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Picture a Dutch scene and the chances are that it will depict a flat landscape in which both a canal and a windmill figure. This representation has become so universally associated with the Netherlands, past and present, that it rarely needs any caption to identify its provenance: the one has become identified with the other in people's minds. Three hundred years ago, much the same image could just as easily have characterized many parts of eastern England. Much of the eastern seaboard lying between East Yorkshire and the Pevensey Levels in Kent constituted an English Lowlands, a distinctive region characterized by large areas of marsh and fen, and a sub-culture borne out of the vicissitudes and travails of living with the constant risk of flood and storm surge. Its landscape was singled out in the national consciousness by the great quantity of land reclaimed from the sea, crisscrossed by drains and dykes, and interspersed with windmills, and by its people with their pallid complexions, strange laws and customs, and a distinctive architecture of houses built on stilts.

This was a landscape where danger lurked not only in the unstable, frequently waterlogged ground, where bog and quicksand might make short shrift of the unwary, but also in its airs where the miasmas given off by rank vegetation were considered to lay low even the locals with the ague or marsh fever that had popularly begun to be called after the Italian "bad air" (*mal-aria*) or malaria. Together water and air defined this English Lowlands as separate and apart from the rest of the country. Commentators remarked on the unhealthy nature of the terrain and on the strange antics and sickly appearance of its people. Then latter, prone to wading through shallow floodwaters on stilts, were said to resemble frogs and reputed to have webbed feet.[1] Generally, people from the Lowlands were held in low esteem: Not for nothing did William Shakespeare christen one of his comic masterpieces from the *Twelfth Night*, the pale-faced, dim-witted, vain-glorious fop, Sir Andrew "Ague-cheek."

For those not accustomed to its environment, even a brief sojourn there might lead to sickness and even death. Daniel Defoe noted how eighteenth-century gentlemen from London who set out to seek sport in the marshes "often return with an Essex ague on their backs, which they find a heavier load than the fowls they have shot."[2] But this was also a changing environment, one that underwent a profound transformation between the seventeenth and twentieth centuries as the land was drained and its soils brought under cultivation. As the waters receded so, too, did the incidence of "intermittent fever" decline. Physicians began to note a dramatic reduction in the cases of malaria beginning in the 1830s that continued to

gather pace during the second half of the century till the disease had virtually disappeared by 1900. This article examines the puzzling relationship between water, malaria, and identity in the nineteenth century: how as one was drained from the land so the other apparently disappeared from the human bloodstream, and how, in the absence of both, the English Lowlands as a distinctive region began to fade from the national and historical consciousness.

The English Lowlands

Much of eastern England constitutes an English Lowlands, coastal salt marshes or inland freshwater fens, protected only by dunes, shingle ridges, and earthen embankments or fields that required an elaborate network of cuts, ditches, or underdraining to keep them from inundation. They were inhabited by a population whose customs and traditions despite their regional variations reflected a shared history of risks based on managing water and mitigating flood and storm surge. As such, both landscape and people closely resembled the other shorelines around the Wadden Sea.[3]

Fenlands are low-lying areas of peat soils that exist extensively throughout England but are especially to be found in an almost continuous swathe extending from the Lower Ouse and the Aire valley in Yorkshire, through the Isle of Axholme and south Lincolnshire, to Cambridgeshire and the Norfolk Broads. Reclaimed to an undetermined extent during the Roman period, only the silt marshlands along the edge of the Wash and some other coastal areas were extensively farmed and settled by the Middle Ages.[4] Most of this region constituted a sparsely inhabited, waterlogged plain apart from a number of "islands" of higher elevation upon which major monastic establishments like Ely were erected.[5] Its subsequent drainage converted these fenlands into one of England's most productive agricultural regions. Further south, Essex, too, had extensive marshlands, particularly around the mouth of the Thames estuary with its sandbanks and mudflats, as did the coasts of Kent and Sussex. Along the south coast lie the great marshes of Romney, one of the earliest reclaimed areas in the country, and the adjoining Rother and Pett Levels, and the great Pevensey Level. This eastern coastline together with its hinterland and southern outliers, despite its variegated topography, constituted a single identifiable region based on a shared risk of water-related hazards that collectively can be denominated an English Lowlands (see Figure 1). The constant exposure of this region to flood and storm necessitated a particular adaptation to the environment over the centuries.

[INSET Figure 1: The English "Lowlands"]

The great enterprise was the draining of the Fen Country starting in the seventeenth century, though much mooted over the preceding hundred years.[6] The Fens are a large, extremely flat plain bordering on the Wash and encompassing over 3,000 square kilometers. Evidence of former great sea defenses suggests these lands had been partially drained in an earlier age if not by the Romans at least some time during the late Saxon period.[7] Whatever its origins, this and other works had mainly fallen into decay by the seventeenth century and much of the region had reverted to river marsh and tidal silt shrouded, according to contemporary reports, in almost perpetual mists and miasmas, and prone to widespread flooding.[8] Increasingly favorable economic conditions and a steadily rising population provided both the capital and incentive to effect the wholesale reclamation of these fenlands, and persuade the Crown, local landowners, and both domestic and foreign investors of the profits that might be had from their drainage. Between 1630 and 1652, 380,000 acres (153,780 hectares) were drained through a judicious mixture of constructing new cuts, enlarging existing drains, and building a number of sluices.[9]

However, financial difficulties to do with maintenance, technical problems to do with subsidence (peat shrinkage), and outfall due to discharge rates into the Wash constantly threatened the whole project with ruin. The more the water was drained, the faster the peat dried out and shrank, blowing away in the wind or disintegrating through bacterial action.[10] In some areas, the frequency and severity of flooding actually intensified and, in others, lands that had previously been dry were now seasonally inundated. Much of the newly reclaimed land reverted to fens within thirty years and flooding remained a serious issue right into the eighteenth century.[11] Gradually over the centuries, however, much of eastern England was transformed from wetlands into a landscape of cultivated fields, crisscrossed by drainage ditches and embanked rivers, its monotonous flatness punctuated by windmills slowly turning in the freshening sea-breeze.

And just as the peoples of the English Lowlands transformed the landscape around them over time into something more "improved" for human purposes, so the variegated environment molded the social and political structures of these communities in similar though distinctive ways. A whole corpus of local rights and customs evolved to regulate this environment and meet the exigencies of fen and marsh life that even in the thirteenth century was described as having been practiced since "time out of memory." A reliance on an infrastructure of dykes

and drains that required constant maintenance, repair, and extension required group effort and fostered communitarian forms of governance. Since each dyke protected several villages and involved sums of money and labor well beyond the capacity of any one community let alone individual family to muster, mechanisms for collective decision-making emerged.

There is an implied reference to the prior existence of communitarian associations in Magna Carta (clause 48) and royal confirmation of their practices in the so-called Marsh Law of 1257. The latter served as a model that was gradually extended to other similar low-lying areas. Living in such an environment necessitated a degree of cooperation that extended beyond the bare requirements necessary to manage water and keep out the sea. The Fen Code of 1549, for example, regularized local usage of wetlands as a communal resource. This "dyke solidarity," however, had to be continually mediated and negotiated and, at times, enforced among communities. Commissioners of Sewers were established to resolve just such disputes though they suffered from the same drawbacks of most medieval bodies and possessed little actual power to enforce judgements, even if the principle upon which their assessments were made, that each landowner had an obligation to maintain and repair the ditches, dykes, and seawalls proportionate to the benefits derived from them, has remained an important principle in English Common Law.[12]

