

Re-imagining Palestine: Scientific knowledge and malaria control in mandatory Palestine

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SUMMARY

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ABSTRACT

Placing scientific knowledge onto a visual grid through malaria maps became a way of re-envisioning the landscape of Palestine during the period of British rule. Malaria maps were not only used by scientists to effect practical results in swamp drainage and in other efforts to decrease malaria morbidity, but they were also co-opted by political organizations and the Palestine Government as tools in a general debate over the development of Palestine. Furthermore, Zionist scientists and settlement officials used malaria surveys and maps to help determine future sites for Jewish settlement and to legitimate previous settlement operations. The anti-malaria programs that resulted from gathering this scientific knowledge had concrete ramifications for the topographical, ecological and demographic transformation of Palestine.

Palabras clave: Palestina, malaria, ciencia colonial, desarrollo, cartografía.

Keywords: Palestine, malaria, colonial science, development, cartography.

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1. INTRODUCTION

During the period of British rule over Palestine (Mandate period, 1920-1947), malaria played a central role in the health status of Palestine's residents and in the production of scientific knowledge about the land of Palestine itself. Like scientists in other locales at the time, British and Zionist scientists in Europe, America and Palestine, together and separately, produced scientific surveys and conducted malaria experiments throughout Palestine to maximize efforts to combat the disease's spread. American scientists assisted their British and Zionist counterparts in the Holy Land, lending technological expertise and much needed financial support. All of these scientists exchanged medical knowledge and collaborated in malaria control as part of a comprehensive anti-malaria campaign during this period.

This paper explores the mechanisms and effects of the malaria control project in Mandate Palestine. The kind of anti-malaria drainage work that scientific professionals implemented not only tried to decrease the morbidity of malaria but also, I argue, served as a way of re-imagining the land through scientific knowledge. The construction of a scientifically-informed and transformed landscape infused with ideologies about development, colonial rule and nationalist renewal (the last for the Zionists), is most vividly seen in the production and use of general malaria surveys, including maps of swamps and mosquitoes. As an instrument by which to survey and reshape the land, malaria information provided scientists both the tool with which to coordinate interactions between different professionals working in malaria control (engineers, agronomists, entomologists, etc.)(1) and—just as important—the conceptual lens through which to view, experience and reclaim the landscape of Palestine.

(1) Thanks to the article reviewer for this consideration.

2. *MALARIA IN THE CONTEXT OF COLONIAL MEDICINE*

For generations malaria, taken from the Italian word *mal-aria*, was thought to be related to a miasmatic association with bad air. With the advent of germ theory in the late nineteenth century, new explanations emerged in the European medical community about the etiology of malaria. Initial experiments and subsequent discoveries came as a direct result of and engagement with, colonialism and colonial, tropical medicine. Indeed, conquering malaria was vital for the success and maintenance of the colonial endeavor (2). The emerging science about malaria at the time, subsequently found that the transmission of malaria occurs when a female anopheles mosquito bites, drawing the plasmodium parasite from the blood of an infected person and then transfers that parasite to another healthy person at the ingestion of the next blood meal (3).

The different malarial fevers include: benign tertian malaria fever, where the victim's temperature peaks every third day but rarely causes death; quartan fever, which occurs every four days, is relatively uncommon and usually mild; and malignant tertian fever, the most lethal type of malaria, characterized by attacks which occur every two days. Most bouts of malaria last for one to two weeks. If no drugs are taken, these episodes can reoccur for at least six months, if not more. Every type of human malaria fever is caused by a different species of parasite: plasmodium vivax causes tertian fever, plasmodium malariae causes quartan fever, and plasmodium falciparum causes malignant fever. Along with *P. vivax* (benign tertian), *P. falciparum* (malignant fever) was a very common form of malarial fever in Palestine.

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- (2) WATTS, Sheldon. *Epidemics and history: Disease, power and imperialism*, New Haven, Yale University Press, 1997, p. 216; HARRISON, Gordon. *Mosquitoes, malaria and man: a history of the hostilities since 1880*, London, John Murray Press, 1978, pp. 13-156; ARNOLD, David (ed.). *Warm climates and western medicine: the emergence of tropical medicine 1500-1900*, Amsterdam, Rodopi Press, 1996.
- (3) HARRISON, note 2, pp. 115-120, 152-156; DOBSON, Mary. *Contours of death and disease in early modern England*, Cambridge, Cambridge University Press, 1998, p. 323.

