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Title: Agricultural Development, Labour Migration, and the Resurgence of Malaria in Swaziland, 1950-1981.

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The introduction of DDT and related pesticides in the war against malaria in Asia, Africa and Latin America during the 1940s had a dramatic impact on anopheles mosquito populations and consequently on the worldwide incidence of malaria.[1] The initial success of pesticide spraying created immense optimism on the part of health officials and economic planners. For the first time, it appeared that malaria, which had had such a devastating impact on human populations and had retarded economic development in tropical and sub-tropical areas, could be controlled or even eradicated. Thirty years later, however, malaria has made a major comeback. In India, where the use of pesticides had reduced the annual incidence of malaria from 100 million cases in 1952 to 50,000 cases in 1962, the annual number of cases rose again to over half a million in 1970. Similar patterns of decline and resurgence occurred in Pakistan, Sri Lanka, Mexico, Central America and East Africa.[2-4]

The resurgence of malaria in many areas has been linked to the so-called "green-revolution", the development of large scale agricultural projects combined with the extensive use of fertilizers and pesticides to increase agricultural production. The heavy use of pesticides succeeded in controlling some crop

destroying pests, however, it had the unforseen consequence of producing DDT resistant strains of anopheles mosquitoes, short circuiting vector control measures and making possible the recommencement of malaria transmission in areas in which the disease had been brought under control. A World Health Organization technical report concluded in 1976 that, "resistance is probably the single biggest obstacle in the struggle against vector borne disease and is mainly responsible for preventing successful malaria eradication in many countries." The report went on to note that, "Evidence has also been accumulated to show that resistance in many vectors has been...a side effect of agricultural pesticide use."[5, p.181,6]

These findings led the WHO, in conjunction with the World Bank and the United Nations Development Programme, to allocate nearly three million dollars for research into anopheles resistance and plasmodia transmission between 1976 and 1980, making this research the primary focus of their attack on malaria.[5,p.185]

The history of malaria control in the lowveld areas of South Africa and Swaziland mirrors the worldwide picture of initial success and optimism during the 1950s and 1960s, followed by a resurgence of malaria during the seventies. In the lowlying areas of the Eastern Transvaal and Natal in South Africa, intensive efforts to control malaria through vector spraying brought the annual notification rate for malaria down from over 10,000 cases a year in the late thirties and early forties to an average of three hundred cases per year between 1957 and 1970. Notification subsequently rose dramatically however, with 1500

cases reported in 1971 and 7500 cases in 1978.[7, p.131] In Swaziland, the annual official incidence of malaria declined from 7850 cases in 1946 to less than 100 cases per year during the late fifties and early sixties, only to rise again to over 1000 cases a year in the late seventies(see table 1).

As elsewhere, the resurgence of malaria in these two areas has been associated with the introduction or expansion of large scale agricultural production. Yet in contrast to the general pattern, increases in the incidence of malaria in South Africa and Swaziland have not been accompanied by the appearance of pesticide resistant strains of anopheles mosquitoes.[8] This is important, for it suggests that the relationship between "green revolutions" and malaria is complex and that vector adaptation may be only one factor in the equation, or causal chain. Changes in agroecosystems, settlement patterns, and labor utilization, associated with the introduction of "green revolution" technologies, may contribute to a resurgence of malaria, as well as to the spread of malaria into areas in which it has been previously unknown or of little importance [3-5] If this is so, then the current WHO emphasis on biomedical research may be somewhat shortsighted, attacking part of the causal chain but largely ignoring possible socio-economic determinants of the current rising tide of malaria. The present paper examines the decline and resurgence of malaria in Swaziland within the context of Swaziland's changing political economy over the last thirty years, in an effort to illuminate some of the socio-economic determinants in the equation between increased agricultural development and malaria resurgence.

Malaria Epidemics and Control in Swaziland to 1959

Prior to the commencement of vector control measures in the late 1940s, malaria was a major health problem in Swaziland.[9] During most of the colonial period, annual outbreaks of malaria occurred during the summer and autumn months from December to May. These seasonal epidemics incapacitated large numbers of Swazis as well as a few Europeans. In most years, the epidemic was limited to the lower regions of the country, which were hyperendemic, and was marked by relatively few deaths. There were however, several years in which the annual epidemic spread into the higher regions of the country and produced a much larger number of cases and fatalities. While the absence of case finding efforts make it impossible to know how large a toll such regional epidemics took prior to World War II, it was estimated that 50,000 cases occurred in the low and middleveld regions of Swaziland during the 1946 epidemic, a figure which corresponds to roughly 26% of the total population of Swaziland at that time. Nearly 8,000 cases were actually seen by medical authorities that year.