This English Lowlands, despite its local variations, constituted a discreet area, one that was based on a shared experience of risk and the political, social, and economic adaptations required to better be able to manage it. A risk society is one whose people have had to adapt to one or more related hazard as a "frequent life experience": one where risk has become deeply embedded in the culture, one where it is very much an integral part of the historical processes of that society, and one that profoundly influences the political structure, economic system, and social order of things.[13] From this perspective, the eastern seaboard of England and its variegated hinterlands constitute one region, sharing a common risk from the sea, and an imperative to manage inland water in certain ways that expressed themselves in similar but distinctive regional cultural forms. But the nature of this environment posed a further threat that was also born out of its aqueous nature. What made the English Lowlands so distinctive from other parts of the country and, in a sense, bound its people together in solidarity, were the miasmas that rose from its water-logged marshes and fens, and that were responsible for the ague or marsh fever endemic among those who lived there. Landscape and fever combined together to forge a sense of separate identity that was acknowledged within and recognized without the region. If, in the seventeenth century, Samuel Butler could

confidently compare the fickle nature of love in his satirical poem, *Hudibras*, to an ague "whose hot fit takes the Patient first" knowing that his audience would fully understand the allusion, the same was not true in 1946. As Sir William McArthur noted, "Today a footnote would be necessary to explain its significance to the ordinary English reader."[14] Malaria characterized the English Lowlands as much as did its topography, and its people had to adapt to this disease as much as to the environment, learning how to "live with uncertainty" in multiple ways and being defined by its effects on the human physiognomy.[15]

Malaria and the marshes

The aqueous, low-lying environment of marsh and fen interspersed by ditches, dykes, and cuts, with fields often seasonally flooded and where pools of stagnant water lay undisturbed under the summer sun, also proved an ideal habitat for mosquitoes. There are five indigenous species of *Anopheles* mosquitoes capable of transmitting malaria in England. The most competent vector for the Plasmodium parasite is *Anopheles atroparvus* that is found widely throughout the British Isles but is particularly abundant in the English Lowlands. The distribution of this species, however, is poorly documented as it is morphologically identical to *Anopheles messeae* except for the patterning on its eggs and the two were classified together as *Anopheles maculipennis* until the 1920s.[16] The first scientific attempt to map the distribution of Anopheles in England and Wales was undertaken by George Nuttall and his colleagues in 1901 as part of their investigation into the prevalence of malaria in the country. Apart from the inadequate resources at their disposal, their findings were limited by their failure to distinguish between species. While they did find that Anopheles were prevalent in areas where there was no historic record of malaria, mosquitoes were more abundant in low-lying areas where the disease had formerly been most frequent.[17] By the turn-of-the-twentieth century, however, cases of malaria had already become much rarer, and the disease was fast disappearing from both the medical landscape of the English Lowlands, and from the popular imagination of its peoples.

The history of malaria in England is reasonably well-documented at least in its outline and geography.[18] When the first parasite appeared in England is a matter of debate and it seems likely that malaria was initially introduced into Britain during the Roman occupation between the first and fifth centuries.[19] Blood samples taken in 1917, the first medical evidence for the disease in England only showed evidence of the more benign form of parasite, *Plasmodium*

vivax, and not the more deadly *Plasmodium falciparum*.[20] Moreover, later studies have shown that *Anopheles atroparvus*, the most common vector species in England, is largely zoophilic, that is it prefers feeding on animals rather than people and transmits the vivax and not the falciparum parasite.[21] Historical descriptions of patients suffering from the disease also confirm the presence of the milder form of malaria. Until recently, direct evidence for the disease could only come from identification of the relevant plasmodium species' DNA in the blood of past sufferers.[22] However, indirect evidence from human remains suggests that there is a clinically established association between *Plasmodium vivax* malaria and skeletal lesions associated with chronic anemia and marrow hypertrophy. Putative evidence unearthed from Anglo-Saxon cemeteries indicates the presence of this form of malaria among the population of Eastern England during the Romano-British transgression and Anglo-Saxon period 300 to 1050 A.D. when warmer temperatures and the flooding of lowlands provided an ideal environment for the propagation of mosquitoes.[23] At any rate, some such intermittent fever was recognized and referred to as the *Lencten ádl* or Spring illness.[24] A lack of documentary sources prior to the sixteenth century may suggest that malaria did not become endemic in the English Lowlands until the post-mediaeval period.[25]

Identifying the disease is further complicated by the fact that sources never specifically refer to malaria until the nineteenth century. The term most commonly used before then to describe any type of acute or continued fever was the "ague" derived from the Latin *febris acuta* or acute fever. Ague, however, was certainly applied to many other conditions, most notably to include typhus and even influenza in general. One clue to differentiate malaria from other diseases lay in the patient's responsiveness to powdered cinchona or Peruvian bark (*Cinchona rubra*) sometimes known as the "Jesuit's powder": those who showed no improvement after the administration of quinine suffered from some other malady.[26] Cinchona bark, though introduced into England in the mid-seventeenth century, was restricted to the elite and wealthy, and was not in common use until the 1780s.[27]

Most authorities, however, agree that malaria was certainly prevalent in England by the sixteenth century, perhaps, (re-)introduced by Protestant refugees fleeing the Netherlands where *Plasmodium vivax* was known to be rife.[28] A wealth of incidental documentary data exists, casual references to the disease in the correspondence of the powerful and wealthy, attesting to its frequency even among the higher echelons of society. Dr. Bancroft, Bishop of London, pleaded to be excused his services as Commissioner to Denmark in 1600 on the grounds that he had recently suffered from "five fits of tertian ague."[29] Similarly, Lord Darcy

was "so exceedingly tormented with an ague" on 24 February 1600 that he had not been able "to stir abroad," commenting that "it hath so weakened me as I cannot well sit on a horse, much less go on foot."[30] Sir Walter Raleigh was troubled by it while he lay in the Tower awaiting his execution in 1618 and the poet, John Milton, was said to have suffered severely from its symptoms while living in Cambridge, in the heart of the Fen country.[31] Already by 1680, the Bishop of Ossory, Thomas Otway, could casually compare the shifting alliances among local aldermen to "the cold and hot fits of an ague succeed[ing] each other."[32]

Nor was the king spared such travails: James I and Oliver Cromwell were considered by their contemporaries to have died of malaria.[33] Charles II suffered repeatedly from it, having an attack in August 1679 and again in May 1680 when he was ill for a week and only recovered through the expeditious administration of the Jesuit's powder obtained from a French apothecary.[34] Queen Anne was also said to suffer from yearly relapses of the ague in the early eighteenth century.[35] Less, of course, is known about the other ranks of society. In this respect, the contribution and career of Robert Talbor (1642-81) is of note both as regards his dissemination of cinchona bark as a cure in England and because his notoriety attests to the prevalence of malaria at least in the lowland areas along the eastern seaboard. Going down from the University of Cambridge in 1668, he settled in Essex along the coast "where the agues are the epidemical diseases" to better concoct an effective remedy.[36] One such epidemic appears to have occurred between 1657 and 1659 when especially the rural population was struck down by waves of intermittent fever.[37] Malaria was also said to have been "among the most prevalent and most fatal diseases of the metropolis" in the years leading up to the Great Fire of London in 1666 and to have recurred again in the 1670s.[38] According to Dr Fothergill, it still had "considerable prevalence" in the eighteenth century, and was particularly virulent between 1751 and 1754.[39]

In fact, any population in the British Isles was susceptible to malaria under certain conditions, such as the epidemic that struck Shropshire between January and July 1785 which, however, "soon yielded to the application of the bark."[40] However, as Mary Dobson observes, malaria "was unique in its geography – it was a disease endemic in the marshlands and rarely prevalent in other parts of England."[41] Its distribution was limited mainly to the English Lowlands -- the Fens, along the banks of the Thames, the coastal marshes of Essex, Kent and Sussex, and the Holderness of Yorkshire (see Figure 2).[42] The inhabitants of this region historically suffered accordingly in terms of much higher levels of sickness, ill-health, and death than other regions of England. Life expectancy at birth was little more than 30 years for

those who resided in the marshlands with crude death rates two or three times those of neighbouring non-marshland parishes.[43] The *Report from the Select Committee on Thames Marshes* published in 1854, for instance, clearly identifies the extent of the problem in the marshes surrounding the metropolitan area and attempts to measure its frequency among the affected populations along the river, suggesting a morbidity rate of around 28 per thousand for the Woolwich Arsenal district in 1843, and a mortality rate of one in every 35 cases.[44]