With the determination of the vector and parasite and the pattern of malaria transmission, swamp drainage and general anti-malaria planning throughout the colonial world became more «scientific» through a high reliance on statistics, measurement and detailed knowledge about the mosquito, parasite and swamps, a common habitat for the anopheles mosquito (4). This scientific knowledge rendered the possibility to then ascertain and describe a detailed interaction of topographical and climatological conditions with the mosquito and malarial parasite. For example, it was key to understand that the female anopheles must have a blood meal in order to lay their eggs, making biting an essential part of the propagation of the species. Similarly, the development of sporozites was found to be dependent upon a particular temperature that varies according to parasite type. This is one of several climatic factors that influences the transmission of malaria. Knowledge of these details and interactions, it was thought, would facilitate more accurate and efficient interventions. Although most malariologists agreed that swamps developed because of human neglect and that they symbolized waste and primitivity, the international scientific community was divided during the Mandate period about how to specifically attack malaria eradication. There were two main approaches: the vector control group, influenced by American and British scientists; and the social-uplift group, who saw malaria as connected to socio-economic conditions such as housing and agricultural methods. The vector control group focused on getting rid of the mosquito through extensive drainage engineering projects, rather than only utilizing prophylactic measures like spraying insecticides and using bed nets or improving nutrition and housing.

In order to figure out «best practices», comparisons of swamp drainage projects were common throughout the colonial world at this time. The results of work conducted in territories like Macedonia, Sicily, Jamaica, Greece or Panama and the characteristics of certain species of anopheles mosquitoes there were frequently cited in malaria surveys in Palestine (5). For its part, the British Government distribu-

(4) ARNOLD, note 2, pp. 1-19; WATTS, note 2, p. 258.

(5) MALARIA Research Unit Annual Report 1923, 18. ISA M1670/130/33a/6420; Pro-DYNAMIS. *Acta Hisp. Med. Sci. Hist. Illus.* 2005, 25, 351-382.

ted its public health reports of Palestine (including malaria surveys within them) to the Department of Health of India, the International Public Hygiene Office in Paris, the Directors of the Liverpool School of Tropical Medicine and the School of Tropical Medicine (6).

In 1925, the League of Nations Health Organization Malaria Commission visited Palestine to assess its anti-malaria efforts and suggest methods for improvement. The tour was planned as a collective inquiry and comparative evaluation of malaria works in Palestine, Syria and areas of Turkish Asia Minor (7). Recognizing the limitations to eliminating the mosquito completely with existing scientific methods (this is before DDT), the League of Nations Malaria Commission supported a method of malaria control that took into consideration social and economic conditions and rejected narrow vector control approaches to malaria. For their part, Zionist malariologists in Palestine actively engaged and contributed to these scientific debates by publishing articles in esteemed journals and distributing their malaria surveys to their colleagues (8).

In his report about his tour in Palestine, Professor Swellengrebel, one of the members of the Commission, noted that the Palestine case was useful for legitimizing modern scientific knowledge of the epidemiology of malaria in its practical application, especially in light of a scarcity of successful examples of anti-malaria schemes around the world.

ceedings of the seventh meeting of the Antimalarial Advisory Commission May 24, 1923. JDC Archives File 280, pp. 5, 7-8; YOFE, Hillel. The problem of quinine prophylaxis. *HaRefuah*, 1925, 1 (4-5), 1-2. Proceedings of the Ninth Meeting of the Antimalarial Advisory Commission, May 22, 1924, p. 7. JDC Archives File 280.

- (6) 1925 Public Health Department report considered by Colonial Advisory Medical and Sanitary Committee on January 2, 1927. PRO CO 733/130/5.
- (7) League of Nations Health Organization, Malaria Commission. *Reports on the tour of investigation in Palestine*, 6; PACKARD, Randall, and BROWN, Peter. Rethinking health, development and malaria: Historicizing a cultural model in international health. *Medical Anthropology*, 1997, 17 (3), 184-185.
- (8) They published in the *Trans Royal Society of Tropical Medicine*, the *Journal of Hygiene* and the *Bulletin of Entomological Research*.

