

Mapping of Malaria in Colonial Bengal using FOSS4G

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Abstract

The term 'Malaria' was synonymous to any types of fever associated with the terms like *Kala-dukh*, Kala-Azar, Assam-epidemic malarial fever, Burdwan Fever during British rule in Colonial Bengal. There are many available researches on (deaths due to) malaria in Colonial Bengal. Geographical Information System (GIS) mapping in the historical studies especially in malaria, is very limited. In this present study, GIS mapping of malaria is very novel. The present study has used FOSS4G (QGIS 2.14.18 Essen) to map the locations and extent of malaria in Colonial Bengal from 1836 to 1947 (till the Independence of India). During the study period, Bengal experienced heaviest death toll due to malaria. It is seen from the GIS maps that among all the regions of Bengal, Western (94.48%) and Central Bengal (89.99%) were mostly malaria infected. Whereas, the people of Eastern Bengal (only 28.68%) were least infected from malaria. The first malaria death was recorded in Calcutta (Presently Kolkata) in 1690 and it caused 460 deaths. In 1921 total death due to malaria was about 700 thousand while the death during 1944-45, death was 763 thousand. All the death locations were mapped using (Q)GIS which shall help us to identify the major geographical and other factors for Malaria.

Keywords: Malaria, Colonial Bengal, GIS Maps

1. Introduction:

The word colonial Bengal represents the British occupied Bengal Province after the battle of Plassey, when the East India Company established their strength in the territory in 1757. The whole Bengal Presidency can be divided into two provinces viz. Upper Provinces and the Lower Provinces. In 1836, separate administration was formed for the two Provinces. The Upper Provinces were named as

North-Western Provinces (Hunter, 1908), and the Lower Provinces were known as Bengal Province. The Lower Provinces were comprised of four sub-provinces i.e., Bengal Proper, Bihar, Chota Nagpur, and Orissa Province, and some Native States i.e., Cooch Behar, Sikkim, Hill Tippera and 26 Tributary States of Orissa and Chota Nagpur (Campbell, 2003), and Our study area is the Bengal Proper sub-province [Figure.1]. Bengal Proper (1) is a geopolitical, and

(1) The then Bengal Proper was comprised of five administrative divisions i.e., Burdwan, Presidency, Rajsahi, Dacca and Chittagong. O'Malley, 1913, divided Bengal Province into four regions- 1. Western Bengal comprised the districts of Burdwan Division, are Burdwan, Birbhum, Bankura, Midnapur, Hooghly, Howrah; 2. Central Bengal comprised the districts of Presidency Division i.e., 24 parganas, Calcutta, Murshidabad, Nadia, Jessore, Khulna; 3. North Bengal comprised the districts of Rajsahi division i.e., Bogra,

Rajsahi, Pabna, Malda, Rangpur, Dinajpur, Jalpaiguri, Darjeeling, and 4. Eastern Bengal comprised the districts of Dacca and Chittagong division i.e., Dacca Division comprised of Dacca, Mymensingh, Backarganj, Faridpur, and Chittagong Division comprised of Noakhali, Tippera, Hill Tippera, Chittagong, and Chittagong hill tracts (L. S. S. O'Malley, 1913). At the time of the partition in 1947, India and East Bengal (Bangladesh) separated from each other. Bengal became West Bengal including 14 districts i.e., Bankura,

historical region situated in the south-eastern part of Asia, eastern part of the India, and at the apex of Bay of Bengal. It (excluding Cooch Behar and Hill Tippera) covered an geographical area of approximately 1038 million.sq.km.(Charles A Bentley, 1925). According to O'Malley (1913), the Bengal province comprised of four natural divisions, namely (i) Western Bengal, (ii) Eastern Bengal, (iii) Northern Bengal, and (iv) Central Bengal (Samanta, 2002).

Bengal was the laboratory of various disease and many of them appeared in their epidemic forms. Among all the epidemics malaria, cholera, plague, diarrhoea, dysentery, small pox, influenza, tuberculosis, leprosy, etc were common (L. S. S. O'Malley, 1913), and among which **malaria** (identically), plague, cholera and small pox were most destructive (Palit, 2008). Bengal experienced approximately 40% malaria cases and deaths of total disease cases and deaths occurred in whole India(Ray, 1998). Thus, the present study i.e., GIS mapping of malaria in Colonial Bengal from 1836-1947 has been framed to map the extent of malaria in Colonial Bengal using GIS. GIS would explore the geographical and other associated factors of malaria epidemic within our study area.

