church and The Law, so you see
The only profession that's left me—my last hope,—an assistant in Tea.
You may not believe me, but, I'm chock full of brains ;
The *one* thing I *can't* do, is to think hard.
But I'm sure I'll love tennis and polo and golf.
I can work hard and play hard and drink hard.
And this, it appears, at least, so one hears,
Is what's "wanted" it sounds just like jam.
So I'll pack up my box and make tracks for the docks
And that heavenly place called Assam.
I'm *told* that commissions run into a lac ;
That the life is—well,—sporting and healthy.
It's your own blinkin fault, if you're handed the Sack ;
But with luck you'll retire, hale and wealthy.
There's my first cousin Charlie, he's just Home on leave ;
He had never a bean to his name.
He's as full of rupees as a monkey of fleas ;
All the men in Cachar are the same.
I *may* be a fool, I *was* one at school ;
But I'm making my mind up instanter
To clear out and go, by the first P. & O.
And hurrah for the life of a "Planter."

J. K. C.

The poem represents the general perception of a planter. Source: *The Assam Review and Tea News*. Vol I. No. 5. (July 1928), p. 30.

Along with the tea planters, another class of officials were also almost simultaneously vying for the forest resources of the province- the foresters. It was in the 1840s that for the first time permanent provisions regarding forest conservancy was seriously thought about in India. Before that, due to an absence of a well-developed market for forest produce, colonial administrators did not foresee much economic benefit in exploiting forest resources.[20] Additionally, the prevailing idea among colonial administrators that colonial forest resources were inexhaustible, a general disregard to forest cover's influence in protecting the environment and influencing the climate aided their unapologetic exploits.[21] These ideas were broadly influenced by factors like the strength of the English navy which enabled them to

[20] Rajan, *Modernizing Nature: Forestry and Imperial Eco-Development 1800-1950*, pp. 8-9.

[21] Ibid., pp. 9-10.

import any resource that they sought, along with an abundance of coal supplies which provided the needed energy for their naval expeditions. Moreover, Britain was situated geographically within the influence of the Gulf Stream which regulated climate and mitigated the ill effects of deforestation.[22] Operating within these ideologies, therefore, it was deemed ideal when forests and lands were acquired, for instance the wastelands in Assam, and converted into agricultural or cash crop production.[23]

The primary category of land that was acquired for this purpose was the wastelands or the uncultivated "spare lands".[24] Wastelands had been defined as "unoccupied land, the property of government, which the government has not disposed of by lease, grant, or otherwise, and which is of such a character or in such a position that it is not likely to be taken up for the cultivation of the ordinary staples of the country within a reasonable time."[25] Through this definition, the formulation of "wastelands" can be understood in terms of the western idea of private rights over property whereby common use of land or fallow lands was objectionable and deemed less productive by the eighteenth century in Europe.[26] The term "waste" was introduced into legal terminology in Bengal with the Permanent Settlement Act of 1793. In Assam, three categories of wastelands were thus identified in the 1830s - wastelands under grass, wastelands under reeds and high grass, and wastelands under forests.[27] The accurate

[22] B. E. Fernow, *A Brief History of Forestry in Europe, the United States and Other Countries* (Toronto: University Press, 1911), pp. 308-309; Rajan, *Modernizing Nature: Forestry and Imperial Eco-Development 1800-1950*, p. 10.

[23] Rajan, *Modernizing Nature: Forestry and Imperial Eco-Development 1800-1950*, p. 10.

[24] William Robinson, *A Descriptive Account of Assam* (Calcutta: Bishop College Press, 1841), p. 92; W. W. Hunter, *A Statistical Account of Assam*, Vol I (London: Trubner & Co., 1879), p. 50.

[25] Govt. of Assam, *The Assam Land Revenue Manual*. Vol I. (Shillong: Assam Govt. Press, 1946) p. vii; Keya Dasgupta, 'Plantation Economy and Land Tenure System in Brahmaputra Valley, 1839-1914', *Economic & Political Weekly*. Vol. 18, No. 29 (Jul. 16, 1983), p. 1290.

[26] David R. Montgomery, *Dirt: The Erosion of Civilizations* (Berkeley and Los Angeles, California: University of California Press, 2007), pp. 94, 96.

[27] B. H. Baden Powell, *The Land Systems of British India*. Volume III (New Delhi: Low Price Publications, 1892), pp. 410-415; A. C. Sinha, *Beyond The Trees, Tigers And Tribes: Historical Sociology of the Eastern Himalayan Forests* (New Delhi: Har-Anand Publications, 1993), p. 44.

estimation of area that came to be termed wastelands is a tough estimate to make, yet some sources opine that more than one-half of the extent of Assam's area, in the nineteenth century, could have been termed as wastelands.[28] John M'Cosh, a Company official, writing in 1837 noted that almost six-eighth or seven-eighth of the Assam province was "covered with a jungle of gigantic reeds, traversed only by the wild elephant or the buffalo."[29]

The Commissioner of Assam in the 1830s, Francis Jenkins, even before the feasibility of tea cultivation in Assam was firmly established, advocated for the investment of European capital on the wastelands of Assam.[30] Jenkins believed that colonization would guarantee efficient development of the "ignorant" and "demoralized" native people. He envisaged the influx of a class of European planters with adequate capital who would initiate production of sugarcane, indigo, tea and other such commercial crops in the vast wastelands of Assam.[31] Later, realizing the potential of Assam in producing tea, the EIC Government wasted no time in legislating land grants in favour of prospective tea planters on these very wastelands that Jenkins referred to.[32] The period till 1870s thus witnessed sweeping approvals to wasteland grant requests by prospective planters in both the Brahmaputra as well as in the Surma Valley. Major Verner, who had been in charge of Cachar from the 1850s can be quoted in this regard, when he replied to a query by a prospective planter, "...you can obtain any

[28] Robinson, *A Descriptive Account of Assam*, p. 217; Dasgupta, 'Plantation Economy and Land Tenure System in Brahmaputra Valley, 1839-1914', pp. 1280-1290.

[29] John M'Cosh, *Topography of Assam* (Calcutta: Bengal Military Orphan Press, 1837), p. 13.

[30] Amalendu Guha, *Planter-Raj to Swaraj Freedom Struggle and Electoral Politics in Assam 1826-1947* (New Delhi: Indian Council of Historical Research, 1977), p. 12.

[31] Ibid.

[32] Rana Pratap Behal, *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam* (Delhi: Tulika Books, 2014), p. 30; For a more detailed discussion on the process of the making of these rules, refer to Arnab Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India* (Cambridge: University of Cambridge Press. 2018), pp. 136-142.

quantity of land in Cachar that you may require, fit and suitable either for the cultivation of tea, cotton, rice, sugarcane, mustard seed and ...indigo."[33]

That ideological sanctions of the colonisers played a role in perceiving nature as an object to tame and colonial subjects as lesser beings who would benefit through their rule, are quite evident from the above discussion. The following section shows how legislations facilitating the establishment of plantations as well as the practical methods of establishing a "tea garden" were manifestations of these very ideologies.

On Entitlement, Disruptions and Rivalry

On 6 March 1838, the first Wasteland Rule, relating only to Assam Proper[34], was framed to make wastelands of Assam available primarily for tea cultivation on attractive terms. Under this rule, it was made mandatory for land grants to be of at least 100 acres and not exceeding 10,000 acres.[35] A revised set of rules were introduced in 1854, commonly known as the Old Assam Rules, that provided 99 years lease on more liberal terms when it was realized that the 1838 Rules were proving to be inadequate in attracting European planters.[36] The minimum land to be applied for under this rule increased to 500 acres which was subsequently reduced to 200 acres and in special cases, 100 acres.[37] These rules were extended to Sylhet and Cachar in the year 1856. In 1861, again, these rules were superseded by the fee simple rules which granted freehold tenure on such lands issued by Lord Canning, to be followed by thirty

[33] Letter to R. Houston, Esq. from Major Verner, dated 4th September, 1885 quoted in W.H.S. Wood, 'Tea in Cachar', *The Assam Review*. Vol I. No. 8. (September 1928), p. 78.

[34] Assam initially stood for "Assam Proper" which constituted the Ahom territories and later the entire Brahmaputra Valley, essentially comprising erstwhile Kamrup, Nagaon, Darrang, Sibsagar and Lakhimpur. -Guha, *Planter-Raj to Swaraj Freedom Struggle and Electoral Politics in Assam 1826-1947*, pp. 28-29.

[35] Govt. of Assam, *The Assam Land Revenue Manual*, p. iv.

[36] Guha, *Planter-Raj to Swaraj Freedom Struggle and Electoral Politics in Assam 1826-1947.*

[37] Govt. of Assam, *The Assam Land Revenue Manual*, p. v.

year lease rules in 1876.[38] The result of these favourable legislations was a stimulation towards land rush in the entire Assam province. Statistically speaking, about 7,00,000 acres of land was settled with tea planters in Assam by 1870-71 which roughly constituted about 3.6 percent of the total area of the province.[39] However the actual area under tea was merely 56,000 acres, which constituted only about 8 per cent of the total land under the planters.[40] These statistics however differed from account to account, for instance Dietrich Brandis, the Inspector General of Forest in India, held that in 1878, the total acres under the ownership of tea planers was 5,87,409, out of which 1,47,840 acres were under actual cultivation.[41] In the Surma Valley, tea cultivation began in the 1850s and with around 12 operational tea gardens in Cachar, the actual area under tea was around 3000 acres in 1856-57.[42] By 1872, the total area under tea planters, in the Surma valley districts was around 1,61,000 acres.[43] And towards the end of the century, in 1897, approximately 2,82,887 acres of land in Cachar was taken up for tea.[44] Overall, except in the Goalpara district where almost half of the forested land was under zamindari estates, tea planters emerged as the chief proprietors of forests due to these Wasteland Grant provisions in the Assam province since the late nineteenth century.[45]

[38] Ibid., p. vii.

[39] The area of the Assam province was calculated to be 30,000 square miles (approx.1,92,00,000 acres) by William Robinson, Inspector of Schools in 1841. Robinson, *A Descriptive Account of Assam*, p. 3.

[40] Guha, *Planter-Raj to Swaraj Freedom Struggle and Electoral Politics in Assam 1826-1947.*

[41] Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India*, p. 144.

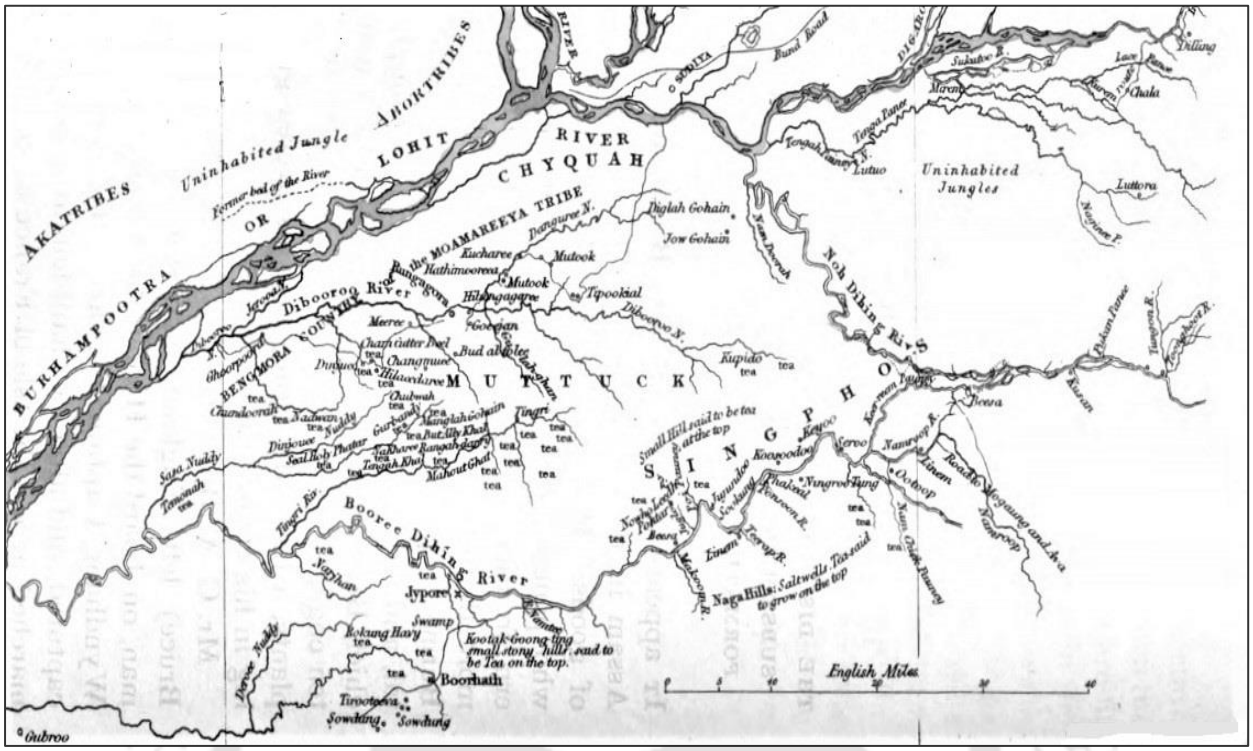
[42] Suparna Roy and R. K. De, 'Growth of Tea Cultivation in Cachar during Colonial Period', *Proceedings of the Indian History Congress* , Vol. 65 (2004), p. 506; Suparna Roy, 'Historical Review of Growth of Tea Industries in India: A Study of Assam Tea', *International Proceedings of Economics Development and Research*. Vol.5 (2011), p. V1-168.

[43] Girban Biswas, 'A Tale of Two Leaves and a Bud (A Case Study of the Beginning of Tea Industry in Cachar)', *Proceedings of the Indian History Congress* , Vol. 66 (2005-2006), pp. 586-587.

[44] Roy and De, 'Growth of Tea Cultivation in Cachar during Colonial Period', p. 509.

[45] Rajib Handique, 'Colonial Wasteland Gants and their Impact on the Ecology and Society of Assam', *Proceedings of the India History Congress*, Vol. 70 (2009-2010), p. 736.

Map 3: Map of Part of Upper Assam Showing the Tea Districts



Source: *Assam: Sketch of the History, Soil, and Productions with the Discovery of the Tea-Plant, and of the Countries Adjoining Assam* (London: Smith, Elder and Co., 1839), opposite pg. 21.

By the beginning of the 20th century, tea estate lands fell into two broad categories- first, lands held on decennial *patta* or land leased for special cultivation at a bigha rate of 12 annas (16 annas = 1 rupee) in Lakhimpur, Sibsagar and the Tezpur division of Darrang, 10 annas in Nowgong and 9 annas in Kamrup and in the Mangaldai subdivision of Darrang. Second, lands held under the Leasehold Rules of 1876 which granted perpetual lease with very low assessment rates for the first thirty years.[46] The former were liable to re-assessment in the course of resettlement of the districts. And the latter were exempt from re-assessment until the expiry of the 30 years' term. Interestingly, the wasteland legislations required that once land grants were made, they had to be cleared of all vegetation within a stipulated time frame, admittedly to promote the reclamation of unproductive lands. Although not all lands were cleared as per the provisions, yet assessments and surveys were conducted to keep the

[46] *Report on the Administration of the Province of Assam for the Year 1877* (Shillong: Secretariat Press, 1878), p. 5.

planters on track and in many instances the lands were resumed from the planters when clearances were not made within the allotted time.[47]

In addition to the wasteland legislations, through the Land Revenue Regulation of 1886 the British government tried to convert the land titles of the Assamese peasants from annual to decennial leases mainly to limit the shifting cultivators and hunter gatherers' access to the cultivable lands and forest resources in Assam.[48] Although, this transition was not enthusiastically accepted by the peasants, yet in the early decades of the twentieth century, the arrival of East Bengali cultivators into the province marked a change in land relations.[49] In an interesting conversation between the then Chief Commissioner of Assam in the 1890s and the GOI, where the Chief Commissioner was pushing for a colonisation scheme of the province under zamindars, a scheme even endorsed by many local interests including the Jorhat Sarbojonik Sabha, the response of the GOI dated January 26th 1899 clearly shows how the highly profitable tea plantations were favoured over the zamindari system:

> …The GOI … are inclined to believe that indirectly the tea industry is already doing, and ultimately will do, much more in the course of the next ten years to colonise Assam than any capitalists who may be attracted under the proposed colonisations scheme….Looking at the present circumstances of the province, the tea industry would seem to be the natural training ground for immigrants. They are probably better looked after and protected against the climate on a tea garden than they would be on a zemindari grant.[50]

[47] Grant of Certain Concession to Purchaser of Waste Land Grant. *Bengal Government Papers*. (1867) Sl. No. 1-25. File No. 384. ASA; Powell, *The Land Systems of British India*, p. 412; Survey and Demarcation of Tea Garden Lands granted in Cachar. *Board of Revenue Papers*. 1870. File No. 123. Sl. No. 1-8. ASA; Correspondence regarding Resumption of Wasteland Grants in Bengal. *Board of Revenue Papers*. (1872-73) File No. 22-134. Sl. No. 1-2. ASA.

[48] Sanjib Barua, 'Clash of Resource Use Regimes in Colonial Assam: A Nineteenth-century Puzzle Revisited', *The Journal of Peasant Studies*. Vol 28, No. 3 (2001), pp. 122-123.

[49] Ibid., pp. 116-117; Amalendu Guha, *Medieval and Early Colonial Assam: Society, Polity, Economy* (Calcutta: Centre for Studies in Social Sciences, 1991).

[50] Quoted in W. R. Grawthrop, *The Story of the Assam Railways and Trading Company Limited, 1881-1951* (London: Harley Pub. Co. for the Assam Railways and Trading Co., 1951), p. 59.

That tea played a major part in the colonization efforts in Assam, complete with the inflow of capital and an indentured labour population that emigrated from different parts of the country operating under the watchful eyes of the "paternalistic" oppressor, is evident from the above excerpt.

Such changes in the land use can be better envisioned through the following table which shows the increasing area that was coming under tea plantations in the Assam valley over the colonial period.

Table 1: Acreage under Tea in Assam Valley (in 1000 acres)

	Lakhimpur		**Sibsagar**		**Darrang**		**Assam Valley**	
Year	Total area	Operational area	Total area	Operational area	Total area	Operational area	Total area	Operational area
1888	129	32	221	47.4	104	20	536	117
1890	122	36	222	54.9	101	21	529	131
1895	188	45	230	63.3	93	29	579	154
1901	192	69	245	79.3	138	40	642	205
1905	219	71	234	78	101	42	620	207
1910	203	72	246	83	136	43	654	215
1915	246	81	284	92	167	48	765	238
1920	292	91	316	99	212	57	740	266
1925	322	96	324	98	222	57	939	271
1930	363	105	343	100	250	62	1039	285
1935	363	109	359	101	236	61		
1940	361	110	368	105	234	60	1037	292
1945	375	113	337	104	237	61	1030	299
1947	377	113	364	105	237	61	1056	300

Source: R. P. Behal, *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam*, (Delhi: Tulika Books, 2014), p: 339.

As evident from the above table (Table 1), there was a steady increase in the area of land acquired for tea since the late 19th century till the end of the colonial rule. Now to understand the changes in the patterns of land use in Assam during the course of the colonial period, in a

broader sense, we can refer to the following table (Table 2). These statistics help us locate the plantations within the larger context of the province and its changing landscape.

Table 2: Land Use in Assam State, 1870-1970

Land Use in Assam State, 1870-1970 (in thousand acres)						
Years:	1870	1890	1910	1930	1950	1970
Arable Percentage of Total Area	2445.55 12.60%	3283.46 16.90%	3573.07 18.40%	4967.7 25.60%	5860.47 30.20%	5953.38 30.70%
Forest/Woods Percentage of Total Area	5535.29 28.50%	5117.94 26.40%	4897.03 25.20%	4275.82 22.00%	3877.99 20.00%	3754.68 19.40%
Interrupted Woods Percentage of Total Area	1688.19 8.70%	1632.34 8.40%	1654.58 8.50%	1568.1 8.10%	1539.93 7.90%	1487.79 7.70%
Grasslands Percentage of Total Area	5587.92 28.80%	5327.72 27.50%	5253.84 27.10%	4780.4 24.60%	4433.96 22.90%	4414.44 22.80%
Wetlands Percentage of Total Area	2295.31 11.80%	2193.26 11.30%	2171.02 11.20%	1967.16 10.10%	1819.4 9.40%	1848.06 9.50%
Scrub/Waste Percentage of Total Area	502.35 2.60%	489.51 2.50%	483.82 2.50%	448.49 2.30%	436.38 2.30%	407.22 2.10%
Total Area	19396.36	19396.36	19396.36	19396.36	19396.36	19396.36

Source: J. F. Richards and J. Hagen, 'A Century of Rural Expansion in Assam, 1870-1970', *Itinerario*. Vol. 11, Issue 1 (March, 1987), p. 196.

From table 2, we see that the category of forests/woods had witnessed the most reduction between the years 1870 till the end of colonialism, with almost a nine percent decrease and the category of arable lands witnessed the most increase, with more than twelve percent increase from 1870 to 1930. These data highlights the trend of increasing pressure on the natural resources of Assam during the period under survey. Now, reading both the tables

(Tables 1 and 2) together, we can make some preliminary assumptions. The steady increase in land under tea in Table 1 and the steady decline in the forest areas in the province in Table 2 seems to show that at least some portion of the decline of the forest cover can prima facie be attributed to the expanding tea gardens.

Between the period of 1870 and 1970, about one-fifth of Assam's total geographical area was converted from natural vegetation to agriculture and human settlement.[51] By the twentieth century with rising competition to acquire lands for ordinary peasant cultivation, provisions of Section I of the Settlement Rules under the Assam Land and Revenue Regulation (which applied to special cultivation and granted 30 years leases to tea and other special cultivation) were increasingly coming under question. For the same reason, this section was discontinued in the Surma Valley; and by 1913, a similar condition of demand for land was seen in many areas of the Assam Valley. This led to a contemplation regarding the withdrawal of this section in the Assam valley as well.[52] However, the Assam Branch of the ITA maintained that in certain areas in Assam Valley there were still tracts of land that were eligible for settlement under the section as they were not likely to be taken up for ordinary cultivation in the near future. With sufficient political influence, the planters' appeal eventually did convince the government and the section was retained till the early decades of the twentieth century in certain regions of Assam.[53]

These land acquisitions, facilitated by the highly attractive wasteland grants made available by the Government led to a change from the earlier state of affairs, an in-depth analysis of which could help deepen our understanding of its ramifications. At this point, many important questions arise- What might have been the impact of such land acquisitions and

[51] Arupyoti Saikia, 'Mosquitoes, Malaria, and Malnutrition: The Making of the Assam Tea Plantations', in Asian Environments: Connections across Borders, Landscapes, and Times, *RCC Perspectives*, No. 3, (2014), p.72.

[52] *Detailed Report of the General Committee of the Indian Tea Association for the year 1914* (Calcutta, 1915), pp. 21-22.

[53] Ibid.

landscape alteration on the neighbouring local population? Was land, previously tilled by the local people seized in these pursuits? How did the tea plantations alter the relationship of the local population with their environment? We strive to address these queries in the following paragraphs.

Disruptions

In order to perceive the transformations that followed the acquisition of these wastelands of Assam by the tea planters, we may briefly look at the pre-colonial relationship of the local population with the land and forests. During the Ahom rule (1228-1826) in Assam, individual property rights, except that of the homestead were non-existent with theoretically all land belonging to the king.[54] Except in special cases, paddy lands were almost invariably seen as communal lands and people enjoyed free access to the products of unoccupied lands such as fuel wood, building materials, etc. Grazing and temporary cultivation privileges too were granted on such lands.[55] However, the changing relationship of the local inhabitants with the forested "wastelands" in Assam comes to light in the following extract from a letter in 1857 addressed to W.J. Allen, Officiating Member of the Board of Revenue by Captain Steward-

> Wastelands for the cultivation of tea have been granted at far more liberal rates and for a longer period than those for rice. These lands for the most part are dense forest, growing upon ranges of low hills which here and there intersect the country. Being unadapted for most kinds of native cultivation it would be thought that the inhabitants would view their settlement, even at such low rates, without jealousy; such is not the case. These lands have, in perpetuity, been in use by the neighbourhood surrounding them for the purpose of cutting timber wherewith to build their houses, bamboo, firewood, etc.,- all of which articles were obtainable for the mere labour of cutting and carrying them away. Having now become private property they are no longer amenable to these purposes, and hence some

[54] Amalendu Guha, 'Land Rights and Social Classes', in *Medieval and Early Colonial Assam*. (Calcutta: Centre for Studies in Social Sciences, 1991), p. 44.

[55] Ibid.

> little discontent is evinced by the inhabitants immediately bordering upon them, but nothing to speak of.[56]

Although the letter sought to dismiss any discontent of the local inhabitants as insignificant, some important revelations regarding the relationship of the local people with their lands and forests are evident. As soon as the previously accessible wastelands were fenced off as private property, the local population were not only deprived from the use of the resources of these lands but could also be legally convicted for trespassing. Therefore, with the flow of capital into tea in Assam, legality too followed closely to cement the rights of the planters over the natural resources in these lands.

An official report of 1884 claimed that except in Sylhet there was no reason to believe that tea cultivation could interfere with the existence of the surrounding villagers. However, this report hinted at the fact that with a rising population density, contestations and grievances would inevitably increase. A junior official from Karimganj reported how "The amount of land available for cultivation by *ryots* in the south of this sub division has been seriously trenched on by tea garden extension on *bil* lands."[57] Instances such as opening up of new roads for tea gardens by encroaching local proprietors' lands, garden managers being attacked by neighbouring villagers for issues pertaining to land etc. were not uncommon even in the late nineteenth century.[58] This issue is also discernible in a memorial to the Viceroy of India in 1886 by G. Bezbaroa, president of the *Hitasadhini Sabha*, a local group in Golaghat Assam. He, on behalf of the Sabha, claimed that the local Assam *ryots* were deprived of age old privileges of freely using forest products as forested lands were increasingly being

[56] Letter from Captain Steward to W.J. Allen, Officiating Member of the Board of Revenue, quoted in W.H.S. Wood, 'Tea in Cachar', *The Assam Review*, Volume I, No. 9. (November, 1928), pp. 149-50.

[57] *Report on Labour Immigration into Assam for the year 1884* (Shillong: The Assam Secretariat Press, 1885), p. 4.

[58] Ibid.

reserved for colonial exploits. Bezbaroa quoted the Lt. Governor of Bengal's observations on the New Wasteland Rules-

> …so long as Government *reserved for the ryots their fields, their grazing ground and wood and water and ample space for the extension of their cultivation*, the people of Assam, Cachar and Darjeeling would be greatly benefitted and *could not be injured by the extension of tea cultivation* in their neighbourhood.[59] (italics mine)

In a similar incident in the Lakhimpur district, the settlement officer G. Milne, while rejecting a plea by a tea company to extend their garden into an area already inhabited by the *Matak* community, sheds light into their plight, as the same people had to relocate even previously owing to the opening up of a plantation.[60] Milne further elaborated that the close proximity to the tea labourers was not favourable to the *Mataks* as well which further made the matter of displacement of these people easier for the garden administrators. He wrote,

> I should explain that these Mataks belong to the Moamaria sect...and observe very strict rules regarding their intercourse with persons of other castes...They have accordingly the greatest aversion to the promiscuous ways of the coolie settler. It is a well known fact that a coolie settlement pushed well up to the cultivation of Matak village is usually enough to dispose them to evacuate their village and cultivation, and tea gardens have not infrequently taken advantage of this to obtain the high land they desire, paying of course a small compensation for pattas.[61]

Such land appropriations also disrupted the hunting and gathering economies of tribal populations that inhabited the hilly areas bordering Assam and we find many recorded instances of raids and conflicts between the planters and the bordering tribes like the Lushais

[59] Quoted in Petition of the Hitasadhini Sabha of Golaghat, Assam, appealing against the Rules and Regulations in Force in Assam under the Forest Act. Department: Revenue and Agriculture Department. Branch: Revenue. Proceedings-Nos. 60 to 63. File No. 147. Serial Nos. 1,2,3 & 4. (August 1886). NAI.

[60] Settlement of Land with Manager of Dumduma Tea Co. on Special Terms for settling Coolies Lakhimpur. Revenue B. (July 1910) 116-790-791 (5-158B): 17. ASA.

[61] Ibid.

and Nagas.[62] This was also affirmed by H. Hopkinson, Commissioner of Assam in the 1860s, when he said that "it often happens that the best tea lands are found in situations- the most exposed to attacks from frontier tribes."[63] In the hilly regions, apart from *jhum* cultivation, hunting, fishing and foraging for edible roots and greens supplemented the hill economy as grain cultivation was not sufficient. Thus their dependence on the forests was quite significant along with the additional importance of free and extensive forest resources like timber, bamboo, reeds, canes and thatching grass.[64] An official report in 1871 stated,

> Within the last few months *there have been disputes and brawls between planters and members of tribes* on our north-eastern frontier. The planter considers (and he has ground for his opinion) that he has an indefeasible right to his garden; the chief of the nearest tribe, on the other hand, believes himself to be the lord of the manor, because his ancestors have for generations roamed or hunted, or levied dues, or occasionally turned up a few acres, or have been buried in that part of the country side.[65] (italics mine)

This implies that even though tea planters did not venture into the heart of the hill territories but they did, at times, tread a little too far which intimidated the tribes. Admittedly, there were cases of prospective planters encroaching on lands belonging to the tribes. At times, planters also secured lands from the tribes which troubled the colonial administrators since recognising such grants would justify the tribes' authority over such lands, thereby invariably

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[62] Attack made by a Party of Lushais on the Jhalnacherra Tea Gardens in Cachar. *Government of Bengal Papers*-6. (1871) File No. 267-538. ASA; Amongst other sources that talk about such raids, the journal *The Assam Review and Tea News* often carried such news and accounts.

[63] Correspondence between Col H Hopkinson, Commissioner of Assam, and T B Lane, Esquire, Secretary to the Board of Revenue, Lower Provinces- No. 427 A, dated the 19th November 1866. Department-Home, Branch- Judicial. February 1867. Part A. File No. Progs., Nos. 19-20, February 1867. NAI.

[64] Amalendu Guha, 'The Geography behind the History', in *Medieval and Early Colonial Assam* (Calcutta: Centre for Studies in Social Sciences, 1991), p. 6; Tiplut Nongbri, 'Forest Policy in North-East India', *Indian Anthropologist*, Vol. 29, No. 2 (December, 1999), p. 9.

[65] Sale of a Plot known as Konapara in Cachar and Correspondences regarding Waste Land Rules. *Government of Bengal. Papers*-22. (1871-73) File No. 103-199. ASA.

dismissing such claims.[66] It has been argued that in response to such indiscriminate expansion of European planters into new lands, the Inner Line was introduced in 1873 to preserve cordial political relationship between the British and the hill tribes.[67] However, instances of settling foothills with non-tribal people, constructing railway lines through thick forests in these areas, extending plains laws and even merging lands belonging to the hill tribes into plains districts in order to encourage expansion of the tea industry invited sporadic aggravation from the hill tribes from time to time.[68]

Plantations also often disrupted access to markets, grazing grounds and intra-village routes. When large plots of lands were enclosed for plantations, communication links within villages were disrupted and the general public were often denied access to the paths that fell within such enclosures.[69] Weekly markets and *haats* too sometimes came within the boundaries of such lands enclosed for tea which gave the planters an opportunity to wield their control over their functioning.[70] The neighbouring population's reliance on forest resources such as bamboos for building purposes or to fence one's crops, thatch and *Tokopat* (palm leaves) for roofing, timber for construction of boats and oars by the fishermen community, timber to build carts and so on also came to a halt when plantations restricted large areas of land.[71] Moreover, due to the increasing pressure on land, pasturelands began to decline and since large areas of land came under private ownership, when cattle strayed into plantation

[66] Ibid.; Boundary Dispute between Sylhet and Jyntea Hills, Dacca Commissioner's File. (1874). File No. 110. Sl. Nos. 1-20. ASA; Correspondence regarding Government Officials speculating in Assam. *Government of Bengal Papers*-9. (1872-73) File No. 27-32. ASA.

[67] Sanjib Baruah, 'Territoriality, Indigeneity and Rights in the North-East India', *Economic and Political Weekly*, Vol. 43, No. 12/13 (Mar. 22 - Apr. 4, 2008), p.17; Sanjib Baruah, 'Policy in the North-East: Achievements and Dangers', *Economic and Political Weekly*, Vol. 24, No. 37 (Sep. 16, 1989), p. 2088.

[68] Nongbri, 'Forest Policy in North-East India', pp.14-15.

[69] Barua, 'Clash of Resource Use Regimes in Colonial Assam: A Nineteenth-century Puzzle Revisited', p. 119.

[70] Ibid.

[71] C. G. M. Mackarness, *Working Plan for Eleven Forest Reserves in the Lakhimpur and Sibsagar Divisions, Eastern Circle, Assam 1931-32 to 1940-41* (Shillong: Assam Government Press, 1932), p. 10.

property, it came under the Cattle Trespass Act, 1871 which enabled planters to exact fines from their owners. This proved to be a frequent subject of dispute between the plantation management and the neighbouring villagers.[72] There were also instances of plantations appropriating and encroaching on grazing lands which although came to the notice of administrative officers, were more often than not excused by issuing a *patta* on the encroached land.[73]

The land problem in Assam further intensified with the plantation-sponsored immigrations into the tea plantations. Many ex-tea garden labourers, whose contracts expired, began settling down in the wastelands as independent peasants. It is important to note here that the wastelands of Assam, since the early twentieth century, had emerged as highly contested pieces of land among the local Assamese population.[74] Migration from the nearby East Bengal region led to an increasing pressure on the cultivable lands of Assam since the early twentieth century giving rise to dissatisfaction among the local population.[75] The increase in the non-indigenous population in Assam seemed to have increased from less than 1 lakh in 1872 to around 5-6 lakhs in 1901 and by 1915-16, land occupied by them was around 1,30,774 hectares (3,23,700 acres).[76] Interestingly, pressure from the tea planters, located

[72] *Report on Labour Immigration into Assam for the year 1885*, p. 2; *Report on Labour Immigration into Assam for the year 1886*, p. 7.

[73] Exclusion of Land from the Grazing Reserve in Village Puranimatigaon, Jorhat, for Settlement with the Kamarband Tea Garden Sibsagar. Revenue Department, Revenue Branch. (1929), XVII-33. ASA.

[74] Arupjyoti Saikia, *A Century of Protests: Peasant Politics in Assam since 1900* (New Delhi: Routledge, 2014), p. 27.

[75] Ibid.; Sarah Hilaly, 'Imagining Colonial Assam: The Figuring of "Wastelands" in Its Making', *Economic and Political Weekly*. Vol LI, No. 3. (January 16, 2016).

[76] Suryasikha Pathak, 'Forests, Fields and Pasture: Environmental and Revenue Debates of Land Usuage in Colonial Assam in 1910-20', in Sajal Nag (ed.) *Playing with Nature: History and Politics of Environment in North-East India* (Routledge: Oxon, New York, 2018).

primarily in the eastern part of Assam, ensured that the wastelands in eastern Assam did not enter such contestations.[77]

Apart from humans, the wildlife too witnessed reordering with the introduction of tea plantations. Planter John Weatherstone discussing the pioneer tea planters of the nineteenth century wrote- "Jungle clearance would always result in young animals of different species becoming separated from their parents or abandoned, and many would find their way into the cooking pot, or end up as pets."[78] Forest clearance for tea plantations as well as allied activities like the construction of railways that facilitated the colonial enterprises in Assam contributed to destruction of forests, along with disrupting wildlife movements and habitats.[79] An instance of the Hollongapar forest, near Mariani in eastern Assam represents the plight of wildlife in different parts of the province. With the introduction of the tea bushes during the colonial period, the Hollongapar forest was gradually cleared from one side to accommodate the new commercially attractive tea gardens which was home to the hoolock gibbons. The large populations of gibbons living in the eastern Assam districts were greatly affected through these forest clearances be it for tea gardens, for establishing railway lines or due to greater human invasions in the adjacent remaining forests.[80] Forest clearances led to increasing appearances of wild animals among human habitats. Planters, plantation labourers, neighboring villagers and domestic cattle and live stocks often fell prey to tigers, leopards and wolves. A tea planter, Weatherstone, notes, "During the 1860s, at the time when much forest land was being opened out to tea, the human mortality rate in all India ranged from

[77] Ibid.

[78] Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*, p. 85.

[79] E.G. Foley, 'The Reminiscences of a Pioneer Planter', *The Assam Review*. Volume I, No. I. (March 1, 1928), p. 19.

[80] Narayan Sharma, 'Over One Hundred Years of Solitude: Ecological History of the Primates, People and Forests of the Hollongapar Gibbon Sanctuary, Upper Brahmaputra Valley, Assam', Presented at the *National Seminar on Cultural Ecology of the Brahmaputra*. Indian Institute of Technology Guwahati (8-9 March, 2015); Anwaruddin Choudhury, 'Ecology of the Hoolock Gibbon (Hylobates hoolock), a Lesser Ape in the Tropical Forests of North-Eastern India', *Journal of Tropical Ecology* , Vol. 7, No. 1 (Feb., 1991), p. 149.

1300 to 2000 victims each year, all from tigers."[81] Poisonous snakes like cobra, banded krait, tic polonga (*Daboia russelii*), bamboo snake too posed a threat, especially to the plantation labourers during garden work.[82]

Hunting emerged as the tea planters' main form of leisure. An account of a twentieth century Assam tea planter notes, "That day our sixteen guns got four hundred and fifty birds (pigeons), which was quite good, as we had some pretty bad shots."[83] The extent of hunting expeditions is quite apparent from the above instance when a single day's game was four hundred and fifty pigeons. Planter's accounts suggest that, at times, even government officials, including forest officials, sought the help of planters to manage wild animals.[84] Big games included- Chevrotain, dappled mouse deer, buffalo, mithun, Indian bison, tiger, jungle leopard, patridge, florican, barking deer, and muntjac.[85] The variety of pets spotted in the planters' bungalows ranged from monkeys, young bears and wolves, deer, squirrels, hornbills, golden oriels, young leopard cubs, and tiger cubs. Leopards, tigers and bears were returned to the wild or sent to zoos as they proved to be impractical pets when they grew bigger posing danger to their human masters.[86] Moreover, elephants, bullocks and horses were commonly used in plantation works.[87] Elephants were especially useful in opening up new tea estates, primarily used in the task of shifting timber and also proved to be invaluable

[81] Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*, p. 75.

[82] Ibid., p. 76.

[83] A. R. Ramsden, *Assam Planter* (Guwahati, Delhi: Spectrum Publications, 2016), p. 31.

[84] Frank Nicholls, *Assam Shikari: A Tea Planter's Story of Hunting and High Adventure in the Jungles of North East India* (New Zealand: Tonson Publishing House, 1970), pp. 69-75.

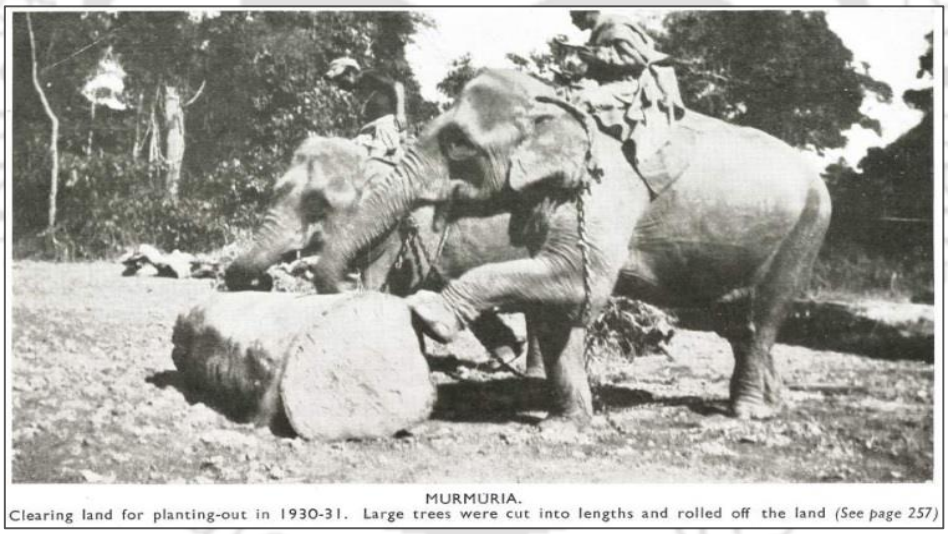
[85] Ramsden, *Assam Planter*, pp. 54-55.

[86] Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*, p. 85.

[87] F. T. R. Deas, *The Young Tea-Planter's Companion: A Practical Treatise on the Management of a Tea Garden in Assam*. (London: Swan Sonnenschein, Lowrey & Co., 1886), pp. 83-84.

on shikar expeditions of the planters.[88] Accounts penned by Assam tea planters never failed to mention elephants. For instance, a nineteenth century Assam tea planter, G. M. Barker, lamented about how seventy elephants that belonged to Assam planters were "worked to death" in a Naga expedition by the army while another early twentieth century planter, Frank Nicholls, frequently recounted his hunting adventures accompanied by his two elephants in his memoir.[89] Interestingly in a government conference held in Dibrugarh in 1917, E. L. Greenhough of the Assam Railways and Trading Company pointed to the difficulty of procuring elephants for timber work in Assam to which the Deputy Conservator of Lakhimpur replied that Assam elephants were very sought after by the large timber concerns of Burma and they bought Assam elephants for great prices making them scarce.[90]

Fig 2: Elephants clearing lands for tea plantations in 1930-31.



MURMURIA.
Clearing land for planting-out in 1930-31. Large trees were cut into lengths and rolled off the land *(See page 257)*

Source: H.A. Antrobus, *A History of the Jorehaut Tea Company Ltd. 1859-1946* (London: Tea and Rubber Mail, 1948), opposite page 256.

[88] Ramsden, *Assam Planter*, p. 77; George M. Barker, *A Tea Planter's Life in Assam* (Calcutta: Thacker, Spink &Co., 1884), pp. 204-211; Geetashree Singh, 'Colonising Elephant Hunting in Assam (1826-1947)', *Indian Historical Review* 47 (2) (2002), pp. 313-329.

[89] Nicholls, *Assam Shikari: A Tea Planter's Story of Hunting and High Adventure in the Jungles of North East India*, p. 50; Barker, *A Tea Planter's Life in Assam*, p. 205.

[90] Protection and Regeneration of Simul for the Development of Tea-box Industry in Assam. Department- Revenue. Branch-Revenue A. (Sept. 1917), No. 1-18. p. 2. ASA; Supply to the Director Acme Tea Chest co Ltd Flasgow of Information to the Areas in the Country likely to Yield Sufficient Timber for the Manufacture of Three Ply Tea Chest Enquiry by the Proprietor Tezpur Saw Miles Assam. Dept. Inspector General of Forest. Branch: General. 1917. File No. 16-24/8. NAI.

This section so far touched upon the transformations brought upon the landscape where forested regions were cleared and a modified environment emerged. Its effect on the local populations' right to commons and terms of usage and impact on the wildlife were primarily discussed. However, the planters were not alone in this pursuit of resource extraction; the forest department too began to demand their share of timber in the guise of conservation.

Rivalry

In understanding the legality of land acquisitions and forest resource utilization in the province, the crucial relationship and competition between the Forest Department and the tea planters cannot be ignored. As previously mentioned, conservancy of forest resources were not particularly paid heed to till the mid nineteenth century. With the initiation of the Forest Department in Assam in 1868, planters and foresters began to vie for the same resources in the province. However the planters began to emerge as the biggest customer of the timber sold by the Forest Department. Historian Richard Tucker had called the foresters and planters as "two of the most significant exotic species introduced into India from Europe. Like imported botanical species competing with indigenous flora, these two human groups became competitors with villagers for access to the land."[91] A perusal of Progress Reports of Forest Administration reflect the race between the two for forest resources in the province, for example a *Progress Report of Forest Administration of Assam* in 1884-85 notes, "Application for waste land grants for tea cultivation had been made with an equal disregard for the preservation of forests, all of which were good reasons for their speedy selection, demarcation, and gazetting, before survey."[92] By the above claim, we understand that tea

[91] Richard Tucker, 'The Depletion of India's Forests under British Imperialism: Planters, Foresters, and Peasants in Assam and Kerala', in Worster, Donald (ed.) *The Ends of the Earth: Perspectives on Modern Environmental History* (Cambridge: Cambridge University Press, 1988), p. 120.

[92] Gustav Mann, *Progress Report of Forest Administration in the Province of Assam for the year 1884-85* (Shillong: Assam Secretariat Press, 1885), p. 6.

planters were indeed seen as a competition as it led the Forest Department to reserve lands even without surveying in the fear that the planters would grab them. In 1877, in an attempt to curb the access of forest lands by tea planters, the *jhumming* population and others, the Chief Commissioner of Assam issued a circular which required district officers to distinguish between "superior" and "inferior" forests in Assam.[93] This was to temporarily provide forest conservancy whereby deterioration of the "superior" forests was to be prevented and cultivation was to be allowed on the "inferior" tracts. Leases of forest lands to tea planters for cultivation as well as permission to collect firewood and manufacture charcoal were to be allowed only in the inferior forests.[94]

For acquiring wastelands[95], planters had to pay the assessed value of timber for the land. The value of timber housed in these wastelands was estimated by the Forest Department and they extracted the revenue from the planters. According to the rules instituted in 1887, the rates of timber on wasteland grants were as follows: first class timber from Rs. 12 to Rs. 20 per acre, second class timber from Rs. 4 to Rs. 10 per acre and third class timber from Re. 1 to Rs. 3 per acre.[96] However, these rates were assumed to be quite low according to Berthold Ribbentrop, then Inspector General of Forests, who foresaw the possibility of people acquiring such wastelands merely for the timber and demanded a re-drafting of the rule in 1888. This invoked sharp objections in the planting community as well as among revenue administrators who believed that it was contradictory to impose, on the one hand low rates of revenue for tea plantation to encourage cultivation but at the same time impose high rates of timber valuation which was believed to produce a prohibitive effect. Ribbentrop's

[93] Ibid., p. 31.

[94] Ibid.

[95] Usually the lands under the 30 years lease.

[96] Proposed Amendments to the Rules Relating to Unclassed State Forests and the Valuation of Timber on Wastelands Applied for Special Cultivation. Department-Revenue, Branch- Revenue A. 1897. Progs., April 1897, Nos. 89-98. p. 4. ASA.

suggestions were still adopted in 1889.[97] This seemed to garner opposition from the planting community who claimed to have been demanded exorbitant rates for the timber that they did not even want in the first place. For instance, reportedly in one case, Rs. 70,000 was assessed as the timber valuation on a block of a few hundred acres of land in the late 19th century.[98] Although the rules were not immediately revoked, yet the planters were given an opportunity to apply for a reduction in these valuations. Such instances give us a glimpse of the kind of interaction that prevailed and the disputes that arose between these two groups who harboured similar pursuits of resource extraction in Assam.

The following excerpt in the early twentieth century shows the inherent competition and mistrust between planters and forest officials in the Assam province-

> There are vast areas of land "reserved," upon which there is not a stick of valuable timber, and even if there was, it is absolutely inaccessible. These areas might be advantageously opened out for tea or other products. Thus opening up the country and rendering forest produce accessible, but no the Department "glues" on to every inch of land it can and will do so till the crack of doom unless some strong minded administrator takes the matter in hand.[99]

The planters complained regarding the reservation of potential tea growing tracts by the Forest Department for no apparent reason (as they claimed that no useful timber grew on these areas); and the Department retorted back saying that "there is no community which has less cause to complain of the treatment it has received in the matter of grants of land."[100] Isolated reports about altercations between planters and forest guards were also not very

[97] Ibid.

[98] Ibid.

[99] Quoted in Disforestation of Lands Suitable for Tea Cultivation in the Cachar District. Revenue Department. Branch-Revenue A. (Oct 1913), Nos. 17-32. p. 1. ASA.

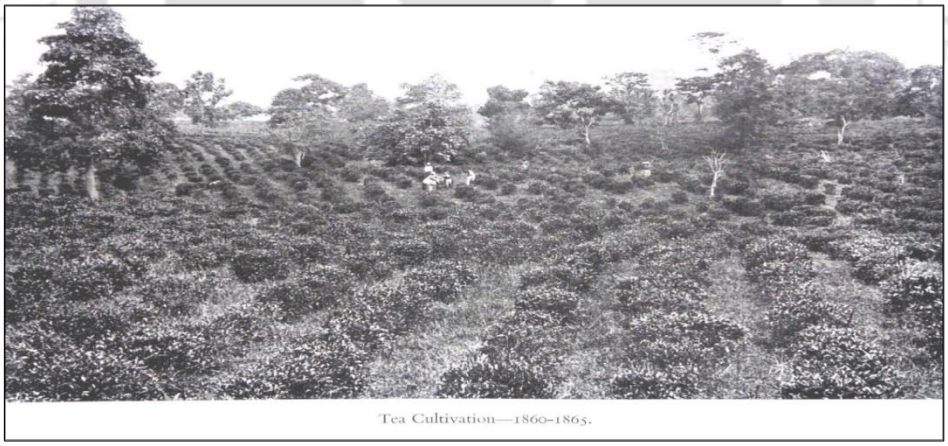
[100] Ibid.

rare.[101] There were also instances of planters applying to clear lands within forest reserves, sometimes to extend their tea cultivation, for ordinary cultivation of their garden labourers, grazing cattle, construction of tramway, and so on.[102] Questions were also raised regarding why wastelands within the grants were not fully planted with tea before the planters moved in pursuit of more land within forest reserves. Such discussions ensued following the claim made by ITA officials that no suitable lands for tea were left in the Surma Valley by the year 1912.[103]

Amidst such varying conditions of entitlement and rivalry, the tea industry, along with other colonial extraction projects, continued acquiring lands till the end of the colonial era, with the requirements for natural resources only rising with the passing of time as we shall see in later sections.

Making way for a "garden"

Fig 3: Tea Cultivation in the 1860s



Source: H.A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957), facing page 256.

[101] E. S. Carr, *Progress Report of Forest Administration in the Province of Assam for the year 1901-02* (Shillong: Assam Secretariat Press, 1902), p. 5.

[102] Disforestation of Two Blocks of Land in the Diju Valley Reserved Forest in Nowgong applied for by the Salona Tea Company. Department- Revenue, Branch- Revenue-A, (April 1902), Nos. 176-216, ASA.

[103] Disforestation of Lands Suitable for Tea Cultivation in the Cachar District. Revenue Department. Branch- Revenue A. (Oct 1913), Nos. 17-32. pp. 1-2. ASA.