3. *MALARIA IN MANDATE PALESTINE*

Swellengrebel's remarks are significant when one acknowledges that malaria was the most prevalent infectious disease in Palestine at the beginning of the Mandate period. Although Mandate Palestine was a diverse country comprised of populations with different religions and origins, the country's main residential groups as defined by health sources and colonial politics included the Jewish communities (Zionist and otherwise), Palestinian Arab communities (Muslim and Christian), and British officers and settlers. Medical and scientific professionals from American agencies also maintained a presence in Palestine alongside European missionaries. The latter parties were commonly involved in public health projects in colonial settings around the world.

Even though anti-malaria measures were undertaken prior to the Mandate period, British and Jewish health officials considered these efforts neither comprehensive nor conclusive. Steady or increasing trends of malaria incidence in different areas of Palestine remained a serious health concern; like in other colonial settings, these trends posed a threat to both British and Zionist settlement and British colonial rule. Malaria virulence seen in World War I persisted into the Mandate period with the most systemic malaria problems occurring in the 1920's, especially in the rural areas. In 1922, for instance, a minimal annual percentage count of new malaria cases (incidence rate) ranged from fifty percent to one hundred percent depending on the area (9). Monthly data showed that an average of 5.7% of the population had malaria in 1922. The average monthly percentage of new malaria cases given for all districts in Palestine *without* malaria control from 1922-1923 was 4%. With the implementation of extensive malaria control efforts throughout Palestine in the 1920s by both British and Zionist health professionals, however, the epidemiology of malaria shifted. So when swamp draining activities were initiated a decline of the average monthly percentage of existing cases (preva-

(9) MALARIA control demonstrations: Breeding places of Anopheles. Department of Health. Malaria Research Unit. Haifa. Annual Report 1923 Part I, 17. Israel State Archive (hereafter ISA) M1670/130/33a/6420.

lence) to 2.9%, a 50% decrease resulted in the country. By 1925, when Swellengrebel visited, the average monthly prevalence rate in Palestine was 0.8% (10). In fact, that same year, the overall malaria incidence rate reached the lowest level ever since British occupation. There were no malaria epidemics that year, a situation partly attributable to little rainfall, but also a result of anti-malaria measures of that and previous years. From then on, sporadic epidemic trends in the 1930s and 1940s occurred.

Despite overall improvement in the malaria status of the country, trends in malaria morbidity ultimately depended upon location, population, political (in)stability and environmental factors. Some districts, for example, continued to exhibit 100% incidence in the 1920s despite malaria control efforts (11).

3.1. *Malaria research agencies and their collaboration*

Mirroring the organization of the public health and medical systems in Mandatory Palestine, British and Zionist anti-malaria control activities were largely performed and funded separately, with some intersections and complementary work. The British Government took care of malaria control and education in Arab areas of residence while the Zionists agencies largely concerned themselves with Jewish settlement areas. Zionist agencies, however, considered implementing measures in nearby Arab villages that affected the health of their own settlements. Despite structural divisions, the exchange of scientific information between the Palestine Government and Zionist anti-malaria agencies was frequent, as we shall see.

(10) KLIGLER, Israel. *Epidemiology and control of malaria in Palestine*, Chicago, University of Chicago Press, 1930, p. ix.

(11) Proceedings of the Antimalarial Advisory Commission. May 22, 1924, 4. JDC Archives File 280; For high Bedouin malaria morbidity in 1940s see: AL-AREF, Aref. *Bedouin love, law and legend: Dealing exclusively with the Bedu of Beersheba*, Jerusalem, Cosmos Publishing Co., 1944, p. 155.