Colonial medical opinion attributed these major upsurges in malaria to abnormally heavy rainfall and increased vector breeding. Yet they were also a product of colonial economic policies, which included the alienation of large tracks of Swazi land designed to provide European settlers with farms and ranches and to create an abundant supply of Swazi labor. The

subordination of Swazi economic interests to those of European settlers led to the semi-proletarianization of Swazi herdsmen/cultivators and prevented many Swazi families from producing enough food to meet their subsistence needs, forcing them to become dependent on food purchased with cash earned through the sale of their labor, or, less frequently, their cattle. This dependancy created a state of nutritional vulnerability in which economic crises, such as the world wide depression of the early 1930s, which severely restricted Swazi employment opportunities and drastically cut cattle prices, or the loss of crops through drought, created famine conditions. Famine, in turn, greatly increased the severity of subsequent outbreaks of malaria, as acute malnutrition, combined with heavy parasite infestations, created a fatal synergism, which was most pronouncied in young children. In addition, famine conditions forced Swazi men and women living in the hyperendemic lowveld areas of Swaziland to seek employment and food assistance in the more economically developed higher regions of the country. Since many of these people were parasite carriers, they increased the reservoir of infection and thus opportunities for transmission in what were normally malaria free areas of Swaziland.

British attempts to control malaria in Swaziland prior to the late 1940s were extremely limited. While Europeans living in the lower regions of the country were advised to put screens on their windows and to avoid walking out of doors in the evening, no health instruction was given to the Swazi. Nor were any efforts made to clear bush or spray larval sites in Swazi settlement areas. Instead, malaria control measures consisted of

distributing free quinine through a variety of formal (clinics and hospitals) and informal(chiefs, police and storekeepers) channels to the Swazi during actual outbreaks. While the Swazi appear to have appreciated the protective benefits of quinine, the methods of distribution were at best haphazard and many Swazi received no quinine. [10]

Following a massive outbreak of malaria in 1937, during which it was conservatively estimated that 5000 Swazis died from the disease, a malaria control scheme was proposed by the Principal Medical Officer for Swaziland.[11] The scheme was based on practices which had been successfully implemented in Natal and Zululand, beginning in 1933, by Dr. Park Ross and involved both anti-larval and anti-adult measures.[12] Swaziland, however, was not Natal and did not possess a large sugar industry, which was willing to underwrite the cost of a malaria control scheme in order to prevent losses to their labor force. There in fact were no comparatively large European enterprises in Swaziland to defray or justify the expense of control measures. Despite British efforts to stimulate European farming and ranching these enterprises remained relatively small in scale, employing only a quarter of all Swazi wage labor in 1936. The remaining three quarters were employed in South Africa. The Swazis were in fact viewed primarily as exporters of labor within the wider southern Africa regional economy. Since most of this labor came from the more densely settled middleveld areas of the country, which were relatively malaria free and only occasionally affected by malaria outbreaks, the benefits of eradication did not outweigh the costs. The colonial administration, therefore, rejected the

proposed malaria control scheme as too expensive.[13]

In the wake of World War II, however, the Colonial Development Corporation proposed the establishment of an irrigation project for growing sugar cane in Swaziland's soil rich but rain poor lowveld as part of Britain's post-war effort to increase overall colonial production levels. The proposal made malaria control a pressing issue. As early as 1931, the Principal Medical Officer for Swaziland had warned that the development of sugar estates in the lowveld could greatly increase the malaria problem in Swaziland. "If there were any works requiring the collection of large numbers of natives in compounds in the lowveld the malaria factor would be a very serious one and if natives from the non-endemic areas had to be introduced, the mortality among them would be very high."[14] This prophetic warning was repeated in 1944 by R. W. Thorton, Agricultural Advisor to the High Commissioner for Swaziland, Bechuanaland and Basutoland,

> Those who advocate settlement in the lowveld stress the grand opportunity of creating irrigation settlements where large numbers of families can be established in close proximity. I have no doubt...that such settlements may be possible but there is little doubt that the malaria trouble will then be aggravated owing to the multitude of small pools which will furnish breeding grounds for mosquitoes. Naturally, these breeding grounds can be treated but that means establishing a proper medical service to supervise and

see that remedial measures are carried out. [15]

In short the creation of agricultural schemes in the lowveld required the implementation of malaria control measures. Whether such measures would have been adopted without the development of the sugar schemes is open to debate. What is clear, is that the decision to establish the lowveld projects, and the potential labor losses which the projects would have suffered in the absence of controls, were the primary motivating factors behind the implementation of a malaria control project in Swaziland following the War.