[INSERT Figure 2: The Geographical Distribution of Endemic Malaria in England]

More interesting, however, is the 1863 specifically commissioned survey of the extent of malaria in marshland areas of England by Dr. George Whitley. Whitley's was the first systematic attempt to ascertain who died, where they died, and what caused their deaths. In the first place, the report confirmed that malaria was mainly confined to the English Lowlands and one or two other pockets of low-lying, mainly drained land on the west coast. The disease was seasonal, most prevalent in spring and early summer, and then in autumn. There were periods, too, when the disease was resurgent and widespread, and other years when there were few cases. Whitley observed, too, that malaria was still endemic to certain parts of England, reaching epidemic proportions in 1826 and 1827, and again between 1857 and 1859. On these occasions, the disease spread much more widely affecting populations in areas where malaria was seldom known. Alfred Haviland, for instance, a member of the Royal College of Surgeons, who visited the village of Cannington in Somerset reported that there had been 94 cases of malaria among a population of not more than 800 people in 1858.[45]

The disease was not often fatal but the statistics may be misleading. Mortality was rarely attributed to malaria even when it was a major cause of death. "For when marsh-malaria destroys life in this climate, almost always it is by secondary, not by primary effects" observed a report into the sanitary state of the people of England in 1858.[46] Moreover, in areas where ague was prevalent, a large number of those affected simply purchased quinine from the druggist and never applied for medical advice at all.[47] There are indications, too, that local populations had built up a degree of immunity to the disease and that in some areas "a regular form has succeeded, which interferes but little with the usual occupations of those affected."[48]

The poor and ill-fed were most at risk. Ague was particularly prevalent amongst the poorer segments of the rural population; hop-pickers in the southern counties were notoriously susceptible to the disease especially during the wet season.[49] Medical officers held existing irrigation practices and the creation of stagnant pools responsible for malaria.[50] In urban areas, though the incidence of ague was lower, the deplorable condition of much of the housing made the disease endemic to the poorer, badly drained quarters of the city.[51] A report on poor relief in 1870 found that 28% of paupers suffered intermittent attacks of malaria with the percentage twice as high among the non-institutionalized ("out-door") indigents.[52] Ironically, too, malaria seemed to follow in the wake of large-scale urban "improvements" or infrastructure projects: in London, the creation of Regent's Park and the excavations involved with St Katherine's Docks were cases in point.[53]

Convicts were another vulnerable group, particularly those incarcerated in the prison hulks moored along the Thames. In the first quarter of 1847 alone, 157 prisoners were treated for malaria on board the "Justitia" and there were recurrent outbreaks of the disease due to the nature of the low-lying surrounding locality. Ague was also prevalent in the surrounding district of Plumstead where "scarcely a family escaped" the fever and among the free laborers employed in the Woolwich Arsenal.[54] Certain occupations were also more at risk of contracting the disease than others. Particularly those who worked on water, sailors, boatmen, and bargemen were said to suffer more.[55] Sailors on-board men-of-war lying in the Medway were frequently infected by the malaria endemic to the surrounding district of Sheerness.[56] Nor were the military implications of this situation unrecognized, with one report concluding that it was: "evident that a large proportion of our naval reserve may be paralyzed by ague and fever at the very time when it may be called upon to fight."[57] Age, too, was a concern. In certain areas, up to one-sixth of the school-aged population might be absent with the ague at any time, especially in spring and autumn.[58] The disease was more common among children than adults.[59] While a parallel inquiry to Whitley's showed no clear link between malaria and higher death rates among children in the mid-nineteenth century, infant mortality in marsh districts was almost as great as in some of the large factory towns.[60] Despite the plethora of historical and contemporary evidence that showed the widespread nature of the problem, however, Whitley's most surprising finding was that "intermittent and remitting fevers and their consequences can no longer be regarded as seriously affecting the health of the population in many of the districts in which those diseases were formerly of a formidable character."[61] That is while malaria until recently had been a significant factor affecting

especially rural health in the English Lowlands, its incidence was in rapid decline by the 1860s.

Water management

As might be expected from such a startling revelation, there was much speculation by Whitley and others as to the factors that might be responsible for the dramatic reduction in the number of malaria cases over the previous 30 years, a decline, moreover, that was only confirmed in subsequent decades. There were 8,209 reported deaths from malaria between 1840 and 1910 though the number of fatalities declined as the century progressed.[62] There was a resurgence of the disease between 1858 and 1860 and isolated pockets of malaria persisted well into the late nineteenth, especially in and around the marshes. The medical officer at Tillingham in Essex reported that a mild intermittent fever known locally as "the chills" was sometimes still contracted in 1876. On the south coast, agues continued to infect the townspeople of Rye and "everybody who goes there" as late as 1882 though the illness was not considered serious as there was "nothing fatal in it though it is unpleasant."[63] In the Isle of Sheppey in the Thames estuary and the Isle of Grain at the easternmost tip of the Hoo Peninsula in Kent, areas notorious for fever, malaria remained endemic till after World War I.[64] These exceptions, however, only proved the rule: that, in fact, the disease had all but disappeared from the landscape of the English Lowlands by the turn of the twentieth century. Improved medical techniques, the use of drugs such as Mepacrine, and the spraying of infected houses with D.D.T. had virtually eliminated the threat by the late 1940s.[65]

If there was general acceptance that malaria in England was declining by the mid-nineteenth century, there was also near unanimity on the cause of that decline. In areas where there had been substantial drainage works, malaria had declined; in areas where few such operations had been undertaken or carried out in an inadequate fashion, the disease was still prevalent. Josiah Parkes, a local landowner, observed how the inhabitants of a small hamlet in the New Forest (Hampshire) who had "previously suffered much from intermittent fevers" were completely free of the disease after an extensive tract of country was drained in the 1840s.[66] Dr. Churchill, a district medical officer near Netley Abbey (Southampton Water) reported in 1858 how malaria had become less frequent over the previous 40 years "under improvement of cultivation and drainage."[67] James Cornwall, another doctor and long-term resident of Fairford in the upper Thames Valley recorded how in 1866 he scarcely saw a single case of

ague where formerly there had been "a great deal," a state of affairs that "has arisen of course from the improved drainage of the parish itself."[68] On occasions, too, it was even possible to quantify this reduction. Admittances for ague at the local hospital serving Woolwich, a district notorious for endemic malaria, declined precipitously in the years following its effective drainage: there were 382 cases of fever in 1848, 146 in 1849, 78 in 1850, 41 in 1851, and a mere five by 1856.[69]

As might be expected, the informants to Whitley's report told a similar story – that the disappearance of malaria was due to improved water management. Mr. Keddle, a doctor who had practiced medicine in Sheerness for over 40 years, attributed the decrease in the number of his malaria patients to "the large amount of surface drainage carried out of late years, both in arable and pasture lands."[70] Another practitioner, Dr. Graham, retired after 47 years practice in Rochford came to much the same conclusion, a state of affairs that he attributed to "the large amount of surface drainage carried out in a gravelly soil during the last 25 years."[71] This and similar evidence persuaded Whitley to conclude that "the diseases which have been made the subject of the present enquiry have been steadily decreasing in frequency and severity for several years, and this decrease is attributed in very nearly every case mainly to one cause, improved land drainage." To substantiate his conclusions, he noted that in areas where land improvements had yet to be made, such as in Huntspill and the marshes on the banks of the River Swale, and in the districts of Sheppey, Hoo, Spalding, Hull, New Romney, and Lewis, there had been no lessening or only a marginal reduction in the number of cases.[72]