The most sought after lands for cultivating tea, since the nineteenth century itself, were lands under dense forests thus aggravating the magnanimity of change to the landscape that came along with the establishment of tea plantations in the province. The rationale being that the soil under such forest lands provided the most favourable conditions for the growth of tea bushes, with years of accumulated vegetable mould providing essential nourishment to the newly planted tea seedlings and the friable loam providing an easy access to the tap roots in their search for support and moisture from the soil.[104] The large trees with their network of roots spreading to great areas made the soil porous and with the gradual decay of these roots after clearance, the organic constituents and nitrogen of these cleared lands mixed with the soil to make it available to the tea plant.[105] This placed forest covered lands at the top, followed by jungle or scrub lands, and grass lands were to be used when no better lands were available.[106] Colonial officials and prospective planters were almost unanimous in their belief that such lands led to higher produce of tea compared to the alluvial low-lying areas which were also prone to ravages of seasonal floods.[107] Slopes too were considered ideal in the earlier times as it was understood early on that the tea plant was adverse to stagnant water. Yet later this practice was discouraged as planting tea on steep slopes often brought all the soil and manures downhill during heavy rainfall in addition to being difficult for labourers to perform garden work and the planters to supervise.[108] Early pioneer planters and administrators in Cachar observed that tea was generally found flourishing in the wild on

[104] *The Tea Cyclopaedia: Articles on Tea, Tea Science, Blights, Soils and Manures, Cultivation, Buildings, Manufacture Etc., With Tea Statistics.* (London, 1882), pp. 68-69; M. Kelway Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture* (Calcutta: Law-Publishing Press, 1893), p. 55.

[105] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*.

[106] *The Tea Cyclopaedia*, p. 69.

[107] Saikia, 'Mosquitoes, Malaria, and Malnutrition: The Making of the Assam Tea Plantations', pp. 71–76; Saikia, *The Unquiet River*, pp. 304-306.

[108] *The Tea Cyclopaedia*, p. 120; Edward Money, *The Cultivation and Manufacture of Tea.* (London: Thacker & Co., 1878), p. 36; Samuel Baildon, *Tea in Assam* (Calcutta: W. Newman & Co., 1877), p. 11.

very low hill lands which were above inundation, "in a rich, rather reddish soil".[109] This fact highlighted the attraction of the highland forest areas that was prominent in the official policies that were framed between 1838 and 1860s for land grants to the tea planters.

Once a plot of land was leased for tea plantation, usually the first step was to survey its soil, aspect, slope, water supply and then mark specific areas for the various sites of the garden like roads, drainages, factory, housing and tea tracts.[110] In the early twentieth century, A. R. Ramsden, an Assam tea planter recounts how upon reaching his tea garden plot, which was just a solid mass of land covered with forests, he initiated operations with his only tools- a theodolite, a clinometer and a compass. With the help of the theodolite, he determined the highest elevation of the plot for the construction of the factory and his bungalow and then began the process of clearance.[111] Undulating forest lands were very favourable due to the availability of ample timber, higher elevation lands for constructing buildings, factories, nurseries, and good natural drainage.[112]

The unruly jungles of Assam inspired awe as well as caused great impediments in the path of the tea planters that arrived in Assam since the very beginning. Scarcity of labour to carry out this arduous task of clearing forests assumed a pre-dominant position in the early discussions on tea.[113] A nineteenth century European planter in Assam jotted down the following in his memoir,

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[109] W.H.S. Wood, 'Tea in Cachar', *The Assam Review*. Vol I. No. 8. (September 1928), p. 78.

[110] Govt. of India, *Report of the Plantation Inquiry Commission*. (Delhi, 1956), p. 59; *The Tea Cyclopaedia*, p. 69; Baildon, *Tea in Assam*, p. 21.

[111] Ramsden, *Assam Planter*, p. 64.

[112] Baildon, *Tea in Assam*, p. 13.

[113] Almost every nineteenth century account like those of Sir Percival Griffiths, H. A. Antrobus, George Barker and many others stressed this point, which eventually legitimized the large-scale migrations of labourers into the Assam tea gardens from other parts of India; Harold H. Mann, *The Early History of the Tea Industry in North-East India* (Calcutta, The Calcutta Gen Printing Co., 1918), p. 24; Baildon, *Tea in Assam*, p. 15.

> …we had best begin at the opening out of a garden, and cut down our jungle.....When the jungle has been cut down and disposed of, there is splendid virgin soil ready to the clearer's hand, and it only requires working to bring forth its richness. The rugged beauty of dense jungle, twisted and interlaced in a perfect network of trees, ferns, creepers, and undergrowth; the variable tones of colour in the leaves, everywhere different in size and shape, from the broad grey-green leaf of the plantain to the silk-like threads of the multitudinous tiny grasses- the impenetrable intricacies of this vast mass of foliage, and the wonderful secrets of animal life that it contains, make the jungle a mysterious cause for wonderment to the lover of nature in its wildest form.[114]

This poetic expression of the incredible diversity that these "junglee" lands housed, exhibited how not merely trees were uprooted in the process of clearance, but an entire ecosystem was replaced by this monoculture.

Fig 4: Clearing Timber for the Establishment of a Tea Estate (Murmuria estate in present day Jorhat district), Sometime in the First Decade of the Twentieth Century.

Source: H.A. Antrobus, *A History of the Jorehaut Tea Company Ltd. 1859-1946* (London: Tea and Rubber Mail, 1948), p. opposite 256.

In the first three years of establishing a tea plantation, removing timber, making the soil ready by hoeing and weeding, and constructing buildings were primarily undertaken.[115] Describing the sights and sounds of clearance in his new garden, Ramsden noted, "All day long the air resounded with the whang of axes, the sharper crack of dahs, the falling and crackling of

[114] Barker, *A Tea Planter's Life in Assam*, pp. 141-142.

[115] Baildon, *Tea in Assam*, p. 21.

jungle giants and the hoarse shouts of the Nagas telling their bhais to clear out of the way of a falling tree."[116] Generally, there were two methods of clearance that were carried out once a good tract was identified.[117] Notably, the earliest tea tracts in the province were established in areas that already consisted of the indigenous tea trees and only once these tracts were exhausted, jungle tracts containing little or no tea trees were taken up. Charles Bruce's method of establishing a "tea barrie" was to cut down trees as well as the undergrowth while sparing the tea trees that already existed in the area.[118] These tea trees were then pruned and the overhead canopy removed to allow sunlight to come in, letting new shoots to emerge from these pruned trees.[119] Subsequently, the gaps in between such pruned trees were filled by transplanting self-sown tea seedlings to establish a compact tea garden. Alternatively, another method of clearance in case of heavily forested regions was to cut down the entire jungle, including the wildly growing tea trees. The stumps of trees too were pulled out following which the land was hoed and all remaining roots and stones were removed.[120] However, in cases when trees were cut down and not uprooted, the remaining stumps at times began to rot in a few years and this facilitated a root fungus which eventually killed off tea bushes within a certain radius. In order to avoid this, planters often resorted to uprooting the trees, mostly by employing elephants which caused extreme pressure on the soil (the effects on soil shall be discussed in the next chapter).[121] And once these timbers dried, they were burned at the end of the rainy season, as an early planter remarked-

[116] Ramsden, *Assam Planter*, p. 67.

[117] Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*, p. 40.

[118] During the early years when the Company was doubtful regarding the feasibility of producing good quality tea in Assam, Charles Bruce took the task of growing and experimenting on establishing tea plantations.

[119] Antrobus, *A History of the Assam Company, 1839–1953*, p. 252.

[120] Claud Bald, *Indian Tea: Its Culture and Manufacture* (Calcutta: Thacker, Spink & Co., 1908), pp. 69-70; William H. Ukers, *All About Tea*. Vol I (New York: The Tea and Coffee Trade Journal Company, 1935), p. 387.

[121] Bald, *Indian Tea: Its Culture and Manufacture*, pp. 70-71.

> …and then on a windy, sunny day fire it in strips about 60 yards wide and the entire breadth of the clearing; collect all the charred debris and re-fire, everything movable being burnt. Grub up every stump by the roots and burn them. This may seem a useless piece of expense; but if the land is to be deep dug, the soil must be rid of the network of roots round every stump.[122]

Attesting to the desirability of burning the jungle, even in the *bheels* (peatlands) mostly found in Cachar and Sylhet tea gardens, M. K. Bamber, a chemist appointed by the tea enterprise in the late nineteenth century, too opined-

> By the burning of the jungle, when cut, a large quantity of mineral matter is given to the soil in the form of carbonates, which assist in neutralising, the acid humic matters contained therein, and rendering the soil fit for the growth of cultivated plants.[123]

And in a year new tea shoots began to emerge in these burnt lands, while shoots of all other trees and plants had to be constantly weeded out, and like the previous method, gaps were filled by self-sown tea seedlings.[124] Some planters, however, did not subscribe to the burning of tree trunks on the land that was used for planting tea as they believed that the heat from such fires contributed to the elimination of essential bacteria from the soil.[125]

Interestingly, another reason that emerged in favour of depleting the forest cover within the plantations was the debate surrounding the optimal amount of shade beneficial to tea. Some planters in the early days of tea planting in Assam believed that large trees as well as certain vegetable plants could lead to overshadowing the tea bushes as well as produce noxious effects.[126] Charles Bruce, in the early years of tea planting advocated the planting of young

[122] Sigma, 'Tea Cultivation' in *The Tea Cyclopaedia*, p. 79.

[123] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture* , p. 56.

[124] Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*, p. 40.

[125] Ramsden, *Assam Planter*, p. 70.

[126] John Sumner, *A Popular Treatise on Tea: Its Qualities and Effects*. (Birmingham: William Hodgetts, 1863), p. 17; Harold H. Mann *The Tea Soils of Assam and Tea Manuring* (Calcutta: W. Newman &Co., 1901), p.145

tea saplings in deep shade but he believed that mature tea fared better in the sun and as such yielded better quality tea compared to the watery liquor of tea grown in shade.[127]

Although shade was a debateable issue within the tea planting community, yet the benefits of shade trees planted at a certain interval in the garden eventually came to be recognized as an indispensable feature. Shade trees were planted in the tea estates to emulate the jungle environment in which they were originally found in Assam.[128] Therefore, at a time when deforestation of large tracts was taking place to facilitate the tea gardens, planting of some specific species of trees were encouraged within the gardens. These shade trees were of primarily the leguminous family as they assisted the tea plants in procuring necessary nutrients from the soil, in addition to providing slight shade to the tea bushes and increased soil fertility through the falling leaves and flowers of these trees.[129] Pre-dominantly the *Sau* or *Siris* (genus *Albizzia*) began to be planted which was first mentioned by Colonel Hannay but brought to the forefront by the experiments conducted under the behest of James Buckingham of Amgoorie tea estate in the 1880s.[130]

The history of scientific research on tea in the province has a fascinating connection with shade trees. Although investigations and correspondences were common to the tea industry since the beginning yet a push towards a collective effort to conduct research in tea was witnessed in 1884, which shall be discussed at length in the next chapter. A discussion

[127] C. A. Bruce, *An Account of the Manufacture of the Black Tea* (Calcutta: Bengal Military Orphan Press, 1838), pp. 10-13; Money, *The Cultivation and Manufacture of Tea*, p. 74.

[128] N. Ahmed, 'Shade Management' in B.K. Goswami (eds.) *Tea Field Management* (Jorhat, Tea Research Association, 2011), p. 48.

[129] Anand Chandra Dutta, 'Shade Trees, Green Crop and Crop Plants in the Tea Estates of North East India', *Memorandum 30*. (Tea Research Institute. Tocklai Experimental Station Jorhat, 1977); Mann *The Tea Soils of Assam and Tea Manuring*, pp. 81-82; Ukers, *All About Tea*, p. 389.

[130] Bald, *Indian Tea: Its Culture and Manufacture*, p. 106; Percival Joseph Griffiths, *The History of the Indian Tea Industry* (London: Weidenfeld & Nicolson, 1967), p. 423; H.A. Antrobus, *A History of the Jorehaut Tea Company Ltd. 1859-1946.* (London: Tea and Rubber Mail, 1948), p. 174.

initiated by J. Buckingham on the topic of shade trees was the first, according to Percival Griffiths, to highlight the need for a more organised collaborative research strategy for tea.[131] Buckingham corresponded with many of his fellow planters regarding the benefits of planting shade trees between tea bushes and invited a discussion on the topic which elicited a number of responses which were published in the Report of the Indian Tea Association (ITA), 1885.[132] The Indian Tea Association (ITA), the earliest Association of tea producers in India, had just started operation from 1881 and it eventually became the mouth piece for the tea industry. Buckingham was not convinced of the positive effects of shade per say on the tea bushes and opined that something special about the *sau* tree, *Albizzia stipulata*, proved to be beneficial to tea. The discussion elicited varied responses from planters. A few out-rightly rejected these claims, while some others attributed beneficial chemical processes associated with the roots of the *sau* trees and the gentle shadow and the debris of the trees as beneficial for the tea bushes.[133] Although much research on shade trees were not immediately taken up and it was only later that the desirability of planting shade trees among the tea bushes was established, yet these discussions induced the formation of a collective and reliable scientific opinion on matters regarding tea. The absence of such scientific advice was often voiced by tea planters -

> There are laboratories in most smelting, dyeing, bleaching, mining large works, but Tea ignores the chemist entirely, and yet manufactures an article which depends, perhaps more than any other on quality.[134]

Another very crucial component of a successful tea plantation was the drainage system. The expenses and labour involved in constructing artificial drainage in the plantations often led

[131] Griffiths, *The History of the Indian Tea Industry*, pp. 423-424.

[132] Ibid., p. 423.

[133] Ibid., pp. 423-424.

[134] As quoted in ibid., p. 424.

planters to believe that "drainage is an operation the less a plantation required the better."[135] Although the best plots for plantations were lands that had excellent natural drainage, yet for those plantations that were unfortunate in this regard, the process went something like this:

> Having found the *lowest level* of the plot, and the *direction* in which this level tends, cut a drain, half as deep again as it is wide, along this lay, until it becomes the tributary of the nearest large water-course…Having provided the channel for carrying off the superfluous water, a regular system of arterial drains must be provided to collect this water, and lead it to the main drain.[136]

Commenting further regarding the upkeep of these drains, the tediousness of maintaining these drainage systems finds expression:

> These drains, especially the main one, will constantly be *silting* up and *scouring* at the sides. A gang of men should be steadily employed to clean out the *silt*…To prevent *scouring*, cut the sides of the drains slanting down from top to bottom, and if possible, turf the sides or encourage grass to grow on them….Every time the tea fields are hoed, the smaller drains down the lines should be dug out in the regular task given the coolies.[137]

Constructing drainage was one of the most important recommendations stressed by experts, which was another big manual intervention inside these plantations.[138] Drains were to be ideally constructed in a manner that could sufficiently drain off rain water but restrict the water from washing over the soil.[139] However, recent studies show how the construction of uncovered drainage in the plantations, with their sluggish flow, became the most prevalent

[135] Quoted in *The Tea Cyclopaedia*, p. 104; Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture* , pp. 182-187;

[136] *The Tea Cyclopaedia*, p. 105.

[137] Ibid.

[138] Edward Money, M. K. Bamber, H. H. Mann- all talked about the importance of drainage in tea plantations for best results.

[139] *The Tea Cyclopaedia*, p. 120.

breeding areas of mosquitoes which probably led to higher incidences of mosquito-borne diseases like malaria in these areas.[140]

Apart from shade trees and tea bushes, a variety of structures and areas were earmarked within a plantation for different purposes. To better visualize a tea plantation in its entirety the following table which is a statement of tea grants and a breakup of the area under tea in the district of Jorhat and Sibsagar in 1961-1962 can be enlightening.[141] Although the data is of a much later period than our period of study, the percentages of the different areas within the land grants could help us reimagine the landscape of a plantation.

Table 3: Statements of Tea Grants in Jorhat Subdivisions 1961-62

Statement of Tea Grants in Jorhat Subdivision 1961-62	
Number of Tea Gardens	94
Number of Tea Grants	137
	Approx. area (in Bigha)
Total Area under Tea	3,12,710
Area under Actual Tea Cultivation	1,15,968
Balance Area under Different Crops	1,96,742
Description of the Balance Area	
	Approx. area (in Bigha)
Building, factory, etc.	8,040
Kothia	888
Sali	28,321
Bamboo	3,021
Thatch	2,942
Forest	2,060
Others	2,061
Fallows: land fit for cultivation	30,319
Fallows: land not fit for cultivation	19,897
Waste land fit for cultivation	59,460
Waste land not fit for cultivation	40,574

Source: 'Tea Garden Lands'. Estimates Committee, Tenth Report. Revenue Department (Shillong, 1962) p. 8.

According to the above figures, in the early 1960s, the total percentage of area actually under tea in Jorhat was only around 37 percent out of the total area under tea plantations whereas

[140] Saikia, 'Mosquitoes, Malaria, and Malnutrition: The Making of the Assam Tea Plantations'.

[141] 'Tea Garden Lands', *Estimates Committee, Tenth Report*. Revenue Department (Shillong, 1962), pp. 8, 17.

the percentage of area within plantations that was not under tea was about 63 percent. This goes to reiterate the fact that oftentimes a large proportion of land granted to tea was not entirely under tea after all. The area that occupied the rest of the garden housed buildings or bungalows, labour housing, and factories. Additionally, fallow lands, forest tracts, patches of bamboo, primarily the *jati*, *bholooka*, giganticus and painted lady variants, along with thatch were a part of such lands. Thatch and bamboos were planted within the gardens for a variety of reasons like constructing bungalows, house flooring, sunshades for bungalows and factory, as well as for aesthetic purposes.[142] A. R. Ramsden, a tea planter since the late 19th century in Assam, also talks about a stretch of jungle (approximately around 1000 acres) that his tea garden housed, which served as a firewood reserve for the garden labourers. These tracts also often served as hunting grounds for the planters and his companions.[143] Thus Ramsden noted, "A planted area of 750 acres means a grant of about 4,000 acres as provision has to be made for many things besides tea, such as bamboos, thatch, timber, a brickfield, firewood reserves, and land for labour settlement."[144]

From the discussion so far, it is evident that a very large extent of land of the province became private property of the planters by the late nineteenth and early twentieth century. Convenient wasteland legislations, clearance clauses as well as their relaxations, and large capital investments in these lands led to de-alienating the common population as well as wildlife from these lands along with the resources that these lands housed. The effect that such transformations had shall be attempted in the following section.

[142] Ramsden, *Assam Planter*, pp. 74-75.

[143] Ibid., p. 27.

[144] Ibid., p. 64.

Imagining the Transformation: A Loss of Diversity in Eastern Assam

Extensive forested tracts in the districts of Sibsagar and Lakhimpur in the eastern part of Assam also colloquially known as Upper Assam, were first taken up for cultivation of tea and harboured the most plantations. Berry White, a tea planter in Assam, while appealing to the GOI for a light railway from Dibrugarh to Sadiya, mentioned that along that route, there were not less than 60 tea estates exporting about 60,000 maunds of tea annually in 1878.[145] Gradually Nowgong, Cachar, Sylhet, Darrang, Kamrup, Goalpara upto Darjeeling too began to witness a growth in tea plantations.[146]

Progress Reports of Forest of Assam in the 19th century opined that at the time of EIC annexation, compared to the "Lower Assam" or Western Assam where forests were already exploited to an extent due to its proximity from Bengal, "Upper Assam" or Eastern Assam's forests were denser and almost untouched. This was attributed to a scarcity of population, distance and difficulty in reaching these parts and a lack of enterprise of the former rulers. However, that was to change soon. Many accounts reported that the forests in the vicinity of the Assam Company tea gardens, especially in the Sibsagar district, were so denuded of its resources that additional lands were procured for solely extracting wood for charcoal to be used in the gardens.[147] Conservator of Forests, Gustav Mann commented in 1885 that "circumstances have completely changed under the present regime is perhaps made by nothing more perceptible than by the rapid disappearance of forests, in consequence of extension of tea cultivation".[148] Moreover, one of the most prominent published notes on the

[145] Grawthrop, *The Story of the Assam Railways and Trading Company Limited, 1881-1951*, p. 10.

[146] Sinha, *Beyond The Trees, Tigers And Tribes: Historical Sociology of the Eastern Himalayan Forests*, p. 44; Hunter, *A Statistical Account of Assam*, pp. 21-22.

[147] E. P. Stebbing, *The Forest of India, The Early History of Forest in India*, Volume II (London: William Brendon & Son, Ltd., 1923), pp. 426-430; Sinha, *Beyond The Trees, Tigers And Tribes: Historical Sociology of the Eastern Himalayan Forests*, p. 47.

[148] Mann, *Progress Report of Forest Administration in the Province of Assam for the year 1884-85*, p. 31.

forests of Assam in 1920s by forester E.P. Stebbing also noted that the forests along the Dibru river, which flows in the eastern part of Assam, were worked very extensively by the Upper Assam Tea Company's saw mills for supplying timber to the company mostly in order to satiate the increasing demand for tea boxes.[149]

Colonial officers, since at least the early nineteenth century, hinted at the availability of a large number of commercially useful and valuable timber in the forests of Assam. Forest officers, at various points of time, categorised the forests of Assam into several categories like savannahs (highland savannah and lowland savannah), *sal*, *sissu* and *khair*, mixed deciduous, evergreen, bamboo, cane-brakes, pine and riverrine forests.[150] Majority of the tea growing districts of the province like Sadiya, Lakhimpur, Darrang, Sibsagar, Nowgong, and Cachar were characterized by evergreen forests. Based on climate, rainfall and soil types, the eastern parts of Assam where tea gardens were the most abundant, with average annual rainfall above 80 inches, the vegetation was tropical evergreen. These evergreen forests also included belts of savannah and bamboo forests in-between, with notable species being the *hollong*, *hollock*, *simul* and *mekai.*[151] One of the characteristics of such evergreen forests, when compared to say, *sal* forests, was the greater variety of species of trees within an area-

[149] Stebbing, *The Forest of India, The Early History of Forest in India*, p. 427; FRI, *One Hundred Years of Indian Forestry 1861-1961*. Vol II. (Dehradun: Forest Research Institute, 1961), pp. 3-4.

[150] M.C. Jacob, *The Forest Resources of Assam* (Shillong: Assam Govt. Publication, 1940) p. 2; Sinha, *Beyond The Trees, Tigers And Tribes: Historical Sociology of the Eastern Himalayan Forests*, pp. 21-22; H. P. Das, *Geography of Assam* (New Delhi: National Book Trust, 1970), p. 66; John M'Cosh, *Topography of Assam* (Calcutta; Bengal Military Orphan Press, 1837), p. 36.

[151] Das, *Geography of Assam*, p. 66; Sinha, *Beyond The Trees, Tigers And Tribes: Historical Sociology of the Eastern Himalayan Forests*, p. 23; P. Ghosh, R.C. Chakravarty and K. K. Gohain, 'Soil Conditions and Rainfall Distribution of Dibrugarh Tea District: Moran, Dibrugarh, Panitola, Nahorkaia & Tingrai Part', *Special Bulletin No. 10*. Tea Research Association. (September 1978), p. 2; Grawthrop, *The Story of the Assam Railways and Trading Company Limited, 1881-1951*, p. 2.

as M.C. Jacob, deputy conservator of forests Assam, remarked- "there being rarely more than 10 to 15 trees per acre of the same species."[152]

A description of the variety of trees housed within the Jokai Forest Reserve located in the Lakhimpur district in eastern Assam would perhaps help us in imagining the composition of areas that plantations began to replace. Interestingly, this reserve itself was bounded by two tea gardens- Sessa and Bolai- on its northern side. The *Working Plan for the Jokai Forest Reserve* of 1910 reports-

> The principle species is Nahor (Mesua Ferrea) which grows on the higher ground...and is found in groups...which gradually merge into evergreen forest containing a mixture of many different species, the chief of which are: Ajhar (Lagerstraemia Flos-Reginae), Uriam (Bischofia javanica), Sam (Artocarpus chaplasha), Paroli (Stereospermum chelonoides), Jutuli (Altingia excelesa), Gonora (Premna bengalensis), Jamuk (Euhenia Jambolana), Phulsapa (Manglietia insignis), Otenga (Dillenia indica), Morhal (Vatica lanceae folia), Hingori (Castanopsis tribuloides), Khakan (Duabanga sonneratioides), Gunserai (Cinnamomum cecicodaphne), Poma (Cedrela Toona), Hilika (Terminalia Chebula), Simul (Bombax malabaricum), Bandardima (Dysoxylum binectariferum), Raghu (Anthocephalus Cadamba), Gandeli Poma (Garuga pinnata).[153]

The Working plan of the Nambor forest reserve, another reserve in the eastern part of the province, in the early twentieth century also highlights the mixed evergreen nature of its trees comprising of a number of different species. The report distinguishes between three different types of forests within the reserve, one being the high land forests, second being the low land forests and finally the riverain forests on the banks of the two rivers Dhansiri and Doyang.[154] Almost half of the reserve was covered by the high land forests, the principal species being

[152] Jacob, *The Forest Resources of Assam*, p. 3.

[153] *Working Plan for the Jokai Reserve of the Lakhimpur Division, Eastern Circle*. (Shillong: Government of Eastern Bengal and Assam Secretariat Printing Office, 1910), p. 2.

[154] A. R. Dicks, *Working Plan of the Nambor Reserved Forest of the Golaghat range, Sibsagar Division, Assam for a period of fifteen years from 1904 to 1919* (Shillong: Assam Secretariat Printing Office, 1905), pp. 2-3.

the *nahor*, and other major species in this category of forest were *poma* (*Cedrelatoona*), *sam* (*Artocarpus chaplasha*), *amari* (*Amoora wallichii*), *gondserai* (*Criptocarya ceciedophne*), *hingori* (*Quercus lanceaedolia*), *hilikha* (*Terminallia chebula*), *paroli* (*Stereoapermum chelonoides*), *satiana* (*Alstonia scholaris*), *bandordem* (*Dysoxylum binectariferum*), *sopa* (*Magnoliaceae oblonga*), *bhelu* (*Torricellia tiliaefolia*), and *tula* (*Sterculia alata*). The predominant species in the lowland forests were- *morhal* (Vatica chinensis), *Elaeocarpus, Carumbium, Bacaurrea, otengah* (*Dillenia indica*), *moj* (*Pithecolobium bigeminum*), *sasi* (*Aquilaria agaloocha*), *sualu* (*Litsaea polyantha*), *gohora* (*Premna bengalensis*), *Glochidion, Antidesma, Symplocos, Vitex, Eriglossum, ajhar, jamu* (*Eugenia jambolana*), along with numerous canes and creepers. And finally the riverain forests housed species like- *hollock* (*Terminalia myriocarpa*), *ajhar* (*Lagerstraemia flos-regninae*), *uriam* (*Bischofia javanica*), *khakan, bhelu* (*Torricelia tiliaefolia*), *jabba hingori* (*Echinocarpus assamicus*), *bual* (*Ehretia asuminata*), *Dellenia indica, roghu* (*Anthocephalus cadamba*), and *jamu* (*Eugenia jambolana*).[155]

This vastly diverse forest landscape witnessed a significant change when lands were cleared to make way for the plantations. In terms of statistics we have no satisfactory estimates of how many trees were cleared in this process. Therefore to come up with a loose approximation with the available data, we decided to calculate an approximate tree density in the Sibsagar district in eastern Assam, which was the district to have the most tea plantations. According to a preliminary survey conducted on 5 percent of the total area of a reserved forest (the Abhoypur RF) in the Sibsagar district, in 1924-25, there were 143.64 number of stems per acre in that RF.[156] Now, the total area under tea operations in 1925 was 98,000 acres in the Sibsagar district, which was the area actually under cultivation of tea or cleared

[155] Ibid.

[156] C.G.M. Mackarness, *Working Plan for Eleven Forest Reserves in the Lakhimpur and Sibsagar Divisions: Eastern Circle, Assam 1931-32 to 1940-42* (Shillong, Assam Govt. Press, 1932).

for plantation purposes like building housing, factories and did not cover the area which were left uncultivated within the estate.[157] If we take the Abhoypur tree density as an approximate of the tree density of the Sibsagar district, then in 1924-25, number of average stems in 98,000 acres would be 143.64 × 98,000 = 1,40,76,720. Going by these rough estimates, we see that at least over 1 crore trees were cut down till the mid-1920s in the Sibsagar district alone.

A similar calculation to estimate tree clearance by the Assam Company is also attempted. As all Assam Company gardens were situated in the "upper Assam" districts in the erstwhile Lakhimpur and Sibsagar districts and, as previously discussed, these districts had a similar vegetation and forest type. Therefore an extrapolation of how many trees might have been cut down by the Assam Company in these districts by relying on the tree density of the Abhoypur Forest Reserve located in a similar landscape has been made. According to this calculation, in 1924-25, the number of stems in 12,241 acres of operational area under tea of the Assam Company would have been (143.64 × 12,241) 17,58,297 stems.[158]

These calculations, when seen along with the forest reports which listed the varied species of trees that these regions housed, we see how a landscape characterised by diverse vegetation was reduced to a single crop. Recent scholarship shows how such monocultures, along with intensive commercial agriculture practices are detrimental to the ecosystem as reduced plant diversity contributed to changes in biodiversity, soil organic matter, soil biota, pests, etc.[159] Interestingly, the Forest Department who was invested in the "conservation' of trees in the province did not have any major reaction to these reductions in trees species diversity. Now,

[157] Behal, *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam.*

[158] Data for the Assam Company area has been taken from Antrobus, *A History of the Assam Company, 1839–1953*, p. 411.

[159] C. Kremen and A. Miles, 'Ecosystem Services in Biologically Diversified Versus Conventional Farming Systems: Benefits, Externalities, and Trade-offs', *Ecology and Society* 17(4) (2012), p. 40; P.A. Matson, W. J. Parton, A. G. Power and M. J. Swift, 'Agricultural Intensification and Ecosystem Properties', *Science.* Vol. 277, Issue. 5325 (25 July 1997), pp. 504-509.

as the forest history in colonial India goes, although the first half of the nineteenth century did not see any restrictions on forest resource destruction, yet the changes in the latter half of the nineteenth century pushed for scientific resource management of Indian forests with officers trained in forestry schools of Germany and France.[160] However, since neither the foresters nor the planters had any intention other than largely to garner economic profit through the province's forests, there was no motivation of the foresters to pay heed to tree species diversity. Thus historian S. Ravi Rajan notes, regarding the ideology of resource exploitation in the British colonies like India,

> Given that the principal goal of economic forestry was to create an optimal resource use regimen defined in terms of yield, there was no particular motivation to maximize species diversity. On the contrary, sustained yield forestry practised during this period (late nineteenth century) sought to economize effort by producing approximations that, for the sake of calculation, simplified the diversity of nature.[161]

It is also interesting to note that in a government of Bengal report on forest published in the year 1939, it was opined that a correlation between diminishing tree cover and lower rainfall and influence in the overall climate was not yet convincingly established.[162] But recent scientific researches has established that monocultures, such as tea, rubber, lac, coffee etc. and intensive commercial agricultural practices are harmful to the ecosystem as reduced plant diversity in such monocultures contributed to changes in biodiversity, soil organic matter, soil biota, insect populations and other degradation of the environment.[163]

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[160] Rajan, *Modernizing Nature: Forestry and Imperial Eco-Development 1800-1950*, p. 55.

[161] Ibid., p. 42

[162] Govt. of Bengal, *Report of the West Bengal Forest Committee* (Alipore: Bengal Govt. Press, 1939), p. 14.

[163] Kremen and Miles, 'Ecosystem Services in Biologically Diversified Versus Conventional Farming Systems: Benefits, Externalities, and Trade-offs', p. 40; Matson, Parton, Power and Swift, 'Agricultural Intensification and Ecosystem Properties', pp. 504-509.

Commercializing Forest Products

As previously observed, in most plantations, forest areas within their boundaries were primarily used to furnish fuel and timber requirements of the gardens. Timber from such reserves was used in constructing the planter's bungalow, furniture, and the "coolie" huts. Planter accounts point to the usage of the likes of *nahor*, *gunseroi*, and *bhola* for constructing bungalows, flooring and furniture.[164] Apart from the forest areas within the tea gardens, some of the main products that came from reserved forests of the province were timber for railway sleepers, tea boxes, scantlings, posts and fuel which also aided the tea enterprise either directly or indirectly.[165]

Forests within the gardens as well as in neighbouring areas witnessed prodigal use of the timber to produce charcoal for various purposes pertaining to the plantations, such as firing and drying the tea.[166] The Deputy Commissioner of Darrang had calculated, towards the late nineteenth century, 1,000 trees were on an average used annually on each garden for these purposes.[167] Moreover, when they ran out of timber to burn from within their estates, they availed the resources housed in forest tracts reserved by the government for the nearby villagers.[168] Essentially, the arrangement was such that either the planters were charged 2 annas per maund of charcoal made in government forests, or they could take a piece of government *pattah* land by paying a certain rate for the trees that the land housed and then

[164] Ramsden, *Assam Planter*, pp. 72-73; Mackarness, *Working Plan for Eleven Forest Reserves in the Lakhimpur and Sibsagar Divisions, Eastern Circle, Assam 1931-32 to 1940-41*, p. 10.

[165] *Working Plan for the Jokai Reserve of the Lakhimpur Division, Eastern Circle* (Shillong: Government of Eastern Bengal and Assam Secretariat Printing Office, 1910), pp. 1,4.

[166] Antrobus, *A History of the Assam Company, 1839–1953*, p. 310; H. K. Barpujari, *Comprehensive History of Assam*, Vol. V (Guwahati: Assam Publication Board, 2007), p. 30; Dasgupta, 'Plantation Economy and Land Tenure System in Brahmaputra Valley, 1839-1914'; Handique, 'Colonial Wasteland Gants and their Impact on the Ecology and Society of Assam', p. 737.

[167] Dasgupta, 'Plantation Economy and Land Tenure System in Brahmaputra Valley, 1839-1914'.

[168] Ibid.

using those to make charcoal.[169] As a rule, the estates were supposed to re-plant trees in place of the ones that were felled within the gardens in order to fulfil their own fuel needs.[170] However, this rule was rarely followed and thus no provision of replanting was taken up either. This lack of conservation within the plantations often necessitated the need to purchase timber from reserved forests. For instance, in the 1930s, considerable quantities of timber for fuel were exported from reserved forest tracts to Tinsukia and Makum to meet increasing demand of the tea gardens.[171]

Moreover, during the course of clearing forest cover, voluminous waste of soft-timbered trees was witnessed which could not even be utilized for building purposes or for producing charcoal.[172] While recognising the fact that hard woods produced the best charcoal, yet it was understood that these were too valuable to be utilized to make charcoal. By 1910s, there were attempts at identifying alternate sources for the production of good charcoal for the tea industry. In the Surma Valley, *chelta* (*Dillenia indica*) or *otenga* trees, *ping* (*Cynometra polyandra*) and *nahor* or *nagessur* (*Mesua ferrea*) were deemed to be good alternatives with easy accessibility and lesser market demands. [173] In the Assam Valley, the usage of *otenga*, *nahor* and a species of *siris* supplemented by other softer species of timber was encouraged.[174] In fact there were instances of Europeans applying for wasteland grants reserved for tea solely for the timber that the land housed, the requests for which were invariably rejected.[175] According to a tea planter, Claud Bald, tea plantations could never

[169] Handique, 'Colonial Wasteland Gants and their Impact on the Ecology and Society of Assam', p. 737.

[170] Dasgupta, 'Plantation Economy and Land Tenure System in Brahmaputra Valley, 1839-1914'.

[171] Mackarness, *Working Plan for Eleven Forest Reserves in the Lakhimpur and Sibsagar Divisions, Eastern Circle, Assam 1931-32 to 1940-41*, p. 10.

[172] Barker, *A Tea Planter's Life in Assam,* p.143.

[173] 'The Manufacture of Charcoal', *Quarterly Journal*, Scientific Department, Part I. (Calcutta: Indian Tea Association, 1917), pp. 13-14.

[174] Ibid.

[175] W.H.S. Wood, 'Tea in Cachar', *The Assam Review*. Vol. I, No. 10. (December, 1928), p. 233.

exist without forest produce and people often under-estimated this dependence. On an average, Bald calculated that in a plantation with 1000 acres of land under tea which produced 6 maunds of tea per acre, the factory required approximately 30,000 maunds of wood for fire per annum in the early twentieth century. And this figure did not include timber requirements of the plantations for building bungalows, labour housing, as firewood for the labourers as well as the employees of all grades that resided inside the plantation boundaries.[176]

Fig 5: Timber being prepared for Charcoal Making.

Source: Indian Tea Association, *Quarterly Journal.* Scientific Department. Part I. (Calcutta: ITA, 1917). Opposite page 15.

By the late nineteenth century, coal mining in the Assam province was gaining pace. Till the 1880s, coal for the tea estates was imported from outside Assam when timber reserves were unavailable.[177] For instance in 1880, the Doom Dooma factory had to import 3,000 maunds of coal from Raniganj.[178] In 1883, Conservator of Forests, Gustav Mann pointing to the coal reserves of Makum, in eastern Assam, hoped that the use of wood as fuel in the plantations would gradually decrease with the introduction of coal.[179] True to Mann's prediction, towards

[176] Bald, *Indian Tea: Its Culture and Manufacture*, p. 158.

[177] Grawthrop, *The Story of the Assam Railways and Trading Company Limited, 1881-1951,* pp. 8-9.

[178] Ibid.

[179] Wood for Tea Boxes. Department of Revenue and Agriculture. Branch: Forests. Part B. Prog. July 1883. No. 105. NAI.

the end of the 1880s with increasing coal mining taking place in eastern Assam, the province's coal was starting to flow into the tea gardens and was slowing replacing wood fuel.[180] However, timber from the province's forests was still in demand to supply charcoal for the plantations well into the twentieth century.

Boxing up tea

Growing demand for tea boxes also kept the requirement of timber high in the nineteenth century. Till many years, tea boxes were made from sawn timber and these boxes weighed almost double that of a three ply chest. Saw mills flourished near the tea gardens where these timber boxes were made.[181] However, by the late 1870s, the use of wood for tea boxes was to a large extent discontinued and the plywood industry took over.[182] Some tea gardens like the Assam Tea Company gardens obtained their tea boxes or the planks of the boxes from Burma.[183] Some of the kinds of wood used for manufacturing tea boxes in Assam were- teak, which reportedly made some of the best tea boxes, *simul*, *bandardima*, *khakan*, *soom*, *sisso*, and mango.[184] Gustav Mann, in the 1880s reported that the great abundance of soft wood in the forests of the province were very suitable for making tea boxes instead of the more expensive hard wood. In addition, these soft woods reached the required girth of 5 to 6 feet in about 30 to 40 years and with increasing restrictions imposed on *jhum* cultivation, Mann believed that the forest reserves of the province would prove to be more than enough for the

[180] Grawthrop, *The Story of the Assam Railways and Trading Company Limited, 1881-1951*, p. 29; Antrobus, *A History of The Jorehaut Tea Company Ltd. 1859-1946*, p. 88.

[181] Grawthrop, *The Story of the Assam Railways and Trading Company Limited, 1881-1951*, pp. 33-34.

[182] Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*, p. 45.

[183] Wood for Tea Boxes. Dept. Revenue and Agriculture. Branch: Forests. Part B. Prog. July 1883. No. 105. NAI.

[184] *Working Plan for the Jokai Reserve of the Lakhimpur Division, Eastern Circle*, p. 4; 'Tea in Assam', *The Assam Review*. Volume I. No. 5. (July 1928), p. 33; Deas, *The Young Tea-Planter's Companion: A Practical Treatise on the Management of a Tea Garden in Assam*, p. 62.

manufacture of these tea boxes.[185] Mann, however, also envisioned that the tea estates would grow further and so would the need for more tea boxes, for which exploiting the dense forest regions in the extreme east of the Brahmaputra Valley was recommended.[186] He wrote-

> The localities in which our mixed forests containing the wood best suited for tea-boxes exist are in the Brahmaputra valley, the country along the foot of the Himalayas, from the Bor-Nadi opposite Gauhati, or the western boundary of the Darrang district, eastwards to the upper end of the valley, and on the south Nambar reserves, and a large extent of unreserved forests south of them, all along through the Sibsagar district to Makum and the head-waters of the Buri and Noa Dehing, as well as the Brahmaputra river.
>
> In the Surma Valley we depend chiefly on the Cachar reserves, supplemented by what will be brought from the Manipur and the Lushai country.[187]

In 1883, Gustav Mann estimated from the amount of tea exported, the cubic feet of timber consumed by tea for boxes.[188] In 1881-82 the amount of tea exported from Assam was 2,88,754 maunds and Mann estimated that approximately one cubic foot of timber was required to export one maund of tea which meant that around 2,88,754 cubic feet of timber was used in the year and given that the importation of tea boxes was decreasing, the timber was all exploited from Assam and some imported from Burma.[189] In this regard, the following excerpt from the Indian Forester of 1889, reflects how the local supply of tea boxes was increasing -

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[185] Wood for Tea Boxes. Dept. Revenue and Agriculture. Branch: Forests. Part B. Prog. July 1883. No. 105. NAI.

[186] Ibid.

[187] Ibid.

[188] Usually each tea box approximately measured about 2 ft. ×1 ft. 7 ins. ×1 ft. 7 ½ inches. - Deas, *The Young Tea-Planter's Companion: A Practical Treatise on the Management of a Tea Garden in Assam*, p. 62.

[189] Wood for Tea Boxes. Dept. Revenue and Agriculture. Branch: Forests. Part B. Prog. July 1883. No. 105. p. 5. NAI; Exemption from Import Duty of Steel Tea-Chests (known as Acme tea-chests) and Wooden Tea-Chests. Dept. Finance. Branch- Statistics and Commerce. Part A. Proceedings, Nos. 589-603, September 1894.

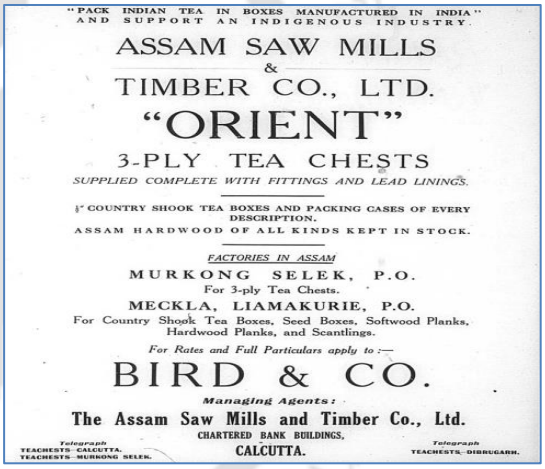
Since 1875 the manufacture of tea boxes in the tea valley districts of Assam has increased from 1,384 to 3,79,089... In 1875, the import of boxes stood at 136,718 and in 1888-89 it had gone down to 127,827...Tea boxes are now extensively manufactured on the various tea estates. Besides these, there are nine saw mills in the Lakhimpur and one in the Darrang districts, where boxes are made for sale. According to the divisional officer's estimate, about 200,000 boxes are made by all the saw mills in Lakhimpur, while the divisional officer at Darrang reports that 13,441 boxes were sold by the Tezpur saw mill during 1888-89. In that year Sylhet and Cachar received 23,075 boxes from Calcutta and exported 131,453 containing teas, from which it is concluded that 108,378 boxes had been made locally, as compared with 47,938 made in the districts in 1875.[190]

Table 4: Total Number of Tea Boxes made in Assam

Year	Total Number of Tea Boxes
1900-1901	3,86,076
1901-1902	4,12,887
1904-1905	5,37,805
1905-1906	5,12,657

Source: *Progress Report of Forest Administration in the Province of Eastern Bengal and Assam for the year 1901-02*, p. 13; Tottenham, *Progress Report of Forest Administration in the Province of Eastern Bengal and Assam for the year 1905-1906*, p. 11.

Fig 6: Advertisement for Tea Chests



Source: *The Assam Review*. Vol. I No. 6. August 1928. p. 27.

In view of the increasing demand from the tea box industry by the early twentieth century, the planting of *simul* (*Bombox malabaricum*) was encouraged as it flourished without much effort and produced a high outturn in a short period of time.[191] In this regard, unique

[190] *The Indian Forester*. Vol. XV (Roorkee: Thomason College Press, 1889), pp. 368-369.

[191] W.F.L. Tottenham, *Progress Report of Forest Administration in the Province of Eastern Bengal and Assam for the year 1905-1906* (Shillong: Eastern Bengal and Assam Secretariat Printing Office, 1906), p. 2; Supply to the Director Acme Tea Chest Co. Ltd. Flasgow of Information to the Areas in the Country likely to Yield Sufficient Timber for the Manufacture of Three Ply Tea Chest Enquiry by the Proprietor Tezpur Saw Mills Assam. Dept. Inspector General of Forest. Branch: General. 1917. File No. 16-24/8. NAI.

measures were also undertaken- "…at Kerua in the Dibru reserve Miris were now allowed to *jhum* on condition that they grow *simul* on their abandoned *jhums*, and this experiment was proving very successful. A similar encouragement of new *simul* growth in abandoned cultivation outside the reserves was discussed."[192] M.C. Jacob, deputy conservator in the 1917, believed that felling of *simul* trees within a distance of one or one and a half mile from rivers should be prohibited to ensure that these trees could be transported with as less labour as possible via such river streams.[193]

All these incentives ensured that timber was slowly depleted within these areas. For instance, in 1905-06 there was a decrease in the number of tea boxes which was officially attributed to the insufficient supply of *simul* in the forests in the neighbourhood of the Sissi Saw Mills, located in the erstwhile Dibrugarh district, to meet the demands of the mills.[194] Again in the 1920s, protesting the move of the colonial Govt. to increase the royalty rate of 6 pice per cubic foot of tea chest logs, Surma Valley Saw Mills Ltd. in the Sylhet district reported that all the accessible timber along the river banks were already extracted and in order to extract timber from inaccessible areas the royalty needed to be kept as low as possible.[195] Therefore along with tea planters, saw mills also began to compete for the forest resources of the province in order to manufacture tea boxes.

[192] Protection and Regeneration of Simul for the Development of Tea-Box Industry in Assam. Department- Revenue. Branch- Revenue A. (Sept. 1917), No. 1-18. p. 2. ASA.

[193] Supply to the Director Acme Tea Chest Co. Ltd. Flasgow of Information to the Areas in the Country likely to Yield Sufficient Timber for the Manufacture of Three Ply Tea Chest Enquiry by the Proprietor Tezpur Saw Mills Assam. Dept. Inspector General of Forest. Branch: General. 1917. File No. 16-24/8. NAI.

[194] Tottenham, *Progress Report of Forest Administration in the Province of Eastern Bengal and Assam for the year 1905-1906*, p. 11.

[195] Re-introduction of the Old Royalty on Third Class Timber used for the Manufacture of Tea Chests. Department- Revenue. Branch- Revenue A. 1922. XX/23/22. p. 6. ASA.

Apart from timber, the saw mills also required regular and bulk coal supplies, which according to one estimate amounted to about 2,000 maunds a year.[196] These huge timber requirements inevitably meant that saw mill owners and the forest department crossed paths. Amidst tension between the saw mill owners and the forest department, in 1917, the proprietor of the Tezpur Saw Mills complained to the inspector general of forests that timber deemed suitable by the inspector general of forest for extraction were often prohibited by the forest department officials deeming them too valuable for making tea boxes.[197] Moreover, reduced imports of tea boxes were not favourable to the agents at Calcutta who made good profit from importing foreign made tea boxes.[198] Therefore, although local made chests were in use, almost three-quarters of the Assam tea that was exported were in imported tea boxes till at least the late 1910s.

In the 1920s, although local-made heavy chests were still in use, gradually, imported three ply chests that weighed much less than the timber ones began to be used which affected these local industries.[199] In a bid to reduce such imports, in a conference held at Dibrugarh on 12 July 1917, the Assam Railways and Trading Company proposed to take up tea box making and projected around two- three lakhs of boxes a year.[200] Eventually, the company did set up a plywood factory in the 1920s in Assam named 'Margherita' and started primarily to make three ply tea chests with a total plywood output of 5 million square feet a year in the early

[196] Supply to the Director Acme Tea Chest Co. Ltd. Flasgow of Information to the Areas in the Country likely to Yield Sufficient Timber for the Manufacture of Three Ply Tea Chest Enquiry by the Proprietor Tezpur Saw Mills Assam. Dept. Inspector General of Forest. Branch: General. 1917. File No. 16-24/8. NAI.

[197] Ibid.

[198] Copy of letter No. 650/2F-55, dated 21st August 1915, from A. Roger, Esquire Forest Research Officer, Burma, to the Chief Conservator of Forests, Burma. Dept. Inspector General of Forest. Branch: General (1917) File No. 16-24/8. NAI.

[199] Ibid.

[200] Protection and Regeneration of Simul for the Development of Tea-Box Industry in Assam. Department- Revenue. Branch- Revenue A. No. 1-18. (Sept. 1917), p. 1. ASA.

1950s.[201] Therefore along with the growth of the tea enterprise, saw mills also began to compete for the forest resources of the province in order to manufacture tea boxes.[202]

An overview of the transformation of Assam's landscape that housed a diverse variety of trees which were cleared to make way for the various processes of the plantations, be it the actual area that was planted with tea, construction of bungalows and "coolie lines", or the copious amounts of coal and timber required for the plantations have been detailed in this section. These instances reveal how the tea enterprise consumed a majority of the forest resources and further encouraged clearance activities in the province.

Conclusion

This first chapter examined the modifications affected in vast stretches of land since the tea plantations took off in the mid nineteenth century in Assam. The EIC's interest in the natural resources and trade in this north eastern province of India was fairly evident as, ever since the eighteenth century itself, there were attempts at establishing trading links with the province. With a brief discussion on the ideology of the colonisers, the chapter endeavoured to understand why they dealt with nature and human subjects in the way they did in their colonies. Caught in the quagmire of novel concepts of private ownership over natural resources and legislations to cement these ownerships, the chapter discussed how the relationship between the local people and their surrounding environment witnessed alterations. Large amounts of "wastelands" thus came under the control of tea planters and large scale modifications of the province's landscape began with the clearing of vast forested regions. Local people and wildlife alike bore the brunt of such modifications and in the long run, large portions of the province began to lose its tree diversity which was replaced by tea

[201] Grawthrop, *The Story of the Assam Railways and Trading Company Limited, 1881-1951*, pp. 33-34.

[202] Supply to the Director Acme Tea Chest Co. Ltd. Flasgow of Information to the Areas in the Country likely to Yield Sufficient Timber for the Manufacture of Three Ply Tea Chest Enquiry by the Proprietor Tezpur Saw Mills Assam. Dept. Inspector General of Forest. Branch: General. 1917. File No. 16-24/8. NAI.

monocultures. The chapter serves as a precursor to the repercussions that came along with these transformations which shall be discussed in the succeeding chapters.