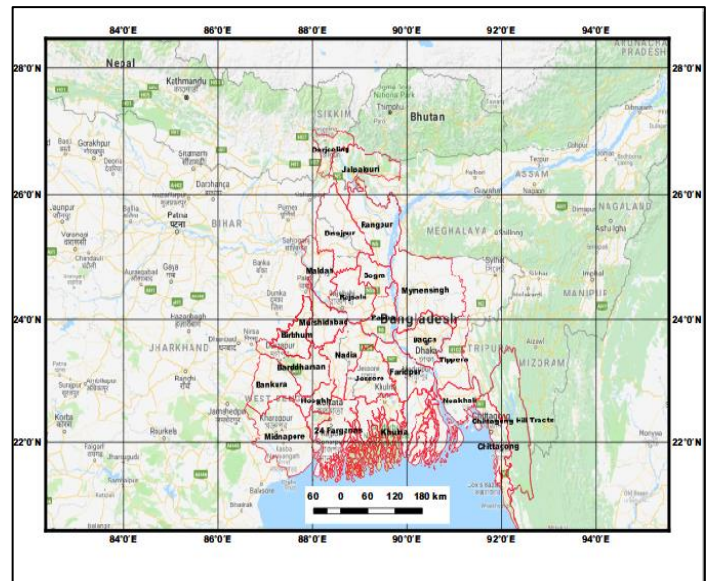


Figure 1: Bengal Proper- The Study Area

Mapping historical events using GIS is a novel idea to the subject (History). ESRI (July, 2012) (2) defined GIS as “a framework for gathering, managing, and analysing data. Rooted in the science of geography, GIS integrates many types of data. It analyses spatial location and organizes layers of information into visualizations using maps and 3D scenes. With this unique capability, GIS reveals deeper insights into data, such as patterns, relationships, and situations – helping users make smarter decisions”. It is the latest technology to map any geographical data. But it is imperative to use GIS in any historical events, happened on the Earth's surface. so, the GIS should be employed efficiently to map the historical events as well.

2.

Birbhum, Burdwan, Howrah, Hooghly, Nadia, Calcutta, Midnapur, 24 parganas, Darjeeling, Jalpaiguri, West Dinajpur, Malda, Murshidabad. Cooch Bihar was princely state till 1949, after that it became a district of West Bengal. Now there are 5 divisions and 23 districts in West Bengal. Darjeeling, Jalpaiguri, Cooch Bihar, Kalingpong, Alipurduar are included in Jalpaiguri Division; Malda, Murshidabad, Uttar and Dakshin Dinajpur are included in Malda division; Burdwan

division comprises Paschim and Purba Bardhaman, Hooghly, and Birbhum; Presidency division comprises Howrah, Kolkata, Nadia, North and south 24 Parganas; and Medinipur Division comprises Bankura, Jhargram, Purba and Paschim Medinipur, and purulia.

² ESRI, 2012,
<http://www.esri.com/library/bestpractices/what-is-gis.pdf>

3. Literature Review:

There are many available researches on (deaths due to) Malaria in Colonial Bengal. (C. A. Bentley, 1916; Bird, 1866; Klein, 1972; Ray, 1998; Samanta, 2002). Many of the available literature did not use the term 'Malaria' directly but we could understand that any death due to 'fever' was synonymous to 'malaria' (Lyons, 1871; Mitter, 1876). Or in some other literature, we could find (malaria) fever was defined with few associated terms viz. '*Kala-Azar*' or '*kala-duk*' (L. O. Malley, 1907) or '*Assam epidemic malarial fever*' (Chatterjee, 1923; P. S. Gupta, 1944; S.-C. L. Rogers, 1897), '*Burdwan Fever*' (Brahmachari, 1911; Lyons, 1872). This is to mention that from this point onwards, we would term all the above-mentioned types of fevers as **malaria**. Researchers have identified rainfall, temperature, elevation, forest cover (Hu et al., 1998); unrefined drinking water supply by municipalities (L. Rogers, 1900); marshy lands, agricultural lands; and siltation of rivers (Charles A Bentley, 1925; Klein, 1972; Samanta, 2002); dampness for obstructed drainage by roads, railways (Klein, 1972; Mitter, 1876); and wet rice and jute cultivation adjacent to the homesteads as responsible factors for the spreading as well as intensification of malaria (Samanta, 2002). Most of the above-mentioned studies are basically the description and chronological records of number of deaths due to malaria, their major locations, fatal effects of fever along with a few factors of malaria. Almost all of the above-mentioned research papers have investigated and analysed the archival data from West Bengal State Archive, Government documents like reports of Sanitary Commissioner of Bengal, District Gazetteers, Census Reports etc. But we could