Popular conviction for such a strong causal relationship between malaria and drainage lay partly in the prevalent medical explanations of how the disease was contracted, and partly in what appeared to be a marked coincidence in timing. Ague, though not unique to the English Lowlands, was clearly associated with the region's fens, marshlands, and low-lying waterlogged environment. It was commonly held, for example, that tidal estuaries were an acute source of malaria, that the admixture of fresh with saltwater proved a particularly deleterious setting, that trees prevented the "free motion of the air" with consequences to health, and that the "prevalence of easterly winds" over the marshes of Essex and Kent caused fever as far afield as London.[73] The timing of its reappearance, too, was noted in relation to seasonal flooding and that "agues and fevers of all characters prevailed to a very great extent" when this occurred.[74] In particular, malaria was directly attributed to the miasmas or vapors rising from stagnant waters. As Peter Bossey, medical practitioner

residing at Woolwich explained in answer to a question put to him at the Select Committee on Thames marshes in 1854:

> "Malaria varies in intensity; it is, perhaps, most intense in the morning and in the summer season, after there has been a great evaporation going on under a hot sun. In the early mornings, at three or four o'clock, a little fog arises upon the marsh, perhaps not about three feet high, which is exceedingly offensive upon going into it; I have taken a very severe remittent fever and ague from passing through that fog; persons who are out early in the morning in the marshes, before the fog is dissipated, suffer very much from ague."[75]

In particular, these noxious and pestilential vapors arose from the exposure of rank vegetation previously submerged in water and exposed to sunlight either through natural causes such as falling water levels from lack of rainfall or hot, dry summers, or as a result of human actions such as dredging waterways, cuts, and ditches. As Richard Heath whose medical practice included the marshes from Purfleet to West Tilbury observed in 1854: "We do not know the specific poison which produces it; we only know that ague, and all the diseases of that type, originate from breathing a malarious atmosphere, which arises from decomposition of vegetable matter."[76] To prove his point, he noted how the use of convict labor to carry out the pernicious work of dredging the ditches had resulted in much higher levels of malaria among the population of the prison hulks moored in the Thames.[77]

However, the English landscape was undergoing radical change in the nineteenth century from a combination of factors that included the enclosure of the last remaining "wastelands" and the widespread underdrainage of fields. This process did not affect the English Lowlands more than other regions. Indeed, enclosure had its most profound effects on the highland areas of the North West and North East, Wales and Cornwall where the percent of land with poor soils, broken relief, and high rainfall was the highest.[78] Much the same areas also underwent intensive underdrainage during the nineteenth century.[79] But the Holderness of Yorkshire, Lincolnshire, Cambridgeshire, and parts of Norfolk were among the counties particularly affected by these processes. Swamps were drained, soils improved, forests felled, and new fields brought under cultivation. Perhaps, as much as 50,000 km² (some 12 million acres) and equivalent to about half the agricultural land in England and Wales had its nature transformed during the nineteenth century.[80] A. D. M. Phillips went so far as to call the laying

of "bush" (timber, stone, and straw) or earthenware tile piping below the surface of fields as having completed the historic "making" of England's soils.[81]

The association between water management and disease seemed obvious to doctor, engineer, and lay person alike in the mid-nineteen century: the ague or malaria had been rife until recently, extensive drainage of low-lying waterlogged fields had been undertaken in recent decades, so there must be a connection between the two. If there were less noxious miasmas to inhale because there was less evaporation from the land because there was less water, then there would naturally be a reduction in the amount of "bad air" or malaria. And the consequent sharp decline in cases of malaria experienced across the English Lowlands simply confirmed the supposed scientific validity of these conclusions. Moreover, there was also the question of timing. The exemption of drainage tiles from tax in 1826 and the mechanization of how they were laid after 1845 reduced the cost of underdrainage by about 70 per cent and led to a period of intensive activity that continued for the next half-century.[82] It was precisely after this that medical practitioners began to observe a notable reduction in the number of patients suffering from malaria – or at least, with hindsight, that appeared to be the case.

The reverse was also true and provided further evidence to confirm people's opinions: where large-scale drainage works had not yet been undertaken, the ague still lay heavy upon the locality leading to ill-health, poverty, and dereliction. The village of Erith in the Thames marshes was one such place whose inhabitants suffered greatly from malaria. The village was also the site for Charles Dicken's "Dumbledowndeary," a community often satirized in his weekly magazine of short fiction and crusading social journalism, *Household Words*.[83] Un-drained, low-lying, marshy neighborhoods, it was considered, were "in one continual state of ague." Moreover, this was a social as well as a physical landscape, one where height above sea level reflected both social position as well as susceptibility to disease. The evidence of Sir Culling Eardley whose estate lay in the same parish of Erith provides a telling snapshot of the verticality of risk in the mid-century English Lowlands. The baronet's own residence was largely protected from the disease compared to the houses of commoners because of the height of its situation and the nature of its construction. But even within the house, there had been more than one instance of malaria among the man-servants who slept in the basement but not one case among his family members or even the maidservants who slept in the attic. Such observations confirmed Eardley in his belief that "the higher you ascend a hill, the less liable you are to ague." People, too, were deterred from settling permanently in the village from fear of the disease. The baronet recounted three occasions when educated professional

men, a scripture reader and two schoolmasters, whom he had employed and brought to work in the locality had been forced to resign and move elsewhere because of the ill-health they and their families soon experienced.[84] Nor was the disease confined only to marshland but "the poison" was carried on the "currents of air…far beyond the centre of its production."[85]

Identity and the disappearance of the English Lowlands

There were few voices at the time who contested the seemingly irrefutable evidence that land improvements particularly drainage dramatically reduced the number of malaria cases in the English Lowlands. True, some more discerning medical men noted that the incidence of malaria had declined even where there had been no extensive drainage carried out in recent decades like at Lewes in Sussex or at Christchurch in Dorset.[86] Even more discerning commentators noticed that the disease had begun to decline before the commencement of extensive drainage works as in Ulverston in Cumbria.[87] Still others observed that the incidence of malaria had actually temporarily increased at the time of such operations or in their immediate aftermath as was the case in the marshes surrounding the towns of Wells and Peterborough.[88] Thomas Peacock, Assistant-Physician at St Thomas's Hospital in Lambeth (London), wrote how malaria cases seem to increase in areas where waterlogged soil had been exposed in the making of roads, railways or canals in marsh districts.[89]

The discovery by Italian malariologists of the mosquito-cycle of the malaria parasite in humans in 1898 initially only served to confirm medical opinion that the drainage of the marshlands during the nineteenth century was responsible for the disease's disappearance from the English Lowlands.[90] Even if miasmas were no longer considered to cause the disease, it was now assumed that draining the marshes had eradicated the breeding ground of the Anopheles mosquito, and, as the vector numbers declined, so did the incidence of malaria. Unfortunately, it was soon discovered that even though the disease had virtually disappeared, the particular species of Anopheles that carried malaria in England had not and was still prevalent in such areas.[91] In fact, the mosquito population of former marshlands in England was often greater than the numbers to be found "in many exceedingly malarious places in the tropics."[92] Evidently, the explanation for the decline in malaria was more complex.