The first nucleus of a malaria control unit came into existence in 1945 and residual hut spraying with DDT began on a limited basis in 1949. Spraying was expanded to cover the hyperendemic areas of the country, primarily in the lowveld, during the 1950s. The program was an initial success, and except for a moderate outbreak in 1953, following a major drought in 1952 and the refusal of some European farmers to spray their compounds, the number of reported cases dropped steadily throughout the decade. After only three years of spraying, the parasite rates in children living in sprayed areas of the lowveld had dropped from 65% to 2%. From 1956, spraying was gradually withdrawn from those areas in which no new cases had been reported in the past two years, and by 1958 only a fifteen mile protective barrier along Swaziland's border with Mozambique, where no control measures were in effect, was being treated. Entomological investigations during 1958 and 1959 showed that a. gambiae, the primary vector in Swaziland, had almost totally

shifted its living and eating patterns, resting out of doors and feeding off of animals instead of man as an adaptive response to hut spraying.[16, pp.3-4] While recognizing the need to continue surveillance work and the potential threat of malaria being reintroduced via migrants from Mozambique, Colonial medical authorities stated in 1959, that malaria had been all but eradicated in Swaziland and ceased spraying activities for fear that continued spraying might produce DDT resistant strains of mosquitoes.[17]

The Sugar Industry, Migrant Labor and Malaria, 1959-1978

The succesful control of malaria in the lowveld permitted work to begin on the Colonial Development Corporation's irrigation project in the northern lowveld. The construction of canals began in the mid-fifties and sugar production got under way in 1958. A second major irrigation scheme, Ubombo Ranches Ltd, initiated by the British owned firm of Lonhro, commenced sugar production in the southern lowveld at approximately the same time.[18, pp.94-95]

Ironically, the development of sugar production in the lowveld created conditions which encouraged a resurgence of malaria in the areas in which sugar was grown. It thus undermined the effectiveness of the malaria control measures it had been largely responsible for initiating. A flare up of indigenous cases occurred around the sugar estates in 1960 and

larger outbreaks occurred in 1967 and 1972. The number of recorded case continiued to rise during the late seventies and began to spread out from the sugar estates to other areas of the lowveld and into parts of the middleveld.

Irrigation agriculture, by its very nature, can create conditions suitable for the breeding of mosquitoes.[3,4] While well maintained canals are incompatable with the reproduction of a. gambiae, which breeds best in small standing pools of water, runover, seepage and improper maintenance produced breeding opportunities in the lowveld projects, especially during periods of heavy rainfall. Moreover, the extremely poor condition of housing provided for sugar workers and the near absence of sanitation measures during the late fifties and early sixties, produced, as R.W. Thorton had predicted, additional ideal breeding sites for a. gambiae around the workers' quarters.[19, 20] Since the malaria control program concentrated on hut spraying and included only irregular and limited provisions for larval control, these environments produced an abundant supply of potential vectors, although it appears from entomological reports, that the most efficient vectors a. gambiae species "A" and "B" had been eliminated, leaving only species "C" which was less efficient, though still a potential vector.[16, p.4]

Additional vectors were introduced via the major rivers from which the irrigation schemes drew their water. These waterways flowed from Swaziland to Mozambique, where species "A" and "B" continued to exist. During heavy breeding seasons, these more efficient vectors entered into the irrigation schemes along the river valleys.[16, p.2]

Finally, while most of the vector population in Swaziland had adapted to hut spraying by resting out of doors and feeding off of animals, some were still found feeding off of man in huts during periods of heavy rainfall and vector breeding. This return to man was particularly marked in the irrigation schemes because there were no domestic or wild animals there to serve as alternative hosts.[21,p.4, 3,p.44]

While the sugar schemes provided abundant opportunities for vector breeding and malaria transmission, they would not have contributed to a resurgence of malaria in Swaziland had they not also been responsible for reintroducing parasite carriers into Swaziland, and thus providing sources of infection for the vector population. By 1959, a decade of control measures had reduced the parasite load of the Swazi population to near zero. Of 15,682 persons tested in that year only 173 or .11 % were found to carry parasites in their blood. This compared to 23% in 1950.[16, p.2) Thus had the sugar estates employed only Swazi workers there would have been few opportunities for transmission. Unfortunately, they chose not to do this and, for economic reasons, employed large numbers of workers from Mozambique, despite repeated warnings by malaria control officers that the use of these workers, who, coming from an area in which no malaria control measures were in effect, represented a threat to the health of Swazi workers and their families, as well as to the general population of the areas surrounding the sugar estates.[22-23]