Chapter II

Perceiving Degeneration: The Soil

Introduction

The tea plantations of Assam, since their very inception in the first half of the nineteenth century, as seen in the earlier chapter, have been affecting irreversible transformations in Assam's landscape by converting large acres of forest lands into plantations, and primarily contributing to disrupted human and wildlife access to these areas along with a loss of tree diversity. However, alongside the distinctly visible changes in the landscape, many other crucial changes were also inconspicuously creeping in, like the human-induced modifications of the wild tea plant to suit the needs of perpetual production and the perennial nature of the monoculture leading to exhaustion and alteration of the soil in the plantations. The environmental specificities, as discerned by the tea expertise, of the soil, rainfall patterns, floods, hailstorms- all worked towards determining the extent and quality of the production of tea in the province. The emphasis was always on producing "good tea" for export with economised means of production as the entire idea of a plantation economy rested on cheap production for a world market. But this was to change eventually. Gradually, the anxiety of planters regarding declining productivity of the soil as well as increased activities of destructive pests, insects, and blights translated into an intensification of botanical, entomological enquires and a simultaneous proliferation of manures, fertilizers, and pesticides in the plantations.

An examination of nineteenth and early twentieth century manuals, treatises and reports prepared by botanists, entomologists, chemist, geologists, and planters reveal prevailing discussions and enquiries on the priorities and the motivations behind investigations conducted on the Assam plantations. Such expertise began to develop as early as the 1830s

with the first scientific deputation sent from London, consisting of surgeon and botanist Nathaniel Wallich, botanist William Griffith and assistant-surgeon and experienced geologist, M'Clelland, in order to conduct initial investigations on the tea plant of Assam.[1] With several botanical and geological samples at their disposal, this deputation carried out the initial enquiries into the soil, climate and characteristics of the Assam tea plant. Once the initial doubts regarding the feasibility of growing tea in the province were put to rest and the exercise of growing tea in a plantation setting began, various questions emerged which compelled a closer look at the immediate environment. Soil, climate and rainfall were among the most essential components that were considered in deciding which districts were the most suitable for tea in Assam apart from labour availability and connectivity.[2] A hot, damp climate and rainfall not less than 80 to 100 inches and spread throughout the year without witnessing drought in any season were deemed ideal.[3] Temperature and rainfall were extremely crucial in determining the growth of plants and vegetation in any given ecosystem and thus historian Arnab Dey notes, "the trio of pests, rainfall, and climate impacted relentlessly in terms of both quality and volume" of tea in Assam.[4]

Soil also gradually emerged as a significant component of the plantation's environment which had interlinkages with lower productivity of the plant, increased pest population and an overall deterioration in quality and quantity of the crop. The characteristic of capitalist

[1] *The Tea Cyclopaedia*: *Articles on Tea, Tea Science, Blights, Soils and Manures, Cultivation, Buildings, Manufacture Etc., With Tea Statistics* (Calcutta: Calcutta Central Press Co., 1881), p. 8; H.A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957), p. 24; *Copy of Papers Received from India Relating to the Measures Adopted for Introducing the Cultivation of the Tea Plant within the British Possessions in India.* (London, H.M. Stationery Office, 1839), p. 48.

[2] Edward Money, *The Cultivation and Manufacture of Tea.* (London: Thacker & Co., 1878), pp. 13-14.

[3] Ibid.; *The Tea Cyclopaedia*, p. 124*;* Claud Bald, *Indian Tea: Its Culture and Manufacture*. 2nd Edition (Calcutta: Thacker, Spink & Co., 1908), pp. 52-53.

[4] Arnab Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India*. (Cambridge: University of Cambridge Press. 2018), p. 87; David R. Montgomery, *Dirt: The Erosion of Civilizations*. (Berkeley and Los Angeles, California: University of California Press, 2007), p. 19.

agriculture which extracted from the soil way more than it gave back, which Marx termed as the "metabolic rift" in the context of nineteenth century England, was essentially at work in the Assam tea plantations as well. Prior to the advent of private property, new industrial systems, and capitalistic crop production, soil fertility was dependent on a particular "metabolic interchange" where cattle were fed farm grains and the cattle droppings and other local wastes were in turn returned to the same soils to replenish it. However with the capitalist move to cultivate in order to export, the nutrients of the soils were sent to far off places which did not find a way back to the soil as before and the necessity of adding additional nutrients to the soil became essential.[5] According to a study, 4.4 billion tons of soil was eroded in Australia since its colonization owing primarily to large scale clearances for agricultural purposes.[6] These changes have, in recent times, resulted in devising "no till" or "low till" technologies in order to have minimum impact on the soil profile.[7] By the early twentieth century, industrialised farming, including plantation cultivation had done enough damage to the soil fertilities worldwide with grave "disturbances in hydrological, carbon and nutrient cycles" which gave a push towards thinking about alternative cultivation techniques.[8] The present globalized market for agricultural produce which transports the best quality local products to wealthier markets is a continuation of the colonial legacy of colonial plantations

[5] Brett Clark, John Bellamy Foster, and Stefano B. Longo, 'Metabolic Rifts and the Ecological Crisis' in Matt Vidal, Tony Smith, Tomás Rotta, and Paul Prew (eds.) *The Oxford Handbook of Karl Marx*. (Dec 2018). Accessed 31st Jan, 2021. https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780190695545.001.0001/oxfordhb-9780190695545-e-38; Montgomery, *Dirt: The Erosion of Civilisations*, p. 187.

[6] Anne Therese O'Brien, 'Ethical Acknowledgement of Soil Ecosystem Integrity amid Agricultural Production in Australia', *Environmental Humanities* 12(1) (May 2020) pp. 267, 270.

[7] Montgomery, *Dirt: The Erosion of Civilisations*, p. 24; O'Brien, 'Ethical Acknowledgement of Soil Ecosystem Integrity amid Agricultural Production in Australia', pp. 267, 270.

[8] Anna Krzywoszynska, 'Nonhuman Labor and the Making of Resources', *Environmental Humanities* 12(1) (May 2020) p. 229; O'Brien, 'Ethical Acknowledgement of Soil Ecosystem Integrity amid Agricultural Production in Australia'; Greta Marchesi, 'Justus von Liebig Makes the World: Soil Properties and Social Change in the Nineteenth Century', *Environmental Humanities* 12(1) (May 2020) p. 205; Mart A. Stewart, 'Plantations, Agroecology, Environmental Thought, and the American South' in Frank Uekötter (ed.), *Comparing Apples, Oranges, and Cotton: Environmental Histories of the Global Plantation* (Frankfurt and New York, NY: Campus Verlag, 2014).

providing for a European market. This chapter therefore essentially aims to address the relationship of this changing nature of the soil and the simultaneous concerns regarding decline in productivity of tea.

In Search of Good Soil

Discussions in the nineteenth century among Assam tea planters often touched upon the types of soil and the proportion of constituents in the soil that made it suitable for tea. [9] The soil in Assam on which tea was grown was mostly alluvial and acidic, but assumed to be "intrinsically poor" in European standards (except the *bheels* or peatlands) and yet the combined effect of temperature, rainfall and humidity made it fertile and apt for tea to flourish.[10] Naturally, planters turned to look at the soil where tea was grown in China which was home to the tea that Europe was familiar with. There was apparently an adage that the Chinese grew tea in poor soils which was unfit for any other crop.[11] However, planters by the late nineteenth century univocally opined that this advice was not to be taken seriously in the Indian context. In China, tea trees were mostly grown by almost all small farmers at a small scale and looked after by their families and these quantities of tea did not fetch great price. Since numerous people were engaged in producing a small quantity of tea, even with great demand, there was no incentive for the farmers to produce tea in their best lands or in higher quantities.[12] But this was not the case in Assam as the scale of production here was much grander and intensive, thus planters realised that inferior soil would not work as it did in

[9] These discussions can be found in a consolidated form in the discussions provided in the *The Tea Cyclopaedia: Articles on Tea, Tea Science, Blights, Soils and Manures, Cultivation, Buildings, Manufacture Etc., With Tea Statistics*; Journal of D Foulis, 'The Tea Assistant in Cachar', MS 9659, National Library of Scotland Manuscript Collection.

[10] E.A. Andrews, *Factors affecting the Control of the Tea Mosquito Bug (Helopeltis Theivora Waterh)* (London: Worrall & Robey, 1915), p. 125; 'The Effect of Manures on the Constitution of the Tea Plant', *Quarterly Journal.* Scientific Department. Part I (Calcutta: Indian Tea Association, 1921) p. 22; Harold H. Mann *The Tea Soils of Assam and Tea Manuring* (Calcutta: W. Newman &Co., 1901), pp. 104-105; *Handbook of Information 1929* (Calcutta, ITA: 1929), p. 13.

[11] *The Tea Cyclopaedia: Articles on Tea, Tea Science, Blights, Soils and Manures, Cultivation, Buildings, Manufacture Etc., With Tea Statistics*, p. 123; Money, *The Cultivation and Manufacture of Tea*, p. 31.

[12] *The Tea Cyclopaedia*, p. 123.

China. As a plant and a manufactured product, tea in Assam was eventually claimed to be superior to the China tea by the planting circle. The greater care taken in identifying superior quality of lands and the planters being more dedicated and involved in the process of tea making unlike the Chinese were posited as key features of the superiority of the tea grown in India.[13]

As a result, the fetish for a freshly cleared "virgin" forest lands with the highest tea growing potential began to permeate the planters' vision as discussed in the previous chapter. The logic behind this obsession can be found in the writings of planters of the early nineteenth and twentieth century. Most planters opined that the soil most suitable for tea consisted "of a surface layer of rich vegetable mould on a bed of deep loam" which only a land covered by forests could provide. The rationale behind this was twofold: one was that forest lands consisted of soil that was more permeable and porous due to the action of the expanding roots of the numerous trees and shrubs which forced the soil upwards; and second was that the abundant vegetable mould that such lands housed was essential for the nourishment of the seedling. In addition, the friable loam provided an easy access for the tap root to obtain the required support and moisture from the soil.[14] The terms most commonly in use to define soil that was suitable for tea, since the early days of tea in Assam, were "light and porous", with "yellow or reddish hue".[15] Upon digging the freshly cleared forest lands, a dark mould of extremely fertile super stratum of about five to eight inches deep was exposed which consisted of years of vegetable deposit and acted as the best manure for the tea bushes and

[13] Samuel Baildon, *The Tea Industry in India* (London: W.H. Allen & Co., 1882), pp. 20-34.

[14] Bald, *Indian Tea: Its Culture and Manufacture*, p. 2; Sigma, 'Tea Cultivation', *The Tea Cyclopaedia*, pp. 68-69; M. K. Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture* (Calcutta: Law-Publishing Press, 1893), p. 55.

[15] *The Tea Cyclopaedia*, pp. 123-124; William Robinson, *A Descriptive Account of Assam* (Calcutta: Bishop College Press, 1841), p. 129; William H. Ukers, *All About Tea*. Vol I (New York: The Tea and Coffee Trade Journal Company, 1935), p. 380.

assured good growth for a number of years.[16] The surface soil, of about 9 inches of thickness, was hidden underneath this super-stratum of vegetable mould and was ideally "light, friable, and rich" and once the earth was made cultivable these two layers mixed and created the ideal soil for tea.[17] However, that wasn't all; the sub soil beneath the above mentioned upper stratum and surface soil also mattered. The tea plant's long tap roots invariably extended into this sub-soil and therefore the plant could thrive only if this part of the soil could provide enough moisture and nourishment. [18] The presence of iron in the sub-soil, making the soil appear reddish, was supposed to be essential for tea along with it being porous and moisture retentive. And ideally, the sub soil possessing the same characteristics as the surface soil was the most ideal.[19] Many regions in the Assam province such as the Doom Dooma area, Tezpur bank area and Jorhat were cited as regions where such uniformity between the surface and sub soil was seen.[20]

According to an account published in 1841 by William Robinson, then Principal of the Gauhati Seminary and also Inspector of Schools, there were very scant wastelands in Assam that could not be utilized, as he reported that most lands in the province had very fine soil and even the hills were free from rocks for the most part and cultivable.[21] The soil of the eastern Assam's erstwhile Sibsagar district, which housed numerous tea plantations, was identified by Robinson as distinct from the rest of the province.[22] He identified the sub soil of this region as being of a higher quality with "a stiff retentive clay, abounding in iron nodules".[23] With the river Brahmaputra flowing through the heart of the Brahmaputra valley, sediments

[16] *The Tea Cyclopaedia*, p. 123.

[17] Ibid., pp. 120, 124; Bald, *Indian Tea: Its Culture and Manufacture*, p. 2.

[18] *The Tea Cyclopaedia*, p. 124.

[19] Ibid.

[20] Mann, *The Tea Soils of Assam and Tea Manuring*, p. 17.

[21] Robinson, *A Descriptive Account of Assam*, p. 217.

[22] Ibid., p. 318.

[23] Ibid.

of about 200-300 m thickness had accumulated over the last two million years which characterizes the fertile alluvial soils of the province.[24] Robinson was talking about this same alluvial soil, composed of sand and clay where evergreen forests abounded in the eastern Assam districts of Sibsagar and Lakhimpur, a large portion of which were gradually replaced by these vast tea plantations.[25]

Much later, Harold Mann, the agricultural chemist employed by the ITA, in one of his writings, showed that in the early nineteenth century while the quest to find identical conditions like that of China for the cultivation of tea was in full swing, it was realised that in addition to the climatic conditions feasible for tea, the soil also had an important impact in determining its flavour.[26] In the early years of tea, before 1840s, geologists like McClelland, made analyses of the soil and environment of Assam with regards to the tea plant and areas where tea trees were found growing abundantly in the wild to understand what conditions were essential for tea to flourish. High levels of humidity and dense forest cover were found to be common in many tea growing regions in Assam which apparently pointed to a lightness of the soil. This lightness of soil was ascribed by McClelland to the "action of the water collected on the foliage of the surrounding trees, and thence precipitated in heavy volumes".[27] Most of Assam's soil consisted of a rich black loam along with a grey sandy clay and sometimes comprising a pale yellow clayey texture.[28] Claiming that both mountainous as well as plains tracts were equally suited for the growth of tea bushes, J. Sumner, a tea dealer

[24] Arupjyoti Saikia, *The Unquiet River: A Biography of the Brahmaputra* (New Delhi, Oxford University Press, 2019), p. 31.

[25] H. P. Das, *Geography of Assam* (New Delhi: National Book Trust, 1970), p. 67; Ukers, *All About Tea*, p. 380.

[26] In this regard, Mann quotes a Calcutta writer in 1834, "Admitting that localities for it may exist in our territories, approximating in climate to its native country, we should fear that, as the value of tea depends upon its aromatic flavour, differences of soil may produce changes as fatal as those which occur in tobacco and in the vine, and that the hyson and pekoe and twankay and souchong of India, will be very little like their high flavoured namesakes of the celestial empire." Harold H. Mann, *The Early History of the Tea Industry in North-East India* (Calcutta, The Calcutta General Printing Co., 1918), p. 4.

[27] Robinson, *A Descriptive Account of Assam*, p. 129.

[28] Ibid., p. 5.

by profession based in Birmingham, in the early 1860s opined that "a light, rocky, ferruginous soil" which occurred in slopes so as to allow rain water to flow off "the rocky substratum" and in the vicinity of springs produced the finest tea.[29]

To give specifics of the components of the soil, Henry Piddington, who interestingly started his career in mercantile marine and took up his intellectual passions in the 1820s, published his individual findings in 1836 on the composition of soil in Assam in a bid to attract attention to the importance of examining the soil for any agricultural advancement.[30] He gave a comparative soil analysis of samples from the Bohea hill in China that was brought by Gordon, Secretary to the Tea Committee and the Assam samples provided by Jenkins and marvelled at their similarity:

Table 5: Constituents of Tea Soils

	Tea Soil of Assam		
	Surface soil	At 2.5 feet deep	Tea soil of China
Water	2.45	2.00	3.00
Vegetable matter	1.00	0.80	1.00
Carbonate of Iron	7.40	6.70	9.90
Alumina	3.50	5.45	9.10
Silex	85.40	85.10	76.00
Traces of phosphate and sulphate of lime and loss	0.25	0.95	1.00
	100.00	100.00	100.00

Source: H. Piddington, 'On the Soil Suitable for Cotton, Tobacco, Sugar and the Tea Plant', *Transactions of the Agricultural and Horticultural Society of India*, Vol. 3 (Calcutta: Baptist Mission Press, 1839), p. 36.

Piddington revealed that the Assam soil was deficit in carbonate of lime, only traces of phosphate and sulphate were available and the iron content in these soils were in the form of

[29] John Sumner, *A Popular Treatise on Tea: Its Qualities and Effects*. (Birmingham: William Hodgetts, 1863), p. 16.

[30] H. Piddington, 'On the Soil Suitable for Cotton, Tobacco, Sugar and the Tea Plant', *Transactions of the Agricultural and Horticultural Society of India*, Vol. 3 (Calcutta: Baptist Mission Press, 1839) pp. 31-36; A. K. Sen Sarma, 'Henry Piddington (1797-1858): A Bicentennial Tribute', *Weather* (1997) 52 (6), pp. 187–193.

carbonate of iron. In accordance to these findings, Piddington identified the soil as poor yellow loam which was not suitable for cotton, sugarcane or tobacco but was surprisingly suitable for tea.[31] Similar Assam soil samples analysed by Joseph Cripps, a soil analyst, in the late 19th century observed that the soil was formed with the disintegration of granitic rocks and therefore generally deficit in food available to plants as evident from the presence of insoluble silicates from the range of 84 per cent and upwards.[32]

Early planters in the nineteenth century were convinced about the rich and fertile characteristics of Assam's soil.[33] The early planters were fortunate to have claim to virgin, freshly cleared forest lands topped with the highly extolled rich layer of vegetable mound. The characteristic light and friable soil and flat lands in Assam were deemed to be superior to the sandy Cachar soil and its undulating terrain by planter Edward Money.[34] However, early planters like Samuel Baildon and Money in the 1870s also opined that there could not be one universal good tea soil as tea grew in a variety of soils-

> There are several lays of land in which tea is planted. Hilly land, flat forest, undulating forest, and grass land.[35]

However, they identified a few characteristics crucial for tea to flourish[36]-

[31] Piddington, 'On the Soil Suitable for Cotton, Tobacco, Sugar and the Tea Plant', pp. 31-36; Robinson, *A Descriptive Account of Assam*, pp.130-131.

Most of these analyses of the soil were also later confirmed by the chemist M.K. Bamber in the 1890s (Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, pp. 18-19) who was employed by the ITA to perform such investigations which we shall touch upon in a later section in this chapter.

[32] Ibid., pp.76-77.

[33] Money, *The Cultivation and Manufacture of Tea*, p. 15.

[34] Ibid., p. 16.

[35] Samuel Baildon, *Tea in Assam* (Calcutta: W. Newman & Co., 1877), p. 11.

[36] Money, *The Cultivation and Manufacture of Tea*, pp. 31-32; Baildon, *Tea in Assam*, p. 11.

> It loves soils friable, that is, easily divided into all their atoms. This argues a fair proportion of sand, but this should not be in excess, or the soil will be poor. The soil should be porous—imbibing and parting with water freely. The more decayed vegetable matter on its surface the better.
>
> To be avoided are stiff soils of every kind, as also those which when they dry, after rain, cake together and split. Avoid also black coloured, or even dark coloured earths. All soils good for the Tea plant are light coloured. If, however, the dark colour arises from decayed vegetation that is not the colour of the soil, and, as observed, vegetable matter is a great advantage.[37]

To sum up, good tea soil were those that were porous and friable with adequate sand, the soil had to be deep, with a good amount of vegetable matter on the surface soil, the subsoil preferably a yellowish red mixture of clay and sand, and a greasy loam mixed with sand which more or less remained similar to earlier years recommendations. These soils however had to be present in regions that had a favourable temperature (ranging between 13 degree Celsius to 32 degree Celsius) and rainfall (the average rainfall in the north east India ranges from 2000-4000mm) in order for tea to flourish.[38] Stiff soil which cake after being rained on were to be avoided, so were black coloured soil, which was not to be confused with the dark coloured vegetable mould. Good tea apparently grew on light coloured soils with adequate number of stones in the soil which assisted in keeping the soil from becoming stiff.[39]

However, according to Mann, the chemical composition of the soil and what tea needs from soils were not much researched till the early twentieth century and planters operated on cliché hearsay, the common identifiers being "friable", "light", etc. to satiate the knowledge of soil appropriate for tea. Mann remarked that even Edward Money's prize winning essay did not

[37] Money, *The Cultivation and Manufacture of Tea*. pp. 30-31.

[38] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 55; The temperature and rainfall data have been accessed from 'Tea Cultivation' Tea Research Association. Accessed January 28, 2021. https://www.tocklai.org/activities/tea-cultivation/

[39] Money, *The Cultivation and Manufacture of Tea*, pp. 31-32; Baildon, *Tea in Assam*, p. 11.

shed any light on the chemical side of soils. Mann credited Bamber's work published in the 1890s of being crucial in bringing the chemistry of tea soils to the forefront. [40]

In the pursuit of tea, planters thus began to define the soil and its components, dissecting the micro environment on which the plantations were to stand for hundreds of years. These early examinations and discussions on Assam soil were highly optimistic about the calibre of producing good tea for many decades in the region without a fall in quality and quantity.[41] However slowly this was to change and in spite of the unrelenting belief in the sustained fertility of Assam's soil, the planting circle had to give in to the idea of manuring their tea bushes. The soil being the most affected by such long-standing mono-cultivation, manuring and replenishing it became a necessary step in these plantations. But what compelled this shift in attitude? At what point did the expertise of the laboratory began and what does it say about the plantation environment? The following section examines these questions.

Distress over Soil

Early history of the earth shows that rocks pervaded earth's surface and with gradual actions of rainfall and bacteria, soil formation commenced which propelled the origin and sustenance of complex life on the planet.[42] With gradual increase in plants and chemical changes made possible through the actions of plant roots and soil biota, more soil formation took place which, in turn, aided the growth of more plants. Higher vegetation cover made soil organically rich "and ever since, organic-rich topsoil has sustained itself by supporting plant communities that supply organic matter back to the soil."[43] Agricultural practices have been affecting soil in multiple ways. Excessive tilling kills earthworms and other organisms

[40] Mann, *The Tea Soils of Assam and Tea Manuring*, p. 34.

[41] Antrobus, *A History of the Assam Company, 1839–1953*, p. 483;

[42] For a more in-depth discussion on earliest soil formation, please refer to- Montgomery, *Dirt: The Erosion of Civilisations*, pp. 15-16.

[43] Ibid., p. 16.

dwelling in the soil, certain agricultural practices like short crop rotation and monocrop farming greatly affect soil fauna which are essential for recycling nutrients in the soil, and the use of pesticides in agriculture also results in affecting microbes and other soil organisms, all of which indirectly encourages diseases and insects to the detriment of the crop.[44]

Therefore in the case of Assam tea too, cultivation practices have exerted the biggest ecological impact on the soil as over the years, a carefully manicured landscape replaced the complex forest system of Assam. With the large scale uprooting of trees, the excessive digging and the added pressure of mono-cultivation as seen in the previous chapter, eventually contributed to an altered soil profile in these plantations. A few decades after the setting in of the frenzy of tea plantations, with the tea boom lasting till the 1860s, it was claimed by planters that only the newly established tea estates were able to produce a reasonably decent amount of tea and the older gardens saw a gradual decline in produce. The following remark by the Assam planter, George Barker highlights the anxiety regarding this declining productivity,

> In the competition between the old and new gardens there can be only one result- the failure of the old gardens. A fair average to take per acre for old tea is four maunds *(about 329 lbs)*; for modern gardens seven *(approx. 576 lbs.)* or eight maunds *(approx.. 658 lbs.)* would not be an excessive computation. How is it possible, therefore, for old tea gardens to compete, with a chance of success, against new.[45] (Italics mine)

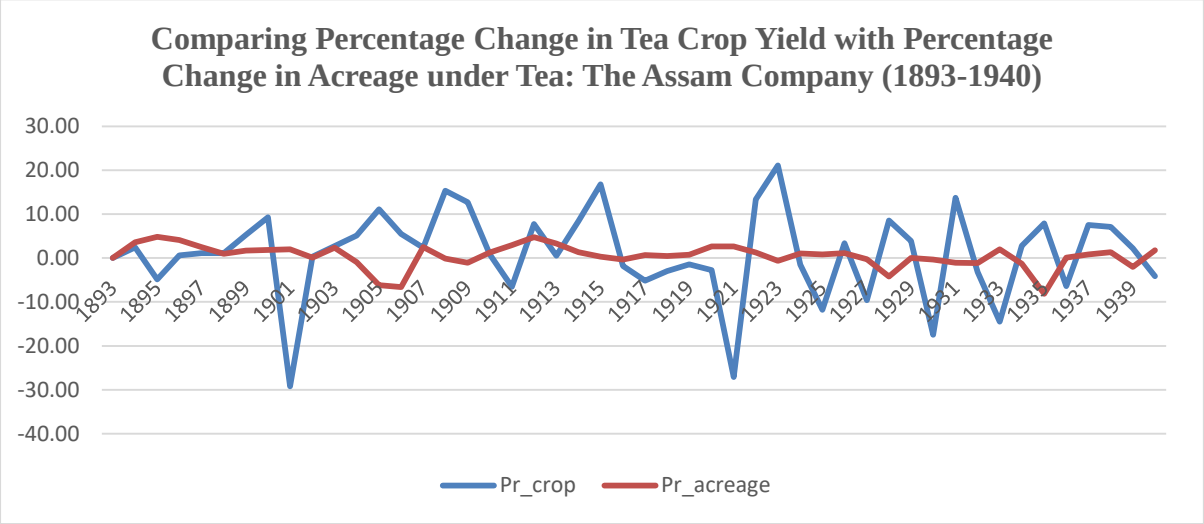
Before exploring how planters and agricultural experts connected concerns regarding the quality and quantity of tea output with that of the quality of soil of the plantations, a brief perusal of the statistics of tea outputs may help us better understand the rising concerns of the planters. Was there a major per acre yield crisis that compelled a systematic investigation into

[44] Ibid., p. 20.

[45] Barker, *A Tea Planter's Life in Assam,* p. 121.

questions of tea production in Assam? We take the case of the Assam Company, the oldest tea company established in 1839 and see if there were any major trends that can shed more light into the subject.[46]

Graph 1: Comparing Percentage Change in Tea Crop Yield with Percentage Change in Acreage under Tea: The Assam Company (1893-1940)



Source: Data taken from H. A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957), pp. 407-12.

In the above graph, the x axis shows the annual percentage change in tea per yield (represented by the blue line) and the annual percentage change in acreage under tea (red line) over the period of 1893-1940. It is evident that the percentage of change in crop yield was much more volatile than the changes in the acreage under tea. It is also important to note here that by the 1880s, the production of tea in Assam was quite favourable in terms of lowered production costs with an overall improvement and efficiency of machinery, cheaper transportation costs, more skilled garden labourers with the years of experience, extension of new tea cultivation in the best soils available as well as with the best class of plants.[47] Therefore the concern that George Barker had of lower productivity in older garden lands

[46] The complete table with the exact figures have been given in Appendix A.

[47] Percival Joseph Griffiths, *The History of the Indian Tea Industry* (London: Weidenfeld & Nicolson, 1967), p. 125.

would have been masked with more efficient usage of the other means of production as well as the newer lands being acquired each year in the overall yield per acre. Even with the lower production costs in the Assam gardens, since the 1890s, the yield per acre barely rose and the prices of tea were gradually decreasing which continued till the twentieth century which the chairman of the ITA in 1900 said was the result of the tea being "common in quality" and the out markets of tea being captured by Ceylon.[48] The graph in question indicates that even with an almost steady acreage under tea and the gradually increasing attention given to maximize profits, the production was extremely volatile, which was probably a cause of concern for the planters.

Encountering Change: Scientific Beginnings

> Is it too much to expect that, in the course of time, to the monotonous report of 'greyish, fair tip, brisk, little flavor', may be added the more desirable information of 'fairly gummy, potash 2-13 per cent only, good trace of Essential Oil'? We could then with our knowledge of manures (,) supply after a while the lacking Potash, and do our best to keep up the desired proportion of Essential Oil. [49]

To initiate a discussion on the scientific beginnings of tea in Assam, it is crucial to understand that, in matters of tea, historians have shown that an over-arching scientific know-how was not always available and "ambivalences and dissonances beset science".[50] The hierarchy between Western scientific knowledge and on-field knowledge was not always fixed and more often than not, field experiences were accorded more importance, sometimes due to the lack of information regarding the issue at hand and at times for the sake of profit.

[48] Ibid., pp. 129, 141; Harold H. Mann, 'The Indian Tea Industry in its Scientific Aspects', *Journal of the Royal Society of Arts*. Vol. 79, No. 4089 (April 3rd, 1931), p. 474.

[49] Talking about the absence of reliable and specific feedbacks on the tea that planters were producing, one A.F. Dowling of the Kornaphuli Association in 1886 made his remark. – Griffiths, *The History of the Indian Tea Industry*, p. 425.

[50] Jayeeta Sharma, 'British Science, Chinese Skill and Assam Tea: Making Empire's Garden', *The Indian Economic and Social History Review*, 43, (4) (2006), p. 433; Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India*, pp.11-12.

This was true in the case of other colonial plantation crops as well, be it tea, coffee, indigo, and in the majority of cases, profitability superseded scientific sensibility.[51] Scientific officers too acknowledged the crucial role played by the planters, with seemingly no formal training, in experimenting with their tea crops which aided the scientific beginnings of the industry to a large extent. For instance, H. H. Mann, the first scientific officer to be employed for Indian tea, admitted that the practical planters of especially upper Assam, were highly instrumental in aiding the progress of scientific knowledge in the tea production process.[52]

Now within this backdrop, a brief engagement with some of the discussions and works of the nineteenth and twentieth century on issues of soil by planters and experts aids us in locating how soil and its replenishment began to occupy a central position in the Assam tea plantations. Although scientific deputations and investigations were underway in tea since the beginning yet it was first in 1884 that a collective initiative towards research on tea was undertaken, as mentioned in the previous chapter.[53] Evident from the above quote, planters were eager to receive specific recommendations about the tea that they were producing and the subject of fertilizing and manuring was one of the first subjects to attract scientific attention.[54]

In 1889, samples of oilcake were sent to the Agricultural and Horticultural Society by Jardine, Skinner & Company on behalf of another tea company to ascertain its value as a fertilizer for tea. The Jardine, Skinner & Company, a trading company based in Calcutta, opined that tea planters and managers were unaware of the richness of manures yet spent a

[51] T. J. Barron, 'Science and the Nineteenth-Century Ceylon Coffee Planters', *The Journal of Imperial and Commonwealth History* 16 (1) (1987), pp. 5-23; Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India,* pp. 11-12; Prakash Kumar, 'Plantation Science: Improving Natural Indigo in Colonial India, 1860-1913', *The British Journal for the History of Science*, 40 (4) (Dec., 2007), pp. 537-565.

[52] Mann, 'The Indian Tea Industry in its Scientific Aspects', p. 479.

[53] Griffiths, *The History of the Indian Tea industry*, p. 125.

[54] Ibid., p. 425.

great deal of money on fertilisers; notably, almost one lakh rupees was annually spent on organic fertilisers in Cachar alone during the late 1880s.[55] In response, the Agricultural and Horticultural Society took the guidance of Surgeon-Major Warden, a professor of chemistry employed in the Calcutta Medical College. Warden stressed the need to analyse the soil of the gardens before any advice on fertilisers could be given and although he undertook this task for a while yet the necessity of a full time appointment of a soil chemist for tea was felt.[56]

To fill this requirement, in 1891, M. K. Bamber was appointed as chemist by a joint committee of the ITA and the Agricultural and Horticultural Society. Bamber began his investigations on the soil of different tea gardens and at the auspices of the ITA and the Agricultural and Horticultural Society liberally made use of the chemical laboratory at the Calcutta Medical College to perform his soil analyses.[57] His observations and recommendations have been discussed in the later section of this chapter. Bamber, having taken up another job with the Government of India in 1893, the research on soil, manures and his possible involvement in solving the insect problem which was also simultaneously raising concerns, also came to a halt for some time.[58] Botanist, George Watt, was sent to tour the province in 1894 to report on the pest problem; and his observations and recommendations form an important part of the next chapter where we discuss the problem of pest at length. However, the important thing to note from these temporary appointments was that by the year 1896, the need for the appointment of a special scientific officer dedicated to thorough investigations into the chemistry of the tea plant as well as its cultivation and manufacture

[55] Ibid.

[56] Ibid.

[57] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 2.

[58] Griffiths, *The History of the Indian Tea Industry*, p. 427; Letter from the Secretary, Indian Tea Association No. 150 O., dated Calcutta, the 18th March 1905 to the Secretary to the Government of India. Dept.-Commerce and Industry, Branch-Commerce and Trade. 1905, Part A. File No. 1-17. p. 8. NAI.

under the control and supervision of the colonial Government was strongly felt.[59] J Buckingham, then Chairman of the Assam branch of the ITA, led this discussion and also proposed ways to acquire the requisite funds for this appointment:

> In order to attract a really first-class man, a salary of at least Rs. 1,500 a month would have to be guaranteed for five years. Mr. Buckingham thinks that the money could easily be raised by a voluntary tax or subscription of one anna per acre under cultivation, and the Committee is also inclined to the opinion that this would probably be the best mode of obtaining the funds necessary, provided planters are unanimously agreed on the necessity for the appointment of such an officer. In this event, the Government could then fairly be asked to provide the necessary laboratory in Calcutta, and also any camp laboratories and instruments needed, in view of the importance of the tea industry as a source of revenue both to the Indian and Imperial Governments.[60]

Harold Mann was thus engaged as the scientific officer for three years in 1900 with the above estimated expenditure collected through contributions from the Lieutenant Governor of Bengal, Henry Cotton- Chief Commissioner of Assam, the Assam as well as the Cachar Branch of the ITA, the Dooars Planters' Association, and the Terai Planters' Association.[61] After a preliminary tour, Mann identified a few main aspects that warranted immediate investigations in the Assam tea gardens, among which the "fundamental investigation was that of the soil, the means of retaining fertility and suitability for tea for an indefinite time, and the methods possible for improving the quality of tea obtained from it."[62]

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[59] *Report of the General Committee for the year ending 29th February 1896* (Calcutta: Indian Tea Association, 1896), p. 40; Griffiths, *The History of the Indian Tea Industry*, p. 134.

[60] *Report of the General Committee for the year ending 29th February 1896* (Calcutta: Indian Tea Association, 1896), p. 12.

[61] *Report of the General Committee for the year ending 29th February 1899* (Calcutta: Indian Tea Association, 1899), p. 11; Griffiths, *The History of the Indian Tea Industry*, p. 426.

[62] Letter from the Secretary, Indian Tea Association No. 150 O., dated Calcutta, the 18th March 1905 to the Secretary to the Government of India. Dept.-Commerce and Industry, Branch- Commerce and Trade. 1905, Part A. File No. 1-17. p. 4. NAI.

Eventually at Mann's insistence in 1902, it was realised that it was about time that the scientific department that he kick-started needed to be expanded both in terms of infrastructure as well as man-power.[63] With annual contributions from the Government of Bengal and Assam, the Government of India, various planters' associations and the rest contributed by the Indian Tea Association amounting to around Rs. 27,000 per annum, Mann's proposal was put into effect.[64] Mann carried out his experiments in various parts of Assam, Darjeeling-Terai and also visited Calcutta from time to time to work on the results obtained in his tours.[65] He also proposed the establishment of an experimental station for dedicated research on tea, effort for which began from 1904, eventually taking concrete shape in the form of the Tocklai Experimental Station in the year 1911.[66] Initially, with thirty-two acres of land at their disposal for conducting tea research at Heeleeka, in eastern Assam in 1905, investigations on manurial requirements, pruning, pests, plant diseases and many other aspects began to take place.[67] The Advisory Officers who worked closely with the scientists at Tocklai were stationed at various tea districts which helped them disseminate the knowledge that Tocklai produced.[68] And by the early 1930s, in the realm of departments maintained by industries similar to tea, the scientific department of the ITA emerged as one of the largest in the world.[69]

[63] Griffiths, *The History of the Indian Tea Industry*, p. 431.

[64] Ibid.; Letter to the Secretary, Indian Tea Association, No. 4050 C., dated 4th August 1905, acknowledging receipt of serial No. 4., Dept.-Commerce and Industry, Branch- Commerce and Trade. 1905, Part A. File No. 1-17. p. 5. NAI.

[65] *Report of the General Committee for the year ending 29th February 1902*, (Calcutta: Indian Tea Association, 1902), pp. 13-14.

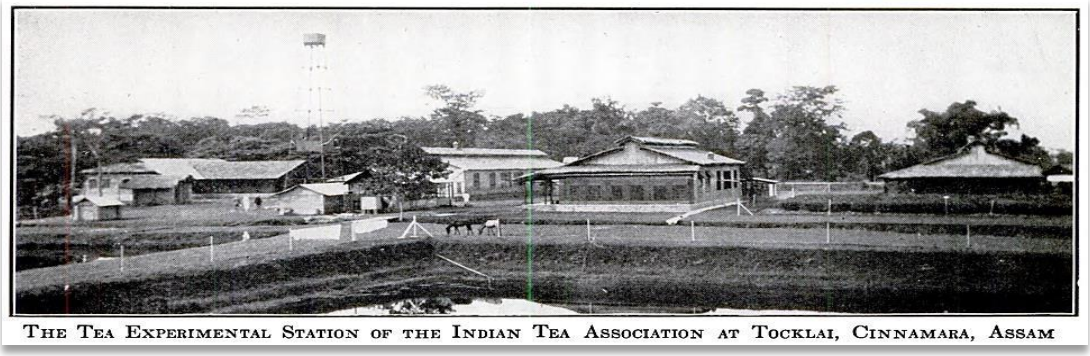
[66] Ibid., p. 14; H.A. Antrobus, *A History of the Jorehaut Tea Company Ltd. 1859-1946*. (London: Tea and Rubber Mail, 1948), pp. 174-175.

[67] Griffiths, *The History of the Indian Tea Industry*, p. 432; *Annual Report of the General Committee for the year ending 30th June 1921*. Surma Valley Branch (Calcutta: Indian Tea Association, 1921), pp. 20, 22.

[68] Govt. of India, *Report of the Plantation Inquiry Commission* (Delhi, Manager of Publications-GOI Press, 1956), p. 233; Ukers, *All About Tea*, p. 408.

[69] Mann, 'The Indian Tea Industry in its Scientific Aspects', p. 474.

Fig 7: The Tea Experimental Station of the Indian Tea Association at Tocklai.



THE TEA EXPERIMENTAL STATION OF THE INDIAN TEA ASSOCIATION AT TOCKLAI, CINNAMARA, ASSAM

Source-William H. Ukers, *All about Tea.* (New York: The Tea and Coffee Trade Journal Company, 1935), p. 409.

With the establishment of the scientific department, there were indeed discernible increases in the production rates of tea in Assam as shown in the table below. Since the beginning of the scientific department in the twentieth century, barring the post WW I disruptions, there was considerable increase in the production per acre figures. However, Mann believed that although greater scientific knowledge played its part, yet this increase was also, in part, due to the extension of new lands and, in consequence, the greater number of newer tea bushes that inevitably had greater produce.[70]

Table 6: Average Tea Yield per Acre in Assam from 1885 to 1929

Period	**Average Tea Yield per Acre in Assam (lb. per acre)**
1875-76	229
1876-77	228
1877-78	286
1878	260
1879	278
1885 to 1889	316
1890 to 1894	358
1895 to 1899	361
1900 to 1904	416
1905 to 1909	477
1910 to 1914	531
1915 to 1919	614

[70] Ibid., pp. 475-476.

1920 to 1924	527
1924	576
1926	575
1929	603

Source: Data for the years 1875 to 1879 is taken from *The Tea Cyclopaedia: Articles on Tea, Tea Science, Blights, Soils and Manures, Cultivation, Buildings, Manufacture Etc., With Tea Statistics* (London, 1882), pp.266-267; Data for the years 1885 to 1929 taken from H. H. Mann, 'The Indian Tea Industry in its Scientific Aspects.', *Journal of the Royal Society of Arts*, Vol. 79, No. 4089 (April 3rd, 1931), p. 475.

Within this background of increasing scientific expertise developing in the province to make tea cultivation successful and to understand its environmental specificities, we move on to see how some of these experts and also their earlier counterparts and planters connected issues of tea output with that of the soil in the plantations.

Depleting the Ground: Exhausted Soil

The plantations imposed constant pressure on the soil resulting in its exhaustion, a common characteristic of almost every mono-plantation; be it in the colonial tobacco plantations in the American south where the planters moved from one area to the other as continuous cultivation sucked all the nutrients from the soil, or sugar plantations which resulted in extreme soil exhaustion in Brazil and Caribbean by the mid-17th century.[71] Exhaustion in the case of the Assam tea plantations was aptly pointed out by Edward Money, a military official turned planter, as early as in the 1870s, whose work was acknowledged by *Agricultural and Horticultural Society of India* in 1872.[72] He wrote, "The tea plant is being continually denuded of its leaves; nothing is returned to the soil; and consequently in process of time that soil is exhausted."[73] Planter Samuel Baildon, writing in the early 1880s discerned a fall in

[71] Tamar Haspel, 'Monocrops: They're a Problem, but Farmers aren't the Ones who can Solve it', *The Washington Post*. May 9, 2014; Ted Steinberg, *Down to Earth: Nature's Role in American History* (New York, Oxford: OUP, 2002), pp. 72-73; Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Islands Edens and the Origins of Environmentalism, 1600-1860* (Cambridge: Cambridge University Press, 1995), p. 63; Sidney W. Mintz, *Sweetness and Power: The Place of Sugar in Modern History* (USA: Penguin Books, 1986); Montgomery, *Dirt: The Erosion of Civilisations*, pp. 136-139.

[72] Money, *The Cultivation and Manufacture of Tea*.

[73] Ibid., p. 178.

flavor and strength of tea in older gardens of Assam which he attributed to exhaustion of the soil.[74]

Similar sentiments found expression in the scientific discussions of Kelway Bamber and Harold H. Mann.[75] Bamber published his findings based on the investigations that he performed on soil samples from almost all tea growing districts of Assam, Dooars, Cachar, and Darjeeling in 1891.[76] Commenting on the varying characteristics of soil in Assam used for planting of tea, Bamber remarked- "Most of them are of the class known as "transported soils " that is, brought down and deposited from running water; a few perhaps are formed from the decomposition of the rock beneath, and are known as "sedimentary soils", and the remainder are the peat or *bheel* soils."[77] Interestingly, while observing a few samples of *bheels*, of Central Cachar, Bamber opined that "it is a curious fact that the longer the different portions had been under tea, the less organic matter and nitrogen they contained."[78] Not only in peaty lands, other lands under tea for longer periods too showed signs of waning productivity in Bamber's investigation of soil samples. The following quotes, first being from a district in Dooars which previously carried good timber before being cleared for tea and the second from Cachar, portrays this depletion of nutrients -

> …soil…had been under tea for some years…The bushes were fairly healthy, but had fallen off in yield, partly owing to age, and partly to the readily available plant food having been largely used up.[79]
>
> A soil from the Hailakandy District of Cachar. This was a heavy clay loam of average fertility that had been under tea for several years. It was exceedingly poor in organic matter and nitrogen, and required

[74] Baildon, *The Tea Industry in India*, p. 104.

[75] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, pp. 76-77.

[75] Ibid.; Mann, *The Tea Soils of Assam and Tea Manuring*.

[76] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, pp. 76-77.

[77] Ibid., p. 55.

[78] Ibid., p. 70.

[79] Ibid., p. 59.

> drainage and the application of a good general manure, or the hoeing in of large quantities of green jungle to lighten the soil, and increase the amount of humus matter.[80]

Mann's work, specifically concentrating on the tea soil of Assam, published in 1901 as a result of his investigations in the province from 1900 to the beginning of 1901 also touched on soil exhaustion. Echoing Bamber, he too noticed a widespread deterioration of the older portions of tea gardens which he believed was the result of either exhaustion of soil or the old age of the bushes, or a combination of the two.[81] Mann was convinced that exhaustion of soil played a crucial role in deteriorating the tea plant and he demonstrated a way to discern the nutrient loss in soils under tea in his treatise. By taking soil analyses of "virgin" lands vis-à-vis lands under 10 years of tea in various tea growing districts of Assam, Mann calculated the loss of nutrients in both categories.[82] He found that in gardens that were extensively cultivated, almost 2 percent of the total nitrogen originally present could be lost per acre under tea in a year. This loss however was not solely due to the regular plucking of leaves from the tea bushes, but also partly attributed to "leakages" which he identified as consequences of longstanding deep and constant cultivation with incessant weed removal and a lack of green manures to retain the loss of nitrates. This, Mann believed, intensified as years passed in soil under tea.[83] Manuring of the garden soil seemed imperative to Mann on all but the youngest gardens. Yet he still believed that very small amounts of manure in the form of artificial manure would be required by Assam soil as organic hummus and the fertile tea soil were enough to sustain good tea for many years to come.[84]

Another planter named G. Sherrard hinted at a connection between exhaustion of soil under tea plantations and the manufactured landscape of the plantations. For instance, one of his

[80] Ibid., p. 66.

[81] Mann, *The Tea Soils of Assam and Tea Manuring*, pp. 2, 4.

[82] Ibid., pp. 4, 42.

[83] Ibid., p. 43.

[84] Ibid., p. 4.

writings in the periodical- *The Assam Review and Tea News* in the late 1920s, argued that nitrogen accumulated in the soils under forest cover and as soon as the forest was removed to facilitate the establishment of tea gardens, as elaborately described in the previous chapter, the fertile nitrogen laden soil began to degrade rapidly. He estimated that in the tea soil the loss of nutrient was from sixty to one hundred pounds per acre per annum. Sherrard too stressed the importance of correct manuring to remedy this degradation.[85] Therefore it was gradually realised that tea would be profitable only if sufficient nourishment was provided to the soil since apart from concerns of declining productivity of plantations, the simultaneous pest problem in the tea gardens also gradually came to be associated as one of the many repercussions of soil exhaustion, which shall be addressed in the next chapter.

In contrast to plantations, tropical Asian agriculture where wetland or paddy rice cultivation covered a substantial portion of agricultural lands, the "sluggish water nurtured nitrogen-fixing algae that functioned as living fertilizer" helped retain nutrients in these lands.[86] Additionally, rice paddies were also ideal for the decomposition and recycling of human and animal wastes in Asia.[87] This points to the higher levels of soil degradation that tea plantations induced on Assam's soil compared to, say, its mainstay rice cultivation. Moreover, with such mass soil degradation, loss of organic matter in these tea plantations' soil was inevitable. In case of forests, the soil and the plants shared interdependence of a nutrient cycle as briefly mentioned earlier which kept the soil fertile for longer. But in case of plantations, next to nothing in the form of decaying leaves and branches came back to the earth to replenish it.

[85] G. Sherrard, 'The Foundation of the Tea Industry', *The Assam Review and Tea News*. Vol. II, No. 5. (July, 1929), p. 381.

[86] Montgomery, *Dirt: The Erosion of Civilizations*, p. 180.

[87] Donald Worster, 'The Good Muck: Toward an Excremental History of China', *RCC Perspectives*. No. 5, (2017), pp. 1-54.

Bamber pointed out another grave issue that he witnessed in the tea gardens- the problem of soil erosion or the whittling away of a land's topsoil. As a rule, apart from "soil properties inherited from the parent material (rock), and the local climate, organisms, and topography" which determined soil erosion rates, soil with higher organic matter were better equipped to handle erosion as "soil organic matter binds soil particles together, generating aggregates that resist erosion."[88] Moreover, recent studies on plantation crops like coffee, cocoa and tea shows that soil erosion was higher in these plantations where there were inadequate shade trees and low planting density which resulted in a low organic matter in the soil in the form of the protective mulch.[89] And as already discussed, the Assam plantations were especially denuded of organic soil matter and therefore erosion emerged as a common problem in tea plantations. In a study on Ceylon in the 1930s, three different forms of cultivation techniques prevalent in tea estates showed soil erosion in six years which were respectively 101.8, 56.7 and 92.4 tons per acre, whereas recent studies show that 4-5 tonnes per hectare (1 hectare = 2.47 acres) is an acceptable rate of erosion.[90] Similar to tea, by the 1930s, British colonies of East, Central and Southern Africa were also witnessing grave soil erosion as evident from the importance this problem was given in their colonial environmental policies.[91] On matters of erosion, forest officials also acknowledged that deforestation was a major contributor of such soil erosion yet no concrete recommendations were put forth to the planters to combat such maladies since the primary concern was safeguarding their rights to lands housing timber.[92] Commenting on the attitude of foresters on such issues, historian S. Ravi Rajan writes:

[88] Montgomery, *Dirt: The Erosion of Civilizations*, p. 20.

[89] Alfred E. Hartemink, 'Plantation Agriculture in the Tropics: Environmental Issues', *Outlook on Agriculture.* Vol. 34, No. 1, (2005), pp 11–21.

[90] Govt. of Bengal, *Report of the West Bengal Forest Committee* (Alipore: Bengal Govt. Press, 1939), p. 13; Hemchandra Saikia, 'Urgency to Stop Soil Erosion', *The Sentinel*. 5 Dec, 2019. Accessed 28 Jan, 2021. https://www.sentinelassam.com/editorial/urgency-to-stop-soil-erosion/

[91] Rajan, *Modernizing Nature: Forestry and Imperial Eco-Development 1800-1950*, p. 182.

[92] Ibid., p. 183.