The rather neat explanation that links the decline in malaria with improvements in field drainage is not accepted by contemporary historians. Tom Williamson, for instance, argues

that nineteenth-century drainage schemes mainly only relocated standing water from fields to perimeter ditches and arterial drainage channels, that the main period of flooding was in winter rather than summer when mosquitoes bred, and that land improvements actually encouraged the spread of farms and cottages across the marshlands exposing more people to the disease.[93] While not dismissing completely the reduction in mosquito-breeding areas, historians proffer other causal factors including changes in agricultural practices, the better ventilation and lighting of houses, the separation of animal shelters from human habitation, the wider use and cheaper availability of quinine, and general improvements in living standards and public health.[94] The combined effect of such factors may have been sufficient to reduce malaria below the critical level necessary for maintaining the parasite's cycle in humans and the disease was reduced to isolated pockets before virtually dying out.[95]

In fact, the malaria parasite did linger on in isolated pockets of the English Lowlands. There were still cases of indigenous malaria in low-lying parts of south-east English at the turn of the twentieth century.[96] A significant outbreak occurred when infected troops returning from Salonika in Greece were stationed on the Isles of Sheppey and Grain between 1917 and 1918, resulting in at least 330 cases of vivax malaria. From 1917 to 1952, there were 566 cases of indigenous malaria, mostly between 1917 and 1921, of which 90 per cent were in coastal south-east England.[97] The very last known case of indigenous vivax malaria occurred in London in 1953 when a housewife aged 27 and an eight-year-old boy who lived in adjacent semidetached houses in Stockwell (South London) were diagnosed with the disease. The vector in this case was thought to be *Anopheles plumbeus* found in the bole of a tree trunk on nearby wasteland.[98]

In many respects, though, the reason for the decline of malaria from eastern England is not so important as the simple fact of its disappearance. The regional character of the English Lowlands was not only defined by its distinctive physical landscape of marshes, fens, and low-lying waterlogged areas but equally by the unique physical and social characteristics of its people brought about by the endemic nature of the malaria that was so much part of living in that environment. As every laborer in Lincolnshire or Essex knew, wrote John MacCulloch in 1829 opening his learned treatise on the causes and treatment of malaria, "his ague is the product of his fens."[99] Not only were its denizens remarked upon for their pallid complexion borne from the anemia characteristic of those suffering from endemic malaria but even their social customs were viewed as strange and quaint by their fellow countrymen.[100] Outsiders were amazed by the boats that supplied people with provisions through the upper rooms of

their houses when the land was inundated and the curious custom of riding unshod horses when it was not.[101] And by the hordes of gnats and midges that required the more affluent to sleep encased by nets, some made from silk, "to secure them from being bitten and disturbing their rest."[102] That notorious and not entirely believable raconteur of English life, Daniel Defoe, not only remarked on "the strange decay" of the female sex in that region but of the propensity of its menfolk to have from five to six (even as many as 15) wives. In an oft quoted passage, he explains:

> "The reason, as a merry fellow told me, who said he had had about a dozen and a half of wives…was this; that they are being bred in the marshes themselves, and seasoned to the place, did pretty well with it; but that they always went up into the hilly country, or to speak their own language into the uplands for a wife: that when they took the young lasses out of the wholesome and fresh air, they were healthy, fresh and clear, and well; when they came out of their native air into the marshes among the fogs and damps, there they presently changed their complexion, got an ague or two, and seldom held it about half a year, or a year at most; and then, said he, we go to the uplands again, and fetch another."[103]

Even as late as the nineteenth century, the reputedly seasonal salutation for people greeting one another in the early months of the year was: "Have you had your ague this spring"?[104] Malaria was figuratively as well as literally in the blood of the people who lived in the English Lowlands. Their widespread use of opium, reportedly as much as a dram a day, as a palliative against the fever, also marked them out as a "race" apart. "More opium," it was said, "used to be sold by the chemists, at the shops in the towns in the Fenland of Lincolnshire, Cambridge and Norfolk, as a stimulant used by the laboring classes, than in all the rest of England put together."[105] "Poppy-head tea" had also been a traditional remedy for all manners of complaints even before the introduction of commercial opium and opium preparations in the nineteenth century.[106] But, like so much that was distinctive about the inhabitants of this region, even the use of opium was dying out by the end of the nineteenth century and not one third of the amount that had previously been sold was now consumed.[107] Even the regional vernacular architecture was undergoing a profound transformation. Gone were the distinctive houses on stilts raised above the flood level and flight zone of most mosquitoes, more reminiscent of a Southeast Asian maritime environment, and in their place were houses that were lighter and had windows, were better ventilated and were less damp, were provided with floors and ceilings that shut off bedrooms from the rafters of the roof,

that were more open and less crowded, and were more frequently painted or whitewashed inside.[108] While these changes made houses much less liable to harbor Anopheles mosquitoes and so contributed materially towards the reduction in the number of malaria cases, they also helped make the English Lowlands far less physically and culturally distinct from the rest of the country.

Ultimately what gave the English Lowlands its distinctive regional character was not so much a matter of scientific or medical fact as the physical and social construction of the landscape and its people: its marshes and fenlands and a history of managing water to reduce risk and increase productivity on the one hand; and, on the other hand, the chills and fevers, the agues caused by vivax malaria to which its inhabitants' bodies had gradually grown accustomed and whose communities had evolved strange customs to deal with. As the water drained away from its fields and the Plasmodium malariae disappeared from the bloodstreams of its inhabitants, so did popular perceptions of a separate regional identity begin to fade from the national and even the local consciousness. This process was already well underway during the second half of the nineteenth century and was effectively completed in the decades following World War I. While a memory of this separate identity lingers on at the local level, a recent survey found that those living in the East Anglian region are three times more likely to be aware of flood risk than residents in some other parts of England, no historical consciousness remains of the risk of malaria.[109] Most people alive in England today have no idea that the disease was once endemic to parts of their country and not simply a necessary precaution to be considered before going on holiday to warmer, more feverish climes.

NOTE

All maps were drawn by Geoffrey Martin.

[1] W. E. Dring, *The Fenland Story from Prehistoric Times to the Present Day* (Cambridge, Cambridgeshire and the Isle of Ely Education Committee, 1967), 33.

[2] Daniel Defoe, *A Tour through the Whole Island of Great Britain* (Aylesbury: Penguin Books 1986 – first published 1724- 6), 53.

[3] The argument for an English Lowlands is set out in an earlier article; see: Greg Bankoff, 'The "English Lowlands" and the North Sea Basin System: A History of Shared Risk,' *Environment and History* 19, 1 (2013):

3-37. The map of England has been subdivided into regions many times. Apart from strictly political divisions, agriculture based on distinctive regional patterns in the field system has been the principal criterion for deciding these boundaries: Howard Grey, *English Field Systems* (London: Harvard University Press/Merlin Press, 1959), and Eric Kerridge, *The Agricultural Revolution* (London: George Allen and Unwin, 1967). Later historians focused more on agrarian histories, such as Joan Thirsk, *The Agrarian History of England and Wales* (Cambridge: Cambridge University Press, 1967), 8 volumes. In most of these histories, however, coastal wetlands do not appear as a comprehensive unit to be dealt with separately. Floods are present in all these narratives but they rarely come to the fore and remain more of a continual backdrop to the unfolding social, economic, and political events that provide the storyline. See, for instance, Anne Reeves and Tom Williamson, 'Marshes,' in J. Thirsk (ed.), *The English Rural Landscape* (Oxford: Oxford University Press, 2000). Only Jeremy Purseglove goes some way to crediting flood with a more central role in *Taming the Flood: A History and Natural History of Rivers and Wetlands* (Oxford: Oxford University Press, 1988).

[4] Stephen Rippon, *The Transformation of Coastal Wetlands: Exploitation and Management of Marshland Landscapes in North West Europe during the Roman and Mediaeval Periods* (Oxford: The British Academy, 2000), 64-72.

[5] See the extensive series of Fenland Survey reports published as volumes of *East Anglian Archaeology*.

[6] Joan Thirsk, *English Peasant Farming: The Agrarian History of Lincolnshire from Tudor to Recent Times* (London: Routledge and Kegan Paul, 1957), 108.

[7] Dorothy Summers, *The Great Level: A History of Drainage and Land Reclamation in the Fens* (London and Vancouver: David and Charles, 1976), 26; Robert Silvester, 'Medieval Reclamation of Marsh and Fen,' in H. Cook and T. Williamson (eds.), *Water Management in the English Landscape: Field, Marsh and Meadow* (Edinburgh: Edinburgh University Press, 1999), 127.