The problem which the use of foreign labor creates for malaria control efforts has been noted by M. Prothero and

others.[24] However, little attention has been given in these studies to the reasons why foreign labor is employed in particular industries. It is important to examine these reasons in order to understand the connection between the resurgence of malaria and the changing political economy of Swaziland.

The rapid penetration of foreign capital into Swaziland and the development of mining, forestry, and agricultural industries during the mid fifties and early sixties created a growing demand for Swazi labor. This demand soon outstripped local supplies and Swazi wage-earners were able to "play the market" and be selective in their choice of employment.[25, pp.48-51] More often than not, Swazi men avoided employment on the sugar estates of the lowveld. While the wages paid by the sugar industry were comparable to those aof other agricultural industries within Swaziland, averaging two shillings and four pense per day in 1960, the living and working conditions were much poorer on the sugar estates than elsewhere. The Labor inspector report for 1957 includes the following evaluation of conditions on the Ubombo Ranches Ltd. Estates.

> Of the major projects visited thus far Ubombo Ranches appears to be the most backward in outlook and planning in the labour field. Unless the company is prepared to offer a higher standard of housing, considerably better rations and develop a more modern outlook for the welfare of its labour force, it is likely to find itself unable to attract labour in the present competitive field.[19]

Conditions had improved little by 1963. Inadequate housing, the absence of proper sanitation facilities, insufficient rations, including no provision for family rations, irregulatities in payment practices, and excessive work hours--all of which industry representatives attributed to the high capital outlays required to start up production and the subsequent need to reduce labor costs--figured prominently in the reasons given by Swazi sugar workers for the major strike which occurred in the Big Bend area in March of 1963.[20, p.14-15.]

The industry's difficulties in attracting Swazi labor during the late fifties and early sixties, especially during peak periods in Swazi domestic agriculture, led them to employ large numbers of women and children to perform the lighter tasks, such as weeding, and to recruit men from Mozambique to cut cane and perform other heavy labor.[26]

The number of Mozambique workers employed in the Sugar estates continued to grow during the late sixties despite a cool down in the Swazi economy and declining employment opportunities, which forced more Swazi men to seek employment on the Sugar Estates. This increasing use of Mozambique labor was apparently a response on the part of the sugar industry to the growing militancy of Swazi workers during this period. The militancy, in turn, was a product of the declining mobility of Swazi labor in the face of a contracting job market and was first given expression in the 1963 Big Bend Strike. [25, p.51-52.] Faced with rising worker protest among Swazi laborers, the management of the sugar estates opted to continue employing Mozambique

workers who were seen as less militant and more manageable than their Swazi counterparts.

The colonial government, which was committed to the agricultural development of the lowveld, as well as to the interests of large scale agricultural capital, refused to limit the use of Mozambique labor, despite the protests of Swazi workers[27] and the clear warnings of health officials that the continuation of the practice might lead to the renewed transmission of malaria in the lowveld.[23,16,p.4] With independence in 1969, however, the sugar industries use of Mozambique labor instead of local Swazi workers, became a political issue. While the newly independent Swazi government continued to serve the needs of large scale agricultural capital, restrictions on the use of foreign labor were imposed on all industries within Swaziland in 1970. The head of the malaria control unit in Swaziland referred to these restrictions as "the beginning of the end of malaria in Swaziland."[28]

It would appear however that while the restrictions reduced the number of Mozambique workers on the estates, they did not prevent the movement of illegal immigrants, who, in the face of severe economic dislocations in Mozambique during the early seventies, continued to seek work in Swaziland. The restrictions also appear to have come too late. While the number of Mozambique workers declined through the seventies, the outbreaks associated with their presence on the estates prior to this time created indigenous reservoirs of infection among Swazi workers and their families.[29,p.6] These reservoirs, moreover, were not limited to the immediate area of the sugar estates, but were

spread more widely through the lowveld and into certain areas of the middleveld--which had been free of malaria since the early 1950s--as a result of the migrant nature of Swazi labor. Thus more recent outbreaks of malaria in Swaziland have had a wider case distribution than those of the late sixities and early seventies, which were more dependent on imported foci of infection and were more closely identified with the sugar estates.[30] In short, the extensive use of Mozambique workers during the sixties and early seventies contributed to the re-establishment of malaria parasites among the inhabitants of Swaziland, which in turn helped fuel the rising tide of indigenous malaria cases during the late seventies.