> The response of foresters to agriculture-related issues such as soil erosion was largely shaped by the belief that they were simultaneously economic producers and environmental guardians. Such a mindset, as argued earlier, has its roots in the very disciplinary ethos of continental forestry, in which colonial foresters were trained and which they imbibed…To adapt a phrase initially used to describe colonial conservationists in general, theirs was an ideology of 'doom and resurrection' stemming from the fear that but for urgent action marginal lands, especially forests, would be taken over and destroyed.[93]

In Assam, the issue of erosion particularly plagued the tea plantations in Cachar. Here, initially plantations were established in the *teelas* or hillocks which, coupled with intense cultivation and weeding practices, often posed an increased and a more visible form of erosion by loosening the top soil which washed off during the rains.[94]

> The sites and soils first selected in Cachar were the small teelas, which are prevalent throughout most of the district…..Most of these soils have little adhesive power, and cultivation together with the heavy rainfall of the district, soon caused the fine portions of the soil to be carried away and deposited in the bheels and valleys between them. With this wearing away of the soil, the plants also deteriorated, and it became necessary for planters to adopt some means of renovation.[95]

> …from a teela that had been under tea for several years, and from which the original surface soil had been largely removed by drainage. It is exceedingly poor in almost every plant constituent, and would require the frequent application of large quantities of general manures to increase the outturn of leaf.[96]

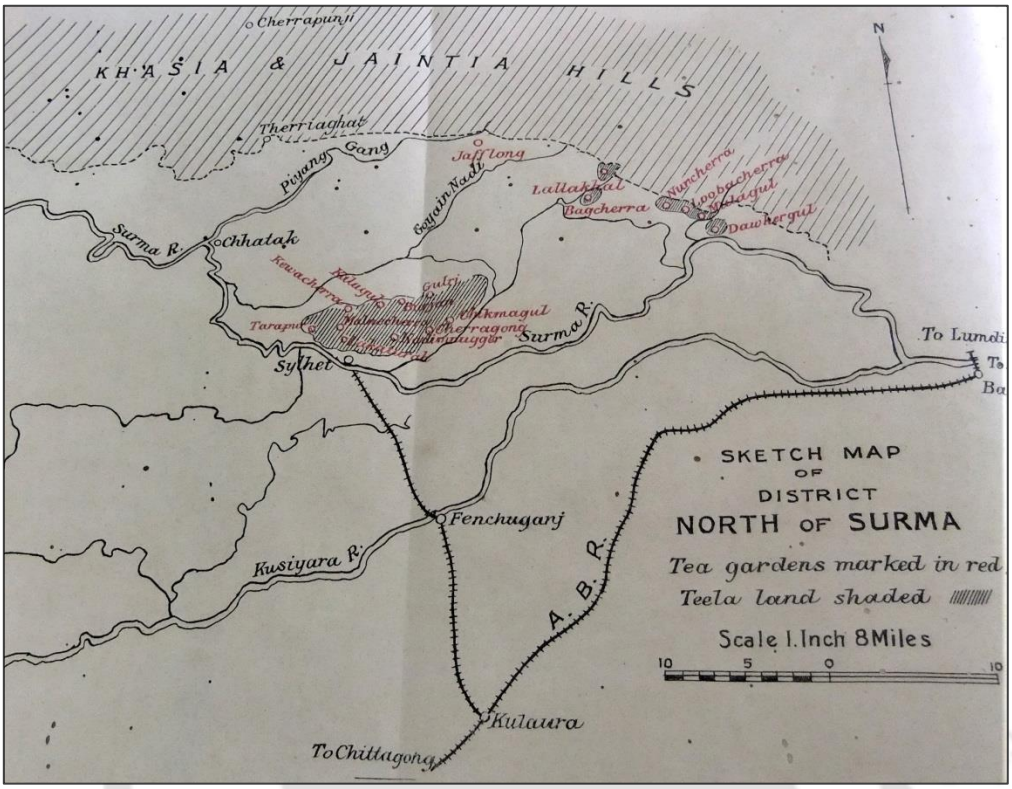
[93] Ibid., p. 188.

[94] Govt. of India, *Report of the Plantation Inquiry Commission.* (New Delhi, Manager of Publications-GOI Press, 1956) p. 60; Ukers, *All About Tea*, p. 380; Bald, *Indian Tea: Its Culture and Manufacture*, p. 160.

[95] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 53.

[96] Ibid., p. 66.

Map 4 : Sketch Map of District North of Surma showing Tea Plantations



The map shows how almost all the tea gardens depicted were established in *teela* lands. Source: *Quarterly Journal.* Scientific Department. Part II 1925 (Calcutta: Indian Tea Association,1925).

Even if we assume that these soils were already friable and thus prone to erosion irrespective of the establishment of tea plantations, a close reading of Bamber's account reveal that earlier these *teelas* were, in fact, covered with forests and would probably not have suffered the fate of grave erosion. Bamber therefore wrote:

> Some of these soils when first cleared must have been fairly rich and strong, from the appearance of the jungle and forest growing on uncleared teelas at the present time, but they have in almost every case rapidly deteriorated, more from the amount removed by wash and heavy rainfall than from what has been removed by the tea itself.

> When protected from direct rainfall by the jungle growth they gradually increased in richness and value in the same way as other forest soils, but after the jungle was cleared away and the surface soil loosened by cultivation, they were washed down from the summit and slopes of the teelas.[97]

However, towards the late colonial period, in order to preserve such sloping terrains planted with tea, discussions emerged regarding the desirability of replacing the general practice of table top pruning of tea bushes in slopes to the method of slope pruning.[98] Slope pruning ensured that all tea bushes were pruned in a way that they covered the varying slopes of the hill slopes uniformly thus lowering the risk of erosion. This method could lessen the force of the monsoon rains on the slopes through the wide spreading foliage of the tea bushes in the slopes.[99] Moreover, in Cachar, by the 1930s, the practice of planting tea on the *teelas* was gradually replaced by planting in the *bheels* or in flat areas that lay between hills that had a lower risk of erosion of its surface soil.[100]

On the question of erosion, another idea put forward by Strickland, professor at the School of Tropical Medicine and Hygiene Calcutta, in the 1930s shows how knowledge regarding the consequences of laying out a plantation was continually evolving. Refuting the pervading idea of jungles being the breeding ground of miasma and fever, Strickland opined that clearing jungle cover, in fact, increased the likelihood of an area becoming malarious.[101] Reducing surface water through good drainage in the tea plantations and covering these drains by planting "suitable jungle" beside them was recommended, as the jungle coverage with their network of roots helped keep the soil together and prevented erosion. Erosion, as Strickland added, was a serious problem in some plantations in Assam together with the

[97] Ibid., p. 57.

[98] J.W. McKay, 'Slope Pruning of Tea', *The Assam Review and Tea News*. Vol. XXVIII, No. IV. (December, 1942). p. 161.

[99] Ibid.

[100] Ukers, *All About Tea*, p. 380.

[101] C. Strickland, 'Musings on Malaria', *The Assam Review and Tea News.* Vol. XXIX. No. II (April 1943), pp. 62-63.

silting up of drains.[102] And this washing off of soil had been connected to higher loss of lands from these regions during heavy rains when, according to Claud Bald, a former engineer turned tea planter, "streams become torrents, and the rivers develop devastating floods."[103] Bald's statement bears resemblance with an eighteenth century flood in the American James river where the river and its streams were overloaded with sediments due to erosion from nearby tobacco plantations which eventually warranted regular dredging of the port at Baltimore.[104]

Connecting the Dots

> The tea plant is a tree; but on a tea plantation it appears only as a low bush about three feet in height. This is because the tea tree-like Peter Pan-is never allowed to grow up.[105]

Discussions among planters and agricultural experts often revealed the interconnectedness between the methods of cultivation practiced in the plantations with the accelerated deterioration of the soil. The tea bush was often deemed to be a hardy evergreen plant in official narratives,

> The periodical exhaustions observable in the operations of agriculture where the soil has borne the same or similar crops for many years successively without manure, do not appear to occur in the tea plant, a circumstance which I imagine is to be attributed more to the nature and habits of the plant itself than to any extraordinary fertility of soil.[106]

The naturally tall and bushy indigenous Assam tea plant was slowly modified through human intervention to stay as a low branched bush densely covered with a number of small branches.

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[102] Ibid.

[103] Bald, *Indian Tea: Its Culture and Manufacture*, p. 160.

[104] Steinberg, *Down to Earth: Nature's Role in American History*, p. 74.

[105] N.W.P. Walsh, 'How Indian Tea is Grown and Made', *The Assam Review*. Vol. I, No. 4. (June 1928), p. 35.

[106] Report of the Superintendent, Correspondence between George Williamson, Supt. Assam Company to Henry Mornay, Secretary Assam Company in Antrobus, *A History of the Assam Company, 1839–1953*, p. 483.

As a result, these bushes bore leaves that were much larger than that of the indigenous wild plant. Moreover, the plant's capacity to flower and bear fruit too had become limited, and in its place the plant's entire energies were forced towards producing complete new set of shoots every seven to ten days, that facilitated plucking.[107] Pruning to keep the plant low and accessible and continuously plucking off tender leaves for the greater part of the year drained the plants' nutrients. Plucking, in the majority of cases, began on the third year of plantation.[108] Estimates made by planters and scientists confirmed that the Assam indigenous tea plant could produce around four or five flushes during a season, however since the late nineteenth century, the yield increased to facilitate around 30 to 35 flushes a year with adequate labour.[109] Thus, through constant tweaking of the natural processes of the plant to serve the capitalist interest of the British Empire, the tea plant was forced to produce a huge and disproportionate amount of leaves without being offered any rest to allow natural and healthy growth.[110] The isolation of the tea plant from the other plants as well as its transposition from the forest environment, as highlighted in the previous chapter, ensured that the natural course of its development was highly restricted.[111] The extreme strain that the tea plant was constantly put through and its resultant effect on the soil were indeed acknowledged by many. These changes were slowly becoming perceptible to the planters and the earlier faith on the never ceasing fertility of the Assam's soil slowly began to fade away and gradually planters, scientists and tea companies began to recognize the need for manuring in tea.

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[107] George Watt, *The Pests and Blights of the Tea Plant: Being a Report of Investigations Conducted in Assam and to Some Extent also in Kangra.* (Calcutta: Government Printing India, 1898), pp.16-17, 28.

[108] Baildon, *Tea in Assam*, p. 21.

[109] Ukers, *All About Tea*, p. 394; Watt, *The Pests and Blights of the Tea Plant: Being a Report of Investigations Conducted in Assam and to Some Extent also in Kangra,* pp.16-17.

[110] Watt, *The Pests and Blights of the Tea Plant: Being a Report of Investigations Conducted in Assam and to Some Extent also in Kangra,* pp.16-17.

[111] Ibid.

Questions of degrading soil quality coupled with problems of soil erosion increasingly necessitated discussions on the effect of plantation practices on the tea plant itself and the soil. Tea plantations as a capitalist venture emerged as a major force behind such re-orientations and exhaustion of natural resources both within and surrounding the plantations. Consequently, with the large scale disruption of the natural landscape, planters and scientific experts began to devise ways to keep these plantations profitable.

Negotiating with Nature: Debates surrounding Manure

> Manuring, reduced to elementary terms is getting nitrogen into the soil either to fertilize poor ground or to replace nitrogen that has been lost from what has been taken out by plucking; for you cannot go on forever on the same soil without re-fertilizing.[112]

> Manure is to a tea garden what daily food is to an animal; it must be procured at any sacrifice.[113]

Manures were defined as substances used to improve the quality of soil or to restore nutrients to the soil denuded of its fertility due to perennial cultivation. Expertise in defining manures, its constituents, methods of use, etc. were attributed mostly to experienced planters and celebrated agriculturalists' works. Although the benefit of manure was known to the Assamese peasants, yet their use was limited to sugarcane and tobacco crops till at least the 1920 and that too animal refuse, bone-meal, *bheel* dressing, ashes, etc. were the preferred manures.[114] Tea cultivation borrowed generously from European and American agricultural researches and farming experiences. As previously mentioned, flat land farming methods in Northern Europe more or less succeeded in preserving soil vitality. By the 17th century, soil improvement theories began to pervade England with the increase in population along with a popularization of yield increasing agricultural techniques like complex crop rotations,

[112] 'The Question of Manure', *The Assam Review and Tea News*. Vol XXIX. No. III. (May, 1943), p. 124.

[113] *The Tea Cyclopaedia*, p. 173.

[114] Rajen Saikia, *Social and Economic History of Assam 1853-1921* (New Delhi: Manohar Publishers & Distributors, 2000), p. 96; Narayan Chandra Baruah, *Assamiya Krishi Boson* (Assamese) 1nd Part. (Jorhat, 1910 saka), pp. 10-15.

growing legumes and usage of manures.[115] By the eighteenth century, communal use of land was deemed to degrade soil fertility and enclosing these lands into big private estates emerged, as did the growing importance given to manuring.[116]

Publications on the varying topics of tea cultivation lent greatly in progressing towards an organized system of information sharing among the planters and practically everyone involved with the tea industry. The *Transactions of the Agricultural and Horticultural Society of India,* the first journal of agriculture in India was published from Calcutta from the year 1829. And over the years, the subject of tea found a major place in this journal; right from enthusiastic declarations "that the Muttock country-the garden of Assam- had just fallen into the hands of the English", to bearing discussions on the assessment of quality of Assam tea by brokers as well as its sales in London and much more.[117] Interestingly, a couple of volumes of this journal were also translated into Bengali under the title of *Hindusthaner Ksetra o Baganera Krsi Samajera Krta Karmera Bibaranpustaka*.[118] Since the first half of the nineteenth century, the subject of Assam tea also found place in various important journals and newspapers like the *Journal of the Asiatic Society of Bengal* and *The Englishman*.[119]

In 1873, the first serial on tea from India was started which was titled *Report on Tea Culture, Assam*. These reports mostly provided standard annual statistical data, such as total number of gardens, gardens closed, amalgamated, abandoned or newly opened, information on the management of gardens, data on exports and imports of tea seeds, prices, outturn and also

[115] Montgomery, *Dirt: The Erosion of Civilisations*, p. 94.

[116] Ibid., pp. 96,98.

[117] B. K. Sen, 'Growth of Scientific Periodicals in India (1788-1900)', (Supplement), *Indian Journal of History of Science*. Vol. 37, No. 3. (September 2002), p. S112; *Transactions of the Agricultural & Horticultural Society of India.* Vol VIII (Calcutta: Baptist Mission Press. 1841).

[118] Sen, 'Growth of Scientific Periodicals in India (1788-1900)', pp. S112-13.

[119] Ibid.

average rainfall records of the last few years.[120] In 1877, the fortnightly journal *Indian Tea Gazette and Tea Planters' and Share-holders Chronicle* began publication from Calcutta. Somewhere in the beginning years of 1880s, the *Indian Planters' Gazette* too began to be published, which later came to be known as the *Indian Planters' Gazette and Sporting News*.[121] All these publications began to re-iterate the relevance of this capitalist crop, with every aspect of its cultivation and manufacture under the watchful scrutiny of the colonial apparatus. With the establishment of Indian Tea Association in 1881, organized scientific research and publications solely concentrated on all aspects of the tea enterprise began to proliferate, and the subject of manuring tea came to occupy an important position in these discussions.[122]

Throughout the colonial period, planters and experts through such scientific exchanges began to discuss the use of sand, clay, chalk, lime, animal excrement, bonemeal etc. as manures to improve the texture of soil under tea.[123] Even in the nineteenth century when the idea of manuring was not universally accepted by planters, a Chinese adage regarding cultivation of tea was popular among the Assam planters- "without continuous manuring there can be no continuous harvest."[124] The prevalent idea that tea grew on poor soils in China as mentioned in an earlier section was supposedly followed by this adage that the Chinese cultivated only in accordance to the amount of manure available. According to planter Edward Money, the amount of tea that a plantation produced depended on a number of circumstances- climates, soil, pruning techniques and also on the use of manure.[125] With adequate manuring and good

[120] *Report on Tea Culture in Assam for the Year 1904* (Shillong: Assam Secretariat Printing Office. 1905); Sen, 'Growth of Scientific Periodicals in India (1788-1900)', p. S146.

[121] Sen, 'Growth of Scientific Periodicals in India (1788-1900)', p. S159.

[122] GOI, *Report of the Plantation Inquiry Commission*, p. 234.

[123] *The Tea Cyclopaedia*, pp. 169, 175, 179.

[124] Ibid.; Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 79.

[125] Money, *The Cultivation and Manufacture of Tea*, p. 95.

cultivation techniques comprising proper attention to land clearing, terracing and drainage[126], Money estimated about 25 flushes during a season in the late 19th century. In contrast, without proper cultivation techniques and manuring, only about 18 flushes were to be expected.[127] Even in the twentieth century, G. D. Hope, chief scientific officer at Tocklai, while admitting that old tea plants, poor soil and soil textures could benefit from the application of manures, believed that good cultivation came first and manuring should not be taken to replace that.[128]

It was realised early on that due to the perennial nature of tea cultivation, the soil will reach a stage when it will cease to provide nourishment to the plant.[129] Therefore returning the nutrients to the soil, especially potash, phosphorous and nitrogen which usually limited growth and productivity of plants, in general, became necessary; more so in tea, where leaves were routinely extracted.[130] To drive this point home, Charles E. M. Russell illustrated by taking the case of a 20 year old garden that annually produced 5 maunds of tea per acre. By this estimate, in 20 years, the yield of tea would be (5×20) 100 maunds per acre. According to his calculations, soils under tea lost around 6 percent of nutrient and taking this estimate, Russell computed that for every 100 maunds of tea, the soil would be denuded of 6 maunds of nutrients due to the action of removing the tea leaves alone. Ideally the removed leaves were the only loss of nutrients from the soil, however, in gardens where the prunings were not buried around the tea bushes and on gardens where seeds of the tea bushes too were

[126] GOI, *Report of the Plantation Inquiry Commission*, p. 108.

[127] Money, *The Cultivation and Manufacture of Tea,* p. 98.

[128] G D Hope, 'The Use of Artificial and Chemical Manures', *Quarterly Journal.* Scientific Department. Part II (Calcutta: Indian Tea Association, 1911), pp. 5-6.

[129] Charles E M Russell, 'On the Necessity for the Introduction of Artificial Manuring in Tea Cultivation', in *The Tea Cyclopaedia,* pp. 187-188; Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture,* p. 77.

[130] *The Tea Cyclopaedia,* pp. 187-188, 192; GOI, *Report of the Plantation Inquiry Commission,* p. 60; Ukers, *All About Tea,* p. 355.

collected along with leaves, the soil was further bereft of nourishment.[131] With most of the required carbon, oxygen and hydrogen obtained from the air and also existing plentifully in good tea soil, the most crucial minerals that needed to be re-applied to the soil regularly was nitrogen and potash. Other minerals like soda, magnesium, lime, oxide of iron, manganese, sulphur and phosphoric acid too were required by the tea plant but in smaller quantities.[132]

H. A. Antrobus, the official historian of the Assam Company while addressing debates involving manures admitted that the "question of manuring was a very controversial one."[133] The Assam Company's Board had their fair share of doubts regarding the usage of manure and it was only in the early twentieth century that their earlier conviction regarding the unrelenting fertility of the Assam Company gardens were dispelled. They gradually became aware of the fact that the demanding production process necessitated the application of manure in the plantations.[134] Dispelling initial doubts of planters regarding the use of manures, Edward Money wrote in the 1870s that initially manure was believed to alter the flavor of tea, which according to him was faulty knowledge, inherited from the Chinese. Money was highly convinced of the benefits of manure in increasing tea yields without affecting the flavour.[135] He encouraged planters to procure high amounts of manure in gardens that were older and deemed application of manure unnecessary in new gardens.[136] While Money discerned cattle manure as the best for tea, along with burying pruned branches, weeds and other garden refuse; yet later Mann dismissed these practices (except applying cattle manure) as impractical since the growth of weeds through these methods was

[131] Russell, 'On the Necessity for the Introduction of Artificial Manuring in Tea Cultivation', pp. 187-188.

[132] *The Tea Cyclopaedia*, pp. 195-196.

[133] Antrobus, *A History of the Assam Company, 1839–1953*, p. 190

[134] Ibid.

[135] Money, *The Cultivation and Manufacture of Tea*, p. 178.

[136] Ibid., p. 99.

noticed and weeds competed with the tea bushes for moisture and nutrients.[137] Money also advocated the use of chemical manures but it is interesting to note that he himself, in collaboration with a certain Mr. Ponder had patented a manure called '*Money and Ponder's Chemical Manure'* which might have played a role in his insistence on the use of chemical manures.[138] Money thus wrote,

> The best way to apply it, if enough manure is procurable, is round each plant ; not close to the stem (the rootlets by which the plant feeds are not there) but about 1 foot from it. Dig a round trench with a kodalee, about 9 inches wide and 6 inches deep, at the above distance from the stem, lay in the manure, and replace the soil at top. If the plants are young the trench should be narrower, shallower, and 6 inches, instead of 1 foot, from the stems….As to the quantity of cattle manure- Say for plants four years old and upwards (if younger, less will be an equivalent) one maund to 20 trees is a moderate dose, one maund to 15 trees a good dose, and one maund to 10 trees highly liberal manuring.[139]

Thus by the 1870s itself we can be sure that research and experiments associated with higher and better quality yield of tea was fully at work and markets saw the emergence of chemical manures designed specifically for the Assam tea plants.[140] Interestingly, Bamber mentioned that prior to 1877, manure was not thought to be a necessity in Assam tea plantations.[141] Even planters changed their opinions with time, regarding the extent of importance of manuring in tea. For instance Samuel Baildon, in one of his books written in 1877 talked about how good cultivation techniques coupled with good soil made the use of manure unnecessary. However, five years later in one of his works, he admitted that manuring was a very essential step to

[137] Mann, *The Tea Soils of Assam and Tea Manuring*, p. 29.

[138] Money, *The Cultivation and Manufacture of Tea,* pp. 66-67.

[139] Mann, *The Tea Soils of Assam and Tea Manuring*, pp. 66-68.

[140] Money, *The Cultivation and Manufacture of Tea,* pp. 66-67.

[141] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 80.

conserve the nourishment of even the best tea soils given the perennial nature of cultivation.[142]

By the last decade of the nineteenth century, it was realized by those at the helm of the tea enterprise that scientific enquiry into questions of tea production and soil fertility was inevitable. In this regard, the Indian Tea Association (ITA), which started out with representatives of nine firms forming its general committee, emerged as the earliest Association of tea producers in India and began publishing extensively on the various issues pertaining to the Assam tea gardens in their reports since its inception in 1881.[143] Surgeon-Major C. H. Warden, professor of Chemistry in the Calcutta Medical College, on being consulted by the ITA, undertook the task of analyzing soil samples from various tea gardens in the later part of the nineteenth century. It was only after that, in the 1890s, it was proposed to the ITA that a chemist needed to be employed in Europe at a government laboratory for at least a period of two years to analyze the tea plant, soil and manures. This expense was proposed to be borne by the ITA by expending a sum of Rs. 10,000 and by levying fees for analyzing soils and manures submitted by various gardens. As primary beneficiaries, appeals were made to the planters and the gardens to contribute to such research as well.[144]

The twentieth century saw an increase in the usage of manures in the tea gardens. For instance, in the records of the Jorehaut Tea Company, although the first mention of manuring its plantations was recorded in the 1880s to remedy the declining quality of their tea, and "top-soiling" was prevalent in the late 19th century, yet manuring experiments were carried out by the Company for the first time in 1905 with oilcakes and phosphates.[145] The Assam

[142] Baildon, *Tea in Assam*; Baildon, *The Tea Industry in India*, p. 104.

[143] *Report of the General Committee for the year ending 29th February 1892* (Calcutta: ITA, 1892), pp. 31-32.

[144] *Detailed Report of the General Committee of the Indian Tea Association*. (Calcutta: ITA, 1890), p. 117; Griffiths, *The History of the Indian Tea Industry*, p. 425.

[145] Antrobus, *A History of The Jorehaut Tea Company Ltd. 1859-1946*, pp. 90, 98.

Company gardens too began the practice of top-soiling, which mainly consisted of digging out the fertile top soil from *bheels* or swamps and applying it around the tea bushes. Antrobus calculated that around 2600 acres of garden land under the Assam Company till 1902 were manured with top soil. However, this process was very labour-intensive and with time the availability of this fertile *bheel* soil was also diminishing, so much so that at times the top soil applied was less fertile than the soil it was applied to.[146] Therefore by 1904, the Assam Company shifted to manuring with mustard oil cakes on a small scale and by the next year about one third of the Company's total garden area was manured using oil cakes.[147] The Assam Bengal Railway facilitated the transport of cheaper oil cakes from oil mills in Lower Assam and the Assam Company itself installed a crushing mill and made arrangements with Indian merchants who provided the raw material.[148]

The scientific department of the ITA in the first decade of the twentieth century, through both laboratory and field experiments, were concerned with determining manurial requirements of tea soils, possible residual effects of manures on tea, effectiveness of various manures, experiments on green manuring, preserving the health of younger tea bushes, renovation of older tea bushes and the like. The results of such experiments were published from time to time for the benefit of the planters who were looking for the best manures that would suit their gardens. Scientific officers paid visits to various gardens to provide assistance and advice regarding manuring and cultivation. Moreover, planters themselves too at an

[146] Antrobus, *A History of the Assam Company, 1839–1953*, pp. 190-91; Mann, *The Tea Soils of Assam and Tea Manuring*, p. 67.

[147] Antrobus, *A History of the Assam Company, 1839–1953,* pp. 190-91. - "By 1905 oil cake had been applied to 3600 acres of the better portions of the older tea-the Company total area being then some 10,184 acres."

[148] Ibid.

individual level, initiated experiments in their own gardens as tea science was still developing and there was still a lack of an overarching authority in matters of cultivating tea.[149]

H. H. Mann, who assessed the soil quality of the tea districts of Assam in the early twentieth century, opined how manure requirements essentially arose due to a need for "organic matter and nitrogen in almost every case, of phosphates often, and occasionally of potash." [150] Only nitrogenous and phosphatic manure were therefore needed till the early twentieth century and only the phosphatic manure was obtained from artificial sources.[151] Since at least the first decade of the twentieth century, it was emphasized that manuring was to be carried out in accordance to the need of the particular soil and a blanket recommendation could not be provided for manures that would benefit tea in general.[152] However, even till the beginning of 1920s, "scientific manuring" or a systematic form of manuring was not prevalent wherein cattle manure, *bheel* dressing and occasionally oilcakes were almost exclusively used, without heed to the specific need of the soils.[153]

However, things did not progress in such a linear manner and at every juncture there were doubts and confusions. For instance, in the twentieth century, the overwhelming support for manuring tea was slowly also revealing questions of mixed results of manures on plants. On a scientific journal published by the ITA in 1912, there were discussions regarding how an eminent school of agriculture in America maintained that applying soluble fertilizers to soil did not directly produce additional food in the soil but rather aided actions that indirectly benefited the soil and often resulted in "precipitating substances poisonous to plants

[149] *The Planters' Chronicle*. Feb 1909-Jan 1910. Vol IV (Madras, 1910) pp. 41, 42.

[150] Mann, *The Tea Soils of Assam and Tea Manuring*, p. 137.

[151] Ibid., pp. 62-63.

[152] E.A. Andrews 'Manurial Experiments', *Quarterly Journal.* Scientific Department. Part IV (Calcutta: ITA, 1913) p. 81; 'Recent Tours', *Quarterly Journal.* Scientific Department. Part IV (Calcutta: ITA, 1913) pp. 104-105.

[153] 'Touring Notes on Sylhet and Cachar', *Quarterly Journal*. Scientific Department. Part III (Calcutta: ITA, 1919) p. 109.

(toxins)".[154] However, these doubts and deliberations notwithstanding, the market for manures and fertilisers for the plantations did emerge since the twentieth century as discussed in the section below.

Manures: An Emerging Market

Even with the emergence of modern chemistry in the last decades of the eighteenth century, the idea that organic waste or hummus (a mixture of complex organic compounds resulting from the decomposition of biomass), top-soiling, and cattle manure were the primary source of all elements required by plants was pre-dominant. In the nineteenth century, a German chemist, Baron Justus von Liebig's findings and his influence in the field aided in popularizing the revelation that the use of inorganic compounds could alone help plants grow.[155] Through this idea, "plant growth was reducible to measurable chemical interactions" which gave birth to the idea that a single set of soil management techniques would work in agricultural production all over the globe.[156] The due attention to region-specific soil biology and ecology were dismissed and this belief "created a foundation for the expansion and acceleration of global capitalist production based on cheap food, expanded distribution, and readily available investment capital in the late nineteenth and early twentieth centuries".[157] This moved the power of expertise from the hands of the farmers to that of the laboratory and allowed colonial crop productions to expand in an unprecedented manner as the need to understand diverse landscapes in the colonies was eliminated to a great extent with their control over such scientific expertise. Moreover, the global market for agricultural chemicals

[154] Hope, 'The Use of Artificial and Chemical Manures', p. 71.

[155] Vaclav Smil, *Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production* (Cambridge, London: The MIT Press, 2001), pp. 1-2; Greta Marchesi, 'Justus von Liebig Makes the World: Soil Properties and Social Change in the Nineteenth Century', *Environmental Humanities* 12(1) (May 2020), p. 205; Montgomery, *Dirt: The Erosion of Civilisations*, p. 183.

[156] Marchesi, 'Justus von Liebig Makes the World: Soil Properties and Social Change in the Nineteenth Century', p. 206.

[157] Ibid.

also witnessed a tremendous growth since the late nineteenth and early twentieth century with "millions of tons of organic nitrogen fertilizer extracted from plant and animal bodies" entered the market, promising flourishing returns to commercial agricultural pursuits.[158]

A number of fertilisers began to be known to the late nineteenth century European farmer like- guano, bones, superphosphate, blood manure, wool manure, nitrates of soda and potash, gypsum, etc.[159] They were not exclusive to the plantations but many of these could be used in the cultivation of any crop for better results.[160] However, it was also admitted that manuring in horticulture was different from manuring other crops.[161] Additionally, historian Amiya Kumar Bagchi had opined that the use of artificial fertilisers and even the creation of demand for natural fertilisers in the whole of British India during the colonial period were not very pervasive.[162] As a whole, in British India, efforts at creating and innovating artificial fertilisers for crops in general were greatly lacking. In the twentieth century, the Departments of Agriculture and the Central Research Institute at Pusa were largely unsuccessful in conducting experiments on artificial fertilisers, mainly owing to financial constraints and therefore the advice that they provided often relied on evidences garnered from a small number of experiments, and such advices were often highly inaccurate and at times resulted in disastrous outcomes. This led to a loss of credibility of these departments in the eyes of the public and even if ordinary peasants wanted to try out the fertilisers, the high costs involved in procuring them proved to be prohibitive.[163] Yet there were localised experiments in some regions. Some results proved uneconomical and as a result in the 1920s, some provinces,

[158] Ibid., p. 207.

[159] *The Tea Cyclopaedia*, p. 180.

[160] Ibid.

[161] Ibid.

[162] Amiya Kumar Bagchi, *Private Investment in India 1900-1939* (Cambridge: Cambridge University Press, 1972), pp. 100-102.

[163] Ibid.

including Punjab, discontinued these experiments.[164] The lack of government initiative in the field of artificial fertilisers was taken up by private companies to an extent towards the late 1920s and by the mid-1940s, there were increasing success in experiments in artificial fertilisers for the major crops in India.[165]

Statistician-*cum*-historian, W. W. Hunter's early account of Assam shows that principal crops like rice were not regularly manured and when required, manuring was mostly confined to the usage of cow dung and rotten roots of plants used as topdressing.[166] In the districts of Cachar and Sylhet too, the use of manure was very limited and only confined to sugarcane cultivation and the use of oilcakes as manure.[167] In Cachar, only a small amount of manure was used for musturd, linseed and *mati-kalai* cultivation. In these districts, whatever manures were given to the fields were refuse that could be found in the homestead like cowdung and ashes.[168] Samuel Baildon was also struck by the continuing fertility of the farm lands of the Assamese small cultivators who cultivated a series of crops over the course of the year like rice, tobacco, sugarcane, melon, mustard, onions, brinjals, sweet potatoes, *mati-kalai* etc. without using manures.[169]

Operating within this context, the gradual expansion of a manure market since the late nineteenth century for tea plantations in Assam is interesting to note. For a long time, tea planters in Assam largely used animal excrement, linseed or castor cakes, bone dust, vegetable ashes, *bheel* dressing and various other wastes to replenish the soil with nitrogen

[164] Carl E. Pray, 'The Impact of Agricultural Research in British India', *The Journal of Economic History*, 44 (2), The Tasks of Economic History (Jun., 1984), p. 438.

[165] Ibid.

[166] W. W. Hunter, *A Statistical Account of Assam*, Vol I (London: Trubner & Co., 1879), pp. 70, 257.

[167] Ibid., p. 299.

[168] Ibid., p. 423.

[169] Baildon, *Tea in Assam*, p. 55.

and certain other soluble salts.[170] Neighbouring ponds, *jheels*, *bheels*, tanks and rivers provided valuable decomposed vegetable matter that was scooped out, making them good admixtures for tea soil.[171] A self-help manual for novice planters in the 1880s noted,

> Where the soil is decidedly in need of renovation, it may be submitted to the following treatment. Firstly, put on women to fork with large forks all round each bush to a radius of two feet...All soil should be carefully removed, saucer shape, and the roots exposed to the air...The roots may be left in this exposed condition for about a fortnight, when women and a few men should be put on to manure round bushes over their exposed roots, with fresh soil from pure leaf-mould from the neighbouring Hulas, (an old water-course or ravine) which are low-lying portions of land where much water collects during rains, and which have never been cleared of jungle. Consequently, as the leaves fall, they gradually become the soil spoken of as Leaf-mould manure, and which is recognised as one of the most strengthening manures which can be applied to a tea garden.[172]

Along with the application of nourishing matter to the tea bushes, discussions also continued throughout the colonial period regarding the effectiveness of green manuring or the planting of leguminous plants between tea bushes. Clearance of lands for tea plantation and continuous cultivation of tea led to a simultaneous loss of the store of nitrogen in the soil. The presence of nitrogen in plants is very abundant as well as essential for their growth. Yet tea plantation soil was very prone to being nitrogen-deficit.[173] Inadequate presence of nitrogen often manifested in the form of yellowing of leaves, stunted growth and lower yields. The climate of Assam contributed to the action of bacteria on the organic matter which rendered the nitrogen soluble and facilitated the absorption by the tea plant but in the process a large part of it was also carried away through the system of drainage in the plantation. In order to

[170] *The Tea Cyclopaedia,* p. 196; Mann, *The Tea Soils of Assam and Tea Manuring*; Baildon, *Tea in Assam*, p. 13.

[171] Sigma, 'Tea Cultivation', in *The Tea Cyclopaedia*, p. 98; F. T. R. Deas, *The Young Tea-Planter's Companion: A Practical Treatise on the Management of a Tea Garden in Assam*. (London: Swan Sonnenschein, Lowrey & Co., 1886), pp. 7-9.

[172] Deas, *The Young Tea-Planter's Companion: A Practical Treatise on the Management of a Tea Garden in Assam*, p. 7.

[173] Sigma, 'Tea Cultivation', in *The Tea Cyclopaedia*, p. 100; Smil, *Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production*, pp. xiv-xv.

combat the loss of nitrogen in drainage, it was advantageous to plant other plants in between the tea bushes which could capture soluble nitrogen, and such plants were buried beside the tea bushes to add organic matter to the soil.[174]

The shade trees planted in between tea acted as green manures most of the times and plants like *arhar*, *boga medeloa*, cowpeas, *dhaincha*, sunn hemp, *mati kalai*, mustard etc. too were at times planted with good results.[175] Although tea plantations in Sri Lanka, Indonesia and Africa planted both leguminous and non-leguminous shade trees, in Assam shade trees were mostly leguminous.[176] Experimental plots of leguminous plants were maintained for many years at the Tocklai tea experimental station. Along with indigenous leguminous plants, seeds of leguminous plants were also imported at times, producing mixed results.[177] In one of Tocklai's publications in 1946, it was asserted that –"In the few cases where fairly thick shade was planted with the tea, and bushes have been kept fully occupying the land, so that the soil's original virgin condition has been maintained, yields will be very high without any manure, and expenditure on manure is completely unnecessary."[178] The fallen leaves of the shade trees helped in replenishing the nitrogen content and acted as mulch in such soils.[179] Therefore it was opined that only when the shade trees outlived their purpose and in the time that it takes for the new shade trees to grow and induce its effectiveness, artificial manures or the use of *boga medeloa* or *arahar* was to be resorted to.[180] Such statements, time and again,

[174] G. Sherrard, 'Green Manures' Part I. *The Assam Review*. Vol. III No. I. (March, 1930), pp. 45-46; Ukers, *All About Tea*, p. 353.

[175] Ibid., p. 87; Ukers, *All About Tea*, pp. 389-390; Mann, *The Tea Soils of Assam and Tea Manuring*, p. 80.

[176] N. Ahmed, 'Shade Management' in B.K. Goswami (eds.) *Tea Field Management* (Jorhat: Tea Research Association (TRA), 2011), p. 48.

[177] A. C. Tunstall, 'The Green Manure Plots at Tocklai', *Quarterly Journal*. Scientific Department. Part I (Calcutta: ITA, 1917), p. 27.

[178] H. R. Cooper, 'Nitrogen Supply to Tea', *Memorandum No. 6*. Tocklai Experimental Station, ITA. (10th August 1946) p. 97.

[179] GOI, *Report of the Plantation Inquiry Commission*, p. 60; Ukers, *All About Tea*, p. 389.

[180] Cooper, 'Nitrogen Supply to Tea', p. 97.

reiterate the point that overproduction and capitalistic demands of tea itself had led to a gradual depletion of the soil's natural fertility which resonates with plantation histories all around the globe.

However, perennial crops with very high quantity yields which extended a large area of land were unable to derive all its nitrogen requirements in such a manner.[181] Assam's soil was at times declared to be more or less sufficient in potash and phosphoric acid for mature tea bushes and deficiency in nitrogen was the most prevalent. Some planters opined that on mature tea, compost manures and cattle manure did not provide much nourishment.[182]

While almost every influential man[183] involved in the tea story, in one way or the other, of the nineteenth century was in agreement regarding the benefits of natural manures, there does not seem to have been a consensus regarding the use of artificial or chemically manufactured manures. In fact, there was also a growing concern among the Assam planters regarding negative consequences of applying artificial manures. Although the advantages of using artificial manures were many, like having the exact proportion of the required nutrients which consequently reduced labour requirements needed to apply them.[184] Yet they were not unanimously accepted by the planting community, first because these were mostly imported and therefore much more costly to obtain and second, planters were skeptical regarding its effectiveness.[185]

In the 1870s, chemist, J. Campbell Brown, experimented with manures that would provide both organic and inorganic matters to the tea bushes. The experiments were carried out in the

[181] Smil, *Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production*, pp. xiv-xv; Sigma, 'Tea Cultivation', in *The Tea Cyclopaedia*, p. 100.

[182] Sigma, 'Tea Cultivation', in *The Tea Cyclopaedia*, p. 100.

[183] There were no women involved whatsoever.

[184] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 94.

[185] Mann, *The Tea Soils of Assam and Tea Manuring*, p. 92.

Doloo garden in Cachar with the assistance of Messrs. Barry and Co., however the effects of the manure wore off during the first year itself.[186] Over the years many such manurial experiments were carried out, some proved successful, others failed. In another experiment, a planter named P. McL. Carter conducted manurial experiments in 1877 with Money and Ponder's manure mixture in Chittagong and made a few observations that did not favour the application of artificial manures.[187] His primary grievance was that the tea bushes ceased to flourish once the application of the manure was stopped thus building a sort of dependence on the manures. In addition, he also believed that the yield was worse than prior to its application.[188] Similar concerns were also voiced in the 1880s by planter Samuel Baildon. Although Baildon accepted manure to be beneficial for tea, he went on to caution his fellow planters that once manures were applied, its usage was to be continued. This made him sceptical about the conduciveness of manuring tea in the long term as manures acted as stimulants that gradually impoverished the soil.[189] Even Claud Bald speaking in the same vein believed that artificial manures were to be very carefully applied to poorer soils as "they may have a tendency to impoverish weak soils by forcing them to part with some of their constituents prematurely or too freely."[190] Bamber too agreed that there was some truth in the widespread opinion that once manure was applied it was to be continued. When highly nitrogenous manures are applied to extremely impoverished soils, it encourages the plant to grow at a faster pace and consequently aides in removing a greater quantity of minerals from the soil as compared to un-manured soils. But this was supposed to be applicable only in exceptional cases.[191] On this point, Mann opined that if manuring was resorted to at the first

[186] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 94.

[187] Ibid., pp. 83-85.

[188] Ibid.

[189] Baildon, *Tea in Assam*, p. 44.

[190] Bald, *Indian Tea: Its Culture and Manufacture*, p. 102.

[191] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 83; Gordon R. Conway and Jules N. Pretty, *Unwelcome Harvest: Agriculture and Pollution* (London: Earthscan, 1991) p. 176.

place, it implied that the soil was already starting to lose nourishment and therefore continuous manuring had to be invariably continued.[192] But till the early twentieth century, Mann did not favour the use of artificial manure especially due to the high cost involved in importing it.[193] Except phosphate chemical manures, other manures in Assam did not have much market till the early twentieth century.[194]

As previously discussed, till the early years of the twentieth century expert opinions favoured the application of *bheel* soil, top dressing of any kind, cattle refuse, green manure, bones, castor and mustard oilcakes, refuse from the "coolie" lines and wood ashes from the factory furnaces in the Assam tea gardens.[195] Although these abovementioned manures more or less were complete on their own in providing tea bushes with nourishment, yet in special cases where soils were deficient in certain elements, artificial manures were recommended, such as nitrate of soda, nitrate of potash, sulphate of ammonia etc.[196] These were to be applied very rarely as they were thought to injure the quality of tea, have very temporal effect and at times also remove other essential elements from the soil.[197]

However, by 1907, the consumption of artificial manure in the tea plantations witnessed a remarkable increase.[198] Mann published a memorandum regarding the use of and trade in manures in Bengal and Assam in the year 1907.[199] The discussions reveal that a nascent stage

[192] Mann, *The Tea Soils of Assam and Tea Manuring*, p. 60.

[193] Ibid., p. 61.

[194] Ibid., p. 92.

[195] Ibid., p. 100; Bald, *Indian Tea: Its Culture and Manufacture*, pp. 103-104; Antrobus, *A History of the Jorehaut Tea Company*, p. 99.

[196] Mann, *The Tea Soils of Assam and Tea Manuring*, p. 100.

[197] Ibid., pp. 92, 95.

[198] G. D. Hope, *Memorandum on the Use of Artificial Manures on the Tea Estates of Assam & Bengal-Decade 1907-1917*. (Calcutta: Star Printing Works, 1918).

[199] Ibid.

of commercial trade in artificial manures was slowly emerging in these regions. Mann made the following observation,

> … the use of commercial fertilizers in Bengal, Eastern Bengal and Assam is, except as regards oilcakes, in its infancy. As regards such materials as superphosphate, dissolved bones and the like, I feel almost certain that the prices will have to be materially reduced before there is even the remotest possibility of their use taking on a great extension even in planting and still more in ordinary country agriculture. In the case of bones and bone meal, caste difficulties will prevent the extension of them being anything but very slow. With saltpeter there is more likelihood of larger quantities being used in the near future, but here again demonstrations will have to be multiplied largely before this result is likely to be brought about. Cakes are already used in much of the area, and their use is spreading fast without any Government interference.[200]

Mann identified an emerging commercialization of fertilisers during this period of time though he was not very assured of the propagation of this trend unless their prices witnessed a fall, caste difficulties were dealt with and more authentic improvements were accomplished, with the exception of oilcakes whose use was spreading rapidly.

G. D. Hope, successor to Mann since 1909, wrote a follow up of Mann's observations in 1918.[201] He noted an increase in the demand for locally produced oilcakes by both smaller village producers and big oil mills in the tea districts as well as a new popularity of lime as manure for tea, which had triggered the exploitations of limestone in the north eastern part of the country.[202] Later experiments in the 1920s at Tocklai led to an advisory against the use of lime in tea as no effect of lime was found and only adverse effect from application of a greater amount of lime were found in experiments.[203] Cattle manure as well as scrapings and

[200] Ibid., pp. 41-42.

[201] Ibid.

[202] Ibid., pp. 3, 16, 17.

[203] C. J. Harrison and N. M. Macgregor, 'Field Experiments', Appendix 2, *Proceedings of the Sixth Annual Conference. Tocklai Experimental Station*. ITA. (February 1948), p. 7.

refuse from the "coolie" lines and refuse of other factories from in and around the tea districts too began to be utilized, marketed and even exported at times.[204] For instance, in the early 1900s, refuse from a distillery near Jorhat were used in tea plantations for manuring purposes until the distillery shut down towards the later part of the 1910s decade.[205] At a national level, some private Calcutta firms took this opportunity to import and market manurial products to be sold at the Assam tea districts. Internationally too, a nexus developed where large quantities of manures began to flow into the big Assam tea companies directly from Europe.

By the second decade of the twentieth century, there was an increasing demand for fertilizers and a corresponding increase in their imports from outside tea districts as well as from outside the country.[206] Mostly private Calcutta firms played a major role in facilitating the supply of manures to the different tea districts in India.[207] However, Hope opined that in case of big tea companies, manures were imported directly from Europe. Imported manures, apparently, had a guaranteed amount of the essential components, which was not the case in the locally procured manures.[208] Import of manures into the tea districts of India were essentially from the United Kingdom (basic slag, superphosphate, sulphate of ammonia, guanos, nitrolium, nitrate of lime, etc.), America (chili saltpeter and sulphur), Japan (superphosphate, sulphur, and nitrate of soda), Sicily (sulphur), and Germany (sulphate and

[204] Hope, *Memorandum on the Use of Artificial Manures on the Tea Estates of Assam & Bengal-Decade 1907-1917*, p. 1; In 1910-11, the total quantity of manures exported from India, which included animal bones, fish manure, guano, oilcakes and others, was 1,59,659 tons which increased tremendously in 1912-13 to 33,75,670 tons. Some of these manures were for tea, specially in countries like Ceylon: 'Note on the Export of Manures from India', *Quarterly Journal.* Scientific Department. Part II 1914 (Calcutta: Indian Tea Association, 1914), p. 51.

[205] Hope, *Memorandum on the Use of Artificial Manures on the Tea Estates of Assam & Bengal-Decade 1907-1917*, p. 2.

[206] P.H. Carpenter and C.R. Harler, 'The Effect of Manures on the Constitution of the Tea Plant', *Quarterly Journal.* Scientific Department. Part IV. 1922 (Calcutta: Indian Tea Association, 1923), p. 125; Hope, *Memorandum on the Use of Artificial Manures on the Tea Estates of Assam & Bengal-Decade 1907-1917*.

[207] Hope, *Memorandum on the Use of Artificial Manures on the Tea Estates of Assam & Bengal-Decade 1907-1917.*

[208] Ibid., p. 4.

muriate of potash).[209] In 1913-14, around 850 tons of phosphates were imported, mostly from Japan into the tea plantations of Assam and Bengal. Till at least the 1917s, Indian rock phosphates used in tea plantations did not surpass 60 tons annually and were mostly delivered by manure suppliers at Calcutta. During the same time, sulphate of ammonia was also being used in the plantations and the Bengal Iron and Steel Works, The Tata Iron Works, The East Indian Railway Company, the Lodna Colliery Company, and the Oriental Gas Company produced this manure for use within the country as well as for exports and around a 1,000 tons of this manure was in use at the time, mostly for manuring in tea.[210] 70,000 tons of ammonium sulphate and 25,000 tons of other 'artificials' which amounted to a total of 95,000 tons was the consumption of artificial fertilisers in India in the late 1930s and that too was mostly for use in the tea plantations.[211] Moreover, within India, sodium nitrate, bonemeal and oilcakes were although produced as fertilisers, yet the colonial government did not advocate its use within the country and they often ended up being exported.[212]

According to William H. Ukers, founder of *The Tea and Coffee Trade Journal*, by the 1930s,

> Practically every type of manure in the market is used on tea. These include: Sulphate of ammonia, nitrate of soda, calcium cyanamide, oilcakes, blood meal, fish manure, animal meal, steamed horn meal, skins and sinews, sardine guano, sterilized animal meal, superphosphate, bones, basic slag, Belgian flour phosphate, Algaricum flour phosphate, ground Sunghbhum phosphate, radiophosphate, saltpeter or nitrate of potash, muriate of potash, cattle dung, and lime.[213]

[209] Ibid.

[210] Ibid., pp. 9-10.

[211] Bagchi, *Private Investment in India 1900-1939*, pp. 100-102; Pray, 'The Impact of Agricultural Research in British India', p. 438.

[212] Bagchi, *Private Investment in India 1900-1939*, pp. 100-102.

[213] Ukers, *All About Tea*, p. 390.

Indicating the gradual acceptance of manuring with artificial manures by tea companies in the province, the Jorehaut Tea Company's gradual increase in the investment of manures over the years is important to note-

> The fear of adverse effects from this type of artificial manure was overcome soon afterwards, for in 1910 a sum of Rs. 18,500 was sanctioned for manuring, a very small sum for nearly 6,000 acres, judges by present day standards. But routine manuring had been started, and one compares this with an expenditure of Rs. 1,35,000 for the 10,000 acres to produce the restricted crop of 1939, and again with the outlay of Rs. 2,34,500 spent in 1943 on the very expensive manures such as it was possible to get under war condition.[214]

Conclusion

Mass clearance of forest lands to accommodate plantations of various sizes in Assam since the mid-nineteenth century brought about many changes, both in terms of its visible transformation of such spaces and also unintended, invisible modifications to the lands on which the plantations stood. Discussions concerning lower produce of tea in Assam towards the late nineteenth century opened the eyes of the planters and experts to the importance of keeping the soil under the tea bushes replenished and healthy. The privilege of employing scientific experts to enquire into the troubles in the plantations came from the prospect of the highly profitable endeavor of producing tea in Britain's own colony at very cheap rates. The initial faith in the never-ceasing productivity of Assam's plantation soil without any heed to improving cultivation techniques and replenishing the soil was perhaps related to a common colonial belief that regarded the resources of its colonies as inexhaustible. With the gradual acceptance of the planting community regarding the inevitability of applying manures and fertilisers, came the trouble of discerning what and how much of such substances were required. Since manuring and fertilizing were supposed to give results when applied keeping

[214] Antrobus, *A History of the Jorehaut Tea Company Ltd. 1859-1946,* p. 99.

in mind the specificities of the soil, such caveats were often not paid heed to, mostly to keep costs low, as such analyses required a fee. Such cases at times, instead of ameliorating production woes, increased the vulnerability of the tea bushes to various diseases as well as the ravages of insects.

The simultaneous rise in insect attacks in the plantations along with concerns regarding the degrading soil also revealed interconnections between exhaustion of nutrients from the soil with that of rising occurrences of insects in these plantations, as we shall see in the next chapter. Apart from pests finding a favourable environment to thrive in a plantation setting, there were also connections between exhausted soil as well as the application of manures and the proliferation and damages by pests infesting the tea bushes.

Chapter III

Invading the Gardens: The Pests

Introduction

The practice of cultivating tea in a plantation setting in Assam was gradually producing obstacles in achieving stable production rates and profits, as observed in the previous chapters. Along with troubles of the waning soil productivity, damages by insects inside the plantations were also on the rise. An unceasing struggle with pests was a price almost all plantation crops had to pay.[1] Early identification and discussion on insects or more colloquially referred to as pests in the Assam plantations revealed that a big percentage of the crop was under attack. Pests were crucial in determining production, quality and price of tea in the global market.[2] Among the most prevalent pests in the Assam plantations were the tea bug, the red spider, the pink mite, the green fly, white ant and the thrip.[3] The pests often took refuge in the nearby shade trees and travelled to all corners of the plantations concealed in labourers bodies and clothes and through other insects like flies, bees, beetles as well.[4]

Interestingly the practice of intercropping, which advocated planting two or more species of crops together so that the presence of one crop minimized the probability of the other crop from being attacked by insects, dates back to at least the era of Pliny the Elder (AD 23-79),

[1] In-depth discussions can be found in works like- James C. Giesen, *Boll Weevil Blues. Cotton, Myth, and Power in the American South* (Chicago and London: University of Chicago Press, 2011); Michael Roche, 'Pines, Pests and Fires: Large Scale Plantation Forestry in New Zealand, 1897–1955', in Frank Uekötter (ed.), *Comparing Apples, Oranges, and Cotton: Environmental Histories of the Global Plantation* (Frankfurt and New York, NY: Campus Verlag, 2014); etc.

[2] Arnab Dey, *Of Planters, Ecology, and Labour: Plantation Worlds, Human History and Nonhuman Actors in Eastern India (Assam), 1840-1910* (Unpublished Phd. Dissertation , The University of Chicago. 2012), pp. 144-148.