[8] Robert Silvester argues that the extent of Saxon drainage practices is often underrated. Silvester, 'Medieval Reclamation of Marsh and Fen,' 127-132. See also Andrew Wareham on 'Cnut's Dyke.' Andrew Wareham, 'Water Management and the Economic Environment in Eastern England, the Low Countries and China, c. 960-1650: Comparisons and Consequences,' *Jaarboek voor Ecologische Geschiedenis* (2005/6): 17-18.

[9] Dorothy Summers, *The Great Level: A History of Drainage and Land Reclamation in the Fens* (London and Vancouver: David and Charles, 1976), 63-78.

[10] Christopher Taylor, 'Fenlands,' in J. Thirsk (ed.), *The English Rural Landscape* (Oxford: Oxford University Press, 2000), 182.

[11] Eric Kerridge, *The Agricultural Revolution* (London: George Allen and Unwin, 1967), 222-239.

[12] Christopher Taylor, 'Post-medieval Drainage of Marsh and Fen,' in H. Cook and T. Williamson (eds.), *Water Management in the English Landscape: Field, Marsh and Meadow* (Edinburgh: Edinburgh University Press 1999), 144.

[13] Greg Bankoff, *Cultures of Disaster: Society and Natural Hazard in the Philippines* (London: Routledge 2003); Greg Bankoff, 'Cultures of Disaster, Cultures of Coping: Hazard as a Frequent Life Experience in the Philippines, 1600-2000,' in C. Mauch and C. Pfister (eds.), *Natural Disasters, Cultural Responses: Case Studies Toward a Global Environmental History* (Lanham: Lexington Books 2009), 265-284.

[14] Sir William McArthur, 'A Brief Story of English Malaria,' *Post-Graduate Medical Journal* 22 (1946): 198.

[15] Anne Reeves and Tom Williamson, 'Marshes,' in J. Thirsk (*ed*.), *The English Rural Landscape* (Oxford: Oxford University Press 2000), 156, 161.

[16] Keith Snow, 'Distribution of Anopheles Mosquitoes in the British Isles,' *European Mosquito Bulletin*, 1 (1998): 9-13.

[17] George H. F. Nuttall, Louis Cobbett and T. Strangeways-Pigg, 'Studies in Relation to Malaria I. The Geographical Distribution of Anopheles in Relation to the Former Distribution of Ague in England,' *The Journal of Hygiene* 1, 1 (1901): 4-44.

[18] See, in particular, a number of works by Mary Dobson: Mary Dobson, *Contours of Death and Disease in the Early Modern England* (Cambridge: Cambridge University Press 1997), 287-367; Mary Dobson, '"Marsh Fever"– the Geography of Malaria in England,' *Journal of Historical Geography* 6, 4 (1980): 357 – 389; Mary Dobson, 'History of Malaria in England,' *Journal of the Royal Society of Medicine* Supplement No.17, 82 (1989) 3-7; Alice Nicolls, 'Fenland Ague in the 19th Century,' *Medical History* 44, 4 (2000): 513-530.

[19] Robert Sallares, *Malaria and Rome: A History of Malaria in Ancient Italy* (Oxford: Oxford University Press 2002), 34.

[20] S. P. James, *Malaria at Home and Abroad* (London: John Dale, Sons and Danielsson 1920).

[21] P. G. Shute, 'Failure to Infect English Specimens of *Anopheles Maculipennis* var. *atroparvus* with Certain Strains of *Plasmodium falciparum* of Tropical Origin,' *Journal of Tropical Medicine and Hygiene* 43 (1940): 175-178. Only one species of mosquito currently found in the UK could have possibly acted as a vector for *Plasmodium falciparum* but it does not have a coastal distribution. Robert A. Hutchinson, *Mosquito Borne Diseases in England: Past, Present and Future Risks, with Special Reference to Malaria in the Kent Marshes*., Durham theses, Durham University, 19, 23. Available at Durham E-Theses Online: http://etheses.dur.ac.uk/3067/

[22] New research uses x-ray diffraction to confirm the presence of hemozoin, a crystalline waste product of the malaria Plasmodium parasite, in the skeletons of people infected with malaria in the past. Jamie Inwood, 'Identifying Malaria in Ancient Human Remains: A Molecular and Biochemical Approach,' Yale University Ph.D., 2017.

[23] R. L. Garland and A. G. Weston, 'Morbidity in the Marshes: Using Spatial Epidemiology to Investigate Skeletal Evidence for Malaria in Anglo-Saxon England (A.D. 410-1050),' *American Journal of Physical Anthropology* 147 (2012): 301-311.

[24] McArthur, 'A Brief Story of English Malaria': 199.

[25] Mary Dobson, 'Malaria in England: a Geographical and Historical Perspective,' *Parassitologia* 36 (1994): 35-50.

[26] S. P. James, 'The Disappearance of Malaria from England,' *Proceedings of the Royal Society of Medicine, Section of Epidemiology and State Medicine* 23 (1929): 72.

[27] Ibid., 82; James L. A. Webb, *Humanity's Burden: A Global History of Malaria* (Cambridge: Cambridge University Press, 2009), 96-97.

[28] Hutchinson, *Mosquito Borne Diseases in England*, 19-20; Dobson, '"Marsh fever"': 381-382.

[29] *Calendar of the Manuscripts of the Most Hon. the Marquis of Salisbury, &c. &c. &c. Preserved at Hatfield House, Hertfordshire Part X.* (London: HM Stationery Office 1904), xxviii.

[30] *Calendar of the Manuscripts of the Most Hon. the Marquis of Salisbury, &c. &c. &c. Preserved at Hatfield House, Hertfordshire Part XI.* (London: HM Stationery Office 1906), 80.

[31] McArthur, 'A Brief Story of English Malaria': 199.

[32] *Calendar of the Manuscripts of the Marquess of Ormonde, K.P. Preserved at Kilkenny Castle new series, vol. V.* (London: HM Stationery Office 1908), 491.

[33] Oliver Cromwell who died of fever in September 1658 was offered cinchona bark but apparently refused it. G. W. Keeble, 'A Cure for the Ague: the Contribution of Robert Talbor (1642 – 81),' *Journal of the Royal Society of Medicine* 90 (1997): 287.

[34] *Calendar of the Manuscripts of the Marquess of Ormonde, K.P. Preserved at Kilkenny Castle new series, vol. V.* (London: HM Stationery Office 1908), 191, 317-318, 324.

[35] Ibid., 444.

[36] Keeble, 'A Cure for the Ague': 285-290.

[37] W. H. Wheeler, *History of the Fens of South Lincolnshire* (Boston: J. M. Newcombe and London: Simpkin, Marshall & Co. 1897): 568-572.

[38] *Papers Relating to the Sanitary State of the People of England: Being the Results of an Inquiry into the Different Proportions of Death Produced by Certain Diseases in Different Districts in England* (London: George E. Eyre and William Spottiswoods 1858), xxxvi.

[39] Ibid., xxxvi; *Sixth Report of Medical Officer of the Privy Council with Appendix* (London George Eyre and William Spottiswoode 1864), 32.

[40] W. Coley, 'Some Account of the Late Epidemic Ague, As It Appeared in the Neighbourhood of Bridgnorth in Shropfhire,' *The Gentleman's Magazine* 50, 1 (February 1785): 83.

[41] Dobson. '"Marsh Fever"': 377.

[42] Outside of the English lowlands, malaria was only endemic to the Ribble district of Lancashire and possibly the Somerset Levels.

[43] Dobson, 'History of Malaria': 4.

[44] *Report from the Select Committee on Thames Marshes; Together with the Proceedings of the Committee, Minutes of Evidence, Appendix* (Westminster: House of Commons 1854), 3-4.

[45] Alfred Haviland, 'Ague Epidemic at Cannington,' *Journal of Public Health and Sanitation Review* 4 (1858): 268.

[46] *Papers Relating to the Sanitary State of the People of England* (London: George E. Eyre and William Spottiswoods 1858), 105.

[47] *Sixth Report of the Medical Officer of the Privy Council*, 430.