find a few researchers have used any map to locate the malarial zones in their research articles (Charles A Bentley, 1925; Dutta & Dutt, 1978; Sarkar, 1931). If any maps are available, they are in very basic shape from Geographers' perspective which creates difficulty of visualizing any location. Geographical distribution or locational extents of any component on the Earth's surface can be represented easily through mapping techniques. So, mapping is the simplest method to show relative location of any event or phenomena. Mapping with the latest techniques shall improve the visual impact of any map. Among all the available technologies, GIS (Geographical Information System) is one of the latest technology to map. Use of GIS is very limited in historical studies. A few studies have used GIS for temporal analysis of diseases in past. Kuo and Fukui showed spatio - temporal study of disease diffusion pattern of cholera between 1882 and 1895 in Fukushima Prefecture in Japan using GIS and geo-statistical techniques (Kuo & Fukui, 2007). Koulentaki et al., studied spatio-temporal analysis i.e., prevalence and incidence and mapping of spatial distribution of the patients of primary biliary cirrhosis disease in Crete Island, Greece in between 1980 and 2010 (Koulentaki et al., 2014). But, there is no study available on analysis of diseases using GIS in old historical time periods. In case of the study of Colonial Bengal we could find no study on malaria using GIS. Use of GIS in mapping malaria has been done by a few researchers worldwide (Dogan, Cetin, & Egri, 2010; Qayum, Arya, Kumar, & Lynn, 2015). So, studying and GIS mapping of Malaria in Colonial Bengal shall add a new dimension to the existing studies.

4. Methods and Materials:

Bringing old maps and data into the Geographic Information System (GIS) was the basic task for this paper so as to obtain the objective.

The base map of Bengal Proper has been collected from Government report i.e., Census of India, 1921, Vol-V, Bengal, Part – I, 1923, as the study area and the administrative boundaries were still same as was in 1836. The image was scanned and georeferenced (3) so that we can put them under the GIS environment. The FOSS4G, QGIS 2.14.18 Essen (4) for GIS mapping has been downloaded and pre-installed in the computer for this purpose.

Malaria events and resultant death records have been collected from different sources. They are:

- i. Bengal District Gazetteers of the Districts of Bengal, (Allen, 1912; Banerji, 1972; Garrett, 1910; Gruning, 1911; J. Gupta, 1910; Jack, 1918; Lambourn, 1918; L. O. Malley, 1907; L. S. S. Malley, 1911; L. O'malley, 1908; L. S. S. O'Malley, 1914, 1923; L. O'Malley, 1908; L. S. S. O'Malley, 1908; Lewis Sydney Stewart O'Malley, 1909, 1910, 1912a, 1912b; L. S. S O'Malley, 1914; Lewis Sydney Stewart O'Malley, 1916; Peterson, 1910; Sachse, 1917; Strong, 1912; Vas, 1911; Webster, 1911)
- ii. West Bengal State Archives (West Bengal State Archives) (*Progs. of GOB.*, March 1863; *Progs. of GoB.*, May, 1869).
- iii. Imperial Gazette of India (Frowde, 1909; Hunter, 1908)

iv.

Government reports (Charles A Bentley, 1925; L. S. S. O'Malley, 1913; Thompson, 1923)

Books (Ray, 1998; Samanta, 2002)

All the data sources indicated the place names for any malarial outbreak and associated death. We have used Google Map to get the location (X, and Y i.e. Longitude and Latitude) of those places. The malaria data and the locational data have been tabulated and arranged using Excel Software. Finally, the data has been imported from Excel to QGIS v2.14.18 for GIS mapping (Fig 2).