Notwithstanding the framework of structural separation yet scientific collaboration, all professional parties believed that the natural landscape of Palestine, like other tropical environments, could be manipulated to fit man's needs (12). As such, health professionals possessed a shared imagining of Palestine as a wasteland in need of modernization through scientific means. Developing the land through swamp drainage was part of a broader practice in colonialism of controlling nature through a direct confrontation with it; an orientation achieved through science to which the British Government, American health agencies and the Zionists clearly ascribed (13). Malariologists and sanitary engineers conducted scientific research in order to eventually undertake specific anti-malaria campaigns intended to make the land more fit for human habitation but less fit for mosquitoes and for the malarial parasite (14).

Anti-malaria collaboration in Palestine was welcomed not only on scientific grounds, but was necessitated for practical reasons. In the early years of the Mandate, consistent reductions in budgets to Government Departments occurred, with the most drastic reductions made to the Department of Health (15). This left the Department of Health with very few resources to actively engage in the expensive work of malaria control. Given the seriousness of the health situation caused by malaria, financial sources and scientific expertise from abroad were accepted by the Government as a way to aid malaria control efforts without having to exceed its already scant health budget (16).

(12) ANDERSON, Warwick. Disease, race and empire. *Bulletin of the History of Medicine*, 1996, 70 (1), 62-67.

(13) This orientation has its roots in the Scientific Revolution. ARNOLD, David. *Colonizing the body: State medicine and epidemic disease in nineteenth-century India*, Berkeley, University of California Press, 1993, p. 15.

(14) HARRISON, note 2, p. 2; For treatment of nature by colonial doctors as a «naturalized» space, see VAUGHN, Meghan. *Curing their ills: Colonial power and Africa illness*, Stanford, Stanford University Press, 1991, p. 25.

(15) Letter from Carley and Mioldazis to Heiser. July 19, 1922. Rockefeller Archives. RG5 148/1964.

(16) Department of Health Annual Report 1922, p. 50; Annual Report 1923, 24.

The two agencies outside of Palestine involved in offering both financial and scientific aid were American; the first agency, the Malaria Research Unit (MRU), was sponsored by the American Jewish Joint Distribution Committee and the second, the Malaria Survey Section (MSS), was financed by the Rockefeller Foundation. The Rockefeller Foundation's work in Palestine was an extension of its public health work in other parts of the colonial world. The American Jewish Joint Distribution Committee engaged in relief efforts for Jewish communities around the world during World War I. The malaria problem in Palestine became one of the Joint Distribution Committee's post-World War I projects that helped the British Government, but more specifically aided Jewish settlement in Palestine. Although the MRU (Malaria Research Unit) was not officially a Zionist agency, it did act in direct ways to promote Zionist agendas in Palestine. As such, the Malaria Research Unit is treated here as a *de facto* Zionist agency.

It should be noted that the existence of scientific agencies doing public health work in Palestine is not unique to the Mandate period. Scientific research and study of malaria before the Mandate period was neither centralized nor organized, yet its importance was not questioned. The Ottoman government, for instance, was known to recruit European scientists to study malaria in the country and draw up plans to eradicate it(17). The Pasteur Institute and the Straus Health Bureau, both in Jerusalem, dealt with the general sanitary issues of the Jewish community in Palestine. Individual Jewish doctors such as Hillel Yofe, Arthur Brunn, L. Goldberg, and L. Puchovsky discerned malaria treatment and incidence for the Jewish community. Their scientific experiments included the analysis of types of malaria plasmodia and their development, methods of checking blood for the parasite, the determination of parasite incidence in patients, as well as the effectiveness of quinine prophylaxis(18). In addition, the

(17) See SUFIAN, Sandra. *Healing the land and the nation: Malaria and the Zionist project in mandatory Palestine, 1920-1947*, NYU (Ph.D. Dissertation), 1999, p. 179.

(18) BRUNN, Dr. Hadiagnosa shel Malaria (Diagnosis of Malaria). *Zichronot HaDavanim*. 1913, 2-3, 89.

American Zionist Medical Unit funded an initiative in 1919 to conduct a malaria survey of Palestine.

Zvi Saliternik, a well known Zionist malariologist during the Mandate period, noted that breeding places of anopheles were not mapped out as part of initial malaria surveys before the Mandate period. In contrast, control measures during the Mandate period systematically included the mapping, and surveillance of the vector breeding places, thus reflecting the expansion of the role of scientific knowledge during this time (19).