The development of the Sugar Estates along with other economic activies such as coal mining and cotton growing, contributed further to the resurgence of malaria in Swaziland by encouraging the movement of peoples from the higher regions of the country, where experience with malaria was limited and thus resistance levels low, into the lowveld. This movement occurred primarily between the southern middle and highveld areas of the country, where land pressures and limited economic opportunities had historically made the area a primary source of migrant labor, and the northern lowveld, where much of the post-war economic development was occurring. Attracted by these opportunities and believing that malaria had been controlled, a large number of highland families resettled in the lowveld during the late fifties and early sixties. Consequently, the population of the northern lowveld grew by 144% between 1956 and 1966, compared to a nation wide increase of only 58%. By contrast the southern

highland districts of Hlatikulu and Mankiana grew by only 33% and 23% respectively over this period, reflecting in part the movement of people from these areas to the new centers of development in the lowveld.[31] During the next decade the population of the irrigation scheme areas doubled,reflecting the movement of over 8000 people from the higher areas of Swaziland into the lowveld.[32] These migrants joined a lowveld population whose resistance level had already been lowered by a decade of effective malaria control measures and low levels of transmission prior to the commencement of sugar production. Together the two populations that grew up around the sugar estates provided a fertile field for the recrudescence of malaria.

While the economic development of the lowveld fueled the resurgence of malaria in Swaziland by creating new vector breeding sites, reintroducing parasite carriers, and by attracting new inhabitants who lacked resistance to the disease, the resurgence was abbetted by the inability of health authorities to maintain effective controls against the disease. This inability was caused in part by difficulties in identifying and screening migrant laborers coming from Mozambique. The sugar industry's lack of cooperation in identfying these workers combined with the illegal status of these workers after 1970, increased these difficulties.[23]

Other failings can be attributed to organizational problems and to deficiencies in the allocation of manpower and transport resources. A 1978 report on malaria control measures in Swaziland by a WHO malariologist concluded that,

> While reviewing the spraying program carried out this year it is observed that the areas were not defined, advanced spraying programmes were not prepared, adequate manpower and transport was not provided, proper training of temporary spraymen was not done, and necessary spraypumps were not available. All of these led to poor spraying so that it could not be completed before the transmission season. Field visits revealed that even positive kraals were found unsprayed. Under these circumstances, it is very difficult to expect any impact of spraying activities carried out during the past years. [29, p.4]

The report was additionally critical of case finding and treatment procedures.

The reasons behind these failings are not discussed in the report and are beyond the scope of this paper. Let it suffice to say that both the Swaziland Ministry of Health and the Colonial Health Department in Swaziland, from the beginning of the colonial period up to the present, have been chronically underfunded and forced to rely heavily on outside sources to fund disease control programs. This outside funding has not always been available. Consequently, health officials have had to make difficult choices in allocating their limited resources. The recent outbreak of cholera in Swaziland, beginning in 1980, forced the ministry to direct a large portion of its resources and manpower to cholera and water-borne disease control measures and away from the control of other diseases, such as malaria and

tuberculosis, which are viewed as less immediate health problems. The long term costs of this perhaps unavoidable decision, however, may be high. As the above 1978 WHO review concluded,

> If high priority is not immediately given to take necessary action for preventing the possible future outbreak, it may bring about a tremendous setback in the over-all socio-economic development of the country as it is clear from the fact that the present malaria flare-up has hit mostly the people in the areas of vital economic projects, e.g. agricultural development like sugar, rice, and cotton, and other development projects like roads, railways and mines where a large number of labourers both from within and outside the country are aggregating.[29,pp.6-8.]

The potential impact of malaria on lowveld industries and particularly on the sugar industry, which contributed 53% of Swaziland's foreign exchange in 1983 and accounted for nearly 40% of domestic wage employment, would appear to necessitate a recommittment to malaria control. [18,p.108,33,p.95] At the same time, the industry's role in the resurgence of malaria suggests that the industry itself needs to shoulder some of the financial burden that this effort will require.