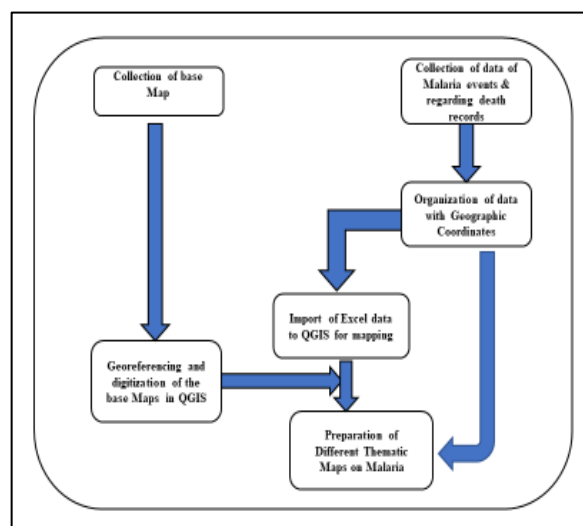


Figure 2: GIS mapping methodology

4. Results and Findings:

In Bengal province, Malaria was known to people even since the Vedic period (Samanta, 2002). But until the beginning of 20th Century proper records of Malaria and deaths therefore was not recorded. From an account of 1911, it is clear from the GIS maps that among all the regions of Bengal, Western (94.48%) and Central Bengal (89.99%) was mostly malaria or

(3) here we got the old maps as raster image. According to ESRI Georeferencing is aligning geographic data to known coordinate system so it can be viewed, queried and analysed with other geographic data. Georeferencing may involve shifting, rotating, scaling and in some cases

warping, rubber sheeting or orthorectifying the data.

[<https://support.esri.com/en/other-resources/gis-dictionary/term/georeferencing>]

(4) QGIS can be downloaded from

<https://qgis.org/en/site/forusers/download.html>

fever infected whereas, the people of Eastern Bengal (only 28.68%) were least infected from this (Charles A Bentley, 1925) (Table 3 & Fig 4).

Table 3: Malaria or Fever Infected Population of Bengal in 1911

Regions of Bengal	Total Population (1911)	Fever Infected Population	% of fever infected Population
Western Bengal	8,467,314	8,000,000	94.48
Central Bengal	9,445,321	8,500,000	89.99
Northern Bengal	10,138,302	8,500,000	83.84
Eastern Bengal	17,432,140	5,000,000	28.68

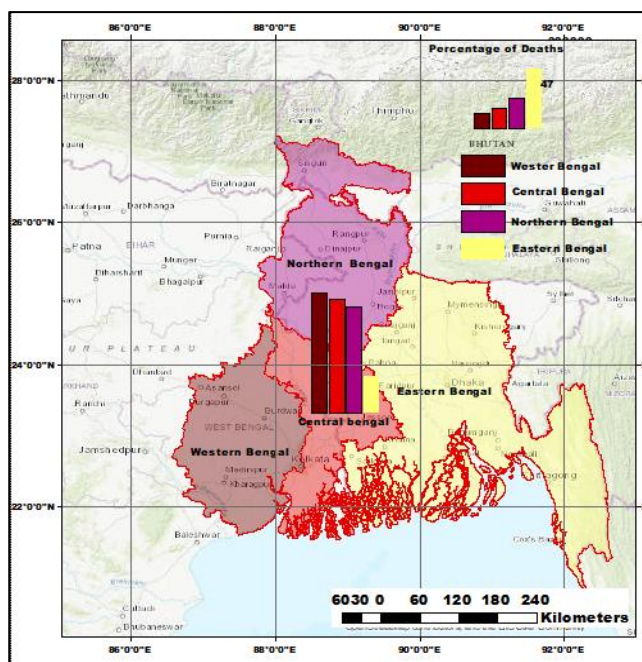


Figure4: Percentage of malaria infected population in the Divisions of Bengal

Malaria and related death was recorded in Calcutta[5] for the first time in 1690 and it caused 460 number of deaths (Samanta, 2002) (Fig 5 a). After a long pause, Marquis of Wellesly in 1770, indicated the unhealthiness and prevalence of malarial fever among the troops at Berhampur of Murshidabad District (Ray, 1998). According to Dr. Thomas, at the end of 18th Century, fever was prevalent at Goamalti, Englishbazar Thana, and Sibganj Thana (Lambourn, 1918) (Fig 5 b). But in later periods, malaria became annual phenomena in Bengal and caused millions of deaths.