From 1920-1947 malaria control became more centralized and coordinated. For the Zionists, establishing malaria institutions answered a call to establish scientific research centers. This call was originally made in a proposal for the foundation of a Hygienic Research Institute. The proposal described Palestine as a «terra ignota» (unknown/unexplored land), a land of «half culture» in need of being filled with «research observatory stations with European science» (20). For the unknown author of this letter, as for the Zionist doctors and scientists in Palestine, such institutes were noted as especially necessary for Jews as part of building a national identity by facilitating the exploration and discovery of Palestine through scientific observation.

What is unique in the Mandate period is that the Malaria Survey Section and the Malaria Research Unit were integrated into the British Mandatory Government's Department of Health; that is, these non-indigenous agencies were considered official public health agencies of the British Mandatory Government. These malaria agencies supplemented the work of British anti-malaria sub-inspectors and medical officers who concentrated on eradication in the cities and other specific places.

(19) SALITERNIK, Zvi. Reminiscences of the history of malaria eradication in Palestine and Israel. *Israel Journal of Medical Sciences*, 1978, 14 (56), 519.

(20) Letter for Hygiene Research Institute (Berlin, no date but most likely 1920s). Central Zionist Archives (hereafter CZA) L1/69, p. 1; See also Otto Warburg's support for institutes for disease control. PENSLAR, Derek. *Zionism and technocracy. The engineering of Jewish settlement in Palestine, 1870-1918*, Bloomington, Indiana University Press, 1991, p. 62.

Considering the emerging, political struggle over Palestine during this period, being part of the British Government was an extraordinary position particularly for a Jewish agency to have during this time and, as far as is known, the only one of its kind. The MRU's status as part of the Palestine Government was consistent with the policy of Herbert Samuel, the High Commissioner of Palestine (1920-1925) who promoted and relied upon outside investment for Palestine's development in general (21). Writing about the importance of funding malaria work in Palestine, Herbert Samuel wrote to Victor Heiser, the director of activities in the East of Rockefeller's International Board of Health:

«I am convinced that the diminution and if possible the extirpation, of malaria is one of the first conditions of the progress and prosperity of this country. The Government will not fail to devote its energies to this end, and would deeply appreciate American cooperation» (22).

It must be mentioned that there was no separate, Palestinian Arab malaria research agency during this time. Such integration of scientific organizations into the Governmental structure shows that British rule in matters of public health was, like in other affairs, tempered by the interests, finances, and organizational presence of non-Governmental but similarly colonial, agencies. In this way, the Zionist malaria project exhibited clear links with the Government's project, rather than it being fully separate from it.

3.2. *Malaria Research Unit*

The first agency integrated into the Government structure, the Malaria Research Unit (MRU), was founded in September 1922 and worked to survey Jewish lands and prepare them for amelioration

(21) SMITH, Barbara. *The roots of separatism in Palestine: British economic policy 1920-1929*, Syracuse, Syracuse University Press, 1993, pp. 13, 20.

(22) Letter from Samuel to Heiser. December 13, 1920. Rockefeller Archives. RG 5 RF 825/103/1429, p. 1; Letter from Florence Read to Colonel Heron. May 4, 1922. Rockefeller Archives RG 5 148/1963.

works. The MRU was the main Zionist institution for anti-malaria work during the early Mandate period. This research unit, founded on September 15, 1922 after a bad year of malaria epidemics, took over Hadassah's (then the American Zionist Medical Unit-AZMU) malaria control efforts, first initiated by Justice Brandeis before the Mandate (23). On that day, Hadassah along with the Zionist Organization officially transferred its malaria and sanitary organization to the Palestine Department of Health. The American Jewish Joint Distribution Committee (JDC), a Jewish umbrella organization based in New York that provided relief work for the benefit of Jewish communities around the world, supplied the funds to establish the Unit in Hadassah's absence. Funding from the JDC for this initiative carried on a tradition of the organization's involvement in Zionist health affairs in Palestine; it had also funded the AZMU effort after World War I to Palestine (24). The idea of the MRU came out of a perceived need by leaders of the JDC, especially Bernard Flexner, the head of its health and relief work, to expand the scope of malaria work in Palestine. The Malaria Research Unit's birth illustrates the status of the U.S. as a quasi-metropole for the Zionist community in terms of financial investment, scientific training and technological importation for malaria and health endeavors. Such medical exchange between the US and the Zionist community before and during the Mandate period foreshadows a growing relationship between these two actors in later years (25). Indeed medical exchange was also a way for non-Zionist American Jews to get involved in Jewish settlement in Palestine.