[48] Ibid., 450.

[49] *Reports of Special Assistant Poor Law Commissioners on the Employment of Women and Children in Agriculture* (London: W. Clowes and Sons 1843), 137.

[50] *Minutes of Information Collected on the Practical Application of Sewer Water and Town Manures to Agricultural Production* (London: George E. Eyre and William Spottiswoods 1852), 8.

[51] *Local Reports on the Sanitary Condition of the Labouring Population of England* (London: W. Clowes and Sons 1842), 49; *Report Lately Made to the Board of Health, in Reference to the Sanitary Conditions of Agar Town, St Pancreas* (London: The House of Commons 1851), 9-10.

[52] *Returns "Showing the Number and Ages of the Paupers on the District and Workhouse Medical Officers' Relief Books in the Several Unions and Parishes in England and Wales, on the Last Day of the Twelfth Week of the Half-Year Ended at Lady-day 1870"* (London: The House of Commons 1870), xv.

[53] Ibid., 16-17.

[54] *Report and Minutes of Evidence Taken upon an Inquiry into the General Treatment and Condition of the Convicts in the Hulks at Woolwich* (London: W. Clowes and Sons 1847), xxiv, 350.

[55] *Papers Relating to the Sanitary State of the People of England*, 108.

[56] *Appendix to the Report of the Commission for Improving the Sanitary Conditions of Barracks and Hospitals (Interim Reports)* London: George E. Eyre and William Spottiswoods 1863), 45.

[57] *Twentieth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England* (London: George E. Eyre and William Spottiswoods 1859), xxvii.

[58] *Sixth Report of the Medical Officer of the Privy Council*, 432.

[59] *Reports of Special Assistant Poor Law Commissioners on the Employment of Women and Children in Agriculture*, 208.

[60] Alfred Haviland recorded that of the 94 cases of malaria he treated in the village of Cannington in 1857, 46 cases were persons under 20 years old. Haviland, 'Ague Epidemic at Cannington': 268; 33, 457.

[61] Ibid., 450.

[62] Katrin Gaardbo Kuhn, Diarmid H. Campbell-Lendrum, Ben Armstrong, and Clive R. Davies, 'Malaria in Britain: Past, Present, and Future,' *Proceedings of the National Academy of Sciences* 100, 17 (2003): 9999.

[63] *Report of a Committee Appointed to Consider Certain Questions Relating to the Employment of Convicts in the United Kingdom* (London: George E. Eyre and William Spottiswoods 1882), 19.

[64] *Forty-Eighth Annual Report of the Local Government Board, 1918-1919. Supplement Containing the Report of the Medical Department for 1918-19* (London: HM Stationery Office 1919), 35.

[65] P.G. Shute, 'A Review of Indigenous Malaria in Great Britain after the War of 1939-1945, Compared with the Corresponding Period after the 1914-1918 War (with Some Observations of the Aetiology), *Monthly Bulletin of the Ministry of Health and the Public Health Laboratory Service* 8 (1949): 2-9.

[66] *Minutes of Information Collected in Respect to the Drainage of the Land Forming Sites of Towns, to Road Drainage, and the Facilitation of the Drainage of Suburban Lands* (London: George E. Eyre and William Spottiswoods 1852), 70.

[67] *Report on the Site of the Royal Victoria Hospital, near Netley Abbey* (London: Harrison & Sons 1858), 74.

[68] *First Report of the Commissioner's Appointed to Inquire into the Best Means of Preventing the Pollution of Rivers (River Thames) vol. 1 Report, Appendix, and Plans* (London: George E. Eyre and William Spottiswoods 1866), 240.

[69] *Reports of the Directors of Convict Prisons on the Discipline and Management of Pentonville, Millbank, and Parkhurst Prisons, and of Portland, Portsmouth, Dartmoor, Chatham, and Brixton Prisons, with Fulham Refuge and the Invalid Hulks for the Year 1856* (London: George E. Eyre and William Spottiswoods 1857), 308.

[70] *Sixth Report of Medical Officer to the Privy Council*, 435.

[71] Ibid., 434-435.

[72] Ibid., 33.

[73] *Report on the Site of the Royal Victoria Hospital*, 6; *Minutes of Information Collected on the Practical Applications of Sewer Water and Town Manures*, 8; *Minutes of Information Collected in Respect to the Drainage of the Land Forming the Sites of Towns*, 5.

[74] *Report of Her Majesty's Principal Secretary of State for the Home Department, from the Poor Law Commissioners, on an Inquiry into the Sanitary Condition of the Labouring Population of Great Britain; with Appendices* (London: W. Clowes and Sons 1842), 83.

[75] *Report from the Select Committee on Thames Marshes*, 5.

[76] Ibid., 30.

[77] Ibid., 5-6.

[78] Michael Williams, 'The Enclosure and Reclamation of Wasteland in England and Wales in the Eighteenth and Nineteenth Centuries,' *Transactions of the Institute of British Geographers* 51 (1970): 55-69.

[79] Cornwall was the exception. M. Robinson, 'The Extent of Farm and Drainage in England and Wales, Prior to 1939,' *The Agricultural History Review* 34 (1986): 79-85.

[80] Ibid., 81-82.

[81] A. D. M. Phillips, *The Underdraining of Farmland in England during the Nineteenth Century* (Cambridge: Cambridge University Press, 1989).

[82] Robinson, 'The Extent of Farm and Drainage': 79.

[83] *Report from the Select Committee on Thames Marshes*, 23. A two-penny weekly magazine, *Household Words* was launched to widespread publicity on 30 March 1850.

[84] Ibid., 22.

[85] Ibid., 29.

[86] *Sixth Report of Medical Officer to the Privy Council*, 447, 448.

[87] Ibid., 446.

[88] Ibid., 437, 438.

[89] Thomas B. Peacock, 'On the Recently Prevalent Malarious Affections,' *Medical Times and Gazette* 40, 1047 (1859): 400.

[90] Francis E. G. Cox, 'History of the Discovery of the Malaria Parasites and Their Vectors,' *Parasites & Vectors* 3, 5 (2010): 1-9.

[91] William Dickson Lang, *A Map Showing the Known Distribution in England and Wales of the Anopheline Mosquitoes, with Explanatory Text and Notes* (London: Trustees of the British Museum 1918); Hutchinson, M*osquito Borne Diseases in England*, 23.

[92] James, 'The Disappearance of Malaria': 75.

[93] Tom Williamson, 'The Disappearance of Malaria from the East Anglian Fens' in Joseph L. Barona and Steven Cherry (eds..), *Health and Medicine in Rural Europe 1850-1945* (Valencia: Universitat de Valencia/Liberia 2005), 117.

[94] Paul Reiter, 'From Shakespeare to Defoe: Malaria in England in the Little Ice Age,' *Perspectives* 6, 1 (2000): 9.

[95] Dobson. '"Marsh Fever"': 385.

[96] Donald Ross, 'Mosquitoes and Malaria in Britain,' *South East Naturalist* 23 (1918): 52-57.

[97] Hutchinson, *Mosquito Borne Diseases in England*, 23.

[98] G. S. Crockett and K. Simpson, 'Malaria in Neighbouring Londoners,' *British Medical Journal* 21 (1953): 1141.

[99] John MacCulloch, *Malaria; an Essay on the Production and Propagation of This Poison, and on the Nature and Localities of the Places by Which It Is Produced: with an Enumeration of the Diseases Caused by It, and of the Means of Preventing or Diminishing Them, Both at Home and in the Naval and Military Service* (Philadelphia: Thomas Kite 1829), 5.

[100] Garland and Weston, 'Morbidity in the Marshes.'

[101] Christopher Merrett, 'An Account of Several Observables in Lincolnshire, Not Taken Notice of in Camden, or Any Other Author,' *Philosophical Transactions of the Royal Society of London* 19 (1696): 345-346.

[102] Ibid., 350.