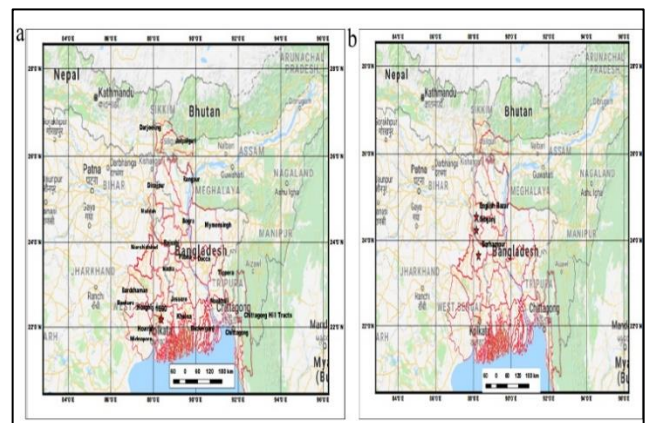


Figure5: (a) First Recorded Malaria in Calcutta with 460 Deaths; b) Prevalence of Malaria in Late 18th Century

Bengal experienced a spate of malaria throughout the early 19th and 20th Century. In 1832, the village of Ula or Beeranagar in Nadia District experienced a scourge of malarial fever though we could not find any death record in this event (Ray, 1998). In 1836, the earliest record of malaria epidemic with virulence in Bengal was at Muhammadpur Village, in Jessore District of Bengal Province (Charles A Bentley, 1925; L. S. S. O'Malley, 1913; Lewis Sydney Stewart O'Malley, 1912b; Ray, 1998) (Fig 6 a). It affected

[5] Calcutta is presently known as Kolkata and it is the capital city of West Bengal

~700 convicts of Sitaram Rai's Jail. They were engaged in construction of Jessore – Dacca road and among the affected people, 150 died. The region was experiencing malaria fever since 1824 as suggested by Dr Elliot (Lewis Sydney Stewart O'Malley, 1912b). The epidemic continued in the region for seven years, and the disease was present till 1843. After that, it took a little pause for about 3 years and again appeared in 1846 and affected the whole district till 1848. After the event of 1848 it again took a pause of six to eight years and came back again in 1854-1856. From this period, it started to spread westward i.e., Nadia and 24 Parganas. The second recorded malaria in epidemic form with a death record has been found in the village of Ula of Nadia district from 1856-62. Approximately 10,000 people died in this event (Fig 6 b) (*Progs. of GOB.*, March 1863).

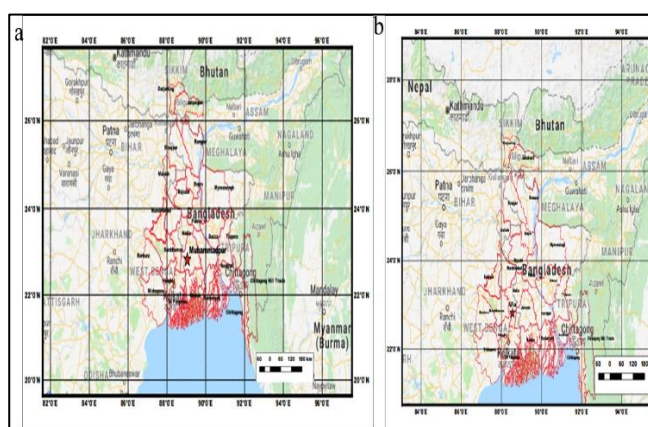


Figure6: (a) earliest Record of Malaria Epidemic with its Virulence in 1836;(b) Second Recorded Malaria Epidemic from 1856-62 with 10,000 Deaths

Continuing its westward movement, the fever gradually spread from Presidency Division to Burdwan Division and perished the region particularly during 1869-1874 and acquired the name 'Burdwan Fever'(Lewis Sydney Stewart O'Malley,

1912b). In 1862 the dreadful epidemic fever attacked Burdwan District for the first time, while before this time the district was very much salutiferous. Before 1862, the people came to the district for getting better treatment facility and for the curing of the disease as the district was well known as a sanitorium. After Nadia District, the fever crossed the river Bhagirathi, and had spread the riverside villages of Cutwa (Katwa), Parbasthali (Purbasthali) and Culna (Kalna) Thana in 1862 and 1863. Afterwards, it had spread in Hooghly and Howrah Districts in between 1864 and 1867, and in 1868-1869 the epidemic invaded Burdwan Town, spreading far to the north and south. From 1870-1872, the whole Birbhum District and the large portion i.e., the north-eastern part of Midnapur District was affected. In 1873, no further pervasion was happened, and slight abatement of the disease was started in the districts of Burdwan Division, though it was more in its severity in Howrah and Midnapur District than the previous year. After 1874 it started to die out prominently and it may be said that this year was the last year of the course of the epidemic (S.-C. L. Rogers, 1897). According to the estimation of Dr. French, about one third of the total mortality of the district was only due to the epidemic fever. From 1869-1872, among the population of 46,000 about 30% i.e., 13,313 died from the fever only in Burdwan Town. The Census report of 1881 shows that from 1862-74, approximately 750,000 population died from the epidemic in the District (Peterson, 1910).