(23) The American Medical Zionist Unit was the name of Hadassah's organization for health activities before renaming and expanding it to the Hadassah Medical Organization.

(24) Letter from Szold to Briercliffe. September 15, 1922 and July 15, 1922. CZA J113/554.

(25) For examples see, KAUFMAN, Menachem. *An ambiguous partnership: Non-Zionists and Zionists in America, 1939-1948*, Jerusalem, Magnes Press, 1991; GROSE, Peter. *Israel in the mind of America*, New York, Knopf Press, 1983; For exceptions, see SUFIAN, Sandra; SHVARTS, Shifra. Mission of mercy: American Jewish medical relief to Palestine during World War I. In: Judit Targarona Borrás; Angel Saenz-Badillos (eds.), *Proceedings of European Association for Jewish Studies Conference, Toledo 1998: Jewish Studies at the Turn of the 20th Century Volume II: Judaism from the Renaissance to Modern Times*, New York, E.J. Brill, 1999, pp. 389-398; BROWN, Michael. *The*

Showing the crossover of health, land and political interests, the Joint Distribution Committee used the financial terms for the creation of the MRU (two-thirds of the financial burden carried by the JDC) as an opportunity to foster other Zionist settlement agendas. In exchange for his guarantee to carry a large portion of the financial burden of the MRU, Bernard Flexner took the opportunity to also submit a proposal to the Palestine Mandatory Government to raise a large capital sum which would be devoted to drainage projects on Government land not given out to concession. A proposal suggested that a non-profit company with a Board of Directors consisting of representatives of donors and the Palestine Government would be established where the fund would serve as a revolving fund until the fulfillment of its purpose. The company would obtain a concession of *jiftlik* marsh lands and would then drain the said land (26). After the area had been drained, a minimal value would be fixed by a Government Commission and offered for sale or lease in «accordance with Government policy to non-profit making companies for agricultural development, in the first instance to Jewish agencies established for the public good» (27). Ultimately, the proposal was a creative, indirect way to try to use swamp drainage as a way to gain more Government land at low cost for the Zionist nationalist project (28). A consistent desire for more Government land was exhibited in the constant Zionist argument that the Palestine Government did not sufficiently follow Article Six of the Mandate document which promised the Zionists, «close settlement by Jews on the land, including state lands and waste

Israeli-American Connection: its Roots in the Yishuv, 1914-1945, Detroit, Wayne State University Press, 1996; KARK, Ruth. *American Consuls in the Holy Land, 1832-1914*, Jerusalem, Magnes Press, 1994.

- (26) Jiftlik lands were originally freehold but were gradually registered under the Sultan's name. Jiftlik also denoted a tract of land, cultivated yearly, that required a pair of oxen to work it. Despite registry designation, the original owners and their families continually thought of themselves as the legal owners. Upon their occupation of Palestine, the British Government acquired jiftlik lands like the Beisan district in the Jezreel Valley.
- (27) Proceedings of the Ninth Meeting of the Antimalarial Advisory Commission, May 22, 1924, 2. JDC File 280, p. 2.
- (28) For details on the connections between swamp drainage and Zionist land purchase, see SUFIAN, note 17.

lands not required for public purposes...» (29). Notably, this argument was also used in development debates regarding malaria that are detailed later in this article. Flexner's proposal implicitly addressed the fulfillment of that promise. Commentary about the plan included fears by Judah Magnes and Israel Kligler —two Zionist activists— that the development of Arab lands through drainage before purchase would actually be harmful to «Jewish progress» because the price of the land would either become too high or the land would never be sold. To the author's knowledge, the proposal was not accepted (30).