While the lowveld populations and industries are presently at greatest risk, the possibility of wider regional epidemics on the scale of pre-control outbreaks cannot be ruled out. The fact

that recent outbreaks have been largely limited to the lowveld is due to the partial effectiveness of control measures, but is also the result of increased employment opportunities in the lowveld region over the past thirty years. These opportunities have restricted the movement of infected Swazi workers, and thus potential parasite carriers into the higher regions of the country in search of employment during periods of economic crisis within lowveld households, such as was created by the recent drought in 1982. The spread of malaria into the higher regions of the country has consequently been avoided. Thus ironically, while the resurgence of malaria can be traced in part to the development of the sugar industry, this development has at the same time helped to limit the resurgence of malaria primarily to the lowveld. It must be remembered, however, that the health of the sugar industry and its ability to absorb a population which is highly dependent on wage employment opportunities to meet subsistence needs, is itself dependent on international market forces which control the price of sugar. At the present time, only a quarter of Swaziland's sugar production is protected from worldwide price fluctuations through agreements with the European Economic Community. The remaining three-quarters has been subject to a general downward trend in world sugar prices since 1979.[34 p.35,33,p.95] Any major downturn in world sugar prices could severely affect Swaziland's sugar industry and employment opportunities in the lowveld. This in turn could lead to a re-establishment of earlier patterns of population movement which contributed to regional epidemics.

Given the complex relationship between malaria and patterns

of economic development in Swaziland over the past eighty years, and particularly since World War II, any program designed to cope with the country's malaria problem must go beyond purely bio-medical responses and combine more effective malaria surveillance and vector control measures, including the screening of workers from outside the country, with renewed efforts to diversify economic development, especially in the lowveld, and to avoid the dangers inherent in the development of a monoculture economy.[35] In addition, domestic food production and distribution needs to be strengthened in order to protect Swazi households from periodic food crises, which historically have contributed to the severity of malaria outbreaks.[36] Without this type of broad based economic approach to malaria control, drought conditions, such have occurred in southern Africa over the past two years, combined with a set back in the sugar industry and ineffective control measures could set the stage for a large scale regional epidemic in the future.

Conclusion

The history of malaria in Swaziland over the last thirty years indicates that changing patterns of economic development associated with the introduction of large scale agricultural projects in an area in which malaria had been previously brought under control can result in a resurgence of malaria transmission without the emergence of pesticide resistant strains of anopheles mosquitoes. Ineffective malaria control measures within the sugar estates and more widely in the lowveld; the creation of

ideal breeding sites for malarial vectors within the irrigation projects; the ill-advised use of foreign workers who were known to be potential parasite carriers, in order to cut labor costs; and demographic shifts, which have led to the build-up of a non-immune population in close proximity to malaria vectors and carriers; all contributed to the re-establishment of malaria as a serious health problem in Swaziland. In addition, the deprioritization of malaria control in the wake of the 1980 cholera outbreak, the growing dependence of Swaziland on sugar production, and of Swazi households, particularly in the lowveld, on employment in the sugar industry inorder to meet their subsistence requirements, raise the possibility that the current malaria problem could get much worse.

The importance of economic and political factors in the recent resurgence of malaria in Swaziland strongly suggests that renewed efforts to bring malaria under control, both in Swaziland and elsewhere, include attempts to better understand and deal with non-biological determinants of malaria as well as research into anopheles resistance and plasmodia transmission.

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2. L.J. Bruce-Chwatt, "Man Against Malaria: Conquest or Defeat," TRANSACTIONS ON THE ROYAL SOCIETY FOR TROPICAL MEDICINE AND HYGIENE, 73, 605(1979)

3. Robert S. Desowitz, "How the Wise Men Brought Malaria to Africa,"NATURAL HISTORY, 85,2(1976),36-44.

4. Hiran M. Dutta and A.K. Dutt, "Malaria Ecology: A Global Perspective." SOCIAL SCIENCE AND MEDICINE, 12(1978), 69-84.

5. G.Chapin and R. Wasserstrom, "Agricultural Production and Malaria Resurgence in Central America and India," NATURE, 5829 (1981); 181.

6. WHO Expert Committee on Insecticides,RESISTANCE OF VECTORS AND RESERVOIRS OF DISEASE TO PESTICIDES,Technical Report Series, No. 585(Geneva, 1976)

7. World Health Organization, APARTHEID AND HEALTH,(Geneva, 1983), 131.

8. Personal communication, Peter Matthews, Director, Malaria Control Unit, Manzini, Swaziland. In both Swaziland and South Africa the possibility of DDT resistance is a major concern of

health officals and testing on both larvae and adults is performed regularly in labs in South Africa and England to monitor the situation.