The locations of some of the major epidemic events from 1861- 1870, found to be clustered in the Central and Western Bengal. Among them, the notorious place for number of deaths was Pandua of Hooghly District with 5222 deaths; followed by Ichapur

Village of Ganguriah Thana, Burdwan, where 5200 people died from fever in 1862. Other notorious places due to fever deaths were Calcutta, Dwarhata, Bansberia, Meherpur, Dwarbasini, Mamudpur, Makurgram, Meghshar etc.(Fig 7a) (Samanta, 2002). The whole province of Bengal experienced the manifestation of malaria.

Bengal Province was comprised of five administrative divisions i.e., Rajsahi, Burdwan, Presidency, Dacca and Chittagong. All the divisions or the whole Bengal province was severely affected by fever epidemic. In both 1885 & 1886 the highest mortality was in Rajsahi division i.e., 171,664 and 199,649 respectively and the lowest mortality was in Chittagong division i.e., 47,231 and 44,991 respectively (Lidderdale, Dec. 1887). Malaria mortality was also higher in rest of divisions. In Burdwan division 109,360 and 102,188 people died in 1885 and 1886 respectively. In Dacca division the mortality was 104,335 and 119,170 and in case of Presidency division 156,288 and 135,800 in 1885 and 1886 respectively (Fig 7 b).

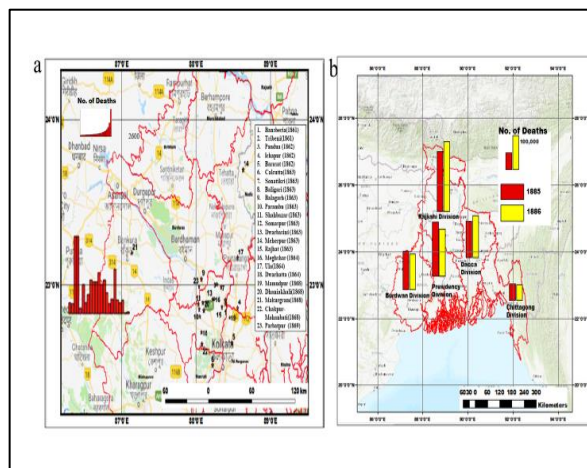


Figure 7: (a) Malaria Events with Death Records in Some Districts from 1872-1911; (b) Death Records in the Administrative Divisions of Bengal in 1885 and 1886

From 1911-1920 approximately 10 million people died only from fever in Bengal Proper, though at that time influenza along with malaria was common epidemic categorised under fever class. No other different account for malaria, influenza and other febrile diseases is available in the literature. The account of fever death from 1911-1920 is given in the table below: -

Table 8 Deaths from Fever in Bengal Proper from 1911-1920

Year	Total number of deaths
1911	882,276
1912	959,193
1913	965,546
1914	1081,041
1915	1064,159
1916	909,880
1917	882,768
1918	1357,906

1919	1229,257
1920	1144,421

Source: Thompson, W. H., Census of India, 1921, Vol-V, Part-I, p. 245

In the 20th Century, before our Independence i.e., 1947, the whole province experienced the lash of the epidemic fever in more or less same intensity. Malaria caused the destruction of millions of human lives. From 1921 to 1944 all the years had experienced a huge number of death. In 1921, about seven lakh people were died only from malaria, but from 1922-1942 the intensity was somewhat low, Whereas, in 1943 and 1944, the number of death increased again to 688,404 and 763,220 respectively` in the whole Bengal Province(Ray, 1998) (Fig 9).

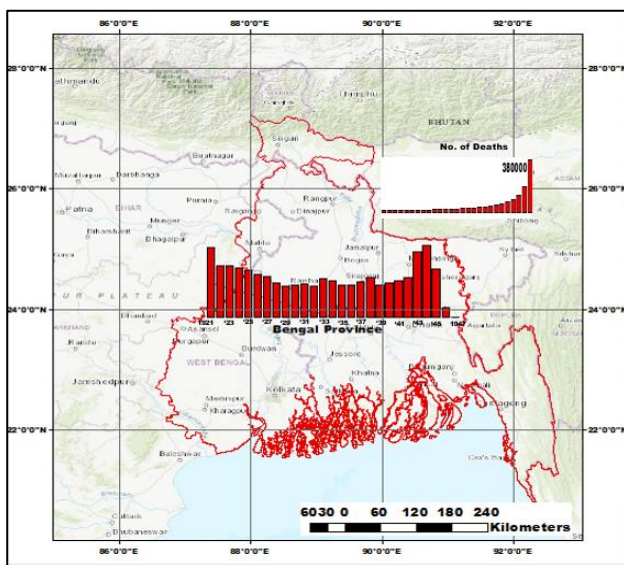


Figure 9: Year-Wise Death Records of Malaria in Whole Bengal Province from 1921-1947*