[3] William H. Ukers, *All about Tea.* (New York: The Tea and Coffee Trade Journal Company, 1935), p. 390.

[4] Arnab Dey, 'Bugs in the Garden: Tea Plantations and Environmental Constraints in Eastern India (Assam), 1840-1910', *Environment and History* Vol. 21, No. 4 (2015), pp. 537-565.

the Roman naturalist, author and philosopher.[5] Therefore the concept of mono-cultivation having the potential of inviting damaging pests into the fields was not unexplored in the past as well.

Arnab Dey's work on the Assam tea plantations shows how the problem of bugs demonstrated that a tea plantation's history cannot be told without engaging with the plantation environment and its role in affecting tea production and quality. He emphasizes on the historical significance of the bugs and other environmental specificities like climate and rainfall patterns to show how they were crucial actors in framing the history of tea in Assam. Dey goes on to show how with scant metropolitan scientific intervention till the late 19th century entomological research was aided by planters' correspondences and even at times sought local remedies. By the twentieth century, pest ravages still continued and plant diseases grew in its virulence which Dey asserts was a "damaging aspect of the tea monoculture ecosystem- and its self-destructive consequences on the land of its birth."[6]

This chapter is an attempt to further this discussion by trying to understand the interplay of the various changes that the plantations brought about, as discussed in the previous two chapters and how they too contributed to the pest problem. Dey shows how the early planters understood the effects of climate, shade trees, and *jat* or variety of the tea plant and their connection with the rise in pest incidences. The chapter attempts to further this argument by endeavouring to show how human expertise- a combined initiative of planters, botanists, entomologists and other professionals- advocated changes in the landscape of these plantations that in turn accelerated environment induced inconveniences, in this case- pests.

[5] May R. Berenbaum, *Bugs in the System: Insects and their Impact on Human Affairs* (Massachusetts : Perseus Books, 1995), p. 285; B. P. Uvarov, 'The Locust Plague', *Journal of the Royal Society of Arts*, Vol. 91, No. 4631 (Jan 22nd, 1943), p. 109.

[6] Arnab Dey, 'Bugs in the Garden', in *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India.* (Cambridge: University of Cambridge Press, 2018), p. 95.

The chapter focuses on the hits and misses of various methods of cultivation advocated by the expertise and practised by the planters till the first four decades of the twentieth century which consequently exacerbated or at least aided the surge of pests in the plantations. While Dey draws attention to the connection between the environment and the tea produced, this chapter attempts to show how this connection translated in the gardens. The chapter fits in within the larger goal of the thesis which endeavours to show the interplay between the tea environment and human actions in these landscapes and how all these elements were interconnected, with one modification leading to a myriad of unforeseen consequences. These discussions help us broaden our understanding of histories of commodities which usually tended to focus on the economic and socio-political aspects. Striving to understand the intricacies involved in the very cultivation process and the larger intellectual expertise involved therein often reveals a universal story of similar commodity productions and their oftentimes similar environmental effects.

Assessing the Damage

Tea planters situated in various tea-growing districts of the Indian subcontinent began to worriedly discuss the threats from the pests in their tea gardens, since as early as the 1870s.[7] A tea planter in Assam, S. E. Peal was probably the first one to point to the tea bugs and forewarn the planting community of its depredations.[8] Peal and his contemporaries, while not professionally trained, were engaged in extensive discussions and deliberations regarding matters related to the tea plantations.[9] Their practical as well as increasingly detailed

[7] Dey, *Of Planters, Ecology, and Labour: Plantation Worlds, Human History and Nonhuman Actors in Eastern India (Assam)*, pp. 144– 148.

[8] J. Wood-Mason, *Report on the Tea-Mite and the Tea-Bug of Assam*. (London: Taylor and Francis, 1884), p. 13; Dey, 'Bugs in the Garden', in *Tea Environments and Plantation Cultures: Imperial Disarray in Eastern India.*

[9] Dey, *Of Planters, Ecology, and Labour: Plantation Worlds, Human History and Nonhuman Actors in Eastern India (Assam)*, p. 18.

knowledge of the insects and their life cycles found place in these writings.[10] Recent studies emphasize the importance of these initial discussions, which were furthered only later by professionals engaged in the tea industry in Calcutta and London.[11] Peal's writings show that planters in Assam were conscious of the fact that mono-cultivation provided a congenial breeding ground to "natural enemies"- "It is unfortunately true that, in the long run, a serious enemy is likely to arise: larger areas being covered by a particular shrub give to its natural enemies unusual opportunities for propagation."[12] Being a perennial crop with the same plants being cultivated for about 40 to 100 years and over, a vast extent of area was covered with tea bushes, almost to the exclusion of other crops thereby making these gardens a breeding ground for pests with abundant supply of year-round food reserves.[13]

With increasing imperial interest on Assam tea, there were attempts at identifying the causes of degenerations that the tea bushes were undergoing. Along with concerns of lowering soil productivity, the problem of increasing number of pest damages in the Assam plantations began to reign supreme. Planter S. E. Peal therefore wrote in the late nineteenth century, "For some years after this Industry was started, blights do not seem to have been serious, or to have attracted much attention. As cultivation increased, it was but natural that the enemies of the plant should gradually assert themselves."[14] The ITA reports also shed light on such correspondences and shows how during the course of such investigations, revelations were

[10] *The Tea Cyclopaedia: Articles on Tea, Tea Science, Blights, Soils and Manures, Cultivation, Buildings, Manufacture Etc., With Tea Statistics.* (London, 1882)

[11] Dey, *Of Planters, Ecology, and Labour: Plantation Worlds, Human History and Nonhuman Actors in Eastern India (Assam)*, p. 18; Harold H. Mann, 'The Indian Tea Industry in its Scientific Aspects', *Journal of the Royal Society of Arts*. Vol. 79, No. 4089 (April 3rd, 1931), p. 479.

[12] *The Tea Cyclopaedia.* p. 34j.

[13] Claud Bald, *Indian Tea: Its Culture and Manufacture*. 2nd Edition (Calcutta: Thacker, Spink & Co., 1908) p. 133; G.M. Das, *Pests of Tea in North-East India and their Control*. Memorandum No. 27. Tea Research Association, Tocklai Experimental Station. (June. 1994), pp. vii-viii.

[14] *The Tea Cyclopaedia.* p. 34j.

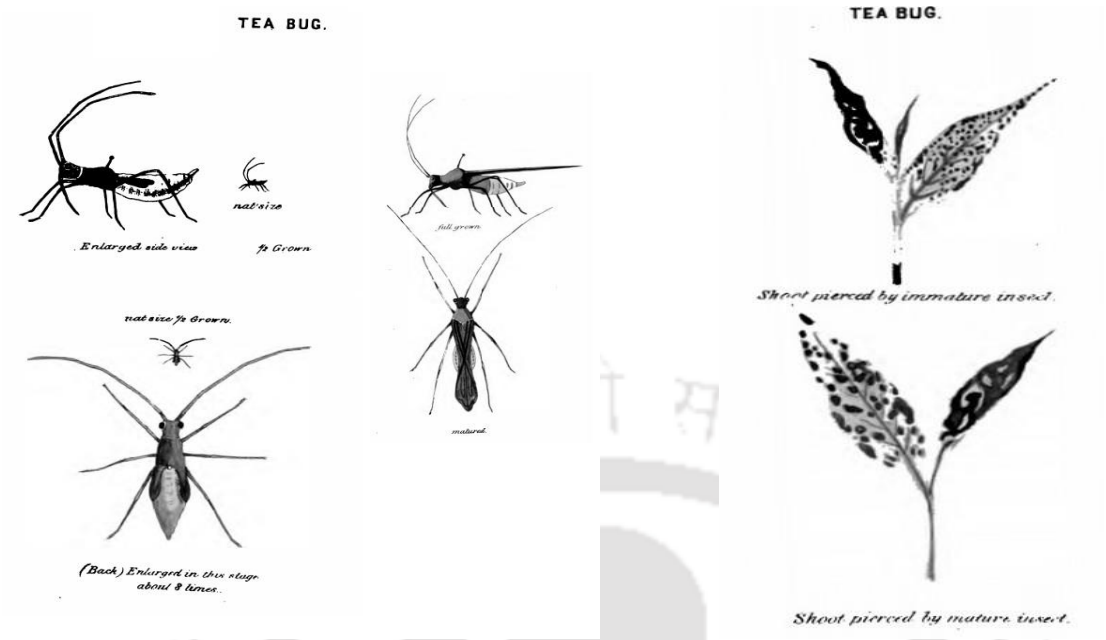
made and older beliefs were debated. For instance, in 1897, a letter from George Watt to Messers. Balmer, Lawrie & Co., a company started by two Scotsmen read,

> ...a white-ant does actually attack and kill tea bushes, more especially young tea or shoots from collar-pruned tea, I have no manner of doubt. You are aware however, that many planters of long experience refuse to allow this, and say that when the ant appears to be doing damage, it is only a natural consequence following on the death of the bush or shoot caused by the borer worm. There need be no doubt on this point. [15]

Gradually with more clarity on the problem, there were dedicated attempts by planters, entomologists and other experts on the field in documenting the life-histories of these pests in order to ascertain their patterns of attack and to devise accurate measures to address the problem. These trends highlights how the economic stakes of this commodity led an entire team of experts to dedicatedly work towards banishing the pests from these plantations. Some of these early discussions, which are replete with descriptions and illustrations, reveal the names of some of the most pertinent pests, blights and diseases that seemed to haunt the Assam tea planters. Ample references to red spiders, blister blights, mosquito blights or the tea bug, tea aphis, orange beetles, caterpillars, borers, crickets, rust and white ants can be found in these discussions.

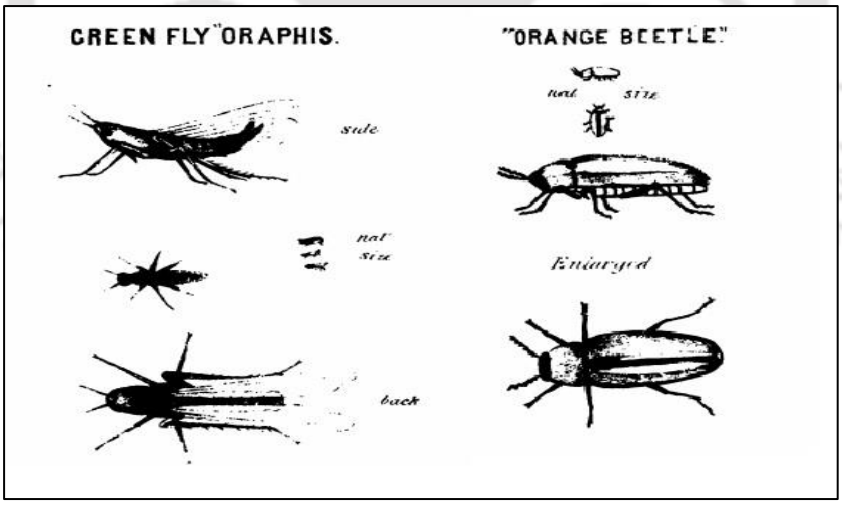
[15] Correspondence from George Watt to Messers. Balmer, Lawrie & Co. in *Detailed report of the General Committee of the ITA for the year ending 28th February* 1898 (Calcutta: Indian Tea Association, 1899), p. 68.

Fig 8: Illustrations of the Tea Bug and the Damage it caused to the Tea Leaves.



Source: *The Tea Cyclopaedia* (Calcutta: Calcutta Central Press Co., 1881), opp. pp. 66-67.

Fig 9: Illustrations of More Tea Pests.



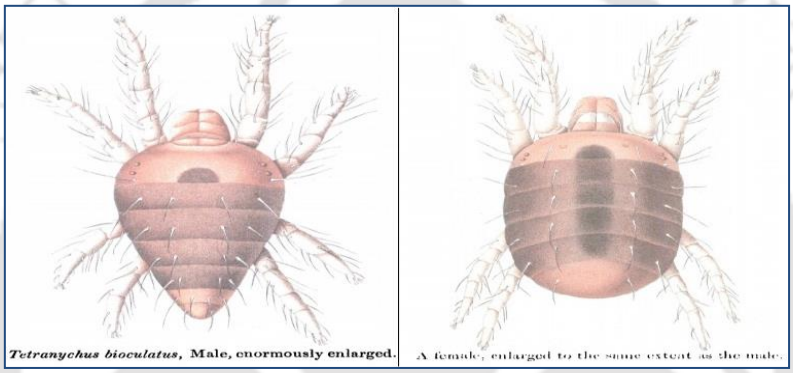
Source: *The Tea Cyclopaedia* (Calcutta: Calcutta Central Press Co., 1881), opp. pp. 66-67.

Among the pests that terrorised planters the most, were the tea bug/tea mosquito and the tea mite/red spider.[16] Mason J. Wood, an English zoologist who went on to become the director of the Indian Museum at Calcutta, wrote in 1884, "Of the numerous animals which prey upon

[16] *The Tea Cyclopaedia*, p. 36.

the tea plant two only are at present known to do such injury to it as materially to diminish the profits of owners of tea-estates; these are the tea-bug or 'mosquito blight' and the tea mite or 'red spider'."[17] Both these pests spent their entire lives on the tea-plant. Wood claimed to have not found either of these two in any plants, other than tea in his six month long investigation in the Assam plantations and in the absence of evidence of its occurrence in any other region, he asserted that it had not been introduced but was indigenous to the north eastern region of the country.[18]

Fig 10: Illustrations of Male and Female Red Spiders



Source: J. Wood Mason, *Report on the Tea-Mite and the Tea-Bug of Assam*. (London: Taylor and Francis, 1884). (Mason had proposed the name *Tetranychus bioculates* for the red spider.)

The tea bug or the tea mosquito (*Helopeltis theivora* Waterh) was one of the most destructive pests of tea, evident from discussions of its prevalence and ravages since the 1860s.[19] It was first noticed in 1865 in Cachar where it incurred a considerable loss of crop. The tea bug was a tiny insect which left small brown-coloured punctures in the tender leaves.[20] Wood demonstrated how the tea bug damaged the young and tender shoots which were most crucial

[17] J. Wood Mason, *Report on the Tea-Mite and the Tea-Bug of Assam* (London: Taylor and Francis, 1884), p. 3.

[18] Ibid., p. 12.

[19] E.A. Andrews, *Factors affecting the Control of the Tea Mosquito Bug (Helopeltis Theivora Waterh). (*London: Worrall & Robey, 1915), p. 49.

[20] *The Tea Cyclopaedia,* p. 36.

for the manufacture of tea.[21] According to an estimate, in 1867 the loss due to tea bugs in the gardens of a company in Cachar was around 22,500 kg of tea. Considering that during those times, the yield per acre in Cachar was around 144 kg, this amounted to a loss of approximately 156 acre of crops in 1867.[22] Another correspondence claimed that many estates were losing upto 25 to 30 per cent of their outturn due to the tea bug in the 1880s while the total overall decrease in crops due to the bug in the province was around 10 per cent.[23] A correspondence from the manager of the Kunchunpore Tea Company in Cachar talks about the loss due to the tea mosquito/bug around the early 1880s, "I know companies who lose from 40,000 to 50,000 rupees annually by blight alone."[24] Tea bug damages were also observed in the neighbouring forest regions where many indigenous plants in the adjoining forests in tea estates were damaged by the bug. Yet the question whether the bugs came from the forests to the plantations or the other way round was still a matter of contention.[25] Accounts of tea bug devastations gradually came to the forefront in other tea growing localities of Assam. A later report in the 1960s recounted- "the damage caused was so severe and extensive that almost all shoots turned black and the whole garden presented a blackened sight instead of a normal green appearance. Many gardens had lost at least 50% of the total crop, if not more, as a result of *Helopeltis* attack alone in the past."[26] Agricultural chemist, Harold H. Mann estimated in the early twentieth century that due to the ravages of the tea blight alone, annually the tea industry lost no less than seven lakh rupees.[27] The problem still seems to persist and an estimate made in the late twentieth century showed that

[21] Mason, *Report on the Tea-Mite and the Tea-Bug of Assam*, p. 5.

[22] George Watt and Harold H. Mann, *The Pests and Blights of the Tea Plant*. 2nd Edition (Calcutta: Govt. Printing India, 1903), p. 248; G. M . Das, 'Some important pests of tea', *Two And A Bud*, 10 (2), 4-8 (June 1963), p. 4.

[23] *The Tea Cyclopaedia*, p. 53.

[24] Ibid., p. 46.

[25] Watt and Mann, *The Pests and Blights of the Tea Plant*, p. 249

[26] Das, 'Some important pests of tea', p. 4.

[27] Letter from the Secretary, Indian Tea Association No. 150 O., dated Calcutta, the 18th March 1905 to the Secretary to the Government of India. Dept.-Commerce and Industry, Branch- Commerce and Trade. 1905, Part A. File No. 1-17. NAI.

around 7 to10 percent of the total crop was lost annually due to pest attacks and this figure shot up to around 15 to 25 percent on gardens where attacks were severe.[28]

Planters found that the rate of proliferation of the tea bug was greatest during the months of June, July, August and the slowest during the cold weather.[29] This perhaps points to the fact that the tea bug thrived in the humid and hot conditions of the region. These bugs could procreate on any day of the year since it was found that there was always some population of the pest "in a condition in which they can resist temporary unfavourable conditions."[30] In a naturally grown forested region, the pests' natural habitat, they might have had difficulty in securing new plants to feed on, in contrast to the plantation setting where tea bushes were readily available close by. Thus ample and suitable food supply in the plantations helped in the speedy propagation of these insects.[31] Climate and ample shade too were believed to influence pest appearances in the plantations, so much so that at one point of time, Peal suggested the complete removal of all shade trees since it was observed that the attacks of the tea bug was at its peak near the edges of forests with thick shade or under large trees.[32] Discussions surrounding the *jat* or variety and condition of the tea bushes were also seen by planters as probable variables affecting the susceptibility of bushes being attacked.[33] Moreover, these tea bugs were discovered to be quite resilient as they were often able to escape unhurt even from carefully applied spray fluids. [34]

The red spider or *Oligonychus coffeae Nietner* (Acari: Tetranychidae) was another grave cause of worry for the Assam tea planters. It was first discovered in Assam in 1868, and by

[28] G.M. Das, *Pests of Tea in North-East India and their Control*. Memorandum No. 27. Tea Research association, Tocklai Experimental Station. (June. 1994), p. vii.

[29] Andrews, *Factors affecting the Control of the Tea Mosquito Bug (Helopeltis Theivora Waterh),* p. 2.

[30] Ibid.

[31] Ibid., p. 5; Bald, *Indian Tea: Its Culture and Manufacture*, p. 133.

[32] *The Tea Cyclopaedia.* p. 37.

[33] Andrews, *Factors affecting the Control of the Tea Mosquito Bug (Helopeltis Theivora Waterh),* p . 5.

[34] Ibid., p . 8.

1880 it became a serious problem which necessitated the appointment of an expert, Wood Mason, then deputy superintendent of Indian Museum Calcutta, to investigate into this problem in 1881.[35] Later, in the early twentieth century, chemist, M. K. Bamber and botanist, George Watt too were consulted for the same problem.[36] The red spider often caused such severe damage that the bushes were almost completely defoliated. It is arguably the most destructive pests in the Assam gardens to date. The red spider targeted the older leaves thereby checking the growth of green shoots and preventing the bushes from flushing. They began their ravages in the early part of the season and the attacked bushes turned reddish. This pest was known to strike tea bushes of all kinds, in every terrain and in any kind of soil.[37]

According to a study in 1960 at the Tocklai Experimental Station, severe red spider attacks often resulted in a loss of yield of at least 25 per cent of the total crop.[38] Moreover there was also a possibility that the variety of pests increased in the tea plantations over time. This is indicated when Watt and Mann in their seminal book, *The Pests and Blights of the Tea Plant*, published in 1903 noted that Wood Mason who investigated the tea bug and the red spider in Cachar for nine months, did not find evidences of damages by any other mites. Yet in the mid-1890s, other varieties of mites were observed in some plantations in these same regions. Watt and Mann hinted that this omission was probably not an oversight and probably during Mason's investigations, there were, in fact, no other pests that attacked tea.[39] In addition to being present in the gardens, the struggle with insects continued well after tea was manufactured. The First World War showed the intensifying effect of pests in manufactured tea and its consequent effect on the sale of tea. Pests of the borer variety damaged a large

[35] Watt and Mann, *The Pests and Blights of the Tea Plant,* p. 349; Das, 'Some Important Pests of Tea', p. 5.

[36] Das, 'Some Important Pests of Tea', p. 4.

[37] Mason, *Report on the Tea-Mite and the Tea-Bug of Assam*. p. 5.

[38] Das, 'Some Important Pests of Tea', p. 5.

[39] Watt and Mann, *The Pests and Blights of the Tea Plant*, p. 348.

amount of packed tea that had to be stored as war time conditions delayed transit and the extended period of waiting time made the attacks more vicious and the damage irreparable.[40]

The aphis was another damaging pest that was supposedly "capable of exterminating tea as an industry" due to their high propagation rates.[41] Its attack mainly led to stunted growth of the young shoots and the effect of this pest was felt more severely towards western Assam and it was noticed in the eastern part of the Assam province only towards the late 19th century. Among the less destructive pests were caterpillars, borers, and orange beetles, among others. Caterpillar was supposedly the largest pest but also the least harmful which attacked only the foliage. The bushes usually took about six to eight weeks to recover from caterpillar attack as they consumed everything, from the tiniest bud to the leaves of the tea bushes.[42] Apparently its conspicuous nature and habit of clustering together made it easy to catch. The borer was identified as another pest and bushes attacked by this pest were marked by their leaves drooping, turning red, and dying.[43] The borer appeared to drill into the stem causing greater damage than caterpillars although they were not found in large numbers and the bush could be saved by cutting off the damaged parts.[44] The orange beetle was an interesting case. They originally preyed on other plants, but gradually shifted their interest to tea. Cattle manure was believed to be a source of orange beetle but Mann did not see how they were related and believed jungle coverage and *ulu* grass were more prone to encourage incidences of this beetle in the plantations.[45] The beetle often targeted the green stems of the

[40] E. A. Andrews 'A Note on the Susceptibility of Woods to Borer Attack, and on the Value of Rosin Varnish as a Protection', *Quarterly Journal*. Scientific Department. Part II (Calcutta: Indian Tea Association, 1921), p. 65.

[41] *The Tea Cyclopaedia.* pp. 37-38.

[42] Samuel Baildon, *Tea in Assam* (Calcutta: W. Newman & Co., 1877), p. 46.

[43] *The Tea Cyclopaedia*, p. 35.

[44] Samuel Baildon, *Tea in Assam* (Calcutta: W. Newman & Co., 1877), p. 46.

[45] Mann, *The Tea Soils of Assam and Tea Manuring*, p. 73.

tea shoots that were ready to pluck thereby leading the shoots to wither, turn dry and black and eventually die.[46]

It is important to note here that pests were not confined to tea gardens alone. There were also instances of timber, bamboos and other crops being ravaged by insects in other parts of the country as well. A notice circulated to officers of the Forest Department was published in a volume of the *Journal of the Agricultural and Horticultural Society of India* in 1867. It listed some of the pests that caused trouble in the Indian forests and also called for an investigation into the life-histories of these insects to devise remedies.[47] White-ants, *bostrichus* that attacked bamboos, *calandra tarmarindi* which affected seeds of tarmarinds, coffee bugs which destroyed coffee estates in Ceylon and Coorg, timber eating beetles, etc. were some of the most prominent ones.[48] Moreover white ants were instrumental in destroying woods and paper, which historian Rohan DebRoy terms as "the key material foundations of the colonial state", and necessitated governmental intervention in attempting to eradicate the ant problem in colonial South-Asia.[49] The menace of white ant in Assam also did not go unnoticed as its effect on Assam's economy was noted by John M'Cosh, "white ants occupy a prominent place in the annual economy of Assam. In no other part of India their ravages are more destructive, they devour the very house as they stand, from the main posts sunk seven feet under ground, to the last bundles of thatch upon the ridge."[50]

[46] *The Tea Cyclopaedia*, p. 35.

[47] Communication by Dr. H. Cleghorn. 'Notice regarding Insects injurious to Timber trees', *Journal of the Agricultural and Horticultural Society*. Vol. 14. Part 1-Jan 1865 to Dec 1866 (1867), pp. 294-95.

[48] Ibid.

[49] Rohan Deb Roy, 'White Ants, Empire, and Entomo-politics in South Asia', *The Historical Journal* Vol. 63, No.2 (2020), pp. 411–36.

[50] Quoted in Rajen Saikia, *Social and Economic History of Assam 1853-1921* (New Delhi: Manohar Publishers & Distributors, 2000), p. 102.

Even in the early twentieth century, the second imperial entomologist to India, Harold Maxwell-Lefroy, wrote about mass destruction of various crops by insects in the country while emphasising the pervasiveness of pests in agriculture all over the world:

> Why does not tree cotton grow successfully in India, or improved American maize; why has no fruit industry been established in places where fruit grows; why is shade-grown tobacco not a success, or the cultivation of sunflower or ground-nuts in North India ? What takes toll of every crop grown in this country to a greater or lesser extent? Insects in every case insects; and insects are a factor to be taken into account in agriculture all the world over.[51]

Locusts and bollworm infested cotton crops, moth-borers sucked on cane-shoots while the rice hispa and grasshoppers destroyed paddy crop. The locust trouble, primarily the desert locust attacks which were the most destructive, was mainly concentrated in the North Western part of the country but in extreme cases its effect was felt as far east as the Assam province.[52] The years 1822, 1840 and 1858 had been especially marked by locust attacks in Assam, and the attacks were often simultaneously accompanied by attacks of other insects. Ravaging anything in their way, the locusts voraciously consumed crops, fruits, not even sparing the leaves of trees.[53] Interestingly, although pests, especially locusts were more or less prevalent since a very long period in the case of food crops, yet a systematic and scientific study on locust was only sanctioned in 1929 by the British in their colonies.[54]

In Assam, insects were a common occurrence in paddy fields as well as among other vegetable cultivations. A brief perusal of vernacular Assamese self-help books on agriculture

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[51] Harold Maxwell-Lefroy, *Indian Insect Life: A Manual of the Insects of the Plains (Tropical India)* (Calcutta & Simla: Thacker, Spink & Co., 1909), pp. 36-37.

[52] Y. Ramachandra Rao, 'Locust Research Work in India', *Current Science*, 4 (1) (July 1935), pp. 9-10.

[53] Saikia, *Social and Economic History of Assam 1853-1921*, p. 103.

[54] Letter from the Secretary, Indian Tea Association No. 150 O., dated Calcutta, the 18th March 1905 to the Secretary to the Government of India. Dept.-Commerce and Industry, Branch- Commerce and Trade. 1905, Part A. File No. 1-17. p. 12. NAI; B. P. Uvarov, 'The Locust Plague', *Journal of the Royal Society of Arts*, Vol. 91, No. 4631 (Jan 22nd, 1943), pp. 109-118.

of the early twentieth century reveals that pests were widespread.[55] Rice crops were mostly attacked by two kinds of insects, called *makhipuk* and *tupula bondha puk*.[56] The *makhipuk* was notorious for attacking the tender leaves of the rice plant by sucking out its juice and leaving the plant white and diseased. The *tupula bondha puk* which roughly translates to insects who weave pockets, used the rice plants to build their pocket-like houses and hence their name. These insects ate the rice and were mostly prevalent where there was a problem of water-logging in the fields.[57] The remedies included kerosene-soap emulsion which could be made by mixing kerosene, soap and water together and sprinkling on the plants in the field, as well as pouring kerosene on the water-logged areas and immersing the affected rice plant leaves on this mixture. Apart from rice, vegetable cultivations too were affected by insects and pests. For instance, potatoes were affected by a condition termed as 'pana' which turned the plant's leaves spotty with white dots eventually leading it to wither, for which spraying Bordeaux mixture on the affected plants was recommended.[58] Interestingly, apart from the above, traditional remedies like applying duck, pigeon and silk worm excrements on the crops to ward off birds and insects were also popular ways of warding off attacks.[59]

The point to be stressed here is that insect occurrences and pest induced damages were not a phenomenon that plagued the tea plantations alone. The discussion, so far, portrays how tea was not divorced from the uncertainties of its environment just like any other agricultural crops, yet the greater human intervention in a plantation landscape exacerbated such depredations as we shall see in the following section. Studies now confirm that mono-cropping is decisively a more unsustainable form of cultivation which induces simplification

[55] Gopal Chandra Dutta, *Krishi Bidhan ba Khetir Kotha*. (Assamese) (Dibrugarh, 1929); Narayan Chandra Baruah, *Assamiya Krishi Boson*. 1st Part and 2nd Part. (Assamese) (Jorhat, Darshan Press, 1965).

[56] Dutta, *Krishi Bidhan ba Khetir Kotha*, pp. 14-15.

[57] Ibid.

[58] Ibid., p. 42.

[59] Baruah, *Assamiya Krishi Boson*, pp.11-12.

within the crop habitat, leads to increasing use of insecticides and herbicides, causes simplification of the landscape, destruction of non-crop habitats, etc.[60]

Plantation Environment and Pest Occurrences

Planters writing in the late nineteenth century seemed to agree that the enormity of the problem of pests and blights was a contemporary phenomenon, and their discussions often revealed its origin in the plantation environment itself. Such correspondences helped the planters identify the different types of pests in their gardens and their probable causes, which in turn facilitated the exchange of ideas on remedial measures.[61] During this time, planters also sought professional advice from the curator of the Indian Museum or from the Agricultural and Horticultural Society of India by sending pest specimens.

Among the various causes attributed to the origin of the pest problem in the plantations, the environment of the plantation occupied a foremost position. Planters tried to draw attention to the possible affinity between certain conditions of the soil of a tea garden and the increasing vulnerability to bugs; while others recognised the exhaustion induced by the monocrop plantation on the tea plant and the soil which aggravated the pest problem.[62] One such correspondence regarding the pervasiveness of the tea bug in the 1880s noted, "It has been argued that their presence is the result of exhausted soil,…impoverishment of the soil is the argument, and doubtless the conscientious belief of many able men…A remedy is also sought in extra cultivation and in using manure; still the pest is present."[63] Peal also accounted for the influence of climate in determining the extent of the occurrence of some

[60] University of California – Davis 'Why Insect Pests Love Monocultures, and How Plant Diversity could Change That', *ScienceDaily*. www.sciencedaily.com/releases/2016/10/161012134054.htm Accessed February 2, 2021; David Andow, 'The Extent of Monoculture and its Effects on Insect Pest Populations with Particular Reference to Wheat and Cotton', *Agriculture, Ecosystems and Environment*, Vol. 9 Issue 1 (1983), pp. 25-35.

[61] *The Tea Cyclopedia*, p. 53.

[62] Ibid., p. 54.

[63] Ibid., p. 46.

pests in the tea gardens.[64] At times, planters also seemed to account for damages in the gardens to rain and the sun in some interesting ways. For instance, "An old belief was, that when a drop of rain or dew remained on a leaf, the sun coming out acted as a magnifying glass upon it, and burnt a hole."[65] But generally, planters did acknowledge bugs and insects as the primary threats nibbling at their profits.

The resultant anxiety of the planters and the colonial government regarding the problem of pests in the tea gardens translated into a keen interest in investigating the problem as well as a scramble to devise remedies since the nineteenth century itself. Historian Percival Griffiths remarked that, "...the need to find remedies for these afflictions (pests and diseases) was one of the factors which led to systematic scientific research in the industry."[66] The troubles that began brewing in these far-off gardens triggered an incessant inflow of resources in the form of agricultural expertise into Assam, be it in the form of enquiry committees, scientific investigations, or collaborative efforts. Tea being a crucial item of colonial interest for the imperial economy, these discussions and experiments benefitted from emerging associations and extensive scientific publications solely dedicated to tea. The Indian Tea Association (ITA) began publishing extensively on the various aspects of tea since its inception in 1881. In fact, dealing with "blight and other diseases affecting the tea plant" was featured as one of the prominent reasons for the initiation of this Association.[67] Within the backdrop of increasing restlessness among planters regarding pests, discussions ensued which called for a stronger staff of entomological officers for the tea industry who would solely study insects and their management. Consequently, in the early 1890s, it was suggested that E. C. Cotes, an entomologist in the service of the Indian Museum in Calcutta, be allowed to visit Assam for a

[64] Ibid., p. 35.

[65] Baildon, *Tea in Assam*, pp. 45-46.

[66] Percival Griffiths, *The History of the Indian Tea Industry*. (London: Weidenfeld & Nicolson, 1967), p. 485.

[67] *Report of the General Committee for the year ending 29th February 1892* (Calcutta: Indian Tea Association, 1892), pp. 31–32; Griffiths, *The History of the Indian Tea Industry*, p. 514.

few months to "examine into the history and habits of the insects which are so destructive to tea."[68] Although the plan did not materialize, such insistence did eventually work in obtaining expertise in the field of entomology in the succeeding years.

As an outcome of ITA's imperativeness in employing a scientist to enquire into the various aspects of tea cultivation and address the rising concerns regarding pests and blights, George Watt, appointed as reporter on India's economic products to the government of India, arrived at Assam in the 1890s.[69] Watt was supposed to conduct enquiries on the *Adhatoda vasica* plant and its value as an insecticide, which was brought to the notice of the Association by M K Bamber, the chemist appointed by a Joint Committee of the ITA and the Agricultural and Horticultural Society in early 1890s.[70] The Association also had high expectations that Watt's investigations would fully prove the value of the *Adhatoda* plant not only as an insecticide that would control mosquito blights, "but also (as) a valuable antiseptic, capable of destroying the germs of disease in drinking water, as well as in the atmosphere."[71] Watt remained in Assam for about five months (March to July) in 1895 and visited again in 1897 for his investigations and wrote a report titled *Pests and Blights of the Tea Plant* in 1898.[72] Watt laid down the scopes of investigations that were to be undertaken in the Assam tea gardens by a special scientific officer. They were to enquire into the relationship between the soil, climate, water, shade and the quality of the leaf, connections between such environmental specificities and diseases and pests, physiological conditions of the tea bushes that encouraged or restricted diseases and pests and so on.[73] When Harold Mann took the position of the scientific officer of ITA in 1900, he and Watt further revised Watt's seminal

[68] *Report of the General Committee for the year ending 29th February 1895* (Calcutta: Indian Tea Association, 1895), p. 16.

[69] H.A. Antrobus, *A History of the Assam Company, 1839–1953*. (Edinburgh: T. and A. Constable Ltd., 1957), p. 185.

[70] *Report of the General Committee for the year ending 29th February 1895* (Calcutta: Indian Tea Association, 1895), p. 18.

[71] Ibid.

[72] Watt & Mann, *The Pests and Blights of the Tea Plant*, p. 2.

[73] Griffiths, *The History of the Indian Tea Industry*, p. 427.

work *Pest and Blights of the Tea Plant.* This was published in 1903. Mann visited Assam, Cachar, Sylhet and Chittagong in 1900, then again visited Assam and Darjeeling the next year in 1901, and visited the Surma Valley and Darjeeling Terai in 1902 before the publication of this work, thus gaining crucial insights on tea plantations.[74] These insights from experts pushed for more organised and permanent scientific investigations which, as we saw in the last chapter, began to take shape in the twentieth century.

Parallel to the venture of information gathering on the types of tea pests in Assam and their life histories, probes into the causes of their occurrences and destructions also commenced since the mid nineteenth century. Discussions ranged from attributing the causes to inferior *jat* of the tea plant, effect of climatic conditions of the region, faulty nature of cultivation in the plantations and so on.

On *Jat,* Climate and Methods of Cultivation

Wood J. Mason, M. Kelway Bamber (chemist), Watt (entomologist) and Mann (chemist), all more or less agreed with the fact that the indigenous tea *jat* was better equipped to ward off pest, either due to the pungency or it being the "better" variety.[75] The consensus of opinion, at one time, regarding the immunity of the indigenous tea plant against pests was so strong that many hundred acres of China and hybrid tea were uprooted and replanted with indigenous varieties in the hope of eliminating the pests. [76]

[74] Watt & Mann, *The Pests and Blights of the Tea Plant*, p. 2.

[75] M. Kelway Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture.* (Calcutta: Law-Publishing Press, 1893), pp. 240-241; Mason, *Report on the Tea-Mite and the Tea-Bug of Assam*, p. 18; Watt and Mann, *The Pests and Blights of the Tea Plant*, p. 20.

[76] Andrews, *Factors affecting the control of the tea mosquito bug,* p. 22.

Fig 11: The Tea Plant of Assam

CLOSE-UP OF AN ASSAM INDIGENOUS TEA BUSH CHINA TEA, VAR. BOHEA, DRAWN FROM NATURE

Source: William H. Ukers, *All about Tea.* (New York: The Tea and Coffee Trade Journal Company, 1935), p. 499.

It was however discovered by the late 19th century that even gardens that housed entirely indigenous tea plants were also attacked with the same intensity as plantations which housed the China and hybrid plants by the tea mosquito. Therefore, although the possibility of the *jat* playing a role in determining the intensity of attack was not completely dismissed, yet plant variety was not seen as the sole determinant and not even the most important.[77] Close observations on what made a certain variety of a given tea plant more susceptible or resistant to pest attacks affirmed that not only did different varieties of tea plants exhibited differing degrees of susceptibility to pest attack but different individual plants of a given variety may also differ in their susceptibility. Not only that, even an individual plant may exhibit differing susceptibility from time to time owing to changes in its environmental settings.[78]

Climate and weather conditions also emerged as important factors in connection with the occurrence of tea pests. Early correspondences reveal that planters believed sudden changes in the weather, be it excessive moisture or drought, were responsible for the occurrence,

[77] Ibid., p. 29.

[78] P.H. Carpenter and E.A. Andrews, *A Note on the Value of Different Insect Control Methods in Tea and against Mosquito Blight in Particular.* (Calcutta: Catholic Orphan Press, 1922), p. 19.

distribution or proliferation of pests.[79] Climatic conditions that led to a rapid increase in water content of the soil early in the season, followed by a continuous rainy weather was arguably the most ideal condition for the breeding of the mosquito blight.[80] When such weather conditions prevailed in a plantation with inadequate drainage, mosquito blight occurrences increased manifold.[81]

The early tea planters of the nineteenth century often hinted at a connection between faulty cultivation of tea and rising incidences of pests. A correspondence of a 19th century Darjeeling planter distressed by red spider attacks thus reads as follows,

> My opinion is, that blight by Red spider, at least in the Darjeeling Terai, is simply caused by hard plucking with very low cultivation (i.e., plucking as hard as possible) and neglecting in the meantime to supply the plant with proper food, in the shape of good manure, after destroying half its life by tearing away nearly all of its lungs (the leaves) during seven or eight months of the year, and then, instead of giving the plants a good rest and plenty of food, and assisting it to recover its former strength, as soon as the plant has, through sheer weakness, stopped flushing set to work and cut off, I mean hacked off, as roughly as possible, all its young wood (and called this operation pruning). Hoe up, as deep as you can, so as to effectively expose to the sun all the unfortunate plant's surrounding soil, worry it in every possible way, and don't give it a moment's rest; and can you wonder then at Red Spider('s) advice to proprietors and managers is:-- Cultivate your gardens better. [82]

As depicted in the above excerpt, cultivation practices employed in the tea gardens were at the root of the gradually deteriorating state of tea production in the plantations. Pointing to the varying degrees of deterioration of the tea bushes in almost all the gardens since the beginning of the twentieth century, Watt and Mann too directed their attention to defective procedure of cultivation which they believed might have been a probable cause of pest

[79] *The Tea Cyclopaedia*, p. 41; Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture.* pp. 240-241; Andrews, *Factors affecting the Control of the Tea Mosquito Bug*, p. 14.

[80] Andrews, *Factors affecting the Control of the Tea Mosquito Bug*, pp. 5-16.

[81] 'Touring Notes on Sylhet and Cachar', *Quarterly Journal.* Scientific Department. Part III (Calcutta, ITA: 1919,) p. 120.

[82] *The Tea Cyclopaedia*, p. 41.

incidences.[83] Planters also showed that drainage and the proliferation of mosquito blights were intimately connected. They asserted that adequate soil aeration determined the quality of nourishment obtained by the plants which affected how vulnerable or resistant the plants would be to insect attacks. [84]

Connecting Pest Occurrences with Changes in Soil

In the above mentioned causes, apart from the environmental peculiarities be it the climate, rainfall or *jat* of the plant which were largely not under the control of the planters, the aspect of pest attacks and soil health was the most crucial human induced connection that has disclosed itself in these discussions. Be it the gross disregard to ensuring sustainable production by replenishing the soil or the large-scale, miscalculated digging of drainage in the plantations, pest incidences and the soil of the plantations came to be intimately connected. The physical, chemical and biological characteristics of the soil determined how the plant would be able to resist or succumb to pest attacks. As already mentioned, it was realized in the nineteenth century itself that continuous cultivation of a single crop in vast areas led to an increased risk of the crop being attacked by insects or diseases. The cause was the constant extraction of essential nutrients from the soil contributing to one or the other deficiency in the tea plant, which hindered healthy growth. Thus Bamber wrote in 1893,

> Experience in all countries has shown that when large areas are continuously cultivated with the same crop, such crops become very liable to insect and fungoid attacks, which ultimately may necessitate the discontinuance of the growth of the crop for some years, if not for good…it may be that the plant has become weakened from the constant abstraction from the soil of the most important mineral constituents, until one or more are too deficient to allow healthy growth. Such a deficiency would not

[83] Watt and Mann, *The Pests and Blights of the Tea Plant*, p. 5.

[84] Andrews, *Factors affecting the Control of the Tea Mosquito Bug*, p. 54; Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, pp. 240-241.

only check growth, but would also cause a change in the proportion of the organic constituents in the plant itself, and it is probable that such a change has taken place in the case of tea.[85]

The above excerpt shows that even in the late nineteenth century, there were ample evidences of failures of mono-cultivation in terms of their increased vulnerability to insect attacks and diseases. And as Bamber articulated, the impoverishment of soil was at the root of it. Same was the opinion of a soil analyst Joseph Cripps who was sent samples of a few Assam tea plantations' soil in the late 19th century. He opined that the nuisance of red spider that had been haunting the Assam tea planters was most likely one of the results of soil exhaustion as the soil lost its nutrients due to the constant cultivation of the tea plant and being deprived of the necessary nutrients became prone to attacks of blights and diseases.[86] Mann pointed out in 1901 that exhaustion of soil and the old age of the tea bushes made them more vulnerable to pest attacks and affected a general decline in their health.[87] This observation had also been made earlier in the late nineteenth century when it was argued that the emergence of mosquito blights was the result of exhausted soil.[88] It was later observed by entomologist, E. A. Andrews, that almost all the estates that were relatively free from severe pest attacks, were also the ones on which labour was scarce and therefore a conservative policy of cultivation that did not inflict as much pressure on the tea bushes and the soil was followed.[89]

P. H. Carpenter, chief scientific officer at Tocklai and his colleague, C. R. Harler revealed in the 1920s how the cycle of soil infertility was perpetuated both through the actions of the natural environment- not within the control of the planter- like heavy rainfall, a soil deficit in lime and magnesia, as well as other aspects of mismanagement like incorrect cultivation and bad drainage. These conditions led to increased acidity and infertility of the soil, and it was

[85] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, p. 240.

[86] Ibid., pp. 76-77.

[87] Mann, *The Tea Soils of Assam and Tea Manuring*.

[88] *The Tea Cyclopaedia*, p. 53.

[89] Andrews, *Factors affecting the Control of the Tea Mosquito Bug*, p. 49.

recognised that much blight that affected tea was due to the soil acidity in the Assam gardens.[90] Moreover, recent studies also confirmed that crops that induce nutritional imbalances in the soil are more susceptible to pest attacks, as a 21st century study notes, "Increasingly, new research is showing that the ability of a crop plant to resist or tolerate insect pests and diseases is tied to optimal physical, chemical and mainly biological properties of soils."[91]

Following from the last chapter, we understand how the soil of the plantations, modified through multiple tweaks and worn out to the extreme, too was a product of the plantation. This very soil simultaneously also began to play a crucial role in understanding the discussion surrounding pest in the Assam plantations. Modifications through mass forest clearances, extensive digging and hoeing, and applying additives to the soil were major ways in which the soil was made "ready" for tea. With over 5 lakhs of labourers brought into the Assam valley plantations alone till the turn of the twentieth century, the intensity of hoeing the soil around the tea bushes increased tremendously. Although in the short term, there was increase in the crop out-turn, yet some years later a loss of tilth which made the soil less suitable for plant growth and pan formation causing the land to form depressions disrupting the drainage system in the plantations were noticed; and these conditions were linked to higher incidences of attacks by pests and diseases.[92]

Within the background of such changes occurring in the soil of the plantations, in the next section, we observe whether remedies to alleviate soil degradation played any part in the occurrences of pests in these plantations.

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[90] P.H. Carpenter and C. R. Harler 'The Action of Potash Salts on the Acid Soils on Assam', *Quarterly Journal.* Scientific Department. Part II (Calcutta: Indian Tea Association, 1921), pp. 139-140.

[91] MA. Altieri and CI. Nicholls 'Soil Fertility Management and Insect Pests: Harmonizing Soil and Plant Health in Agroecosystems', *Soil & Tillage Research,* Vol. 72 Issue 2 (2003) p. 204.

[92] C. R. Harler 'Cultivation and Water Content of Soils', *Quarterly Journal.* Scientific Department. Part III (Calcutta: Indian Tea Association, 1921), p. 148.

Manured Soil vis-à-vis Pests

As evident from the last chapter, the trend of manuring in tea plantations became a necessity by the end of the nineteenth century. While this practice was aimed at sustaining high production yields from the plantations yet it had effects on the insect population and plant diseases which emerged as a major obstacle for planters to sustainably increase tea yield since the late nineteenth century. While Dey talks about how pests were intrinsically connected to the very nature of the plantations, we take this concept further in this chapter and look at how remedies advocated by experts to make soil more productive like manuring too contributed to the pest problem.

Imperfect manuring had consistently been looked upon with caution in scientific reports. A prolonged application of nitrogenous manures on tea bushes were known to have made the tea bushes more susceptible to diseases. The availability of soil nutrients to plants played a dual role-one it determines the susceptibility to damage by pests and second, it also affected the way the plant recovered from these attacks. Since the pests relied on the plant for its nutrients, it made sense that an increase in the nutrition of the plants by way of manuring also made more nutrients available for the pests.[93] Additionally, manures that tended to increase the acidity of the soil if applied without caution often led to increased attacks of pests, like the dreaded red spider.[94] The only relief was that while continuous application of cattle manure and oilcakes could turn the soil acidic, it could also be corrected with lime application from time to time.[95] Sufficient understanding of garden specific soil and their needs was the only sure shot way to go about while manuring but this did not materialize in

[93] Altieri and Nicholls 'Soil Fertility Management and Insect Pests: Harmonizing Soil and Plant Health in Agroecosystems', pp. 205-206.

[94] E.A. Andrews, 'Cultural Control', *Quarterly Journal*. Scientific Department. Part IV (Calcutta: ITA, 1918), p. 123.

[95] G. D. Hope, 'The Use of Artificial and Chemical Manures', *Quarterly Journal*. Scientific Department, Part III (Calcutta: ITA, 1912), p. 74.

most cases. With instances of large swathes of lands being abandoned after a couple of years realizing that they were not conducive to planting tea after all shows how even after several decades of tea cultivation in the province, as Dey remarked, "tea cultivation remained a flawed science."[96] Amidst such confusion and ignorance, often planters' and managers who did not have enough knowledge did not pay heed to such caveats and thus manuring turned adverse in certain cases. Scientific journals also carried observations that connected the fatigued soil and improper manuring with rising cases of pests as well as parasitic fungi in the 1920s. Apart from climatic conditions that made the proliferation of these fungi possible, other conditions like altered soil conditions affected the resistance of the tea bushes and often encouraged occurrences of such fungi in epidemic forms.[97]

A series of experiments conducted since the 1920s at Ceylon demonstrated a very interesting phenomenon which might hold some significance in the case of Assam as well. C. H. Gadd, a mycologist at the Tea Research Institute of Ceylon in the 1940s published his findings on the connection between the incidence of the shot-hole borer and the application of manures to the tea bushes.[98] The shot hole borer (*Xyleborus fornicatus* Eichoff, subsp. fornicatior Eggers) was a major pest in tea districts of Ceylon and they bored into the tea stems and formed a "gallery" or cavity within the wood of the plant where the female borer laid eggs. These galleries made the stem weak and liable to breakage which led to loss in yield of tea leaves. Gadd opines that in the early twentieth century, it was believed that suitable pruning and good cultivation would automatically help alleviate the problem. However this was challenged in the 1920s when it was seen through experiments that manurial application to tea bushes which was a part of the hitherto "good cultivation" plan, in fact, had little to no

[96] Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India*, p. 94.

[97] E.A. Andrews and A.C. Tunstall, *Notes on the Spraying of Tea.* (Calcutta, ITA: 1925), p. 23.

[98] C. H. Gadd, 'An Unusual Correlation between Insect Damage and Crop Harvested', *Ann. Appl. Biol.,* Vol. 31, Issue 1, (1944), p. 47.

effect in the number of galleries formed by the borers. However, the number of healed galleries or the cavities that were no longer open were a little higher in the plots which were manured when contrasted with plots that weren't manured. It was then assumed that healed galleries were a little stronger than the open and active ones which made them less prone to breakage than the latter.[99] However later experiments by Gadd along with other researchers showed that increasing application of manures indicated signs of increasing attacks by the borer as well.[100] His research showed that the number of healed galleries as portrayed by the earlier research with the application of manures was actually a growth phenomenon. This meant that as manuring aided the growth of tea bushes, there were no doubt increasing number of healed galleries but interestingly there was an increase in the number of overall galleries as well.[101] Thus he found that application of manure which increased yield of the tea leaves also simultaneously led to an increase in the susceptibility of the plant to borer attacks which ultimately led to a loss of crop.[102] The author gives us a few possible reasons why this might be the case, one- manures might make changes to the tea branches which rendered them to break more easily which explained the higher breakage of branches even if infestation remained constant. Second, the branches might have become more attractive to the borer which encouraged more galleries and as a consequence, increased breakage. Or it could be the case that both these phenomena were occurring simultaneously.[103] And third, Gadd showed that the borer actually derived its nutrition from an ambrosia fungus grown in the gallery walls and not directly from the plant and therefore there could also have been a connection between manuring and the growth of the said fungus which might have affected

[99] Ibid., p. 48.

[100] Ibid., p. 49.

[101] Ibid., pp. 50-51.

[102] Ibid.

[103] Ibid., p. 50.

the pest's proliferation.[104] Now although Gadd does not conclusively prove these connections yet these instances propel one to think how the interrelatedness of the various elements of the tea environment played a part in creating a domino effect with one thing leading to the other.