9. For a more detailed discussion of the history of malaria epidemics in Swaziland prior to the commencement of vector control measures in the late 1940s see: R.M. Packard, "Maize, Cattle and Mosquitoes: the Political Economy of Malaria Epidemics in Colonial Swaziland," JOURNAL OF AFRICAN HISTORY, 25, 2 (1984): 189-212.

10. It was not in fact until the 1930s that the medical budget for Swaziland exceeded that of the veterinary department

11. D.Drew, Principal Medical Officer for Swaziland to Government Secretary, Mbabane, "Proposals for the Control of Malaria in Swaziland," 26 July 1938, RCS 428/38, Swaziland National Archives (hereafter SNA)

12. F.W.P. Culver, "Malaria Control in Natal and Zululand", typescript, RCS 278/39, SNA.

13. Government Secretary Mbabane, to Administrative Secretary for the High Commissioner, 20 July 1940 RCS428/38, SNA.

14. Annual Medical and Sanitation Report for Swaziland, 1931 RCS 22/32

15. R.W.Thorton, Agricultural Advisor to the High Commissioner," Land Settlement in Swaziland" Mbabane, 1944, RCS 301, SNA.

16. L.F. Delfini, "Report on a Short Term Mission to Swaziland", AFR/MAL/92, WHO(Brazzaville, 1969),3-4.

17. Director of Medical Services to Government Secretary, Mbabane, 6 October 1959, "Malaria Control" File 3231L, SNA.

18. John Daniels, "The Political Economy of Colonial and Post-Colonial Swaziland" SOUTH AFRICAN LABOUR BULLETIN 7,6(1982), 94-95.

19. "Labour Conditions in Swaziland" 19 November 1958, file 3049w, SNA

20. Swaziland Government, "Report of the Commission appointed to Inquire into the Causes and Circumstances on the Strike which took place in the Big Bend Area during March 1963."(Mbabane, 1963), SNA

21. V. Ramakrishna, "Malaria in Swaziland" AFR/MAL/142, WHO (Brazzaville, 1974), 4

22. Director of Medical Services to Government Secretary, Mbabane, 6 October 1959,"Malaria Control" File 3231L, SNA

23. Director of Medical Services to Governmnet Secretary. Mbabane, 2 May 1960 "Outbreak of Malaria" File 3231L; Director of Medical Services to Swaziland Farmers Association, 11 September 1961, File 3231L, SNA.

24. M. Prothero, MIGRANTS AND MALARIA(London, 1965)

25. Alan Booth, "The Development of the Swazi Labor Market," SOUTH AFRICAN LABOUR BULLETIN, 7,6 (1982), 48-51.

26. Returns of Labour Employed in Swaziland, 1959-1963, File 3049X, SNA.

27. NRC Monthly Reports, Mbabane, September, 1966, located in TEBA Headquarters, Siteki.

28. Quartlerly Report, Malaria Control Unit, April-June, 1970, MH1154, SNA.

29. R.M. Shrestha, "Malaria in Swaziland" WHO, Draft Report, July 1978, p6.

30. Swaziland Government, Department of Public Works, "Malaria Control Maps of Swaziland", Case Distribution, 1975/76,1977/78.located in Malaria Control Unit Headquarters, Manzini. I wish to thank Peter Matthews, director of the control unit for having allowed me to examine these and other files located in the control unit office.