*1946 and 1947 represent the records of West Bengal only

5. Discussion and Conclusion

The whole province of Bengal experienced the outbreaks of malaria. The malarious thanas or places of every districts of Bengal have been plotted on GIS map (Fig 10).

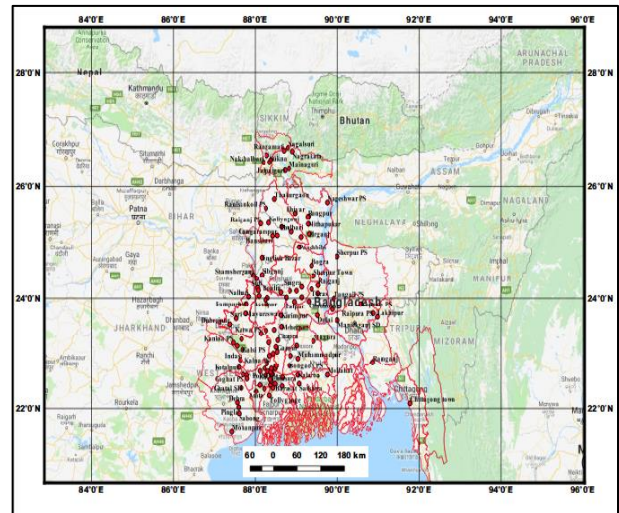


Figure 10: Malarious Places of Every Districts of Whole Bengal Province

The map shows that among the four natural regions, the whole Eastern Bengal was least affected. Bentley C. A.(1925) showed agricultural prosperity as the reason of healthiness or low incidence of malaria in Eastern Bengal (Charles A Bentley, 1925).and District wise some malaria events with death records in different years from 1872 to 1911 have been highlighted through GIS map (Fig 11).

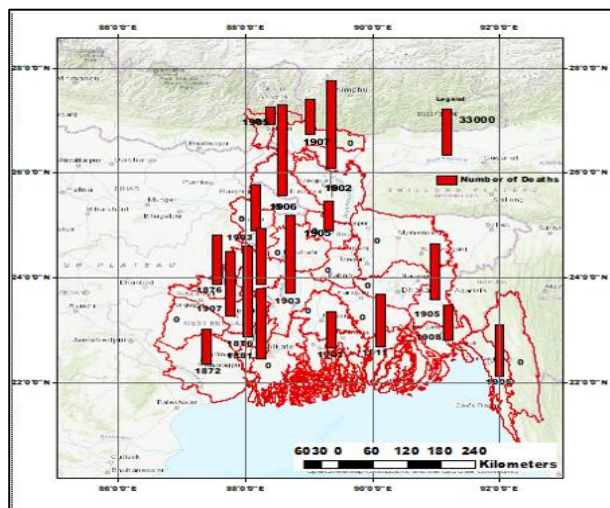


Figure 11: Malaria Events with Death Records in Some Districts from 1872-1911

Almost every district experienced the scourge of malaria in more or less same frequency. GIS maps provides birds-eye-view on date-wise malaria death of each districts of Bengal.

5.1. Limitations:

- Methods of investigation of the epidemic:

The death statistics of people were recorded by the village *Chaukidars* from 1869. The reports, prepared by the *Chaukidars*, were practically full of inconsistencies as many of those were incomplete and inaccurate. The present system of recording the vital statistics was introduced in 1892. The *Chaukidars* were ordered to report the birth and death statistics to police on parade days and the police submitted the monthly report to the civil surgeons, who compiled the report for a whole district. But the statistics and the regarding causes of deaths, recorded by the village *Chaukidars* were not reliable at all as because the *Chaukidars* were not properly trained, they hardly had the medical knowledge about diseases or to distinguish the diseases from one

another. They were not able to differentiate the febrile symptoms of malaria from rest of the diseases e.g. bronchitis, pneumonia, phthisis, typhoid, Leishman-Donovan infection etc. An experiment shows that out of 2616 deaths recorded in the thanas, 1056 were reported wrongly (L. S. S. O'Malley, 1913; Peterson, 1910). So, many a times, the death records may be exaggerated but we have reported as we have seen in those reports or records.