It is now an accepted scientific fact that "the optimal physical, chemical, and biological properties of soils determine the capability of a crop to resist or tolerate insect pests."[105] And the general idea of organic manuring with oil-cakes, decomposed tea prunings, animal manure, green manures are still considered an important step towards conserving the well-being of the soil. A balanced NPK (nitrogen, phosphorous and potassium) infused manure helps in warding off pests by the tea plants. In this regard, a potential connection between the ratio of nitrogen, potash and phosphoric acid in the soil and the occurrence of mosquito blight was published in a comprehensive treatise by entomologist E. A. Andrews in 1915.[106] He was a member of the scientific department of the ITA and this crucial study drew quite a bit of attention even globally.[107] Andrews concurred that the history of tea cultivation in Assam showed that planters paid adequate attention to the application of nitrogenous manures for the upkeep of the tea bushes. Nitrogen is a necessity for any crop grown for its leaves and tea was no exception, yet according to his investigations, it was found that excessive nitrogen in the soil tended to make tea bushes more vulnerable to diseases. A couple of cases had shown an increase in the attack by the mosquito blight in tea bushes, along with other tea pests like termites and other sucking pests with excessive nitrogenous manuring. In some cases this was noticed in plots of tea manured with sulphate of ammonia and in others several years of

[104] Ibid., p. 254.

[105] Lakshmi K. Hazarika, Mantu Bhuyan and Budhindra N. Hazarika, 'Insect Pests of Tea and Their Management', *Annual Review of Entomology* 54 (1) (2009), p. 273.

[106] Andrews, *Factors affecting the Control of the Tea Mosquito Bug.*

[107] As evidenced by the mention of Andrews' work in the abstract of an unpublished dissertation by P.R. Stephenson, *The Effect of Potassium and Phosphorus on the Susceptibility of Cacao to Cacao Thrips (Selenothrips Rubrocinctus. Giard)* (Trinidad: I.C.T.A, 1938).

consistent application of oil cakes too proved to be detrimental.[108] However Andrews claimed that this increase in pest and diseases must have been an indirect effect of consistent nitrogen manuring as it tended to turn the soil more acidic which, in turn, usually resulted in greater mosquito blight attacks.[109] Simultaneously, he also found that tea bushes situated in soils with a lower ratio of potash in comparison to phosphoric acid had a higher risk of being attacked by the mosquito blight.[110] Even though a balanced manure comprising of nitrogen, phosphoric acid and potash was deemed to be beneficial for tea, yet it was noticed that, apart from nitrogenous manures, only phosphoric acid eventually managed to find its place in the gardens' manurial regime till at least the first decade of the twentieth century and potash, to a great extent, was neglected. A higher phosphorous content in soil too led to increased soil acidity thereby increasing mosquito blight attacks. Experiments were carried out in a garden in Cachar for the first time in 1914 and many other experiments ensued in the succeeding years, and they more or less proved that frequent potash dressings, applied in the form of sulphate, helped reduce attacks by the mosquito blight while also assisting the tea bushes with an increase in yield.[111]

In the same vein, chemist at Tocklai, H. R. Cooper's important essay in the 1940s too showed a positive co-relation between an increase in nitrogen in manured soil and increasing incidences of brown blight in tea plantations.[112] However, since this blight only affected the old and dead leaves that did not affect the production of tea, the connection between manuring and pest damage in tea was denied. However, Cooper also found an increase in mosquito blights whenever the nitrogen content of the leaf witnessed an increase. In an

[108] Hazarika, Bhuyan, and Hazarika, 'Insect Pests of Tea and Their Management', p. 273; Andrews, *Factors affecting the control of the tea mosquito bug*, p. 57.

[109] Andrews, *Factors Affecting the Control of the Tea Mosquito Bug*, p. 55.

[110] Ibid., p. 85.

[111] Ibid., pp. 57, 82, 83, 90.

[112] H. R. Cooper, 'Nitrogen Supply to Tea', *Memorandum No. 6*. Tocklai Experimental Station, ITA. (10th August 1946), p. 99.

instance, a heavy application of sulphate of ammonia led to a discernably large increase of mosquito blights in tea in which case, the manured plots yielded lesser crop than un-manured ones. However, Cooper opines that this happened only in exceptional cases. That a balanced amount of nitrogen actually benefitted the tea bush and helped it tide through a pest attack was emphasized by Cooper, be it the mosquito blight or red spiders.[113] However, the question that arises here is whether in the state of affairs as observed in the earlier chapters, where till a major portion of the 1st quarter of the 20th century planters and experts themselves were not in unison regarding what was the best way to proceed with planting tea, can we assume that planters were aware of the delicate balance of nutrients and the soil specific manure requirements of their plantations, at least till the first decade of the 20th century? Many cases leads us to presume that in multiple instances, the problems and more importantly the intensity of such troubles in the tea plantations were a direct result of human actions and miscalculations.

The connection between manuring and rising pest incidences was not peculiar to tea alone, and similar studies that look at fertilized soils and its effect on other crops have also pointed to such connections. For instance, in the 1950s, experiments conducted on cotton plantations in Missouri, US, revealed that application of fertilizers led to a three-fold increase in boll weevil larvae when compared with unfertilized plots. The study showed how with the application of fertilizers, the cotton plants' life pattern was altered and the plant remained succulent for longer and the fruiting of the crop too shifted towards the later part of the season than normal which affected the boll weevils' population.[114] Attacks by chinch bugs on sorghum, cotton aphids on cotton plants, cabbage aphids on cabbages and two-spotted mites

[113] Ibid.

[114] P.L. Adkisson, 'The Influence of Fertilizer Applications on Population of *Heliothis zea* and Certain Insect Predators', *Journal of Economic Entomology* 51 (6) (1958), pp. 757–759.

on beans were other instances of crops which were adversely affected by these pests with an increase in the application of nitrogen fertilisers.[115]

Such connections reiterate the fact that the consistent application of manures and fertilisers when used without regard to the requirement of the environmental specificities like soil, climate etc. very often backfired and such application, instead of buttressing the plant in resisting insect attacks, actually helped in escalating the situation.

Shade *vis-à-vis* Pests

The debate surrounding shade trees and shade requirements of tea bushes in the Assam plantations continued to include the question of pest occurrences as well. As previously mentioned, a factor of considerable importance in influencing the distribution of tea pests, especially the mosquito blight was identified as shade. Such conclusions were drawn from the assumption that this pest's natural habitat was the forest and due to its attachment to the tea bushes, both in the jungle in its wild state as well as in the garden, it appeared to prefer ample shade to proliferate.[116] This, at times, led to mass removal of shade trees in many tea plantations. However, instances of severe pest ravages from the Duars region where all shade trees were removed seemed to debunk this assumption that removing shade ameliorated mosquito blight attacks.[117] It, however, did not resolve debates surrounding shade as some species of trees were still opined to be harmful for tea, such as *Nahor* (Mesua Ferrea) and several species of Ficus as bushes around such trees were seen to be more damaged by pests than the rest of the bushes. However, this fact also did not sufficiently explain the sustained

[115] E.C. Klostermeyer, 'Effect of Soil Fertility on Corn Earworm Damage', *Journal of Economic Entomology.* Vol. 43, Issue 4 (1950), p. 427.

[116] Andrews, *Factors Affecting the Control of the Tea Mosquito Bug,* p. 30.

[117] Ibid.

tea bug attacks since such trees were almost invariably removed in all gardens and were left to grow only in very exceptional cases.[118]

It was eventually thought that shade, per se, did not contribute to such a large extent in determining the amount of damage done by the pest, "and that in all cases where shade appears to do harm, a more probable explanation is to be found in the effect produced either by the action of the trees on the soil in the case of shade trees, or by the soil conditions incidental to the existence of other shady circumstances." [119]

An important observation was shared by W.Y. Wyndham, director and manager of the Longview Tea Co. Ltd. at a meeting of the Terai Planters' Association in November 1934 regarding his experience with the tea mosquito. Based on his trial and error experiments conducted on his plantation in the early years of the 1930s, Wyndham stated a number of steps that he had taken to alleviate the problem, such as altering cultivation techniques, manuring etc. which as we had seen were highly debated in the early years yet highly encouraged to combat the pest problem. However, the most interesting development that his experiments brought forth was that the tea bushes that were growing at the edges of the plantation, surrounded by a jungle tract, were remarkably free from the tea mosquito. After many experiments he concluded that the jungle must have provided an alternative shady region for the bugs to inhabit, thus sparing the tea bushes. He therefore devised a method of leaving a strip of unpruned and unplucked tea bushes outlining the other tea bushes to lessen the intensity of the bug which proved to be beneficial.[120]

[118] Ibid., p. 31.

[119] Ibid., p. 42.

[120] W. Y. Wyndham, 'Tea Mosquito (Helopelthis Theivora) Control', *The Planters' Chronicle*. Vol XXX No. 1. (January 12, 1935), pp. 14-15.

Later, at least by the 1950s, it was evidenced that red spider attacks were most concentrated in unshaded areas of gardens while shaded areas had a lesser impact.[121] As experiments in Tocklai showed, although application of nitrogenous manures was found to be beneficial in unshaded and less shaded areas, it had almost no effect in medium to heavy shaded areas. This points to the fact that while some gardens chose to cut down almost all shade trees in the hope of eliminating the tea bug, as we previously observed, ironically this move was contributing to the proliferation of other pests. Moreover, going by the above experiment, it was opined that the cost of manuring could have been greatly lessened, to prevent or cope with red spider, had there been ample shade.[122] In cases of certain blights or diseases like the black rot disease, even till the mid-1920s we find recommendations that favoured the removal of excessive shade.[123] Apart from the most pervasive tea pests, the tea mosquito and the red spider, some studies showed that other pests too like the pink mite and the purple mite both showed declining intensity where there was shade. For instance, the pink mite which was known to attack the indigenous Assam tea plant the most, were seldom seen attacking the tea bushes growing in the shade of *Siris* trees and later studies, in the second half of the twentieth century showed a positive correlation between the removal of shade trees and an increase in the purple mite.[124]

The discussion so far regarding the incidences of pests in the Assam tea gardens are replete with miscalculations on the part of the planters and experts regarding many aspects of tea cultivation which seemed to aggravate the problem further. Crucial issues of the soil and

[121] G.M. Das, 'Pests in Relation to Environment', *Two and A Bud*, IV (4), (1963), p. 17; *Tocklai Experimental Station Annual Report 1963* (Tea Research Association, 1964), p. 19; G. M. Das, 'Some Important Pests of Tea', *Two and A Bud*, 10 (2), (June 1963), p. 5.

[122] Das, 'Some Important Pests of Tea', p. 5.

[123] Andrews and Tunstall, *Notes on the Spraying of Tea,* p. 29; 'Black Rot Disease of Tea', *Quarterly Journal.* Scientific Department. Part II (Calcutta: ITA, 1917), p. 80.

[124] Bald, *Indian Tea: Its Culture and Manufacture,* pp. 138-140; Ukers, *All about Tea,* p. 391; J. E. Cranham, 'Tea Pests and their Control', *Annual Review of Entomology*. 11 (1) (1966), p. 495.

shade are only two among many other factors that contributed to an increasing presence of damaging pests in these plantations. These interconnections are crucial to understand how the human-induced modifications and the workings of the environment intertwined to create a unique yet a largely similar trajectory of tea in colonial Assam, compared to other plantation crops in different parts of the globe.

(Mis) Managing Pests- Remedial Measures

Pest control in the tea plantations primarily started out with conservative methods which included careful attention to cultivation methods, improving drainage, using organic wastes to equip the bushes to withstand pest attacks, and trying out ways to combat pest attacks without the use of synthetic pesticides. This continued to a large extent till the end of the period under study in this thesis and therefore, the period up to the 1940s has been termed as a pre-pesticide period. Since the most evident aspect of environmental impact of plantations is the indiscriminate pesticide usage in the post 1940s, an enquiry into the pre-pesticide period holds the key to understanding why these excesses occurred and how the earlier years set the stage for the later years' pesticide use.

Earliest correspondences on remedial measures that took place among Peal and other planters discussed many possible ways of curbing the problems of pests and blights. Many planters put forth their experiences of combating these problems. Some suggested removal of insects manually one at a time, catching beetles using butterfly nets, removing shade trees, heavy pruning and destroying spider eggs by burning those prunings, applying lime, applying salt water, sprinkling the affected bushes with muddy water, using a tomato decoction for red spider eradication and so on.[125] Other drastic measures included burning the entire tea bush to

[125] Mason, *Report on the Tea-Mite and the Tea-Bug of Assam*, pp. 10-11; *The Tea Cyclopaedia*, p. 40;

get rid of pests! Such a measure was undertaken by the Jorehaut Tea Company gardens in Numaligarh in 1904, where 125 acres of bushes were heavily pruned and the prunings were burned off, 76 acres "were scorched by burning with grass, and on 105 acres the bushes were burnt *in situ*."[126] Although this practice was not very encouraged, yet it was seen as an effective measure to get rid of mosquito blight from the bushes. These methods were at times effective yet not fool-proof and sometimes even backfired. Critical of the harsh measures meted out to the tea bushes when insects in the plantations increased, planter Claud Bald opined that a bush under attack "need sympathy and help" and not more pressure.[127]

Interestingly, some even contended that small birds could prove to be useful in ameliorating the pest problem. However, we see an interesting debate emerging on the matter of decreasing bird population in the region owing to the hunting expeditions of planters.[128] Refuting the importance of birds in managing pests, Peal wrote, "Birds have nothing to do with spider (red spider), directly at least; so the gun is not to blame. If anything eats the spider, it will be another insect, and not a bird."[129] The idea of introducing natural predators or parasites of the pests to control their population was tried time and again since the beginning of the tea industry in Assam in the mid-19th century. With gradual investigations shedding more light on the bionomics of pests, it was realised that the tea pests too were food for other predators located above them in the food chain. The idea of transporting predators from different regions of the world came to be given serious thought.[130] The impressive success story of the introduction of the vedalia beetle, (Rodolia cardinalis), a

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Report of the General Committee for the year ending 29th February 1892 (Calcutta: Indian Tea Association, 1892), pp. 31–32; Carpenter and Andrews, *A Note on the Value of Different Insect Control Methods in Tea and against Mosquito Blight in Particular*, pp. 3-4.

[126] H. A. Antrobus, *A History of the Jorehaut Tea Company Ltd. 1859-1946* (London: Tea and Rubber Mail, 1948), p. 97.

[127] Bald, *Indian Tea: Its Culture and Manufacture*, p. 135.

[128] *The Tea Cyclopaedia*, pp. 35,39.

[129] Ibid., pp. 38-39.

[130] Berenbaum, *Bugs in the System: Insects and their Impact on Human Affairs*, p. 286.

predatory ladybird beetle, in order to manage cottony-cushion scales on citrus in California, which came to be dubbed as "biological control" quickly rose to prominence in the twentieth century.[131] In other instances, *mynah* birds (*Acridotheres tristis*) were transferred from India to the Mauritius in order to control grasshopper infestation in the year 1762, making it the first long-distance transfer of a predator.[132] Biological control mainly targeted the relatively sedentary pests like aphids or scale insects and most of the thriving control agents were parasitoids.[133] However, some practical concerns regarding this method began to emerge. Even when successful transportation of the parasites from one part of the world to another was made, certain environmental requirements of the predator or parasite to survive went unnoticed only to be realized after the importation. Climatic conditions and shade requirements did not prove to be conducive sometimes and at times it was realised that indigenous parasites might have proved to be more efficient than the transferred ones. It was also not uncommon for the introduced parasites to take to attacking other types of insects in the new environment that may not be favourable.[134]

Out of the pests infesting the tea gardens, the gelatine bug's cocoons, to a large extent, were successfully parasitized. Various ladybirds and the larvae of lace-winged flies too aided in reducing the pest population of red spiders and tea aphis by consuming them in large numbers. Tea mosquitoes were preyed upon by spiders and praying mantis although they did not appear to be the staple food of these predators. Tea mosquitoes were also preyed upon to a very small extent by the mermithid worm. However, they occurred almost wherever tea

[131] Berenbaum, *Bugs in the System: Insects and their Impact on Human Affairs*, pp. 158, 286; L.E. Catagirone and R. L. Doutt, 'The History of the Vedalia Beetle Importation to California And its Impact on the Development of Biological Control', *Annual Review of Entomology* 34 (1) (1989), pp.1-16.

[132] Berenbaum, *Bugs in the System: Insects and their Impact on Human Affairs*, p. 158.

[133] Ibid., p. 159.

[134] Carpenter and Andrews, *A Note on the Value of Different Insect Control Methods in Tea and against Mosquito Blight in Particular*, p. 16.

mosquitoes were to be found so there was no need to transport them from a different region or country. This method however, did not prove to be of much importance in the future in helping manage tea pests, since in many cases "it has been found that the problem of encouraging the parasite in the field is as difficult as, if not more so than, that of controlling the pest."[135]

Plantation and Pesticides

Apart from relying on predators of tea pests and employing other conservative methods in the absence of pesticides during the initial periods, tea planters made use of various concoctions and caustics in their gardens. For instance sulphur, either by itself or combined with lime as lime-sulphur, to check ravages of red spiders and other mites were in use in the Assam plantations.[136] Ordinary lime too was successful to an extent to combat red spider, fungus and other insect blights, along with soda-wash and fumigation used as palliative against pests.[137] For example, in 1893, the Jorehaut Tea Company reported that "50 fumigating pots, 10 cwts. tobacco paper and 50 covering sheets 6 yards square were ordered for the purpose of trying to prevent the spread of insect blights on the plantations."[138] A tea planter from Chittagong talked about "manuring the plant with lime, just before the rains set in, and at the beginning of the cold weather, (which) will scare away the white ants from the immediate vicinity of the plants so manured."[139] Yet planters had to use it with caution and only in emergency as the lime benefitted the bush immediately but long usage of lime tended to impoverish the soil.[140]

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[135] Ibid., pp. 17-18.

[136] Barua, *Science and Practice in Tea Culture*, p. 546; Ukers, *All about Tea*, p. 391.

[137] Carpenter and Andrews, *A Note on the Value of Different Insect Control Methods in Tea and Against Mosquito Blight in Particular*, pp. 10-13.

[138] Antrobus, *History of the Jorehaut Tea Company Ltd. 1839-1946*, p. 97.

[139] 'Preventive against the Attacks of White Ants', *Journal of the Agricultural and Horticultural Society India*. Part 1. Vol XIV (1867), p. 302.

[140] Baildon, *Tea in Assam*, pp. 45-46; Mann, *The Tea Soils of Assam and Tea Manuring*, p. 99.

Correspondences in the pages of the *Journal of Agricultural and Horticultural Society of India* discussed another couple of methods of tackling white ant in the 1860s. One measure talked about taking a small quantity of arsenic and "mix(ing) it up with a few ounces of burnt and pulverized ship's bread, oatmeal, flour, or ripe plantain, moistened with molasses."[141] This mixture was then to be placed in the garden and presumably the ants died consuming it.

Globally too, till the mid-nineteenth century, "chemical control of insects consisted mostly of the use of plant-derived dusts, powders, or extracts, as it had since the days of the Greeks and Romans."[142] The chance discovery of the first chemical insecticide, Paris Green in the turn of the twentieth century, led to a launch of the pest control industry at a global level.[143] First used in France by grape-growers to prevent passersby from stealing grapes, Paris Green, an aceto-arsenite of copper, worked as a deterrent for insect pests as well. Its success led to experimentation and subsequent use of many inorganic compounds as insecticides, many containing metals, generally referred to as the first generation of insecticide chemicals.[144]

Writing in the 1890s, Bamber stated that pesticides as a remedial measure for the problem of blights was not used pervasively at the time, primarily due to the lack of effective machines to spray these pesticides that could reduce the cost of application and also enable a large area to be treated in a short period of time.[145] Moreover pesticides, whenever applied, too were not perceived to be very effective in preventing blights and pests. And the possible harm that might be accidentally inflicted upon the tea labourers as well as stray animals when exposed to these poisonous compounds was also a concern voiced by Bamber.[146] The eminent

[141] 'Preventive against the Attacks of White Ants', p. 302.

[142] Berenbaum, *Bugs in the System: Insects and their Impact on Human Affairs*, p. 286.

[143] Ibid., p. 287.

[144] Ibid, pp. 286-87.

[145] Bamber, *A Text book on the Chemistry and Agriculture of Tea: Including the Growth and Manufacture*, pp. 240-241.

[146] Ibid., p. 250.

botanist, George Watt, writing under the auspices of the colonial government in the late 1890s, also shared similar views on pesticides and insecticides as that of Bamber,

> In my opinion, however, insecticides are in the majority of cases impracticable and the labour charge in most cases too great even when…the insecticide would cost next to nothing. Were it possible to run carts between the rows of bushes and to thus use larger and more powerful syringes than can be employed by manual labour, the case might be different.[147]

Watt here highlighted the impracticability and high expenses involved in using insecticides, primarily due to the labour charges and not necessarily because of higher costs of the insecticides. However, Watt was not as concerned about the effectiveness of the insecticides as he was of its poisonous content.

> … But there arises still another consideration, namely, that most, if not all, the insecticides in use are poisons and some of them even contain arsenic. It is all very well to say that the plants so syringed need not be plucked until after the fall of sufficient rain to wash the leaves- clean. But were an insecticide of this nature- extensively employed it would by no means be improbable that some of the poison might find its way into the manufactured tea, moreover its use would; undoubtedly endanger the lives of the coolies, and it might even poison the tea bushes themselves.[148]

While he was not entirely dismissive of the usefulness of insecticides, Watt contended that insecticides like 'Paris Green' and 'London Purple' were to a large extent successful in eliminating certain pests[149], yet his writings clearly reflected his apprehension regarding the possibility of the insecticides' arsenic content poisoning the tea consumers, the "coolies" and even the tea bushes themselves.

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[147] Watt, *The Pests and Blights of the Tea Plant: Being a Report of Investigations Conducted in Assam and to Some Extent also in Kangra*, p. 10.

[148] Ibid.

[149] Ibid.

The concern regarding the method of applying such poisonous pest deterrents is best explained in Carpenter and Andrew's words-

> The application of any substance might naturally be supposed to be the more effective the nastier the substance used, and the early history of liquid applications to plants teems with references to mixtures which must have been horrid in the extreme, and probably caused more irritation to the operator, in many cases, than to the insect.[150]

In the quest to prepare and market effective pesticides, further investigations were commissioned by the ITA. And towards the second decade of the twentieth century, these efforts led to the categorization of the pests into two classes, one which extracted the plant juices and others that ate the plant tissues. This was an important step towards developing a more effective method of spraying and reminded the planters that a blanket pest management programme would be ineffective. Pests that ate portions of the plant could be exterminated by applying a poison on the plant surface however; a pest that might suck out the juices from the tissues of the plant could not be killed in the same way. The second category of pests required substances that could kill them as soon as they came into contact with it. Consequently, insecticides were divided into poison insecticides to be applied to the plant and to be swallowed by the insect like lead arsenate, lead chromate, paris green, copper salts, etc.; and contact insecticides which essentially killed the pests as it came into contact with it externally like soap solutions, oil emulsions, alkali washes, and rosin washes.[151] Additionally, fumigants, though not very successful in exterminating tea pests, were used to suffocate pests, mainly in confined spaces like godowns.[152]

[150] Carpenter and Andrews, *A Note on the Value of Different Insect Control Methods in Tea and Against Mosquito Blight in Particular*, p. 6.

[151] Andrews and Tunstall, *Notes on the Spraying of Tea*, p. 5.

[152] Ibid., p. 6.

There was a general sense of optimism regarding pesticides prior to in-depth research on these chemicals. And with subsequent investigations in this regard, failure to discover any substance of "unquestionable merit" at least till the 1920s led to disillusionment among the planting community.[153] Spraying pesticides in the vast tea plantations involved a great amount of manual labour-

> Enormous areas are in existence, planted at varying distances apart, intersected, in many cases, with numerous drains of varying width and depth and cut in all directions; often interplanted with shade trees and standing green crops such as arhar dal and boga medeloa; containing bushes of all shapes and sizes, which touch one another, so that passage between them is difficult for the greater part of the season; and often poorly furnished with communicating roads...(making) it impossible to use heavy power-spraying machines, and the knapsack machine.[154]

Along with large requirements of labour, large requirements of water too had to be available to spray the insecticides effectively. According to estimates by Carpenter and Andrews in the 1920s, in order to spray 400 acres of tea, the supply of 40,000 gallons of water was necessary. The labour required to carry out such spraying activities was calculated to be 120 men per day to spray 400 acres in ten days.[155] Moreover, the spraying of chemicals on tea bushes became tricky as the tea leaves were the primary commodity and there was a growing concern about poisonous substances finding its way into manufactured tea, a premonition which eventually came true.[156] As Carpenter and Andrews puts it - "..in tea faulty application is the rule, even when the strictest supervision is exercised" which reiterated the risks of insecticide application in tea.[157] Even till the 1920s, an insecticide that checked the boxes of

[153] Carpenter and Andrews, *A Note on the Value of Different Insect Control Methods in Tea and Against Mosquito Blight in Particular*, p. 7.

[154] Andrews, *Factors affecting the Control of the Tea Mosquito Bug*, p. 10.

[155] Carpenter and Andrews, *A Note on the Value of Different Insect Control Methods in Tea and Against Mosquito Blight in Particular*, p. 8.

[156] Ibid., p. 7.

[157] Ibid., p. 11.

being powerful enough to kill the pests as soon as it came into contact, resilient enough to stick to the plant even during the rainy season but not too poisonous to contaminate manufactured tea while still being affordable was found to be impossible even after many decades of tea cultivation in Assam.[158]

The problem of pests was as pervasive as ever, in official statements, in the later years of the colonial rule as well. For example, in the twentieth ordinary general meeting of the Assam Consolidated Tea Estates Limited, in 1944, the chairman J. E. Humphery remarked,

> The total crop of 3,497,122 lb. in 1943 compared with an output of 4,031,415 lb. for the previous year is decidedly disappointing. This falling off must be ascribed to a variety of causes, among which mosquito blight and weather conditions generally played a not inconsiderable part.[159]

And remedies were still not satisfactory as E. Hainsworth, a plant pathologist who joined Tocklai in the 1940s commented- "…the biology of tea pests was for the most part well known, but that control methods were in general open to improvement."[160] Moreover, insects that were not considered a threat to the tea bushes sometimes showed their virulence in the later years. For example, the looper caterpillar (B. suppressaria), which did not even qualify as a tea pest in the 1890s became a major threat when in 1947 there was major outbreak of looper attacks in the Assam tea plantations.[161] Therefore, over the years, the pest trouble in the gardens did not ameliorate and when harsh chemicals were introduced towards the late 1940s, planters were more than willing to embrace their use in the plantations.

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[158] Andrews, *Factors Affecting the Control of the Tea Mosquito Bug*, p. 9.

[159] 'Assam Consolidated Tea: Difficult Conditions', *The Times* (London, England) Issue 49977 (Wednesday, Oct 18, 1944), p. 10.

[160] E. Hainsworth, 'Past, Present and Future Work in Plant Protection', Appendix, *Proceedings of the Sixth Annual Conference.* Tocklai Experimental Station, ITA. (Feb 1948).

[161] Ibid., p. app. 3.

Conclusion

Monocultures, like tea, have been known to be "ecologically fragile, and particularly prone to disease and failure" which consequently led to an increasing usage of toxic products in the plantations.[162] The period under study till the late 1930s was largely conservative in terms of usage of chemical pesticides. The World War II exerted tremendously pressure on the tea plantations of India and Ceylon to satisfy the tea requirements of the United Kingdom and the Allied countries which along with war time shortages of labourers, planters, fertilisers and pesticides led to an even greater pressure on the tea bushes and its environs.[163] After the end of the war, chemical fertilizers and pesticides saw a vast increase in agriculture in general as well as in tea. Although this is not to say that all previous pest management methods completely failed, yet the volatile production figures were perhaps a continuous source of worry for the planters. However, as in the pre WW II period that is under study in this thesis, the later years too continued experimenting with remedies which contrarily, in many cases, led to an increase in the problem that it sought to solve.[164]

The introduction and use of DDT was highly effective against *Helopeltis* and its usage brought the tea bugs under control to a large extent by the second half of the twentieth century. A glimpse into its rising prominence can be witnessed when Hainsworth, a plant pathologist, in the 6th annual conference held at Tocklai in 1948, claimed that *Helopeltis* can be controlled "with DDT at a cost of under Rs. 20/- per acre."[165] Although gardens that were previously heavily infested by the mosquito blight attacks were relatively freed, yet certain localised conditions still aided its ravages. For instance, such an outbreak occurred in the

[162] Brian Williams, ' "That we may live": Pesticides, Plantations, and Environmental Racism in the United States South.', *Environment and Planning E: Nature and Space* Vol. 1, No. 1-2, 2018, p. 3.

[163] Antrobus, *A History of the Assam Company, 1839–1953*, pp. 227-233; Griffiths, *The History of the Indian Tea Industry*, pp. 203-210, 451, 452.

[164] Das, *Pests of Tea in North-East India and their Control*, p. vii.

[165] Hainsworth, 'Past, Present and Future Work in Plant Protection', p. app. 2.

central Dooars in 1958. The attack suddenly took a serious turn and the weather conditions were such that no measures could be adopted. The insecticide was washed away soon after application without much result and eleven gardens in the Nagrakata sub-district were said to have lost about 9,00,000 kg (25,000 maunds) of tea from *Helopeltis* attack alone that year.[166] The period from the 1940s to the 1970s saw an almost absolute dependence on pesticides and consequently the yield of tea in India rose doubly from 600 kg per hectare in 1950 to 1,200 kg per hectare in 1970.[167] However, the indiscriminate usage of such substances called for its curtailment. Rachel Carson's phenomenal work "Silent Springs" in the 1960s portrayed similar excesses of pesticide use since the World War II in the United States of America which disrupted ecological balance resulting in sustained harmful chemical residues on the earth's surface.[168]

Increasing uses of such synthetic fertilizers and pesticides were deemed to be a major cause of exacerbated pest attacks, especially in monocultures like tea.[169] With the almost universal- and, at times, indiscriminate use of pesticides, disturbance in the population dynamics of the pests as well as their natural predators and parasites began to occur. These latter pesticides had many adverse effects like decrease in the pests' natural predators, pesticide residues in tea, resistance development of the pests, environmental contamination and so on.[170] In other cases, certain pesticides, in fact, increased pest population, for instance the application of DDT was linked to increase in certain tea pests.[171] The use of DDT however in the tea gardens of Assam for pests control was not widely prevalent, if at all, till the 1940s. This is

[166] Das, 'Some Important Pests of Tea', p. 4.

[167] Barua, *Science and Practice in Tea Culture*, pp. 546-547.

[168] Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 2002).

[169] Altieri and Nicholls 'Soil Fertility Management and Insect Pests: Harmonizing Soil and Plant Health in Agroecosystems', p. 203.

[170] Hazarika, Bhuyan, and Hazarika, 'Insect Pests of Tea and Their Management', p. 267; Das, *Pests of Tea in North-East India and their Control*. pp. vii-viii;

[171] Das, *Pests of Tea in North-East India and their Control,* p. vii-viii.

apparent as participants at the annual conference of the ITA held at Tocklai in 1948 were still curious about whether commercial DDT powder had any benefit as an insecticide against tea mosquito and red spider.[172]

As discussed in the chapter, various interconnected trajectories aided by the transformations of a largely forest landscape into a monoculture and the consequent impoverishment of its soil played a major role in aggravating the problem of insects in the plantations. Through the above discussions we see that plantation specific issues like- soil exhaustion due to constant extraction of nutrients by the perennial plants, divergent growth of the plants due to human-induced modifications to suit capitalist market needs, inadequate nourishment of the plants due to faulty cultivation techniques etc. were acknowledged to be some of the primary causes that brought on the menace of increasing pest attacks in the Assam gardens. However, the large capitalist endeavour of tea plantations in Assam brought about tremendous interventions in various aspects of the tea environs and the impoverished soil and its connection with pest is only one of its consequences. These discussions illustrate how a tiny insect sought to destroy an endeavour as big as the tea industry which had ready availability of expertise at its disposal. These prolific tiny pests in the tea gardens contributed to the unmaking of the tea environment and this infestation took on a bigger scale as a result of the very nature of the plantations.

[172] *Proceedings of the Sixth Annual Conference*. ITA Tocklai Experimental Station. (9th February 1948), pp. 16-17.

Chapter IV

Plantation Environment and Labouring Bodies

Introduction

With the proliferation of tea gardens in Assam in the nineteenth century, a simultaneous demand for manual labourers also commenced. Citing scarcity of willing local people to work in the gardens, the colonial planters initiated a system of importation of labourers from other regions of India, primarily from labour-surplus erstwhile provinces of Bengal, Bihar, Orissa, Central Provinces, United Provinces and Madras.[1] Inhabitants of Assam, apart from being engaged in European owned tea gardens as accountants, overseers, petty suppliers, and a handful being planters themselves by the early twentieth century[2], did engage in labouring jobs too albeit in very small numbers as compared to the migrating labour population. In the 1870s, George Stocks, manager of the Brahmapootra Tea Company, noted that a daily average of 100 "assamese and cacharies" were engaged in his garden; whereas the total imported and time-expired labourers were 647 during the same year.[3] However, the local labourers generally worked only for a few months at a stretch and engaged willingly without being bound by a contract like their immigrant counterparts.[4] In fact, in the initial days of operation of the iconic Assam Company since 1839, procuring local labour was apparently

[1] A vast literature concerning labour in the Assam tea plantations is available - Amalendu Guha, *Planter-Raj to Swaraj Freedom Struggle and Electoral Politics in Assam 1826-1947* (New Delhi: Indian Council of Historical Research, 1970); Rana P Behal, *One Hundred Years of Servitude* (New Delhi: Tulika Books, 2014); Dwarkanath Ganguly, *Slavery in British Dominion* (Calcutta: Jijnasa, 1959); Amal Kumar Chattopadhyay, *Slavery in India* (Calcutta: Nagarjun Press., 1959); Nitin Varma, *Coolies of Capitalism: Assam Tea and the Making of Coolie Labour* (Oldenbourg: De Gruyter, 2017); Rana P. Behal and Prabhu P. Mohapatra, 'Tea and Money Versus Human Life: The Rise and Fall of the Indenture System in the Assam Tea Plantations 1840–1908', *The Journal of Peasant Studies*. Vol 19. No.3-4 (1992), etc.

[2] Arnab Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India* (Cambridge: University of Cambridge Press. 2018), p. 18.

[3] *Papers Regarding the Tea Industry in Bengal* (Calcutta: Bengal Secretariat Press. 1873), p. 48.

[4] Charles Dowding, *Tea Garden Coolies in Assam* (Calcutta: Thacker, Spink and Co., 1894), p. 7.

not a difficult task. It was only once tea plantations began to expand rapidly since the mid-1850s that the clamour for more labour began.[5] Although initially, Chinese tea cultivators and manufacturers were brought into these Assam plantations, this system soon became defunct and by the 1860s, they disappeared from the Assam tea scene.[6]

From the 1860s till the 1920s, an arrangement of indentured labour recruitment system which bound the labourers by a legal contract to work for a certain number of years was firmly put into place backed by harsh penal legislation for the Assam tea plantations. Labourers along with their families arrived in these plantations and till the 1920s, over a million labourers and their dependents were living in and around such plantations. The cotton plantations in the southern states of North America, sugar plantations in Guyana and the Caribbean, rubber plantations in Malaysia, tobacco plantations in Indonesia and tea plantations in Sri Lanka all depended on such migrant labour.[7] Indentured labour recruitment was a tactic to avoid the growth of a labour market which would increase the wage rates and thus exploitation was rampant in such scenarios.[8] The centrality of the labour question in the Assam tea plantations is an undeniable feature and their corporeal existence also the most unfortunate. Bodily deterioration and general un-healthiness of the labouring population is a colonial legacy in the Assam plantations which is pervasive to this day. The tea labourers emerged as a displaced group of people who were brought into an environment that was being altered greatly, as evident from the previous chapters. And in most cases, these alterations were

[5] *Papers Regarding the Tea Industry in Bengal*, p. xvii.

[6] Jayeeta Sharma, ' 'Lazy' Natives, Coolie Labour, and the Assam Tea Industry', *Modern Asian Studies.* Vol. 43. Issue 06, (2008), p. 1294; J.C. Jha, *Aspects of Indentured Inland Emigration to North-East India 1859-1918* (New Delhi: Indus Publishing Company, 1996). p. 17; The Assamese fiction *Makam* by Rita Choudhury deals with the Chinese diaspora in the eastern-most part of Assam in the nineteenth century- Rita Choudhury, *Makam* (Assamese) (Guwahati: Jyoti Prakashan, 2010).

[7] Sharit K. Bhowmik, Virginius Xaxa, M.A. Kalam, *Tea Plantation Labour in India* (New Delhi: Friedrich Ebert Stiftung, 1996), p.4.

[8] Bhowmik, Xaxa and Kalam, *Tea Plantation Labour in India*, p.4.

physically manifested through the labourers themselves. From clearing forests, uprooting trees, deep ploughing lands, to operating within a strict regime of daily garden work, the labourers lived a debilitating life. The question of the health of the labourers can be contextualised within the two major sources of hazards for them, one being their migration into an unfamiliar region with scant knowledge about this new region and environment. A highly restricted and regularised life strictly confined within the walls of the plantations also did not help the new labourers to get acquainted to their new surroundings. And the second being that they were located right in the middle of a landscape that in itself was in a process of change which increased incidences of bodily danger mainly from diseases and malnutrition, coupled with a harsh work regime.

The early days of tea which can be said to have started with the establishment of the Assam Company in 1839 coincided with the widespread agreement that tropical places like Assam were especially deadly for the European race and this concern gradually extended to include the imported labourers by the mid nineteenth century.[9] An early tea planter in Assam, John Weatherstone noted that the climate of Assam for many Europeans meant disease and death- "The young European assistants on the new tea gardens would succumb to the unhealthy climate and lack of good food."[10] John McCosh, East India Company surgeon stationed in Assam in the 1830s, opined that the diseases prevalent in Assam were the consequence of miasma generated via the decomposition of vegetable matter. He wrote,

> I am of opinion that intermittent fever, and far the greater portion of other fevers and other diseases prevalent in Assam, are the consequence of miasma or malaria, generated in the decomposition of vegetable matter. Indeed, no fact is better ascertained, or receives more general assent than that a

[9] David Arnold (ed.), *Warm Climates and Western Medicine: The Emergence of Tropical Medicine, 1500-1900* (Amsterdam-Atlanta: Rodopi, 1996), p. 8.

[10] John Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*. (London: Quiller Press Ltd., 1986), p. 73.

> certain quality, whether a gas or a vapour, or a film or an impalpable powder is evolved by vegetable matter while exposed to heat and moisture, and undergoing the process of putrefaction, which has the property of engendering fever when brought in contact with the body.[11]

From assigning miasma gravity to ascertaining certain seasons and durations of the day as being most miasmatic, the miasma theory was largely used to account for the mortality and morbidity in the colonial tropics.[12] This attitude has also been understood as an indication of the colonial "underlying belief that India was as distinct epidemiologically as was culturally, and therefore any disease originating there must arise from some idiosyncrasy in its climate or geography."[13]

This was also the period when the study of tropical disease and medicine began to gain ground. Historian David Arnold identified a few developments in the late eighteenth and early nineteenth century in the area of tropical climates and diseases which help us contextualize our study. One was the use of statistical data in illustrating patterns of disease and mortality. This, in a way, strengthened the "evidence' of the European medical expertise and highlighted the hitherto generalized dangers of the tropics in concrete statistical terms.[14] Second was the growing field of medical geography and topographical surveys which stressed the origin of diseases in the climate, vegetation and physical landscape.[15] Thus Arnold remarks- "partly because of their wide-ranging scientific brief, medical personnel had a vital role in the European investigation of the Indian environment (including its topography, climate and diseases), and hence in understanding how nature fashioned the human condition

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[11] John M'Cosh, *Topography of Assam. Calcutta: Bengal Military Orphan Press, 1837*, p.100.

[12] Ibid., pp.100-101.

[13] David Arnold, 'Cholera and Colonialism in British India' *Past and Present*, No 113 (Nov., 1986), p. 145; This idea of increasingly portraying Indian environments as "intrinsically pathogenic" and the native inhabitants as carriers of dirt and diseases have also been discussed by historian Mark Harrison 'Tropical Medicine in nineteenth Century', *The British Journal for the History of Science*. Vol. 25, No. 3 (Sept. 1992), p. 301.

[14] Arnold (ed.), *Warm Climates and Western Medicine: The Emergence of Tropical Medicine, 1500-1900*, p. 9.

[15] Ibid.

in India".[16] These developments show how such "expertise" in the field of medicine reiterated colonial prejudices and often affected the course of diagnosis and treatment of the colonised.

Linda Nash, in her work *Inescapable Ecologies*, argues that prior to the late nineteenth century in the American scenario, health and bodily well-being were conceived in terms of a balance between the environment and the human body thus drawing a larger comparison between the human bodies to its surrounding environment.[17] This outlook witnessed change with the acceptance of the germ theory in the late nineteenth century which pinned the causes of diseases to microbes and overlooked conditions of the environment that affected human bodies. A single etiological cause of disease was identified as the sole reason of un-healthiness of an otherwise self-contained body.[18] However, during the interwar years, factors such as the influenza pandemic, tropical diseases hindering development efforts, and growing medical specialization renewed an interest in a more holistic approach to health and diseases.[19] Gradually, European medical science began to show how biotic and abiotic factors affected host-parasite interactions and its resultant proliferation of tropical diseases.[20] Although the late nineteenth century saw the gradual distancing from the environment and climate argument in explaining ill-health, yet the remnants of this line of thought still continued.[21] As historian Nandini Bhattacharjee also asserts, the role of climate, and the

[16] David Arnold, *Science, Technology and Medicine in Colonial India*. (Cambridge: Cambridge University Press, 2000), p. 57.

[17] Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge*. (Berkeley, LA, London: University of California Press. 2006); Gregg Mitman, 'In Search of Health: Landscape and Disease in American Environmental History', *Environmental History*, Vol. 10, No. 2 (Apr., 2005), p. 184.

[18] Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge*, p. 84.

[19] Mitman, 'In Search of Health: Landscape and Disease in American Environmental History', p. 186.

[20] Ibid., p. 190.

[21] Arnold (ed.), *Warm Climates and Western Medicine: The Emergence of Tropical Medicine, 1500-1900*, p. 10.

environment in general, in affecting human bodies always remained a central trope in the medical discussions of tropical colonies till the end of colonial rule.[22]

With Alfred Crosby's *The Columbian Exchange,* followed closely by another crucial work by William McNeill, *Plagues and Peoples,* the idea of the environment facilitating microorganisms and diseases and affecting the course of history was prominently brought to the forefront of historical discussions.[23] 'Black Death' mortality in the fourteenth and fifteenth century Europe and similarly tuberculosis deaths in industrializing regions connected industrialisation and the surge of infectious diseases where over-crowding, unsanitary dwelling areas, poor ventilation- characteristics of urban poverty- exponentially increased the facilitation of infection to huge number of individuals.[24] Although such industrial processes did not per se "invent" such diseases, evidences point to increased occurrences of diseases associated with such work. When low wages, malnutrition and wretched working conditions were added to the mix, the mortality rates rose tremendously.

In a similar fashion, the growing pursuit for tea by the mid nineteenth century in Assam exerted considerable impact on the health of the labouring class. Existing historiography on health in tea plantations in India mostly touches on how disease management in the tea plantations were highly influenced by principles of colonial capitalism, which afforded financial gain the highest priority. On the issue of health and diseases in a plantation scenario,

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[22] Nandini Bhattacharjee, *Contagion and Enclaves: Tropical Medicine in Colonial India* (Liverpool: Liverpool University, 2012), p. 47.

[23] Alfred W. Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492* (Connecticut: Greenwood Press, 1972); William H. McNeill, *Plagues and Peoples* (New York: Anchor Press/Doubleday, 1976); Christopher Sellers, 'Thoreau's Body: Towards an Embodied Environmental History', *Environmental History*, Vol. 4, No. 4 (Oct., 1999), pp. 486-514.

[24] Nash, 'Beyond Virgin Soils: Disease as Environmental History', p. 86; René J. and Jean Dubos, *The White Plague; Tuberculosis, Man and Society*, (New Jersey: Rutgers University Press, 1996); Randall M. Packard, *White Plague, Black Labor: Tuberculosis and the Political Economy of Health and Disease in South Africa* (Berkeley: University of California Press, 1989).

Nandini Bhattacharjee writes on the intersection between tropical medicine, the colonial state and colonial enclaves. Her study shows the contradicting medical outlooks in action in Darjeeling, imagined as a rejuvenating colonial enclave with superior medical provisions for the Europeans vis-a-vis the neighbouring tea gardens of northern Bengal where labourers had little to no medical facilities and lived a life fraught with diseases and morbidity.[25] Arnab Dey argues that in order to understand disease and health in the Assam plantations we need to simultaneously engage with "the pathological, the productive and the legal."[26] His study on health and diseases in colonial Assam tea gardens claims that "ideas of mortality, death, and well-being exceeded instrumental logics of scientific objectivity, imperial sanitary policy, vector identification, and preventive cure in these estates. It was shaped by the expedient exegesis of medical knowledge, law, commercial interests, and idioms of corporeality."[27] In order words, narratives of ill health and diseases in the Assam gardens did not follow any single path anchored to scientific or medical viewpoints but "transcended logics of bodily disorder, pathogens, or preventive medicine."[28] It varied conveniently to serve the interests of the planters and was conditioned by medical opinions, prospects of financial gains and the law.

Within this background of historical narratives on health in the Assam plantations, this chapter seeks to locate the corporeal conditions of the labourers within the context of a manufactured landscape as discussed in the previous chapters. Their pervasive ill health and bodily deterioration were often understood by planters and colonial medical expertise as emerging from inherent environmental flaws of the region or from inherent socio-economic-

[25] Bhattacharjee, *Contagion and Enclaves: Tropical Medicine in Colonial India*.

[26] Arnab Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India* (United Kingdom: Cambridge University Press, 2018), p. 98; Arnab Dey, 'Diseased Plantations: Law and the Political Economy of Health in Assam, 1860–1920', *Modern Asian Studies*, Vol. 52, Issue 2 (March 2018), pp. 1-38.

[27] Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India*, p. 131.

[28] Ibid., p. 97.

corporeal conditions (which I argue was implicitly enabled by the tea environments themselves). How did the tea environment transform the bodies of the labourer? And how did the medical expertise operating in the Assam tea gardens perceive the relationship between the tea environment and ill-health of its labourers? In doing so, the labourers' diseased bodies becomes one of the focal points of the chapter, and the tea environments' connection with conditions of nutrition (or the lack thereof) and sanitation unveils its connection with deteriorating labourers' bodies. As Linda Nash rightly points out, "the history of occupational disease has been told from the perspectives of labor and social history", and the material conditions of the environment which are so closely intertwined with such occurrences seldom surfaced.[29]

Becoming "Coolies"

> I was greatly struck with the extreme emaciation of many of the coolies. They presented all the appearance of extreme starvation. Every particle of sub-cutaneous fat had disappeared, the skin was dry and hard, the muscles were wasted to an extraordinary degree, and the *tout ensemble* was that of hide-bound skeletons. This language may seem exaggerated, but it is really not so.[30]

An estimated number of 7,50,000 labourers were recruited between 1870 to 1920 to work in the Assam plantations and during the 1920s, the total strength of the labour force including their dependents amounted to around 10,67,662.[31] They were recruited, often by deceit and false promises, through the indenture system which bound them to the gardens. The labourers

[29] Nash, 'Beyond Virgin Soils: Disease as Environmental History', p. 90; "Environmental history can contribute to the body scholarship by exploring connections that class and economics have on the bodies which have been relatively rare in comparison to emphasis on gender, race, imperialism or patriarchy when it comes to writings on body and health."- Sellers, 'Thoreau's Body: Towards an Embodied Environmental History', p. 502.

[30] Quoted by A C. C. DeRenzy, Deputy Surgeon General and Sanitary Commissioner of Assam, 1879 in *Annual Sanitary Report of the Province of Assam for the year 1878* (Shillong: Assam Secretariat Press, 1879), p. 7.

[31] Jayeeta Sharma, ' "Lazy" Natives, Coolie Labour, and the Assam Tea Industry.' *Modern Asian Studies.* Vol. 43. Issue 06, (2008), p. 1307; Rajani Kanta Das, *Plantation Labour in India* (Calcutta: R. Chatterjee, 1931), p. 20.

were usually made to accept a contract right away in the Calcutta depots which read something like this:

That my wage will be at the rate of rupees four a month, but I agree to work on the contract or nirrick system, and I understand that I am to be paid a day's wages if I do a day's work, and if I do more than a fixed day's work I am to be paid extra. I accept the following as a fixed day's work:-

Hoeing - 16 nulls of 8 huttes each.

Weeding - 20 nulls of 8 huttes each, etc. etc.[32]

Fig 12: Labourers at Work in a Tea Plantation

Source: Bampfylde Fuller, *The Empire in India* (Boston: Little Brown and Company, 1913), p. opposite p. 202.

In majority of early recruitments, false information regarding the type of labour to be performed and wages rates were conveyed and contracts were entered with the labourers for anywhere between three to five years with a threat of prosecution on the failure to honour the clauses.[33] By inducing contract-bound migrations into these far-away plantations, often fraught with fraudulent recruitment tactics, the plantation economy distanced the labourers

[32] W.H.S. Wood, 'Tea in Cachar', *The Assam Review*. Volume I, No. 12. (February, 1929) p. 424.

[33] Guha, *Planter-Raj to Swaraj Freedom Struggle and Electoral Politics in Assam 1826-1947*, p. 41; Behal, *One Hundred Years of Servitude*, pp. 44-49; The maximum length of the indenture was first set at five years in 1863, but then reduced to three years in 1865, increased to five years in 1882, and reduced to four years in 1893: *Report of the Assam Labour Enquiry Commission*, (Calcutta: Office of the Superintendent of Government Printing. 1906), pp. 135-47.

from their homelands and secured a stable workforce. The Assam tea labourers' folk songs are replete with accounts of their hard toil in the gardens and a doleful realisation of their deceitful recruitment.[34]

Recruitments took place either through contractors based in Calcutta or through the more popular system of "sardari" recruitment whereby the garden authorities sent senior "coolies" employed in their gardens to their home districts to recruit more labourers. These *sardars* or *sirdars* were mostly men, but in the Cachar district of Assam, at times women, mostly the wives of the *sardars*, too were given recruiting licenses.[35] The *sardari* system often ensured that labourers migrated with their entire families and for this very reason, the *Report of the Assam Labour Enquiry Committee 1906* lauded the recruitments done by garden *sardars* as opposed to the contractors since the former were capable of recruiting more families "with a high proportion of women and children" as opposed to single men and women recruited by the contractors. [36] The over-arching idea behind recruiting women into these plantations was to assist in establishing a settled workforce which otherwise comprised of unmanageable and absconding male labourers.[37] However, this is not to assume that every woman was a welcomed migrant. In certain cases, the planters' desired idea of a "settled" labour force was not fulfilled when single women began arriving at the plantations. It was assumed that women not accompanied by guardians were either lured away from their families by the recruiter or that the women were escaping marital ties by desiring to move to Assam. And

[34] Sukdev Adikari, *Chah Janagosthir Lokageet, Loka Parampara aru Utsavar Ruprekha.* (Assamese) (Guwahati: Saraswati D.N. Publication, 2015), pp. 37-185; Rajen Gogoi (ed.), *Chah Janagostir Cinta Cetana*, (Assamese) (Jorhat: Assam Sahitya Sabha, 2001).