31. H.M. Jones, REPORT ON THE 1966 SWAZILAND POPULATION CENSUS (Mbabane, 1968), p.84

32. Swaziland Government,REPORT ON THE 1976 SWAZILAND POPULATION CENSUS, Central Statistical Office,(Mbabane, 1979),51

33. A. Booth, TRADITION AND CHANGE IN A SOUTHERN AFRICAN KINGDOM(Boulder, 1983), 95.

34. Barklays Bank of Swaziland Ltd., SWAZILAND: AN ECONOMIC SURVEY AND BUSINESS GUIDE, 1981, p.35

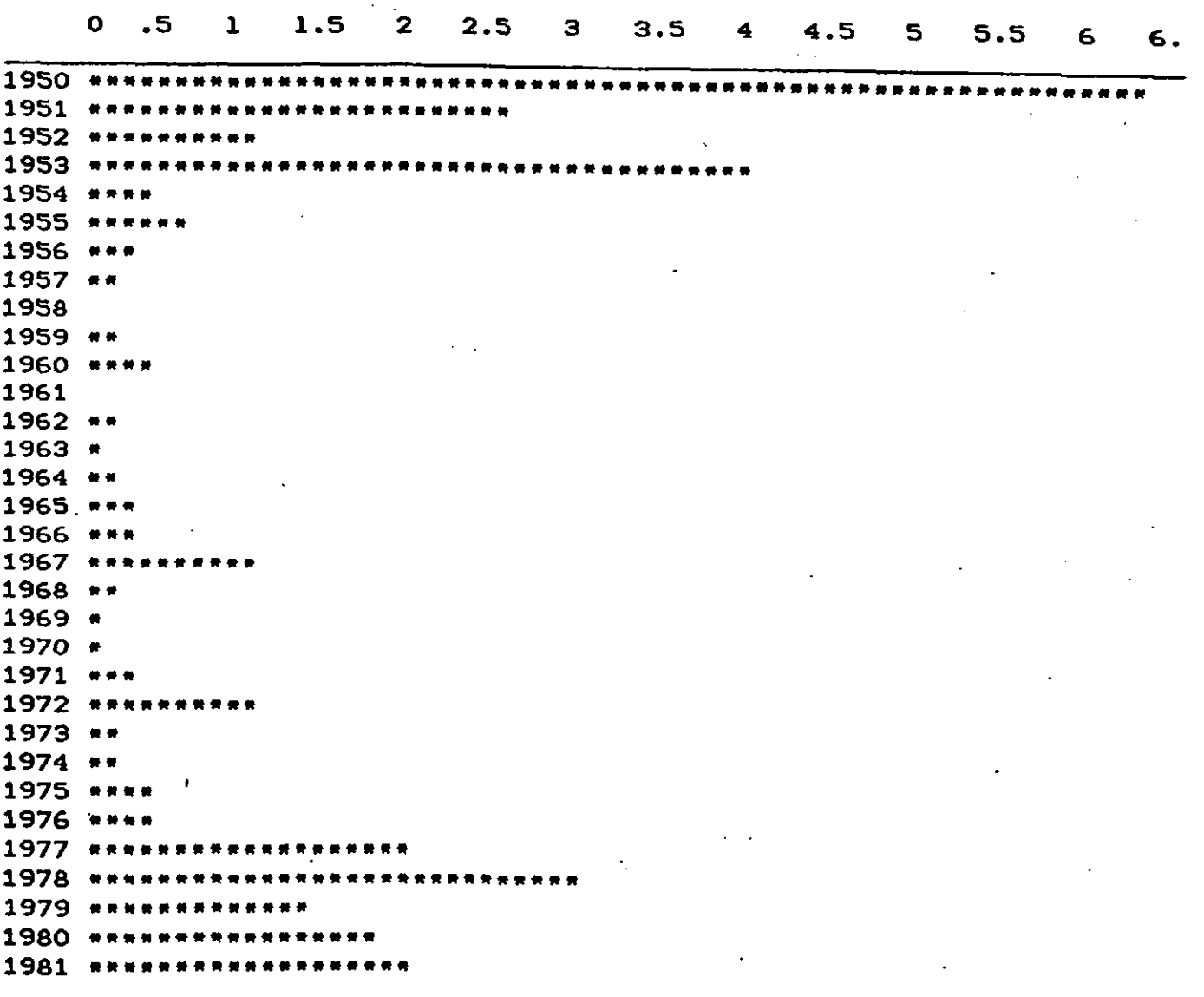
35. Since the publication of the Third National Development Plan in 1977, the Swaziland Government has made considerable efforts to attract labor intensive industries to Swaziland and to develop a light industrial base centered around Manzini and to a lesser

extent Mbabane. The lowveld, however, remains heavily dependent on employment opportunities offered by the sugar industry.

36. Efforts to establish food self-sufficiency in Swaziland have been going on since the 1940s and has been a major goal of the Rural Development Administration scheme which involves 60% of Swazi National Land. To date, however, the goal of food self-sufficiency has not been met and the percentage of homes dependent on wage income to meet their subsistence needs has increased since 1978, Fion de Vletter, THE SWAZI RURAL HOMESTEAD(Kwaluseni), 1983, p.64

TABLE 1

Reported Cases of Malaria per 1000 Total Population*



* These rates represent observed cases divided by the total population of Swaziland. Since most of the cases of malaria occurred in the lowveld region of Swaziland the actual population at risk is much smaller than the total population and the actual rate of reported cases for the lowveld is would be much higher than those reported here.