- Difficulty to plot the historical places: In some cases the older names of the places has got altered and at present they are known in another names. So there is the difficulty to find the exact locations of those historical places in google maps and to plot through GIS.

6. Acknowledgement:

The authors are thankful to the Department of Geography, The University of Burdwan for pursuing research activities. TR is also thankful to DST PURSE Phase-2 Programme for Research Fellowship (Ref No, R.T.I./PURSE/Phase 2/34).

6.1. Conflict of interest:

The authors declare no conflict of interest.

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8. Appendix

Events of Malaria in Different Places

Places	Year	No. of Deaths from Malaria
Calcutta	1690	460
Muhammadpur, Jessore	1836	~700
Ula, Nadia	1856-62	10,000
Bansberia	1861	700
Makurgram	1861	500
Tribeni	1861	645
Burdwan Town	1862-74	750,000
Pandua	1862	5222
Ichapur Village, Ganguriah P.S.	1862	5200
Barasat	1862	400
Parbatpur	1863	100
Calcutta	1863	1959
Sonatikri	1863	700
Baligari	1863	1284
Balagarh	1863	2271
Parambu	1863	2169
Shahbazar	1863	2176
Somaspur	1863	2737

Dwarbasini	1863	1959
Meherpur	1863	2300
Rajhat	1863	1400
Meghshar	1864	662
Ula	1864	1000
Dwarhatta	1866	3045
Mamudpur	1868	937
Dhaniyakhali	1868	697
Makurgram	1868	937
Pandua	1868	393
Chakpur-Mohanbati	1868	86
Parbatpur	1869	171
Burdwan Town	1869-72	13,313

Source: Samanta, A. (2002). *Malarial fever in colonial Bengal, 1820-1939 : social history of an epidemic*. Kolkata: Firma KLM; Banerji, A. K. (1972). *West Bengal District Gazetteers: Hooghly*: Government of West Bengal

Death Records of Malaria in Some Districts of Colonial Bengal

Districts	Year	Deaths
Midnapur	1872	25000
Birbhum	1876	35000
Hooghly	1876	65000
Howrah	1881	50000
Rangpur	1902	62471
Nadia	1903	55527
Murshidabad	1903	39596

Khulna	1903	26063
Tippera	1905	40000
Chittagong	1905	36091
Bogra	1905	20826
Darjeeling	1905	12704
Dinajpur	1906	65096
Jalpaiguri	1907	25149
Burdwan	1907	45815
Noakhali	1908	25094
Backerganj	1911	37040
Malda	1911	32434

Source: Bengal District Gazetteers for the Districts of Bengal and Samanta, A., *Malarial fever in colonial Bengal, 1820-1939 : social history of an epidemic*. 2002, Kolkata: Firma KLM.

Deaths in Malaria in Bengal Province from 1921-1947

Place	Year	No. of Deaths
Whole Bengal Province (Colonial Bengal)	1921	737223
	1922	540463
	1923	539899
	1924	527902
	1925	497473
	1926	458208
	1927	429143
	1928	368691
	1929	335414
	1930	336879

	1931	349111
	1932	327386
	1933	413922
	1934	387191
	1935	342955
	1936	337647
	1937	372992
	1938	416521
	1939	341321
	1940	369448
	1941	388381
	1942	426573
	1943	688404
	1944	763220
	1945	516099
Bengal (Only West Bengal)	1946*	103339
	1947*	82539

* represents the records of West Bengal only

Source: Ray, K., *History of Public Health: Colonial Bengal, 1921-1947*. 1998: KP Bagchi & Company.



9. Authors' Biography:

Ms. Tanusri Roy (DOB-21/01/1992), completed her Master's degree from Vidyasagar University in 2014. Presently she is working as Research Fellow under the DST Purse phase - 2 Programme, in the Department of Geography, The University of Burdwan, West Bengal, India.



Biplab Biswas (DOB: 03/04/1973) has completed his Masters' in Geography from The University of Burdwan (1996), followed by M.Phil degree in the Jawaharlal Nehru University, New Delhi (2000). In 2008, he was awarded the Ph.D degree in Geography from The University of Burdwan. The title of his doctoral thesis was "Land use and land cover change in Damodar Basin: A Spatial Modelling Approach". He joined the Department of Geography, The University of Burdwan on 02nd January, 2002 as a Lecturer in Geography. While in service, he carried out his Post-

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