[35] However, the then Chief Commissioner of Assam Colonel Richard Harte Keating directed the discontinuance of this system of recruitment by women, following the judgement of the Lt. Governor of Bengal who denied legal recognition to this practice: *Report on Labour Immigration into Assam for the year 1878*, pp. 1, 4.

[36] *Report of the Assam Labour Enquiry Committee 1906,* p. 37

[37] Piya Chatterjee, *Encounters Over Tea: Labor, Gender, and Politics of an Indian Plantation*. Unpublished dissertation. (The University of Chicago, 1995), pp. 11-12.

neither of these conditions was deemed ideal by planters and law-makers in fulfilling their ideal "settled" labour force.[38] This demanded explicit administrative control on women's immigration, and female labourers who were unaccompanied by their husbands or guardians were often detained in the depots.[39] An increasing female labourers' presence also had the added benefits of incurring lower costs via lower wages to women and with a variety of jobs assigned to men, women and children of a family, this system promised the steady supply of labourers to the plantations for generations.[40] Another reason that planters cited in favour of family recruitment was that families tended to each other during sickness and planters believed that single men and women labourers had a higher chance of perishing than families.[41]

Perilous Journeys

The labourers thus recruited from various regions were brought to depots in Calcutta usually by trains and connected to Dhubri, from where they embarked on their journey to their respective tea gardens mostly in river steamers and flatboats on the river Brahmaputra which lasted anywhere between a few weeks to a month at times.[42] At the depots, the immigrants were supposedly made a payment of 5 rupees and provided with a few utensils, one or two blankets and some clothes.[43] By the year 1890, it was noted that immigration into the Assam

[38] *Report of the Assam Labour Enquiry Committee, 1906*.

[39] Chatterjee, *Encounter over Tea: Labor, Gender, and Politics of an Indian Plantation*, p. 103; Strict Control of Recruitment for the Tea Gardens in Assam in the Allahabad and Basti Districts, February, 1917, Nos. 20/22. Part B, Department of Commerce and Industry, p. 3. National Archives of India (NAI).

[40] For statistics on the number of female labourers immigrating into the Assam gardens in relation to the male labourers, please refer to Appendix C.

[41] *Papers Regarding the Tea Industry in Bengal* (Calcutta: Bengal Secretariat Press. 1873), p. 50.

[42] S. M. Akhtar. *Emigrant Labour for Assam Tea Gardens* (Lahore, 1939), pp. 20-21.

[43] Ranajit Das Gupta, 'Structure of the Labour Market in Colonial India', *Economic and Political Weekly*, Vol. 16, No. 44/46, Special Number (Nov., 1981), p. 1787.

gardens had two popular routes- a steamer route via Goalundo[44], which was apparently more popular, and a railway route by Kaunia.[45] The journey from the Raniganj depot in Bengal, both by waterways or railways, to Dhubri in Assam took a minimum of 4 to 5 days in an ideal situation and the journey from Dhubri to the tea garden districts took additional time.[46] In October 1883, a fast steamer service was introduced that could take the labourers from Dhubri to Dibrugarh in the Brahmaputra Valley in four to five days, carrying about 120 emigrants.[47] Prior to that, large commercial steamers were arranged for the emigrants to be transported from Goalundo and Dhubri, and the voyage generally took about 12 to 14 days from Dhubri to Dibrugarh, and from 4 to 6 days between Goalundo and Dhubri.[48] On the other hand, the labourers travelling to the Surma Valley gardens into Sylhet and Cachar had to embark on boat journeys from Goalundo, which could take anywhere between ten to thirty days to reach their destination.[49]

Since 1863, concerns regarding the health of the tea "coolies" and high mortalities in transit to the Assam tea plantations began to figure in official reports. It was calculated that even after the implementation of provisions specifically aimed to address the mortality of the immigrant labourers in their journey in 1863, the mortality was around 5,500 in the three years succeeding the implementation of the Act in contractor depots and voyages alone, out of a total of approximately 90,000 recruits.[50] They were transported in revolting conditions and these journeys were fraught with diseases, hardships, and mass deaths. Over-crowding made these journeys extremely tough and aided in the spread of epidemics within a very short

[44] Goalundo is, in the present-day, a town in the Dhaka division of Bangladesh.

[45] Kaunia is, in the present day, located in the Rangpur division of Bangladesh.

[46] *Report on Labour Immigration into Assam for the year 1890* (Shillong: The Assam Secretariat Press, 1891), p. 5.

[47] *Report on Labour Immigration into Assam for the year 1882* (Shillong: The Assam Secretariat Press, 1883), p. 10.

[48] *Report on Labour Immigration into Assam for the year 1883* (Shillong: The Assam Secretariat Press, 1884), p. 2.

[49] *Report on Labour Immigration into Assam for the year 1882*, p. 10.

[50] *Papers Regarding the Tea Industry in Bengal*, p. xviii.

span of time.[51] Cholera epidemics were extremely rampant and carried off large numbers of labourers in transit itself.[52]

Matters relating to sanitation and the health conditions of the immigrating labourers in transit were relegated to inspecting medical officers in the depots, from where the labourers embarked on their journeys to Assam, to ascertain whether they were fit enough to travel and work in the plantations.[53] Then Deputy Surgeon General and Sanitary Commissioner of Assam, A C. C. DeRenzy's observations on the spread of cholera in the steamers among the immigrant population led him to recommend an abundant and clean supply of water in the steamers as well as in other points of their journey to the plantations. This did lead to lower incidences of cholera for a few years, however, deaths during transit shot up again with 925 deaths among 31,217 labourers in 1888 and 596 deaths among 34,507 immigrants in 1889 which was largely identified as a consequence of flouting DeRenzy's recommendations.[54]

Deplorable travelling conditions aided sickness and mortality and in many instances, inspecting officials accused the on-board native medical doctors of inadequacy, inaction and neglect. There were also instances of medical men being threatened by the vessel commanders or owners to conceal the number of deaths and cases of sicknesses.[55] An inspection of a cholera infected steamer by a medical officer, Curran in 1872 showed that although the steamers did seem to have an adequate supply of medicines on board, yet the

[51] Ibid., p. 3.

[52] *Report on Labour Immigration into Assam for the year 1895* (Shillong: The Assam Secretariat Press, 1891), p. 13; For example : Outbreak of Cholera on Board the Flat "Hoogly" and Steamer "Punjab" etc., File No. 191-327. Papers-22. 1872. ASA; Outbreak of Cholera amongst the Imported Coolies on Board the Steamer Burmah and Flat Hoogly proceeding to Assam, File no. 134-244. Papers- 10. Government of Bengal, 1872. ASA ; Outbreak of Cholera on Board the Steamer "Panjab" which Arrived with Coolies at Goalpara, File no. 49-87, Papers-5, Government of Bengal, 1873, ASA; Construction of Temporary Buildings at Dibrugarh for Coolies Infected with Cholera who were Landed from Simla. Paper 2. Fil no. 136-246. Government of Bengal. 1872, ASA.

[53] Das, *Plantation Labour in India*, p. 102.

[54] A. C. C. DeRenzy, 'Cholera among the Assam Tea Coolies', *The Lancet*. Vol. 137, Issue. 3528 (April 11, 1891), p. 823.

[55] Ibid.

efficiency in dispensing them to the affected seemed to be absent.[56] The obvious hierarchy and disdain among the inspecting medical experts and the native medicine man on-board the steamers are clearly apparent in such instances. At times, virulent outbreak of cholera and the consequent high mortality among the immigrants in transit even led to the temporary stoppage of emigration. Such an event occurred in 1888 when the Bengal Government, on account of a lamentable outbreak of cholera during such a transit of labourers, prohibited emigration on a temporary basis.[57] Towards the late nineteenth century, precautionary measures included careful assessment before providing licenses for vessels that plied in this route, establishment of accommodation facilities in the depots that could tend to the infected immigrants and vesting the power to Embarkation Agent at Dhubri of reducing the number of passengers in a vessel if circumstances justified.[58] Additionally, in accordance with the rules laid out by the Chief Commissioner, during outbreaks of cholera the managers of the tea estates were responsible for transporting the affected labourers from the depots to their gardens.[59]

These perilous journeys which wiped off a number of these immigrants marked the beginning of a life of exploitation and despair of the labourers who reached the Assam plantations.

Plantation Work Regime

The majority of the immigrant population that came to the Assam plantations were peasants who cultivated rice, maize, wheat, barley, millets and so on in their homelands.[60] Although tea was an agro-industry that did have similarities to their prior agricultural lives, yet the plantation regime was an extremely new experience for these immigrant labourers. As

[56] Ibid., p. 3.

[57] *Report on Labour Immigration into Assam for the year 1888* (Shillong: The Assam Secretariat Press, 1889), pp. 9-10.

[58] Ibid.

[59] Ibid.

[60] *Imperial Gazetteer Bengal, Chota Nagpur Division* (Calcutta: The Bengal Secretariat Press, 1907).

discussed in Chapter I, labourers were engaged in all sorts of physically taxing jobs, be it clearing forest lands, digging, hoeing or plucking. As John Weatherstone, an Assam tea planter recalled regarding the state of injuries within the plantations, apart from epidemics and diseases—"wounds from the thorns and cuts during clearing operations were naturally numerous."[61] Moreover, labourers were the most likely to be attacked by wild animals, reptiles and insects whose natural habitats and movements were obstructed with the establishment of plantations.[62] A twentieth century tea planter in Assam, Frank Nicholls, thus wrote the following two instances,

> A little boy of six was taking some food to his father, who was working on the estate. He was passing along a narrow road near our hospital, on either side of which there was some very light jungle, when suddenly a leopard sprang on him, mauling his chest and arms and according to an eye witness, disappeared as quickly as it had appeared.[63]

> The boys were working at the extreme end of the area to be planted, which was contiguous to an area of three feet high thatch grass grown for thatching purposes. While watching them, my eye caught a slight movement a few yards inside the grass... A few minutes later, a leopard sprang out on to the nearest boy, clawed and bit him and leapt back again into the grass-all in a flash![64]

Such instances frequently compelled labourers and neighbouring villagers to seek the help of planters who, at their request, shot man-eating tigers, leopards, *gharials* or raging elephants from time to time.[65]

Plucking tea leaves in the gardens was one of the most time-consuming and manually taxing jobs and the immigrant women were mostly employed in this task. It was believed that these

[61] Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*, p. 69.

[62] Ibid., p. 76.

[63] Nicholls, *Assam Shikari: A Tea Planter's Story of Hunting and High Adventure in the Jungles of North East India*, p. 19.

[64] Ibid., p. 21.

[65] Frank Nicholls, *Assam Shikari: A Tea Planter's Story of Hunting and High Adventure in the Jungles of North East India* (New Zealand: Tonson Publishing House, 1970); A. R. Ramsden, *Assam Planter* (Guwahati, Delhi: Spectrum Publications, 2016).

women who traditionally belonged to agriculture-based communities would adjust easily to this agro-based industry that utilized a minimum level of mechanization and their customary role of foraging and harvesting must have prepared them for the task of plucking tea.[66] However, as already mentioned, this was not the rationale behind recruiting women into these plantations initially. Women were not recruited for their adeptness to such works, but were recruited as a unit of a family, in relation to the male workers, and in an attempt to settle the labour force and reproduce it.[67] Contrary to the assumption that plucking was light work, the strenuous work of plucking and carrying tremendous weight on their backs often led to musculoskeletal disorders among these women.[68] They also had to resort to wearing protective sheeting in their waists to avoid injury to their torso from the branches of the tea bushes.[69] Weeding, hoeing, transplanting, manuring and pruning were carried out largely by men in the gardens.[70] Spraying tea bushes with pesticides too was predominately carried out by the men. The concerns of experts regarding the effects of poisonous pesticides on the sprayer, as briefly mentioned in the previous chapter, became a reality in these plantations since the later part of the twentieth century. Apart from being a labour intensive work, these substances when came in contact with the labourers' bodies caused great discomfort. After bushes were sprayed, the soil was laden with corrosive products which oftentimes caused blisters on feet of workers who walked barefoot.[71] Historians writing on the plantations of the American South have thus theorised that "modernisation" of plantation agriculture through

[66] Mita Bhadra, 'Gender Dimensions of Tea Plantation Workers in West Bengal', *Indian Anthropological Association: Indian Anthropologist*, Vol. 34, No. 2. (December, 2004), p. 46; Chatterjee, *Encounters Over Tea: Labor, Gender, and Politics of an Indian Plantation*, p. 105.

[67] Chatterjee, *Encounters Over Tea: Labor, Gender, and Politics of an Indian Plantation*, pp. 190-91.

[68] N. Bhattacharyya; D. Chakrabarti, 'Ergonomic Basket Design to Reduce Cumulative Trauma Disorders in Tea Leaf Plucking Operation.' *Work*, vol. 41, no. Supplement 1, (2012). pp. 1234-1238.

[68] Susan R. Ward, *A Glimpse of Assam*, (Calcutta: City Press, 1884), p. 130.

[69] Chatterjee, *Encounters Over Tea: Labor, Gender, and Politics of an Indian Plantation*, p. 210.

[70] Mita Bhadra, 'Women Workers in Tea Plantations', *Indian Anthropologist*, 15 (2), (1985), p. 95.

[71] Chatterjee, *Encounters over Tea: Labor, Gender, and Politics of an Indian Plantation*, p. 112.

pesticides was "a continuation of agro-environmental racism", as "the biopolitics of pesticides are shaped by an uneven valuation of human life through the establishment of thresholds of 'acceptable risk' through both exposure and dispossession."[72]

Plantation work strictly adhered to a hierarchy among the labourers and staff as well as a stringent time-bound structure. The labour force was divided into men, women, boys and girls and placed under an overseer, who in most cases carried out rampant exploitation and harassment.[73] Since the 1870s itself, hours of labour in the Assam plantations were fixed at 9 hours and six days a week.[74] However, what needs to be stressed is that garden work was based on piece work or daily tasks that needed to be completed in order for the labourers to earn a full day's wage irrespective of the hours of work. According to George Barker, an Assam tea planter in the 1870s, the typical work day in the plantations started at around 6 am in the morning.[75] With water breaks and a lunch break in between, the work in the gardens continued till the end of the work-day at 6 pm.[76] Reportedly, labourers often complained about not receiving sufficient time to consume meals during the busy seasons and at times subsisted on a single meal to complete their daily tasks in the gardens.[77] Interestingly, although machinery, such as rollers, driers, fanning and sorting machines etc. was gradually introduced in the plantations, yet the extent of manual labour with regard to plucking and hoeing remained the same. The technological advancement and greater mechanisation

[72] Brian Williams, ' "That we may live": Pesticides, Plantations, and Environmental Racism in the United States South.', *Environment and Planning E: Nature and Space* Vol. 1, No. 1-2, 2018, p. 16; Perfecto I 'Pesticide Exports to the Third World', *Race & Class* 34 (1) (1992), p. 107.

[73] Existing literature on this exploitation and disciplining of the Assam tea plantation labourers is ample. Some of these works are- Guha, *Planter-Raj to Swaraj Freedom Struggle and Electoral Politics in Assam 1826-1947*; Behal, *One Hundred Years of Servitude*; Ganguly, *Slavery in British Dominion*; Chattopadhyay, *Slavery in India*. etc.

[74] Das, *Plantation Labour in India*, p. 126.

[75] George M. Barker, *A Tea Planter's Life in Assam* (Calcutta: Thacker, Spink & Co., 1884), p. 134; David Crole, *Tea: A Text Book of Tea Planting and Manufacture*, (London: Crosby Lockwood and Son, 1897), p. 60.

[76] Barker. *A Tea Planter's Life in Assam.* pp. 259-260.

[77] *Proceedings of Assam Labour Enquiry Committee in the Recruiting and Labour Districts* (Calcutta, The Superintendent of Government Printing, 1906) pp. 64, 87.

achieved by the beginning of the twentieth century did not substantially affect the cultivation process. On the contrary, it often increased the demand for intensified manual inputs to keep up with the speedy production process with the introduction of machinery in the factories, which resulted in further tightening of the plantation work regime.[78]

The State of (Un)Health of Tea "Coolies"

In addition to the deaths that occurred during these journeys, the gardens too did not provide much respite to these labourers. Inadequate housing facilities, unsanitary living conditions, hard and long hours of garden work coupled with a poor diet added to their un-healthiness which resulted in tremendous mortality rates. Diseases like malaria, cholera, dysentery and anaemia were rampant among the labour population. For instance, Secretary to the Government of Bengal, J. Ware Edgar's calculation on the extent of mortality in the tea districts of Assam in a span of just three years makes a compelling case regarding the magnitude of the problem.[79] According to Edgar, between May 1863 and May 1866, 84,915 labourers arrived at the Assam tea districts, however in the revised returns submitted for the year 1866, only 49,750 labourers were shown to have remained in the gardens as of 30th June 1866. Even after adjusting for possible completed contracts, Edgar's calculations left him with around 31,876 unaccounted labourers who most probably died or had deserted during the three years under consideration.[80]

[78] This was because the machinery that could be successfully used in the plantations were the drier, roller, etc. and these machines although did alleviate manual labour in the tea processing factories and fastened the pace of these processes but it also resulted in a higher exertion of manual labour in the fields, be it plucking leaves or making the garden conducive for more rapid growth for which machines could not be used, to match the demands that these machineries created: Nitin Varma, *Producing Tea Coolies?: Work, Life And Protest In The Colonial Tea Plantations Of Assam, 1830s-1920s.* Unpublished Dissertation. (Berlin: Humboldt University, 2011), pp. 144-145.

[79] *Paper Regarding the Tea Industry in Bengal* (Calcutta: Dept. of Agriculture, 1873), pp. xix-xx.

[80] Ibid.

A measure devised to identify plantations on the basis of mortality rates was to declare any garden in which death rates exceeded 70 per thousand in a year or an annual death rate exceeding 7 percent as "unhealthy".[81] And through an act instituted in 1873, the local government was invested with the authority to shut down plantations in which death rate exceeded 7 percent per year or if mortality of 3 years exceeded 7 percent.[82] However, the calculation for assigning the "unhealthy" tag was based on the death rates of only the labourers who were under contract (also known as the Act labourers) till the late 1880s. As a result, in 1888, it was decided to calculate the death rates on the average mortality and consequently the percentage of unhealthy gardens in the Brahmaputra Valley shot up to 12.2 per cent in 1889 from 7.2 per cent in 1888.[83] Witnessing an increased prevalence of unhealthy gardens, in 1891, rules were instituted by the Government of Assam whereby any garden that featured in the unhealthy list for two years continuously had to prove that they were following the recommendations of sanitary officers.[84] This too did not seem to alleviate the situation as the percentage of unhealthy gardens further increased to 16.4 per cent in 1892.[85] Consequently, in 1893 laws were enacted which strengthened the power of the local administration over matters of sanitation enforcement and with further modifications legislated in 1901 an improvement was witnessed in the number of unhealthy gardens for some years.[86] But still some years witnessed very high mortality rates owing to epidemics which showed that control over epidemic propagation was yet to be achieved.

As evident from the table below (Table 7), the death rates were very high among the plantation labourers, especially among the Act labourers which were mostly because the Act

[81] *Report on Labour Immigration into Assam for the year 1883* (Shillong: The Assam Secretariat Press, 1884), p. 33.

[82] *Report on Labour Immigration into Assam for the year 1874* (Shillong: The Assam Secretariat Press, 1875)

[83] *Report on Labour Immigration into Assam for the year 1889*, (Shillong: The Assam Secretariat Press, 1890), p. 28.

[84] Das, *Plantation Labour in India*, p. 104.

[85] *Report on Labour Immigration into Assam for the year 1893* (Shillong: The Assam Secretariat Press, 1894) p. 48.

[86] *Report on Labour Immigration into Assam* for respective years.

labourers were also the new immigrants who entered into a contract. Since the late nineteenth century, the health of the labourers was a primary area of concern and debate among planters as well as administrators and at least some form of preventive measures in the form of inoculation, sanitary arrangement etc. were carried out among this population which was not the case in the other parts of the province; yet the state of ill-health and morbidity continued in the plantations.

Table 7: Deaths among the Tea Plantation Population of Assam categorised into Act and Non-Act labourers

Year	Deaths in the Assam Gardens						
	Deaths		Average Strength		Death Rate per 1,000		Death Rate in Assam per 1,000 population
	Act	Non-Act	Act	Non-Act	Act	Non-Act	
1876	2967	1345	43654	50805	67.9	26.4	
1877	3740	1558	45657	59660	81.9	26.1	
1878	5396	2676	50763	68713	106.2	38.9	
1879	3759	2936			78.6	38.6	
1880	2398	2012	40950	82005	58.8	24.5	
1881	1994	2162	31938	92512	63.8	23.3	
1882	2301	2874			67.9	29.3	
1883	3667	2838	59078	94661	61.5	30	
1884	4755	2859	80736	96886	58.9	29.5	
1885	4369	2747	84793	103469	51.5	26.5	
1886	4794	3271	81557	110518	58.9	29.5	
1887	4634	3267	80835	122188	57.2	25.8	
1888	5494	4008	87113	132748	62.9	30.2	
1889	6202	5120	97531	143765	63.5	35.6	
1890	5653	4290	101525	148587	55.6	28.8	
1891	5416	5366	108384	156931	49.8	34.1	
1892	7509	6316	116499	167320	64.3	37.7	34.21
1893	6324	5186	122067	180491	51.7	28.5	30.28
1894	5778	5848	118164	192603	48.9	30.3	30.69
1895	6316	6626	121812	212416	52.8	31.2	33.72
1896	5998	7262	131089	235371	45.7	30.8	36.33
1897	8359	10723	146824	255373	56.7	41.9	
1898	6728	8136	142998	261448	47	31.1	36.15
1899	5812	7015	133486	266619	43.6	26.3	
1900	5815	7407	133398	281833	43.5	26.2	
1901	4454	7196	119649	284589	37.2	25.2	27.85
1902-03	3885	7633	96175	301751	40.3	25.2	
1903-04	3384	7213	88792	313831	38.1	23	26.55
1904-05	2811	7024	82144	325113	34.2	21.6	25.85
1905-06	2716	7951	78381	335424	34.6	23.7	
1906-07	2558	7535	73310	345016	34.9	21.8	31.67
1907-08	3202	10870	65635	370320	48.8	29.3	
1908-09	3115	14669	51053	404089	61	36.3	
1909-10	1751	13081	33728	424002	51.9	30.8	
1910-11	1290	13544	23821	436864	54.1	31	
1911-12	1064	13454	17572	454919	60.6	29.6	
1912-13	692	13237	12821	478633	54	27.7	
1913-14	618	13701	10678	497209	57.8	27.5	
1914-15	469	13992	9087	513050	51.6	27.2	
1915-16	335	17041	6621	543385	50.5	31.3	
1916-17	176	16760	3895	563887	45.2	29.7	
1917-18	63	14332	1925	556581	32.7	25.8	
1918-19	38	43678	619	586441	61.4	74.5	
1919-20	0	30696	58	626207		49	
1920-21		15192		600784		25.3	

Sources: Ralph Shlomowitz and Lance Brennan, 'Mortality and Migrant Labour in Assam, 1865-1921.' *The Indian Economic and Social History Review*, 27(1) (1990), p. 98; *Report on Labour Immigration into Assam* for *the respective years*; *Annual Sanitary Report of the Province of Assam for the the respective years*; M. V. Seshagiri Rao, 'A Statistical Study of Labour in the Assam Tea Plantation', *Sankhyā: The Indian Journal of Statistics (1933-1960)*, Vol. 7, No. 4 (Jul., 1946), p. 447.

Understanding Ill-Health in Colonial Assam Tea Plantations

Official and medical narratives tended to account for the high rates of mortality in the Assam plantations in a myriad of ways. The most persistently cited causes of high mortality and general ill-health among the labourers till at least the late nineteenth century, apart from diseases, are reflected in the following excerpt from a joint report by a Civil Surgeon and an Assistant Commissioner in 1884 regarding an unhealthy garden in the province:

> (1) The *bad quality of coolies*, especially North-West coolies, imported.
>
> (2) The majority of the coolies were individuals of different castes and nearly all were *unmarried*.
>
> (3) The *unsuitability of the damp climate* to natives of the dry plains of the North-West.
>
> (4) The *unsuitability of a rice diet* to persons accustomed to satto and atta.
>
> I think a fifth cause may be found in the *peculiar saving habits* of the North-West coolies. It is a well-known fact that they will almost starve themselves for the purpose of scraping together few pices.[87]
>
> (italics mine)

Inferior quality "coolies", unmarried labourers contributing to low birth rates, unsuitable climate, unsuitable diet and peculiar saving habits- all these factors pointed to aspects that were inherently wrong with either the labourers themselves or the intrinsic environment of the province. Although most of the acclimatization claims centred on the racial anxieties around survival and well-being of the white colonizers with publication of popular primers and hacks on how to survive the tropics[88], yet concerns regarding mortality and morbidity of the Assam tea "coolie" too came to occupy official reports. In a bid to understand how the medical expertise, colonial officials and planters justified this narrative and how it absolved the planter and the colonial government to an extent shall be explored in this section.

[87] *Report on Labour Immigration into Assam for the year 1883* (Shillong: The Assam Secretariat Press, 1884) p. 37.

[88] An example of such a guide would be J. T. Calvert, *The Preservation of Health for the Guidance of Young Officers on their Arrival in India* (Calcutta: The Bengal Secretariat Press, 1906).

However, alongside this popular narrative of environmental determinism, understanding such ill-health in terms of the material conditions of the labourers- their socioeconomic status and lack of sanitation and proper medical aids, too simultaneously began. As we shall see in this section, all the aforementioned causes of ill-health cited in the above excerpt, had, in fact, explanations that were a direct consequence of conditions affected by the plantation regime, be it the extremely harsh work schedule, very low wages, or delayed acclimatization and its connection with malnutrition. The same goes for the diseases that prevailed amongst the labourers like cholera, malaria, dysentery, and diarrhoea. Although vectors of such diseases were viruses, bacteria or infections yet the plantations facilitated the proliferation of these diseases by creating conducive conditions, such as weakened bodily constitution due to overwork and malnutrition, usage of infected water, and so on which aggravated their conditions. A careful reading of the *Reports on Labour Immigration into Assam* for the various years shows us the differing opinions among the medical expertise regarding the causes of this diseased state. These discussions show how right from pre-migration socio-economic conditions to insufficient nutrition, low wage rates, extremely labourious work patterns, nonviable reproductive environment and lack of sanitary measures in the gardens were all, at various points of time, deemed essential in understanding the situation. The following section seeks to understand these conditions within the context of the plantation environment which enabled a protracted state of ill-health among the labourers of the Assam tea plantations in the colonial period.

Famines, Immigration and the Image of the Sick "Coolie"

With large scale migrations beginning from the 1860s, it was soon realised that extremely high mortality rates existed among the immigrants. The large number of mortality in the gardens raised questions about the viability of continuing the tea enterprise and therefore time and again we see various enquiries being constituted and subsequent changes effected in the

legislation to alleviate the situation.[89] Tea planters and managers consistently pointed to "weak and sickly batches" or "bad batches of coolies" imported into the Assam gardens as a justification for the steep mortality rates as seen in the excerpt previously quoted. But as reported, in a majority of cases, the planters had no substantial evidence to back such claims that could merit an official enquiry into the matter.[90]

To corroborate their stand, the planters often pointed to the high rates of mortality in the gardens in the years when labourers were brought in from recruiting districts that were experiencing famine. This excused the planters from providing a healthy dwelling space and amenities to the immigrating labourers as they already asserted notwithstanding the provisions undertaken, the labourers were "inherently" unhealthy to begin with. Famines were also associated with extremely high mortality rates when they coincided with cholera epidemics. For example, the *Immigration Report for the Province of Assam for the year 1878* reported that the exceptionally high mortality rates in the Assam gardens in the year 1877 was not due to any special un-healthiness in the gardens but because of the introduction of labourers who were weakened by the effects of the Madras famine of 1877:

> It appeared…from the special inquiries instituted that the mortality among Madrasis in 1877 was quite exceptional, and was due not to special unhealthiness in the gardens on which they resided…, but to the introduction in large numbers during the year 1877 of labourers who had become weakened by scarcity during the late famine in the Madras Presidency.[91]

[89] For example, Act XIII of 1859 Workmen's Breach of Contract Act was used in the initial phase of immigrations into the Assam gardens. But as a result of an enquiry constituted in 1861 to enquire into the high rates of mortality on the journey as well as in the gardens, it was replaced by the Act III of 1863-Inland Immigration Act.

[90] *Report on Labour Immigration into Assam for the year 1878* (Shillong: The Assam Secretariat Press, 1879), p. 2; Mortality in the Gardens of Biswanath Company in Darrang. *Government of Bengal Papers*. File No. 132-242. 1871-72. p. 45. ASA.

[91] *Report on Labour Immigration into Assam for the year 1878* (Shillong: The Assam Secretariat Press, 1879), pp. 3-4.

Madras in 1877 also experienced the "lethal alliance" of famine coinciding with cholera which caused inordinate amounts of deaths. These causes also aided in pushing the people from those regions to the plantations in Assam in search of a livelihood.[92] Such a case is reported in the twentieth century by Anthrobus, the official historian of the Assam Company. He wrote that during 1918, a virulent onslaught of influenza affected many regions of India which was also worsened by simultaneous famine conditions. These conditions led to unprecedented immigrations into the Assam tea gardens of the Company which admittedly not only replaced the Company's losses of deaths of existing labourers but also recorded the highest number of labourers than ever before in the history of the company during this period.[93] Interestingly, famines in the recruiting districts led to the lower cost of labourers and also facilitated the immigration of entire families compared to good harvest years.[94] But on the downside, it was soon realised that although bad harvests and famine did help in securing a greater number of labourers for the plantations, they were often not at their prime health.[95] The immigrating labour population, already enfeebled by famine conditions exacerbated by exploitative landlords and colonial taxation in their homelands, were portrayed as the "sick batches of coolies" by planters and colonial officials. Mass starvation and malnutrition pervaded their bodies and exploitation of these immigrating labourers began right from the moment they were perceived and objectified as "bad batches".

[92] David Arnold, 'Cholera and Colonialism in British India', *Past and Present*, No 113 (Nov., 1986); H. A. Antrobus, *A History of the Jorehaut Tea Company Ltd. 1859-1946* (London: Tea and Rubber Mail, 1948), p. 184.

[93] H. A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957), p. 201.

[94] *Report on Labour Immigration into Assam for the year 1879* (Shillong: The Assam Secretariat Press, 1880), p. 7; *Report on Labour Immigration into Assam for the year 1880* (Shillong: The Assam Secretariat Press, 1881), p. 6; *Report on Labour Immigration into Assam for the year 1895* (Shillong: The Assam Secretariat Press, 1896) p. 4; *Report on Labour Immigration into Assam for the year 1897* (Shillong: The Assam Secretariat Press, 1898), p. 7; *Report on Labour Immigration into Assam for the year 1903-04* (Shillong: The Assam Secretariat Press, 1904), p. 2; Das, *Plantation Labour in India*, p. 67, etc.

[95] *Report on Labour Immigration into Assam for the year 1879* (Shillong: The Assam Secretariat Press, 1880), p. 7.

Delayed Acclimatization- Poor Diet and Low Wages

The inability of the labourers to acclimatise to the province's climate and its diet was a liberally used explanation of planters to justify high labour mortality in the Assam gardens. Planters and medical experts almost unanimously agreed that "up-country coolies", by whom they meant labourers from all districts above Patna, were extremely ill-suited to the Assam gardens. The labourers did reportedly complain of the excessive rain and the consequent emergence of leeches in the gardens both of which they disliked.[96] Persistent bouts of both rains and fever also concerned the labourers about their well-being in this new region.[97]

Most deaths within the plantations occurred among the "un-acclimatized" new arrivals and in many years these happened to be labourers from the North West Provinces. That new recruits were more prone to death were later shown through findings supported by time series evidences as well as cross-section evidences which explained high deaths among them in two ways.[98] First, the new recruits who came from relatively smaller and rural regions lacked familiarity and immunity to a variety of diseases that they were introduced to, be it *en route* or in the gardens itself. And the second reason was due to their poor health even before their journeys, such as conditions of famine in their homelands, or stress associated with migration, low wages or adjustment to their new work and living conditions.[99] Thus, acclimatization in the case of the tea garden labourers did not merely denote the challenge of adapting to the new climatic conditions of Assam but also in terms of the disconnect that the labourers experienced with their surroundings through their altered diet and an unusual

[96] *Proceedings of Assam Labour Enquiry Committee in the Recruiting and Labour Districts* (Calcutta, The Superintendent of Government Printing, 1906) p. 34.

[97] *Annual Sanitary Report for the Province of Assam for the year 1879* (Shillong: The Assam Secretariat Press, 1890), pp.32, 34.

[98] For more on their analysis, please refer to, Ralph Shlomowitz and Lance Brennan, 'Mortality and Migrant Labour in Assam, 1865-1921', *The Indian Economic and Social History Review*, 27 (1) (1990), p. 95.

[99] Ibid., pp. 99-100.

intensity of manual labour. Therefore acclimatization also implied, perhaps to a greater degree, the-

> knowledge of the ways of life suitable to this Province as determined by the absence or scarcity and dearness of many of the kinds of food to which the immigrant has been in his own country accustomed...It must also include, in case of the labourer, the gradual training and hardening of the frame to a new description of severe physical toil. Besides these difficulties to be contended with, the new immigrant has no assistance to derive from the small store of earnings or stock,-his cows, pigs and poultry,- which the acclimatized coolies has usually managed to accumulate, and which form so important an addition to his well-being.[100]

A.C.C. DeRenzy, the Deputy Surgeon General and Sanitary Commissioner of Assam believed that among the old settled communities of Assam, people produced different ingredients of a wholesome diet in accordance to the availability of different vegetables, plants or herbs in the given environment. But especially the labourers who came from wheat or millet growing belts like the North West Provinces, had to shift to a diet constituting only of rice that were made available by the garden authorities at subsidized rates.[101] The planters usually supplied rice at the subsidized rate of Rs. 3 a maund to labourers and all other items of their diet had to be procured by the labourers themselves.[102] A good portion of the rice imported for the plantation was from Burma and these were mostly highly processed, poor quality rice which had very low nutritional value.[103] Even for labourers whose original diet did consist of rice complained of inability to retain their former ways of eating. For instance, labourers from Chota Nagpur reportedly were unable to consume cooked rice provided in the Assam gardens when kept overnight for their morning meal as they were accustomed to in

[100] *Report on Labour Immigration into Assam for the year 1878* (Shillong: The Assam Secretariat Press, 1879), p.18.

[101] *Annual Sanitary Report for the Province of Assam for the year 1879* (Shillong: The Assam Secretariat Press, 1880), p. 15.

[102] *Report on Labour Immigration into Assam for the year 1878* (Shillong: The Assam Secretariat Press, 1879), p. 6.

[103] Griffiths, *The History of the Indian Tea Industry*, pp. 203-204; Sunil S. Amrith, *Crossing the Bay of Bengal: The Furies of Nature and the Fortunes of Migrants* (Cambridge, London: Harvard University Press, 2013), pp. 207-208.

their homelands since the rice, probably due to the high humidity and the low quality of rice, became unfit for consumption when kept overnight.[104] They also complained about the "salty" taste of water and its un-potability which led them to believe that water was the main source behind their bowel disorders.[105] Their diets in the garden consisted of low grade and highly milled rice mostly made available in the gardens, a small amount of dal and vegetables with very little dairy consumption. Different varieties of greens fried in mustard oil seemed to be popular in the gardens.[106] In contrast, agricultural labourers in the rice growing regions in the country often started their mornings with cooked rice soaked in water and left overnight which was eaten with curds, chillies or dal. People in wheat or millet growing regions usually consumed stale chapatis with jaggery or a few morsels of soaked gram with subsequent meals consisting primarily of cereals.[107] Although, the general Indian diet too was critiqued in the prevailing colonial medical discussions for being too low in protein, especially of the animal origin, the garden diet was estimated to be qualitatively very deficient in fats, proteins as well as vitamins and quantitatively the food was less than that provided in prisons or in hospitals.[108] A lack of sufficient quantity and variety of food, according to J. Ware Edgar, Secretary to the Government of Bengal, contributed to high mortality rates in the Assam tea districts in the early 1870s.[109] Criticising the lack of far-sightedness of the administrators and planters in estimating the imperfect transportation system and the system of distribution with regards to importing food for the huge influx of labourers, Edgars forewarned that the problem would assume great precedence for years to come.[110]

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[104] *Proceedings of Assam Labour Enquiry Committee in the Recruiting and Labour Districts,* p. 32.

[105] *Annual Sanitary Report for the Province of Assam for the year 1879* (Shillong: The Assam Secretariat Press, 1880), p. 15.

[106] N. Gangulee, *Health and Nutrition in India* (London: Faber and Faber Ltd., 1939), p. 229.

[107] Ibid.

[108] Ibid., p. 230.

[109] *Paper Regarding the Tea Industry in Bengal,* p. xx.

[110] Ibid., p. xxi.

DeRenzy reported in 1879, noting the highly emaciated labourers of certain tea gardens in Assam that in some "out of the way gardens, where owing to the high price of dal, the main source of…nitrogen, the coolies were unable to procure a sufficiency of these articles to maintain them in health. They had tried to live on rice alone. The rice satisfied the sense of hunger; but…it did not contain in sufficient quantity the elements necessary for the repair of the daily waste of certain tissues of the body."[111] Moreover, he opined that the general population of the province mostly derived their nitrogen from fish, whereas, mostly the newly arrived labourers who were unable to procure food items other than the supplied rice, survived on as little as 84 grains of nitrogenous food in their diet, when about 250 grains a day was deemed sufficient for a person performing moderate work.[112] In fact, the labourers of the Kalagul garden in Karimganj in the early 1880s reportedly asserted that they did not earn enough to be able to feed themselves properly and that they were unaccustomed to rice in their earlier diets.[113] DeRenzy thus explained the ubiquitous presence of malnutrition especially among the new immigrants. Reflecting similar thoughts, the sub-divisional officer of Darrang, on inspection of an "unhealthy" garden in 1882, advised,

> Vegetables might be grown for the coolies. I saw hardly any growing near the lines. The garden is so cut off from any village that unless vegetables are grown in the garden itself the coolies cannot possibly get any from any other sources. A supply of vegetables and milk would, in my opinion, cure many of the coolies from dysentery and debility.[114]

Malnutrition was consistently identified as a major cause of mortality among the labouring population of the tea plantations in official reports.[115] Insufficiency of animal protein and vegetable in their diets, inadequate nourishment during sickness and insufficient medical

[111] *Annual Sanitary Report of the Province of Assam* 1878 (Shillong: Assam Secretariat Press, 1879), p. 9.

[112] Ibid., pp. 9-15.

[113] *Report on Labour Immigration into Assam for the year 1883* (Shillong: Assam Secretariat Press, 1884), pp. 36-37.

[114] *Report on Labour Immigration into Assam for the year 1882* (Shillong: Assam Secretariat Press, 1883), p. 25.

[115] Ibid., p. 27.

attention were deemed as some of the issues plaguing these plantations. As malnutrition worsened, civil surgeon Dr. Hughes recommended that the labourers be encouraged to keep cows, goats, pigs and fowls to supplement their diets. Also, planting fruit trees and lime trees by the garden managers for their labourers' was also recommended.[116] In concordance with the above discussion and estimates, in the 1920s in the Assam tea gardens, an enquiry by Dr. Margaret Balfour, a Scottish doctor stationed in British India, showed that each adult consumed only about 1,460 calories in a day.[117] This calorie consumption was barely above the 1,200 calorie mark which is recommended as the minimum calorie intake by the World Health Organization, since anything lesser than that could result in the body consuming itself even to perform bodily functions like breathing.[118] The 1920-21 labourer protests that ensued in the Assam gardens brought to the forefront corrupt practices like providing old and inferior quality of rice and a scarcity of adequate food supply.[119] Moreover, the system of supplying rice by the garden authorities at low prices was slowing waning away in the 1930s and the labourers had to make their own arrangements.[120]

Along with issues of availability and familiarity of food, DeRenzy also once pointed out that the exceptional high mortality among new immigrants were most likely due to the fact that they were often unable to "earn anything more than a full ration of rice at the very time when their constitution requires that the rice diet should be supplemented with ghee and

[116] Ibid., p. 28.

[117] Gangulee, *Health and Nutrition in India*, pp. 229-230. For a table on daily allowances on board steamers for immigrating labourers, please refer to Appendix D.

[118] Lizzie Collingham, *The Taste of War: World War II and the Battle for Food* (New York: The Penguin Press, 2012) pp. Introduction.

[119] For a detailed discussion on these issues please refer to Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India*, pp.165-194.

[120] Proceedings of a Conference held by the Assam Government with Representatives of the Tea Industry at the Legislative Council Chamber, Shillong, on 25th September 1931. Dept. Industries and Labour. Branch: Labour. 1932. p. 26. File No. L-3003-2. NAI.

condiments."[121] Although wage rates varied widely from one garden to another, yet in the colonial period the industrial labourers' wages, be it the tea garden labourers or the miners or the jute cultivators, indisputably remained at the lowest possible level.[122] The table below gives an instance of the comparative wages prevalent in the early twentieth century among agricultural labourers and tea plantation labourers in the Lakhimpur district.

Table 8: Yearly Averages of Monthly Wages of Agricultural and Tea Plantation Labourers in Lakhimpur District, Assam, 1900-10.

Yearly Averages of Monthly Wages of Agricultural and Tea Plantation Labourers in Lakhimpur District, Assam, 1900-10 (in rupees)			
Year	**Agricultural Labourers**	**Act Labourers**	**Non-Act Labourers**
1900	8 to 11	5.38	5.43
1901	9 to 12	5.57	5.21
1902	9 to 12	5.21	4.65
1903	9 to 12	5.29	5.03
1904	10 to 12	5.13	5.21
1905	8 to 10	5.42	5.76
1906	8 to 10	5.23	5.59
1907	8 to 10	5.57	5.18
1908	8 to 10	5.04	5.19
1909	8 to 10	5.4	5.93
1910	6 to 10	5.64	5.4

Source: R. P. Behal, *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam* (Delhi: Tulika Books, 2014), p. 347.

Discussions on the meagre amount of wages doled out to the Assam tea labourers were often evoked in the pages of official reports. Yet planters were ready with excuses. In one instance, some planters argued that wages were calculated in the off season when there was no work in the gardens and thus the average wages were very low in the official reports.[123] Calling their bluff, a sub-divisional officer of Karimganj, Porteous in the early 1880s reported,

> There are not a few gardens at which I found the rate of wages for Act labourers less than Rs. 3 during last cold weather. With rice at 3 rupees a maund, or close to that figure, it can hardly be said that this is

[121] *Report on Labour Immigration into Assam for the year 1878* (Shillong: Assam Secretariat Press, 1879), p.18.

[122] Das Gupta, 'Structure of the Labour Market in Colonial India', p. 1780.

[123] *Report on Labour Immigration into Assam for the year 1883* (Shillong: Assam Secretariat Press, 1884), pp. 10-11.

> a fair rate of wages…The fact that the averages are struck from inspections made in the cold weather should in the case of the Act coolie make no difference. Managers are bound, whatever the season, to supply the coolie with work at which for a reasonable task done he can earn full pay. This, is however, the excuse commonly put forward by managers for the existence of a low scale of wages. A low scale of wages is usually accompanied by a high mortality, as I have repeatedly noticed in my inspection reports… Where wages are so low... it is impossible that coolies can save. They must, therefore, turn out to work, whether sick or well, with the consequence that they very speedily die.[124]

Additionally, planters also argued that the wage rate was not an accurate representation of the expenditure that planters incurred for the sake of their work force. Housing facilities, water-supply, sanitary arrangements, medical facilities and diet allowances for sick labourers were listed as major sources of expenditure. Moreover, on multiple occasions it was reiterated that "coolies" had various other collateral sources of livelihood such as cultivation of crops, live-stock rearing and therefore the extremely low wages were, in fact, justifiable.[125]

Through an Act in 1865, the minimum rates of wages were set to Rs. 5 per month for a man, Rs. 4 for a woman, and these rates seemed to have remained stagnant at least till the late nineteenth century and early twentieth century, although variations existed in various districts. That too the labourers were entitled to receive their full wages only if they satisfactorily completed their daily allotted tasks.[126] The planters utilized every opportunity to keep wages low by not adhering to rules that allowed for higher wages in the fourth year of

[124] Ibid., pp. 10-11.

[125] *Report on Labour Immigration into Assam for the year 1878* (Shillong: Assam Secretariat Press, 1879), p 18.

[126] *Report on Labour Immigration into Assam for the year 1896* (Shillong: Assam Secretariat Press, 1897), p.25; *Reports on Labour Immigration into Assam* for various years; Geeta Das Choudhury, *Producing Labour: En-gendering Plantation Politics in Colonial Assam valley, 1826-1910.* Unpublished dissertation. (The University of British Columbia, 2002), p. 93; *The Assam Labour and Emigration Act*. Act No VI of 1901, p. 20; To provide a perspective, a European manager's monthly salary ranged between Rs. 800 to Rs. 1000, with an additional 5 per cent commission on net profit. Interestingly, even the Chinese tea makers and carpenters who were initially engaged in these Assam plantations were paid at the rate of Rs. 45 a month and the apprentices were paid Rs 20 per month. The ordinary Chinese labourer signed a contract for three years at Rs. 16 a month, which was a vast contrast to the wages paid to the indigenous labourers.- Behal, *One Hundred Years of Servitude*, pp. 118, 262; Antrobus, *A History of the Assam Company, 1839–1953*, p. 383.

the labourer's contract by cancelling the contract just before the increment was due.[127] By the late 1890s, it was acknowledged that an improvement in the quality of labour could be expected only if wages were hiked in order to attract better classes of labourers which would consequently reduce mortality rates and expenditure on the sick. However, till the last decade of the nineteenth century, although prices of commodities had risen, the wages of tea garden labourers remained almost the same.[128] With the Act of 1901, the minimum monthly wage remained the same, but for the second and third year of the contract, men were to be paid 5 rupees 8 annas and women 4 rupees 8 annas, and for the fourth year, men were to be paid a minimum of 6 rupees and women 5 rupees.[129] The practice of assuming plucking as "light" work justified this lower wage to women throughout the colonial period and even till decades after the country's independence.[130] The fact that wages were abysmally low in the Assam plantations has been unquestionably recognised and this compelled every member of the family, even children, to put out their labour in order to sustain a livelihood.[131] Such low wages and a strenuous work schedule therefore occasioned a further lowering of the labourers' well-being and highly obstructed their means to invest in their diets. And these conditions eventually contributed to their inability to withstand epidemics and kept many of them in a state of morbidity.

The Question of Race

Oftentimes, official reports drew connections between a specific race and their inability to survive in the plantations, by sometimes referring to their inability to endure the new climate,

[127] Choudhury, *Producing Labour: En-gendering Plantation Politics in Colonial Assam valley, 1826-1910,* p. 93.

[128] *Report on Labour Immigration into Assam for the year 1896* (Shillong: Assam Secretariat Press, 1897), p.24.

[129] *The Assam Labour and Emigration Act 1901*. p. 19.

[130] Chatterjee, *Encounters Over Tea: Labor, Gender, and Politics of an Indian Plantation*, pp. 191-92.

[131] Ranajit Das Gupta, 'Peasants and Tribesmen to Plantation Workers', in S. Karotemprel and B. Dutta Roy (eds.) *Tea Garden in Labourers of North East India: A Multidimensional Study on the Adivasis of the Tea Gardens of North East India*.(Shillong: Vendrame Institute, 1990), p. 12.

as previously discussed, or at times attributing "peculiar" traits to a race that rendered them undesirable in the plantations.[132] The most popular opinion was that the labourers from the Chota Nagpur region who were also known as the "jungly" coolies were the best suited to work on Assam gardens whereas labourers from the North Western Provinces and Madras did not prove to be as good.[133] In explaining the "peculiar saving habits" of the North-West "coolies", as quoted in the excerpt in the beginning of this section, two crucial aspects emerges, that of race and income. The North Western labourers were assumed to be more stringent in their expenses than the Chota Nagpur labourers and therefore more likely to under-eat when food became costly.[134] The unwillingness of these labourers to invest in adequate nourishment was often deemed as a reason for their deteriorating health and inability to bounce back to health after an illness.[135] However, the labourers probably did not have enough resources to obtain the required nourishment and the kind of nourishment that they were used to. Although the argument about race was used as a measure to separate the "superior" from the "inferior" races in colonial discussions, yet as economic historians, Ralph Shlomowitz and Lance Brennan had shown, the regions that the immigrant labourers came from were more important in determining their differential immunity and thus their suitability in the Assam gardens.[136]

[132] Throughout the 19th century, race was even supposed to be a major determinant in susceptibility to certain diseases as well. For instance, DeRenzy in the 1890s mentioned that according to popular belief the non-Aryan races (the "coolie") were especially prone to cholera than the Aryan race. He later goes on to debunk this notion and identified the source of the disease in the water supply: DeRenzy, 'Cholera among the Assam Tea Coolies', p. 823.

[133] *Report on Labour Immigration into Assam for the year 1878* (Shillong: Assam Secretariat Press, 1879), p. 28.

[134] Ibid., p. 28.

[135] *Report on Labour Immigration into Assam for the year 1882* (Shillong: Assam Secretariat Press, 1883), p. 27.

[136] Shlomowitz and Brennan, 'Mortality and Migrant Labour in Assam, 1865-1921', p. 100.

Table 9: Distribution of Garden Labourers by Place of Origin

Distribution of Assam Tea Garden Adult Labourers by Place of Origin, 1928-29		
Localities	**Number of Labourers**	**Percentage out of the total labour force**
United Povinces, Bengal and Bihar	2,20,474	36
Chota Nagpur and Santhal Purganas	1,91,838	31
Central Provinces	78,558	13
Madras	61,882	10
Assam	57,498	9
Others	7,935	1
Total	6,15,479	100

Source: Rajani Kanta Das, *Plantation Labour in India* (Calcutta: R Chatterjee, 1931) p. 27.