[103] Defoe, *A Tour through the Whole Island of Great Britain*, 55.

[104] James, 'The Disappearance of Malaria': 77.

[105] Wheeler, *History of the Fens of South Lincolnshire*, 489.

[106] Virginia Berridge, 'Opium in the Fens in Nineteenth-century England,' *Journal of the History of Medicine and Allied Sciences* 34, 3 (1979): 293-313.

[107] Ibid., 489.

[108] James, 'The Disappearance of Malaria': 77.

[109] Kate Burningham, Jane Fielding, Diana Thrush, '"It'll Never Happen to Me": Understanding Public Awareness of Local Flood Risk,' *Disasters* 32, 2 (2008): 222-223.

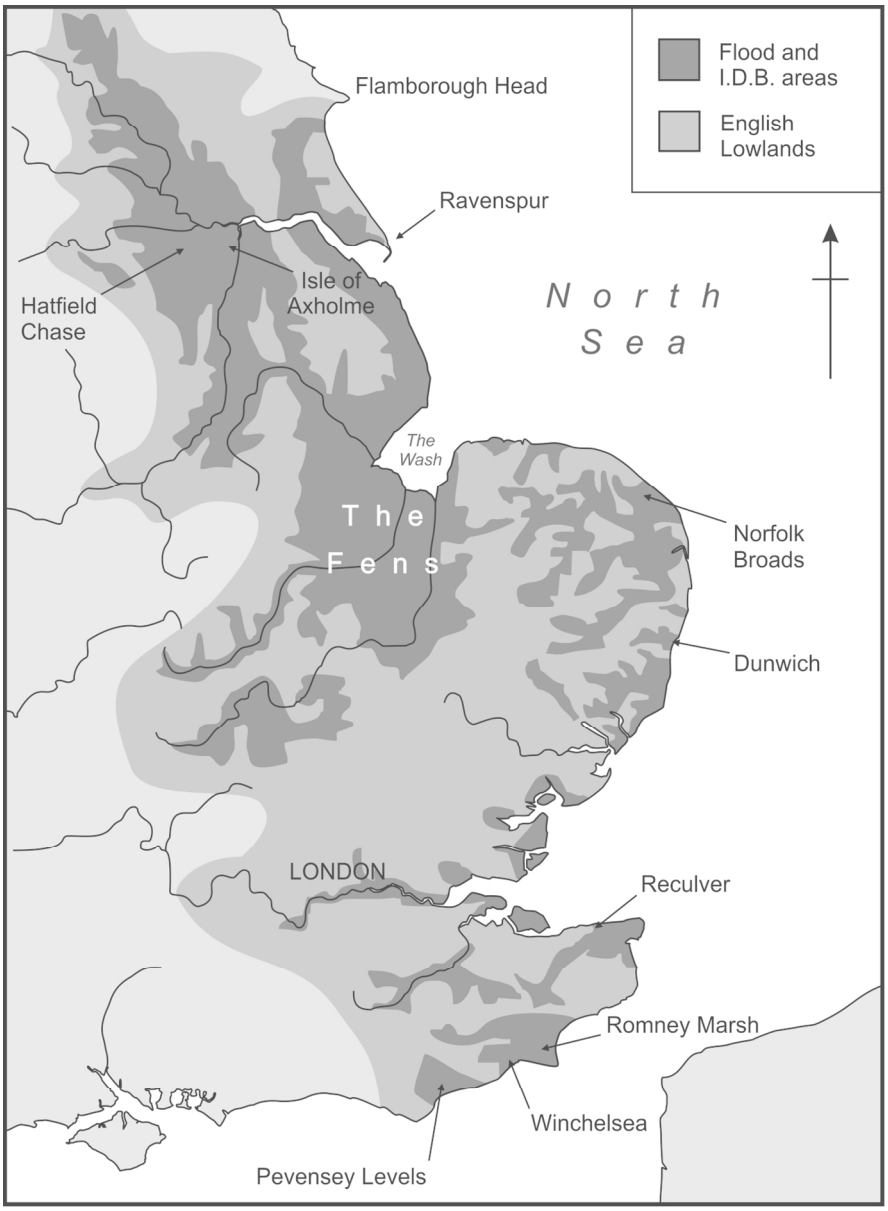

Figure 1: The English "Lowlands"

109x149mm (300 x 300 DPI)

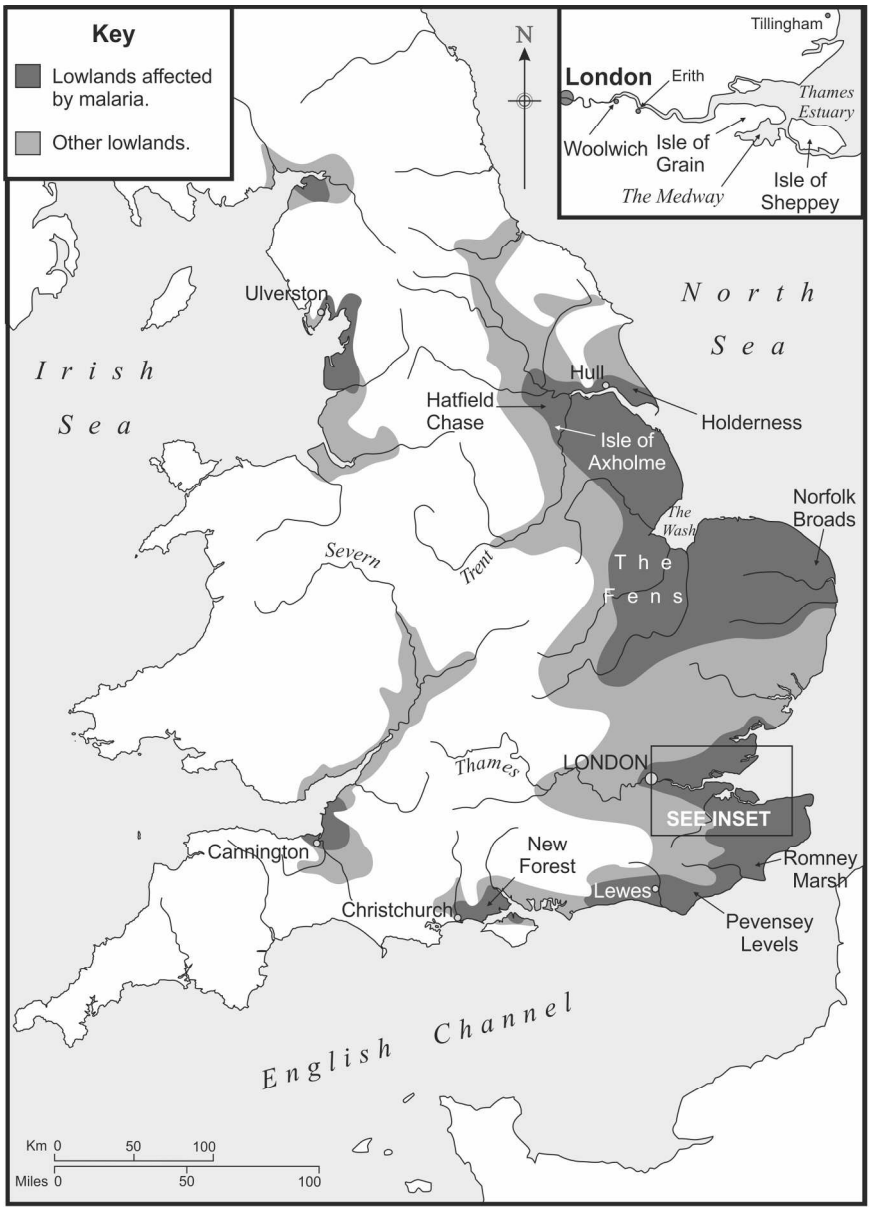

Figure 2: The Geographical Distribution of Endemic Malaria in England

384x533mm (120 x 120 DPI)