While on the subject of "peculiar habits" of labourers, the following observation made by a medical officer, Dr. Gray, of a Sibsagar district garden seems interesting- "…One man, on being discharged from hospital convalescent from chronic dysentery found a dead armadillo in the jungle which he surreptitiously cooked and devoured. He of course had a relapse and dies."[137] Such instances, possibly points to the grim reality of the sheer lack of resources to supplement their weak diets instead of any "peculiar habit" that compelled them to do so. Similar reservations were also expressed by the Deputy Commissioner of Sivasagar upon hearing the above account and, in fact, his view reflects the wide array of opinions that existed even within the colonial officers regarding the condition of life led by the garden labourers:

> It is…very curious that labourers who should be able to get good food on the estate and earn wages to buy it with should have recourse to eating filthy and inwholesome food and there must be some underlying cause.... the ability or non-ability to obtain good fish or flesh, vegetables and milk or such requisites occasionally in the neighbouring market is a matter which would certainly affect health very materially among a hard working population. Coolies are charged with wantonly eating food unfit for human consumption, but would they do this if the food supply available was good and sufficient. And then another question occurs, and that is whether their means to purchase requisites have been for any

[137] *Report on Labour Immigration into Assam for the year 1883* (Shillong: Assam Secretariat Press, 1884), p.40.

> reason cut down, I don't mean here to suggest unlawfully cut down, but merely, as a fact, cut down so closely as to disallow their obtaining them.[138]

Colonial discussions therefore utilized racial distinctions to explain poor saving habits and "peculiar" dietary choices to explain the continuous state of morbidity among the tea plantation labourers. Yet these instances more strongly points to low incomes and harsh physical labour as underlying causes instead of race peculiarities.

Locating Gendered Un-healthiness within the Plantation Environment

The idea behind recruiting families in place of single men or women labourers was motivated by a number of factors.[139] And such preferences increased instances of "depot marriages" where labourers were paired together in the depots before sending them to the Assam gardens. These often did not lead to successful unions. Moreover, labourers from different castes and ethnic origins recruited into the garden, at times, had difficulty shedding caste prejudices and settle down as family.[140] As mentioned earlier, unmarried labourers were deemed to be more susceptible to deaths as it was assumed that families tended to overcome sicknesses more easily. However, a crucial underlying reason behind such mortality was perhaps the inability to survive without the earnings of every member of the family, as has been discussed in the previous section. Additionally, encouraging marriages and increasing the number of families in the plantations were also emphasised to promote healthy reproduction rates for a steady regeneration of the plantations' labour pool. However, the plantation population exhibited extremely low and skewed birth rates, which became a cause of concern for the planters.

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[138] Ibid.

[139] Planters regarded the inability of the labourers to form a family unit as an unfortunate condition as evident from the excerpt in the beginning of this section- "The majority of the coolies were individuals of different castes and nearly all were unmarried" quoted in p. 199.

[140] Bhadra, 'Women Workers in Tea Plantations', pp. 93,104.

Women labourers in the Assam plantations, like their male counterparts, were engaged in gruelling labour while subsisting on extremely nutrition-deficit diet. However, lower wages for women, sexual exploitation at the hands of men in authority, coupled with gendered division of labour at homes heightened the burden of this exploitative enterprise for women. Simultaneously, malnutrition, severe physical labour and absence of any maternity benefits gravely affected reproduction among them. Deaths before, during and after childbirth was, and till this day is, a stark reality among the labourers in most gardens.[141] It was an accepted notion that among the garden population, the percentage of mortality of women was greater than that of men mostly due to the risks of childbirth.[142] For instance, in 1880, the percentage of deaths of women to the average strength was 3.67 while that of men was 3.52.[143] Two decades later in 1901, percentage of such deaths among women still remained higher at 2.92 percent in comparison to 2.83 percent in case of men.[144] Medical officers had different theories to account for high maternal mortality.[145] The *Report of Immigration into Assam for the year 1881* noted that "the immigrant population is not of course under altogether normal conditions; the number of women to men is disproportionately small," while accepting that such abnormal conditions affected reproduction and contributed to low birth rates.[146] Assam's Sanitary Commissioner DeRenzy was greatly struck by the high maternal mortality rates in the tea plantations in the late 1870s. He observed that a large number of women exhibited symptoms of dropsy during pregnancy and he later found it to be caused due to debility, an effect of a poor diet.[147] Dropsy had been identified since the mid nineteenth century to be an indicator of underlying diseases of the heart, liver, kidneys or malnutrition and was

[141] 'Wage Compensation Scheme for Pregnant Women in TEs Launched', *The Assam Tribune*. 2nd October, 2018.

[142] *Report on Labour Immigration into Assam for the year 1878* (Shillong: Assam Secretariat Press, 1879), pp. 10-11, 15.

[143] Ibid., p. 12.

[144] *Report on Labour Immigration into Assam for the year 1901* (Shillong: Assam Secretariat Press, 1902), p. 8.

[145] S. S. De, *The Problem of Labour in Assam (1826-1901).* Unpublished dissertation (University of Gauhati, 1968), p. 164.

[146] *Report on Labour Immigration into Assam for the year 1881* (Shillong: Assam Secretariat Press, 1882), p. 19.

[147] *Annual Sanitary Report for the Province of Assam for the year 1879* (Shillong: Assam Secretariat Press, 1880), p. 22.

characterised by either one or multiple of the following conditions- an abnormal accumulation of fluid in the chest cavity or abdominal cavity, overall swelling in the body or large ovarian cysts filled with fluid.[148] Anaemia too was extremely common among the labourers and especially women which often accounted for high maternal mortality rates.[149] The *Annual Dispensary Report of Assam* for the year 1896 stated that out of 5,089 cases of disease treated in the "All other general disease" category in the entire Assam province, 1,489 were cases of anaemia of the tea garden population.[150] Globally too, Jamaican sugar plantations during the eighteenth and nineteenth century provide evidence of inadequate nutrition among the slave women as one of the most pressing factors that affected their fertility.[151] Lower levels of protein, calcium and iron in their diets aggravated the ill-health, especially of pregnant women.[152]

The penal contract system through which labourers were engaged in the tea gardens produced a highly restrictive and exploitative state of existence which prevented normal reproduction rates among the labour force. Even though the people from the Chota Nagpur region, who constituted a good majority of the Assam garden population, were known to have remarkably high fecundity, yet the trend of low birth rates in the gardens continued.[153] The average birth rate in the gardens was only 86 per 1,000, while the average was 127 per 1,000 in the non-tea garden population in the state of Assam over the decades of 1880-1901.[154] Low birth rates seemed to be a universal problem in plantations across the globe. For instance, the women

[148] J. Estes, 'Dropsy' in K. Kiple (ed.), *The Cambridge World History of Human Disease* (Cambridge: Cambridge University Press, 1993), pp. 689-696.

[149] Gangulee, *Health and Nutrition in India*, pp. 229-230; Sunil S. Amrith, 'Food and Welfare in India, c. 1900-1950', *Comparative Studies in Society and History*, Vol. 50, No. 4. (Oct., 2008) p. 1017.

[150] *Annual Dispensary Report of the Province of Assam 1896* (Shillong: Assam Secretariat Press, 1897).

[151] Kenneth Morgan, 'Slave Women and Reproduction in Jamaica, c. 1776-1834', *History*. Vol. 91, No. 2 (302). (April 2006), p. 235.

[152] Ibid., p. 236.

[153] *Imperial Gazetteer Bengal, Chota Nagpur Division* (Calcutta: The Bengal Secretariat Press. 1907), p.7.

[154] Behal, *One Hundred Years of Servitude*, p. 85.

slaves who toiled in the sugarcane plantations in Jamaica during the eighteenth and nineteenth century too failed to reproduce naturally after the legal end of the British slave trade in 1807 when breeding among them became necessary to keep the slave pool large.[155] Heavy, arduous labour and over-work contributed to low birth rates among them.[156] Although sugar plantations demanded more physical exertion than other plantation crops, similar activities like long hours of standing and carrying excessive amounts of weights on their backs, which inhibited normal ovarian functioning in the Jamaican plantations, might have had a similar effect in the Assam plantations as well.[157]

Planters, continuing the trend of staying clear of blame, began to assert that under-reporting of birth data was the reason behind such low birth rates.[158] Another widespread notion among the planting community which justified low birth rates was that of self-induced abortions in the plantations.[159] In the early twentieth century, the medical officer of Nazira observed the appalling rates of abortions and opined that in certain gardens, almost 65 percent of women labourers did not give birth to living children.[160] Official explanations relegated the burden of such deeds to the "selfish" women as they believed abortions were carried out by them since they were reluctant to part with their earnings for the upkeep of their children.[161] However, if we compare similar accusations placed on the Caribbean plantation workers of inducing abortions, studies have shown that these accusations of self-induced abortions have been highly exaggerated and in reality, the intensity of the labour regime – low wages and almost no rest granted pre and post childbirth more often than not, contributed to accidental

[155] Morgan, 'Slave Women and Reproduction in Jamaica, c. 1776-1834', pp. 231-253.

[156] Ibid., p. 237.

[157] Ibid., p 238.

[158] *Report on Labour Immigration into Assam for the year 1879* (Shillong: Assam Secretariat Press, 1880), p.3.

[159] *Handbook of Castes and Tribes Employed on tea estates in North-East India*. Appendix A, (Calcutta: Catholic Orphan Press. 1924), p. 341.

[160] Behal, *One Hundred Years of Servitude*, p. 85.

[161] Ibid., p. 85.

miscarriages.[162] A Civil Surgeon, in describing the highly unfavourable conditions of children and infants in these plantations, reported how unless the infant is "strangled at birth, she must either take it out to her work, or leave it behind, with no one to look after it" [163] He further stated that, "so alive are coolie women to these facts that, to avoid the trouble of bringing up their children under such circumstances, abortion is frequently resorted to, and *daes* (midwives), who produce it, often find their business a very profitable one."[164] Exposing the infant to the outdoors for extended hours, potential exposure to pesticides as well as lack of adequate attention were possible threats to the life of the infants. Low rates of reproduction aided by the alarming rates of maternal mortality in Assam tea plantations points to highly unfavourable conditions prevalent in the plantations. This condition even continues today and goes to show that the plantation labourers to this day continue to carry the colonial burden of deaths and misfortunes.

The discussion so far discussed the general trope of colonial narrative built around the labourers that emerges from the reading of official reports. The arguments of "bad quality of coolie", "unmarried coolies", un-acclimatised "coolies", unsuitable diet, and "peculiar saving habits"- all sought to pin ill health of the labourers to an inherent inferiority of their bodies, social norms, and a peculiarity of their race. However, through the above discussions, feeble bodies prior to migration, delayed acclimatization, low birth rates and peculiar racial traits all point to the pernicious relationship of these labourers with these new environments. The burden of establishing the plantation landscape and maintaining it through their physical toil fell entirely on the labourers and this coupled with low wages and even lower nutritional intakes had adverse consequences on their bodies.

[162] Morgan, 'Slave Women and Reproduction in Jamaica, c. 1776-1834', p. 247; Behal, *One Hundred Years of Servitude*, p. 85.

[163] *Report on Labour Immigration into Assam for the year 1894* (Shillong: Assam Secretariat Press, 1895), p. 41.

[164] Ibid., p. 41.

A Breeding Ground for Diseases

> The interaction of malnutrition and infection was far more serious than would be expected from the combined effect of the two working independently.[165]

In addition to the above causes identified as causes of labour morbidity, diseases like cholera, diarrhoea, dysentery, malaria, anaemia (hookworm disease or ancylostomiasis was included in this category since 1893), kala azar, dropsy, influenza, hookworm and respiratory complications were widely prevalent among the labourers in the Assam tea gardens during the colonial period. The following table enlists the main causes of deaths among the tea garden population and the percentages contributing to their total death rates. However, it is to be noted here that these values are to be taken as approximations to roughly give an idea of the primary causes of deaths among the garden population in Assam.[166]

Table 10: Main Causes of Death among the Tea Garden Labourers.

Main Causes of Death Among the Assam Tea Garden Labourers (values are a percentage contributing to the total death rate)												
Year	Cholera		Diarrhoea		Dysentery		Malaria		Anaemia		Respiratory Disease	
	Act	Non-Act	Act	Non-Act	Act	Non-Act	Act	Non-Act	Act	Non-Act	Act	Non-Act
1877-1879	19.4	18.7			33.2	27.1	9.8	14.9				
1880-1889	20.6	19.1			22.9	16.9	9.4	14.8				
1890-1899	15.1	13.2			22.5	19.4	9.6	15.7	12.1			
1900-1909/10	8.3	11.6	9.3	9.3	22.8	16.5	8	11.2	15.3		15.4	14.1
1910/1-1919/20	5	8.3	6.8	8.6	30.7	17.4	4.1	8.4	17.8		12.1	16.4

Source: Ralph Shlomowitz and Lance Brennan, 'Mortality and Migrant Labour in Assam, 1865-1921.' *The Indian Economic and Social History Review*, 27 (1) (1990), p. 105.

Malnourished labourers often fell prey to these diseases which hiked their mortality rates. As evident from the above table, dysentery was a very consistent killer and civil surgeons and other officers who inspected unhealthy gardens opined that dysentery was one of the

[165] Morgan, 'Slave Women and Reproduction in Jamaica, c. 1776-1834', p. 240.

[166] For more details on how these figures were calculated and for caveats and explanations please refer to Shlomowitz and Brennan, 'Mortality and Migrant Labour in Assam, 1865-1921', p. 105.

principal causes of mortality in the gardens.[167] In case of the slaves in Jamaica too, malnourished and overworked labourers in the plantations were easy victims of dysentery.[168] Tea planters in India however, often pinned the cause of diseases such as cholera and dysentery to the propensity of the labourers to consume spoilt food.[169] But as already addressed to some extent, the compulsion to make poor choices regarding food stemmed from the sheer lack of nutritious food among the labour population due to reasons discussed in the previous section. In this regard, Sanitary Commissioner of Assam in the 1870s, J. J. Clark, remarked, "Rice is a poor food. A purely rice diet means, ill-health and a high death-rate, it means the loss of flesh and the loss of physical power, it means diarrhea, dysentery, scurvy, dropsy, inanition, failing powers and death.'[170]

Cholera remained one of the biggest killers in the tea gardens which spread through the water used by the labourers. In 1884, Robert Koch's discovery of the *comma bacillus* virus in water in Calcutta showed that it entered the human body orally, primarily via drinking water contaminated with infected human faeces. In the words of David Arnold, "given the nature of the disease, its mode of communication, and especially its connection with insanitary living conditions and polluted water supplies", this was inevitably an epidemic of the poor."[171]

[167] *Report on Labour Immigration into Assam for the year 1883* (Shillong: Assam Secretariat Press, 1884), pp. 36-37.

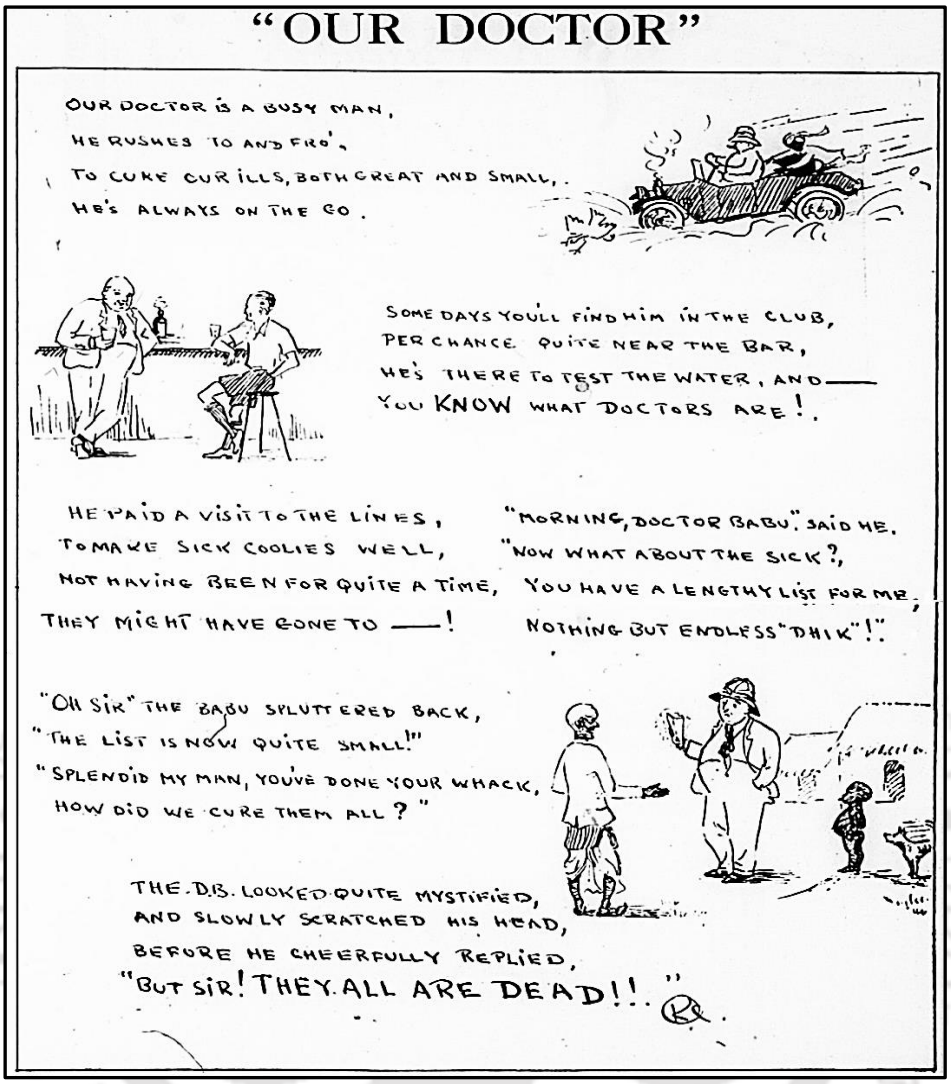
[168] Morgan, 'Slave Women and Reproduction in Jamaica, c. 1776-1834', p. 240.

[169] Bhattacharjee, *Contagion and Enclaves: Tropical Medicine in Colonial India*, p. 127.

[170] Quoted in Behal, *One Hundred Years of Servitude: Political Economy of Tea Plantations in Colonial Assam*, p. 220.

[171] Arnold, 'Cholera and Colonialism in British India', p. 124.

Fig 13: A Comic Strip on Healthcare in the Plantations



Source: *The Assam Review*, Vol II, No. 11 (Jan, 1930). p. 397.

Cholera deaths were rife among the workers right from the moment they began their journey to the Assam tea plantations. It was estimated that in the years 1871 to 1878, the annual average death rate during transit was 47.8 per cent of the average strength.[172] A close perusal of the *Reports of Immigration into Assam* shows that most deaths in transit were caused by cholera epidemics that broke out among labourers in the over-crowded steamers, or at the "coolie" depots before embarkation, or via identified labourers infected with cholera without being treated and being transported regardless. Unsanitary conditions, mal-nourished

[172] DeRenzy, 'Cholera among the Assam Tea Coolies', p. 823.

constitution of the labourers and a defective water supply on board the steamers were cited as major reasons for such outbreaks.

The problem of cholera epidemics in the Assam tea gardens took an extremely deadly form right from the 1860s when large numbers of labourers began to arrive at the plantations.[173] As Shlomowitz and Brennan points out, "the hostile disease environment which was created on the tea gardens, as workers brought with them diseases from their rural communities or diseases which they acquired *en route* to Assam, and the aggregation of workers on the tea gardens resulted in the admixture of susceptibilities with the infected."[174] In exactly such conditions, cholera deaths too began to proliferate in the gardens.

In 1877, DeRenzy recommended two major provisions to combat cholera. First, the supply of clean water, as the source of cholera epidemics in the tea plantations, in most cases, was linked to faulty water source which was in most cases contaminated river water, and second, the necessity of supplying food besides rice to the labouring populations in the tea plantations of Assam to improve their nutritional status which would aid in their recovery.[175] Apart from cholera, impure drinking water was also believed to be the main cause of diarrhoea and dysentery which had a very high share in mortality percentages in the plantations.[176] The most pressing improvement that the planters were encouraged to undertake was to build proper wells for the labourers which would remove possibilities of contamination of the

[173] *Reports on Labour Immigration into Assam* of later years that were consulted often talked about higher cholera rates in earlier years.

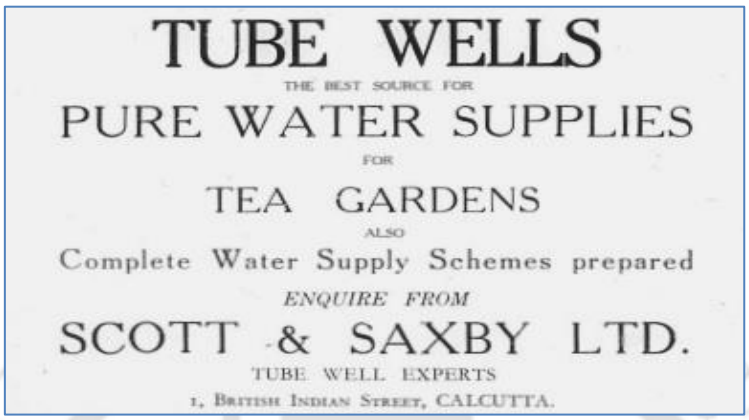
[174] Shlomowitz and Brennan, 'Mortality and Migrant Labour in Assam, 1865-1921', p. 99.

[175] *Report on Labour Immigration into Assam for the year 1878* (Shillong: Assam Secretariat Press, 1879), p. 28.

[176] *Report on Labour Immigration into Assam for the year 1877* (Shillong: Assam Secretariat Press, 1878), p. 18.

water supply.[177] The labourers were discouraged from using the river water and all sickly "coolies" were re-assigned to different healthy gardens.[178]

Fig 14: An Advertisement for Tube-Wells



Source: *The Assam Review*. Volume 3, No. 2. (April, 1930) p. 74.

Kala-azar and malaria too were potent killers in the Assam gardens, and febrility being a characteristic of both these diseases often made diagnosis difficult. In fact, many a times, cases of kala-azar, malaria and "jungle fever" were interchangeably enumerated.[179]

Fig 15: Kala-azar Patients

Kala-azar patients- a group of men, women and children. Charingia, Assam. Photograph taken somewhere between 1900-1920. Credit: Wellcome Collection. Attribution 4.0 International (CC BY 4.0)

[177] *Report on Labour Immigration into Assam for the year 1877* (Shillong: Assam Secretariat Press, 1878), pp. 16, 19.

[178] Ibid., p. 16.

[179] Dey, *Tea Environments and Plantation Culture: Imperial Disarray in Eastern India*, p. 110.

A planter situated in Sadiya, Oscar Lindgren, in the 1870s noted, "It was no uncommon thing to have 50 per cent of one's labour force down with malaria, without counting stomach complaints, which are always large items amongst coolies in jungle areas."[180] Interestingly, Dr. G. C. Ramsay, then principal of the India branch of the Ross Institute, London identified that most malarial cases were, in fact, an unwitting creation of mankind.[181] Interestingly, the Ross Institute opened a branch in India in the 1930s primarily to carry out investigations on malaria in the tea gardens in Assam and Northern Bengal. Moreover, during the same time, an Assam Medical Research Society was formed which was concerned mainly with malaria control in Assam and was financed by the Government and the tea industry.[182]

The nineteenth century narrative connected jungle cover with higher incidences of malaria. Therefore apart from the inevitable clearance of forests for planting tea bushes, it was always advised that living quarters of labourers as well as staff and planters be cleared of all jungles too in order to make the areas more conducive to health.[183] These clearance activities often resulted in, what the early tea planters called, "clearance fever" which was believed to be caused from the emanations from the soil after the burning of the jungles in the cleared area.[184] On September 24, 1898 the chief commissioner of Assam writing to the Government of India regarding the high mortality rates in the Assam tea plantations, hinted at how clearances were linked to salubrity -

> …the high mortality of Assam is not necessarily of long duration. As soon as the tree growth has been cleared off, and the land has been planted out and exposed to the action of the sun and air, the

[180] Weatherstone, *The Pioneers 1825-1900: The Early British Tea and Coffee Planters and Their Way of Life*, p. 69.

[181] 'Minutes of Evidence, Evidence of Dr. G.C. Ramsay', *Royal Commission on Labour in India*, (Assam) Vol. 6 (London, 1931), p. 10.

[182] Proceedings of a conference held by the Assam Government with Representatives of the Tea Industry at the Legislative Council Chamber, Shillong, on 25th September 1931. Dept. Industries and Labour. Branch: Labour. 1932. p. 26. File No. L-3003-2. p. 30. NAI.

[183] Samuel Baildon, *Tea in Assam* (Calcutta: W. Newman & Co., 1877), p. 13.

[184] -, 'Malaria Control and the Tea Planter in Assam', *The Assam Review*, Vol III, No. 1. (March 10, 1930), p. 8.

> unhealthy influences soon pass away, and many of the healthiest tea gardens in the province are those which only a few years ago had very heavy death rates. A striking instance of this is afforded by the gardens to the northwest of Tezpur, which are served by, and support, the Tezpur-Balipara Tramway….The great work done by the Assam Railways and Trading company represents clearances on a still larger scale, and with similar results. If the argument had been admitted that special encouragement ought not to be given to the exploitation of an unhealthy country, the tracts would still have been a dense and impenetrable forest: there would have been no Borjuli tea, no Margherita settlement, no Digboi oil, and no Makum coal.[185]

However, Dr. Ramsay's opinion in the 1930s was quite the opposite. He opined that such clearances made the areas more prone to malaria which perhaps explained the "clearance fevers". In fact, the *anopheles minimus*, a vector of malaria was extremely rare under the dark shade of the "virgin" jungles. Construction of uncovered drainage in the plantations and exposing nearby water sources by clearing the jungles were some of the major causes which introduced *anopheles minimus* and malaria.[186] An account on drainage in tea gardens noted, "…care must be taken to keep them (drains) well oiled-with kerosene or some similar substance-if they are malariogenic, and that an effort be made to 'get back to nature', by planting a hedge, such as privet, that will create dense shade along their whole length."[187] Additionally, the soil of these plantations having lost its porousness, as discussed in chapter 2, led to increasing incidences of waterlogging which provided a conducive breeding ground for mosquitoes.[188]

Occurrences of anaemia, debility and dropsy contributed to the high mortality rates as well. In the 1880s, most cases of anaemia in the gardens were realised to be caused by

[185] W. R. Grawthrop, *The Story of the Assam Railways and Trading Company Limited, 1881-1951* (London: Harley Pub. Co. for the Assam Railways and Trading Co., 1951), pp. 58-59.

[186] -, 'Malaria Control and the Tea Planter in Assam', p. 8.

[187] Ibid.

[188] Arupjyoti Saikia, 'Mosquitoes, Malaria, and Malnutrition: The Making of the Assam Tea Plantations' in *Asian Environments: Connections across Borders, Landscapes, and Times, RCC Perspectives*, No. 3, (2014).

ancylostomiasis or the hookworm disease.[189] Hookworm was caused by parasitic worms attached to the human gut which entered the human body usually through bare feet when it came in contact with human faeces. Severe anaemia, listlessness and emaciations were its major symptoms.[190] Various environmental factors like rainfall, humidity, temperature, soil, vegetation, drainage and irrigation, along with factors such as occupation, defecation habits, use of footgear etc. played a major role in the spread of this disease. Notably, one of the factors that affected resistance against hookworm infection was malnutrition. Infestation of hookworm in the tea gardens of Assam, Dooars and Darjeeling were well known in the colonial period.[191] A lack of shoes in cases of Jamaican slaves facilitated the entry of hookworms into the body which further depleted these slaves' nutritional status which was true for the Assam tea garden labourers as well.[192] The civil surgeon of Lakhimpur in 1904 reported that he believed that the hookworm disease was much more common in the tea plantations than among the general population of Assam. He further opined that most cases of dysentery in the gardens were in fact terminal cases of the hookworm disease.[193] With faulty to no toilet facility in place, the plantations were rife with hookworm infections.[194] In attempts to keep down hookworm incidences, some gardens employed an interesting measure. In the area where the leaves were brought from the gardens for the daily weigh-in, the pluckers, who mostly traversed the garden barefoot were made to walk through a solution of permanganate of potash.[195] This disinfectant agent was supposed to rid the labourers from hookworms that they might have picked up during the day in the garden.

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[189] David Arnold, 'British India and the "Beriberi Problem", 1798–1942', *Med Hist.* 54 (3) (2010 July), pp. 295–314.

[190] Bhattacharjee, *Contagion and Enclaves: Tropical Medicine in Colonial India*, p. 176.

[191] P.S. Seshadri, 'Ancylostomiasis-The Lurking Scourge of the Labour Population', *The Assam Review and Tea News*. Vol. XXIX, No. I. (March, 1943), p. 39.

[192] Morgan, 'Slave Women and Reproduction in Jamaica, c. 1776-1834', p. 240.

[193] *Annual Sanitary Report of the Province of Assam* for the year *1904* (Shillong: Assam Secretariat Press, 1905), p. 8.

[194] Das, *Plantation Labour in India*, p. 104.

[195] Ramsden, *Assam Planter*, p. 21.

On paper, nearly every plantation had a native medical attendant and occasional supervision by a European doctor.[196] The Chief Commissioner of Assam even passed a rule in the early 1880s which necessitated the presence of a medical man "qualified to some extent" whenever a plantation employed 50 "coolies" or above.[197] However, in reality, it was seen that some plantations did not have any medical attendants and the managers or planters themselves, assisted by medical books, treated the "coolies" for various ailments.[198] The idea of a diffused paternalistic tendency in the Assam tea plantations seems to hold true where instead of investing in long term medical facilities, planters themselves administered medicines when necessary.[199] Such deficiencies in medical aid also contributed to the further deterioration of labourers' health in the Assam plantations.

Infectious diseases like the ones pervading the Assam plantations intertwined with the malnourished and worn out bodies to cause intensification of mortality rates and cases of debility in the gardens. The above discussion shows how intricately all these diseases were connected with the living environments of the labourers. In the 1880s the Deputy Commissioner of Darrang quoted civil surgeon, Dr. Hughes' remark regarding the heightened probability of deaths among the labouring population in the Assam gardens when malnutrition interacted with infectious diseases- "…having to work in all weathers in a climate to which coolies are unaccustomed must predispose them to sickness; and insufficient nourishment when fevers, coughs, and bowel-complaint overtake them reduces their chances of recovery to a minimum, hence the long list of casualties from diarrhoea, dysentery, fever (frequently succeeded by dropsy) and general debility."[200]

[196] *Report on Labour Immigration into Assam for the year 1878*, p. 25.

[197] *Report on Labour Immigration into Assam for the year 1882*, p. 27.

[198] Ibid.

[199] Bhattacharjee, *Contagion and Enclaves: Tropical Medicine in Colonial India*, pp. 69, 148.

[200] *Report on Labour Immigration into Assam for the year 1882* (Shillong: Assam Secretariat Press, 1883), p. 27.

Conclusion

Right from the push that induced the labourers' journey to the Assam tea plantations, nature played a crucial role in setting the scene for the biggest influx of immigrant labourers into the province of Assam. Increasing tax coercions by landlords due to pressure from the British overlords conflated with conditions of famines, in most cases, encouraged the poor labourers to migrate to other parts of the country to sustain a livelihood. The river Brahmaputra that flows through the province of Assam facilitated the passage to the tea gardens but these fluvial journeys also heavily annihilated the weak and the sick.

The gardens that awaited the labourers were to decide the fate of generations of their kind for a life of exploitation and subjugation while living extremely unhealthy lives. Plantation life operated under a strict disciplinarian regime and the labourers existed within the boundaries of these gardens with extremely limited mobility. Along-with a loss of mobility, their agency in choosing a diet was also highly restricted, at least in the first few years of their arrival in the gardens. Minimal interaction with the native population of Assam made these new labourers unaware of the dietary habits and nutritional quotient of herbs and other foods that could have assisted their nutritional intakes in these regions. Thus the term "newly arrived coolies" became a separate category in explaining ill-health and death rates in terms of their corporeal vulnerability in this new environment. Extremely low wages compelled them to subsist on an exceedingly malnourished diet and they became dependant on the supply of rice that was provided to them at a subsidized rate by the garden management. A sudden departure from a wheat-dominant diet, mostly for the labourers from the north-west and the central parts of the country, adversely affected them as evident from the concerns voiced in the *Reports of Immigration* on the un-healthiness of the North West Province "coolies" on several occasions.

The interesting concept of biological invasion that was disseminated by Alfred Crosby's *The Columbian Exchange* opened the vista for exploring connections between the environment and diseases. The movement of microorganisms and the facilitation of its dispersal to the mass number of labourers via the plantation environment figure as one of the major arguments of this chapter. Water and food being the primary source of sustenance, diseases and ill-health facilitated through or due to the lack of these sources have been explored in the chapter. Even the land and soil that they treaded on were disease ridden. On aspects of nutrition, an altered state of existence of the labourers which included a lack of mobility and interaction, low wages, a harsh work regime and an unfamiliar diet made them nutritionally impoverished. Similar deterioration of health conditions in case of the mine-workers of South Africa afflicted by tuberculosis epidemics has many commonalities in the way capitalistic endeavours aggravated health concerns of its poorest labourers.[201] Long hours of work, heat and humidity, faulty ventilation, dust and risk of hookworm infection characterised working conditions of these miners which increased their vulnerability to diseases. Similar was the case in the Assam tea plantations where the plantation structure itself shaped the environment surrounding the labourers to induce poor health and deaths contributing to the replication of diseased bodies.

But the chapter is not merely a description of the socio-economic poverty of these labourers, it is also an account of the multiple narratives that emerged in the colonial planting circle as well as the medical circle pertaining to the tea gardens in Assam. Right from arguing that "unhealthy tropics" contributed to the state of morbidity and mortality in the plantations, the trend of staving off responsibility continued throughout the colonial period. However, if we read the accounts close enough, the real causes emerges and betrays such justifications. We realise how the entire plantation environment was set up in such a manner that labourers were

[201] Packard, *White Plague, Black Labor: Tuberculosis and the Political Economy of Health and Disease in South Africa.*

the first wall of defence against the consequences of such environmental modifications. Be it the clearance activities that was the first step towards establishing a plantation where the labourers were physically engaged in such manually taxing works, amidst the threat of wild animals and a highly malarious surrounding, made more so by such clearances. Within the plantations itself, the soil also posed a threat to their bodies. Pesticide laden corrosive soils as well as heightened instances of hookworm infestations within these soils further consumed them. In addition, restricted mobility, strict work regimes and unfamiliarity with the overall climate and diet further added to their anguish. However, these conditions were a direct consequence of the overall failure of the plantation system that operated in a system of profit generation which dehumanised the very people that shaped these plantations. Yet the conditions of the labourers more or less remain the same to this day, with the same clamour for a life of dignity, fair pay and better health.

CONCLUSION

The decade of the 1930s commenced with "unrelieved gloom and depression" with the Indian tea industry witnessing an unprecedented slump as overproduction of cheap tea from its colonies flooded Britain's market.[1] This warranted a reduction in the cost of production in the Assam gardens as well. The functions of the scientific departments, plantation workshops as well as medical staff and facilities were greatly reduced in the Assam plantations during this period. However, the situation improved towards the mid-1930s when international agreements were concluded which sought to regulate the demand and supply of the crop.[2] During this time, in 1935, the Engledow Commission, headed by F. L. Engledow, Professor of Agriculture at Cambridge University, visited Tocklai to review the organisation, management and works undertaken by its scientific department. Lauding the overall work done by Tocklai for the tea industry, the Commission did make recommendations regarding improving the quality of tea as well as expanding its advisory services. In 1953, the Engledow Commission visited for a second time and during the span of these two visits, many realisations regarding the interconnections between the cultivation methods, manuring and shade were slowly being realised.[3] For instance, deep hoeing which exerted immense pressure on the soil biota was discontinued although the aim was to lower production costs, plucking and pruning methods were improved such as increasing the initial height of pluck-able bushes and abolishing collar pruning. There was also a simultaneous increase in

[1] H. A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957), p. 214.

[2] P. J. Griffiths, *The History of the Indian Tea Industry* (London: Weidenfeld & Nicolson, 1967), p. 445; Antrobus, *A History of the Assam Company, 1839–1953*, p. 214.

[3] Griffiths, *The History of the Indian Tea Industry,* pp. 445-457.

knowledge regarding soil, shade, fertilisers as well as fungicides and insecticides in plantations.[4]

However how these studies and knowledges came about and how they affected the tea enterprise in future years is a study that needs to be undertaken later. Even prior to that, the WW II disrupted the tea enterprise of Assam again in a myriad of ways. With Java and Sumatra occupied by Japan in 1942, India and Ceylon became the sole supplier of tea to the U.K. and the Allied Countries.[5] This exerted immense pressure to produce tea in the Assam plantations, as well, amidst war time disruptions. Along with a shortage of fertilisers, insecticides as well as food, some tea labourers were engaged in construction works for the war; and those who remained in the gardens were swamped with long hours of plantation works.[6] The trajectory of the plantation environment took a different turn after the war with the growing emphasis and dependence on chemical fertilisers and pesticides. Even for the labourers, conditions of shortage of food continued well after the war with an all-India food crisis. The war years stand out to me as an important phase which could benefit immensely from an independent study on its environmental repercussions in the plantations.

The issues under scrutiny in the study, from the origin of the tea enterprise in Assam since the late 1830s to the late 1930s, were not remedied immediately in the later years. In fact, with an intensification of production, the usage of chemical fertilisers and pesticides, everything that early planters and experts were sceptical about, only witnessed an upward surge. In a way, the years under study were only a precursor to the era of extremes, where along with the degradation and contamination of the environment of the plantations with chemical additives

[4] Ibid., pp. 455-456.

[5] Antrobus, *A History of the Assam Company, 1839–1953*, p. 225.

[6] Antrobus, *A History of the Assam Company, 1839–1953*, pp. 227-233; Griffiths, *The History of the Indian Tea Industry.* pp. 203-210, 451, 452; For a detailed study on the conditions of food availability, scarcity and its aftermath in the WW II, please refer to Lizzie Collingham, *The Taste of War: World War II and the Battle for Food* (New York: The Penguin Press, 2012).

and pesticides, the threat of affecting its consumers- mostly located in regions far away from the plantations- became paramount.

The thesis is an endeavour to explore human actions in re-structuring the plantation environment and how it affected the trajectory of tea in Assam in the pre-WW II era. It is an attempt to bring to the forefront the highly volatile plantation environment and how the global market for cheaply manufactured commodity affected environments of highly obscure places of the world in the process. Along-with the environment and also as a consequence of this new physical, social, and economic environment, the labourers who were at the lowest rung of the plantation hierarchy were also the most hard-hit in all aspects of life, especially their corporeal well-being.

The highly manufactured landscape, mostly orchestrated by the European planters and accessible expertise at their disposal, proved to be more troublesome than imagined. Although prior plantation experiences in other parts of Britain's colonies were not scarce, yet how the plantations operated on ground in each colony was a different story. As evident from the narrative of this study, the available expertise was mostly accurate in pointing out the flaws in cultivation and how its continuation could spell doom for the plantation system. Yet the emphasis was always on hiking production rates and not really on keeping these plantation sites fairly ecologically stable for posterity. Was this attitude entrenched on the notion that colonies and their resources were disposable and once profitability of a region wore off, they could move on to a different place? Perhaps.

This study fits right in with the greater scholarship on environmental history of plantations all over the globe. Issues pertaining to most other plantations like diminishing forest cover, degrading soil, incessant pest damages and ill health of labourers were simultaneously a reality for the Assam tea plantations as well. The circumstances were eerily similar for

intensive commercial cultivations: be it the mass reconstruction of the Caribbean landscape to make way for sugar plantations, or the environmental degradation of coffee plantations in Central and South America[7]; the large scale erosion in Australia largely due to clearance for agriculture since its colonization, or instances of industrialised farming all over the world that damaged soil fertilities[8]; monocrops that proved to be unsustainable by simplifying the landscape and encouraging increased use of insecticides and herbicides[9]; or the millions of African slaves who toiled for long hours in the sugar plantations which greatly affected their death and birth rates in the Americas, or the western medical expertise which did not pay attention to the material conditions which often rendered a landscape more prone to disease and morbidity for such labourers.[10]

[7] Richard S. Dunn, *Sugar and Slaves: The Rise of the Planter Class in the English West Indies, 1624-1713* (Chapel Hill, London: University of North Carolina Press, 1972); Anthony N. Penna, *The Human Footprint: A Global Environmental History* (United Kingdom: John Wiley& Sons, Inc., 2015), p. 257; Stuart McCook, 'Environmental History of Coffee in Latin America' *Oxford Research Encyclopaedia of Latin American History.* (27 Jul. 2017); Accessed 31 Jan. 2021. https://oxfordre.com/latinamericanhistory/view/10.1093/acrefore/9780199366439.001.0001/acrefore-9780199366439-e-440

[8] Anne Therese O'Brien, 'Ethical Acknowledgement of Soil Ecosystem Integrity amid Agricultural Production in Australia', *Environmental Humanities* 12 (1) (May 2020), pp. 267, 270; Anna Krzywoszynska, 'Nonhuman Labor and the Making of Resources', *Environmental Humanities* 12 (1) (May 2020), p. 229; Anne Therese O'Brien, 'Ethical Acknowledgement of Soil Ecosystem Integrity amid Agricultural Production in Australia', *Environmental Humanities* 12 (1) (May 2020); Greta Marchesi, 'Justus von Liebig Makes the World: Soil Properties and Social Change in the Nineteenth Century', *Environmental Humanities* 12 (1) (May 2020), p. 205; Mart A. Stewart, 'Plantations, Agroecology, Environmental Thought, and the American South' in Frank Uekötter (ed.), *Comparing Apples, Oranges, and Cotton: Environmental Histories of the Global Plantation* (Frankfurt and New York, NY: Campus Verlag, 2014).

[9] University of California - Davis. 'Why Insect Pests Love Monocultures, and How Plant Diversity could Change That' *ScienceDaily*. www.sciencedaily.com/releases/2016/10/161012134054.htm Accessed February 2, 2021; David Andow, 'The Extent of Monoculture and its Effects on Insect Pest Populations with Particular Reference to Wheat and Cotton' *Agriculture, Ecosystems and Environment*, Vol. 9 Issue 1 (1983), pp. 25-35.

[10] Linda Nash, *Inescapable Ecologies: A History of Environment, Disease, and Knowledge*. (Berkeley, LA, London: University of California Press. 2006); Gregg Mitman, 'In Search of Health: Landscape and Disease in American Environmental History', *Environmental History*, Vol. 10, No. 2 (Apr., 2005); Linda Nash 'Beyond Virgin Soils: Disease as Environmental History' in Andrew C. Isenberg (ed.) *The Oxford Handbook of Environmental History* (New York: Oxford University Press, 2014), p. 90; Richard S. Dunn, *Sugar and Slaves: The Rise of the Planter Class in the English West Indies, 1624-1713* (Chapel Hill, London: University of North Carolina Press, 1972); Penna, *The Human Footprint: A Global Environmental History*, p. 257; McCook, 'Environmental History of Coffee in Latin America'.

Different plantations affects the environment to a different degree on account of the diverse nature of the geography, climatic conditions, labouring class, socio-economic-cultural backgrounds of planters, uses of pesticides and fertilisers, amongst a host of different reasons. Yet, such discussions, as briefly touched upon in the chapters, points to excesses in commercial agricultural pursuits all over the globe, and at different points of time, which reveals how they contributed to overturning the fragile ecological balance in its environs and led to increased ill-health of the labourers involved therein, like the tea plantations in Assam.

The study remains largely an insight into the plantation environment and do not venture too much outside its boundaries, much like the actual functioning of a plantation which strived for exclusivity and confinement. This limitation can be taken up in further researches. Above all, this is a study of the web of interconnected environmental networks which were at work in a plantation setting. These networks when disrupted produced innumerable and interconnected changes which inform us of ways that a specific production system could impact its surrounding environment.

Appendix A: Assam Company Statistics Table

Assam Company Statistics		
Year	Crop per acre in Bearing (lb)	Acreage under Tea (bearing)
1893	359	8550
1894	368	8870
1895	351	9319
1896	353	9718
1897	357	9970
1898	361	10069
1899	381	10242
1900	420	10431
1901	325	10642
1902	326	10655
1903	335	10913
1904	353	10811
1905	397	10184
1906	420	9550
1907	430	9791
1908	508	9776
1909	582	9675
1910	587	9796
1911	551	10090
1912	597	10593
1913	600	10954
1914	655	11098
1915	787	11134
1916	773	11093
1917	735	11170
1918	714	11219
1919	704	11307
1920	685	11615
1921	539	11933
1922	622	12085
1923	788	12009
1924	776	12137
1925	694	12241
1926	718	12381
1927	655	12349
1928	716	11847
1929	745	11845
1930	634	11805
1931	735	11678
1932	712	11549
1933	622	11786
1934	640	11634
1935	695	10756
1936	653	10767
1937	706	10857
1938	760	11004
1939	777	10783
1940	746	10973

Source: H.A. Antrobus, *A History of the Assam Company, 1839–1953* (Edinburgh: T. and A. Constable Ltd., 1957), pp. 407-412.

Appendix B: The variety of manures available to the Assam tea planters (as quoted in 'The Use of Artificial and Chemical Manures', *Quarterly Journal.* Scientific Dept. Part II. (Calcutta, ITA: 1911) pp. 12-13).

1. Manures containing a single manurial constituent.

Nitrogenous Manures				
	Approximate % of			
Name	Nitrogen	Potash	Phos. Acid	Approx. market price (in Rs.)
1. Nitrate of Soda	16%	-	-	245 per ton.
2. Sulphate of Ammonia	20 %	-	-	250
3. Oil-cake	4-6%	-	-	-
4. Shoddy	12%	-	-	-
5. Dried blood	12-14 %	-	-	150 per ton
6. Nitrate of lime	13%	-	-	180 per ton
7. Nitrolim	18-21 %	-	-	200 per ton

Potash Manures				
	Approximate % of			
Name	Nitrogen	Potash	Phos. Acid	Approx. market price (in Rs.)
1. Wood-ash	-	3.5%-7%	2-4%	-
2. Muriate of Potash	-	51%	-	170 per ton
3. Sulphate of Potash	-	48-50%	-	220 per ton

Phosphatic Manures				
	Approximate % of			
Name	Nitrogen	Potash	Phos. Acid	Approx. market price (in Rs.)
1. Basic Slag	-	-	7.5-8.5%	75 per ton
2. Superphosphate	-	-	10-20%	75 per ton
3. Bone-ash	-	-	32-38%	55 per ton
4. Guano	-	-	-	-
5. Bone Char	-	-	30-36%	50 per ton

2. Manures containing two manurial constituents.

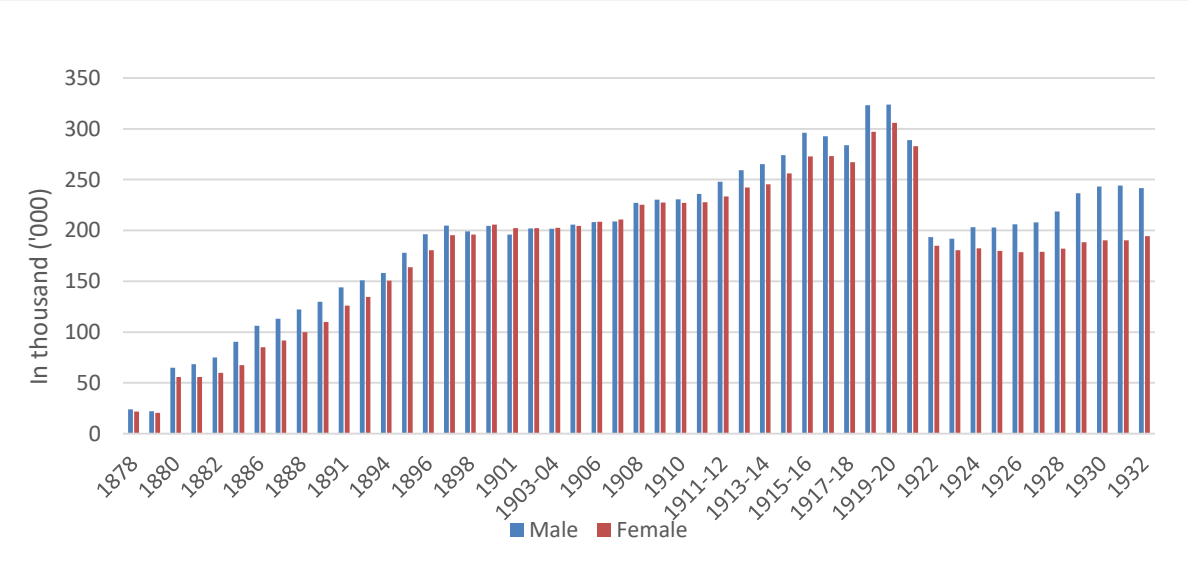
Nitrogen and Potash				
	Approximate % of			
Name	Nitrogen	Potash	Phos. Acid	Approx. market price (in Rs.)
1. Nitrate of Potash	14-16%	42%	-	270 per ton

Nitrogen and Phosphoric Manures				
	Approximate % of			
Name	Nitrogen	Potash	Phos. Acid	Approx. market price (in Rs.)
1. Steamed Bones	3-4 %	-	-	80 per ton.
2. Sterilised Animal Meal	8 %	0.5 %	12 %	107-8 per ton
3. Bone Meals	3-4 %	-	22-24 %	70 per ton
4. Fish Manure	-	-	-	75 per ton

3. Manures containing three constituents.

Nitrogen, Potash and Phosphoric Manures				
	Approximate % of			
Name	Nitrogen	Potash	Phos. Acid	Approx. market price (in Rs.)
1. Cattle Manure	2-3 %	Trace	.1-.2 %	-
2. Muriate of Potash	5 %	2 %	8 %	147 per ton

Appendix C: A representation of number of male and female adult labourers in Assam valley tea plantations for the period 1878-1932



Sources: *Report on Labour Immigration into Assam for the corresponding year* (Shillong: The Assam Secretariat Press); Rana P. Behal, *One Hundred Years of Servitude* (Delhi: Tulika Books, 2014), pp. 365-367.

Appendix D: Rules published in 1933 regarding the daily scale of allowances for two meals to every emigrant into the Assam gardens accommodated in the depots.

Daily Allowance to Each Emigrant		
Articles	**Of and above ten years of age**	**Remarks**
	In grams	
Rice	699.8	Quality to be that ordinarily eaten by labouring classes
Arhar Dal	116.6	
Flour	466.6	To be given to flour eater in lieu of rice
Vegetables	175	Such as are ordinarily eaten by labouring classes and are obtainable in the markets
Salt	29.16	
Mustard Oil (Oct. to March)	43.74	
Mustard Oil (April to Sept.)	21.87	
Condiments	14.58	

Source: *Tea Districts Emigrant Labour Manual* (Calcutta: Tea Districts Labour Association, 1934), p. 42

Meanwhile, the following table shows an estimate of the mean amounts of food required daily to sustain an average working man that was calculated by Moleschott who was presumably the greatest authority in this matter during the 1860s.

Daily food and water requirement for an average working man	
	In grams
Albuminous substances (protein)	130
Fat	84
Carbohydrates	404
Salts (all kinds)	30
Water	2800

Source: E. A. Parkes, *Manual of Practical Hygiene. Prepared Especially for Use in the Medical Service of the British Army* (London, John Churchill & Sons 1864), p. 147.

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