The Malaria Research Unit made an important contribution to the public health affairs of Palestine. Prominent Zionist medical figures like its director, Dr. Israel Kligler, a well-respected malariologist in Palestine and in the colonial world at this time ran the agency. Other leading figures of the MRU, Shapiro (Field Medical Officer MRU), Lieberman (Field Engineer, MRU) and Weitzman (MRU Sanitarian and Engineer) as well as most if not all sub-inspectors were Jews (31). Moreover, the Zionist Health Council significantly influenced decisions and directions of the Unit. In Zionist political memorandums as well, the MRU was treated as a Zionist entity (32).

The MRU's malaria survey work chiefly dealt with the sanitation of Jewish settlements and «Arab vicinities» that threatened Jewish health

From 1922-1923, the MRU set up nine malaria demonstration areas in Petach Tikva, Ekron, Zichron Yaakov, Hadera, Yavniel, Ein Harod, Kinnereth, Rosh Pina and Merchavia. In 1924, they added the Metulla area (33). Their work, as the map 1 shows, primarily covered the N-

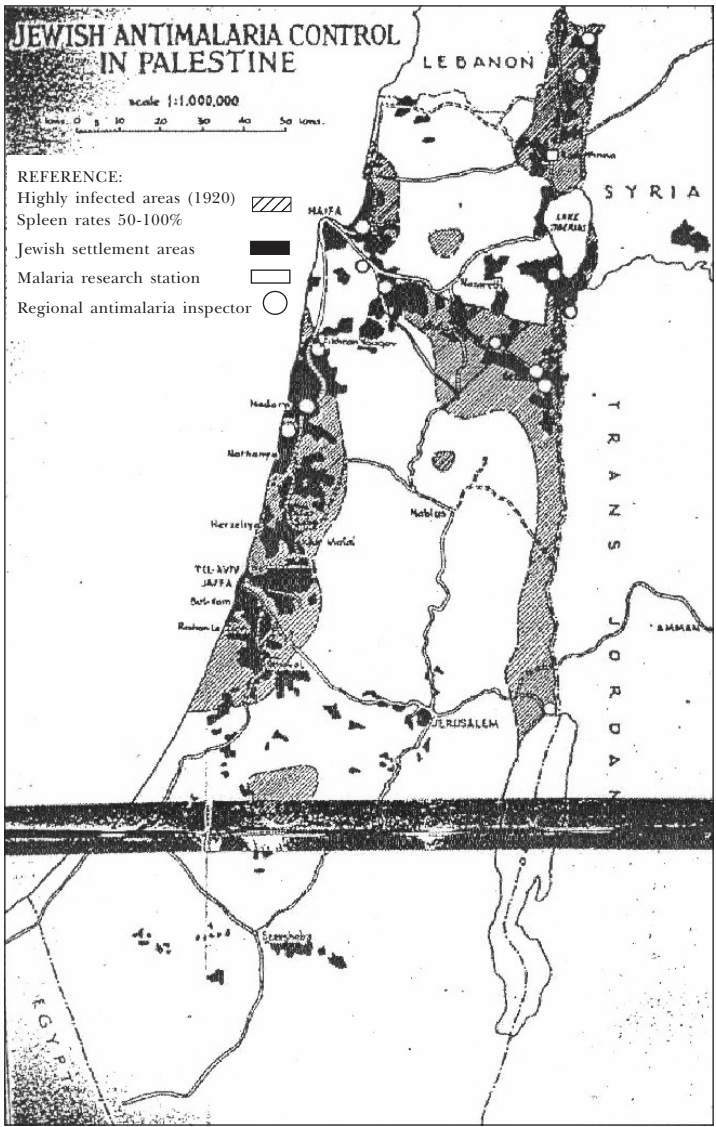
(29) League of Nations: the British Mandate (July 24, 1922) *In: Walter Laqueur and Barry Rubin (eds.), The Israel-Arab reader: A documentary history of the Middle East conflict*, New York, Penguin Books, 2001, p. 31.

(30) Letter from Kligler to Flexner. June 3, 1924. JDC File 279; Proceedings of the Ninth Meeting of the Antimalarial Advisory Commission, May 22, 1924, pp. 2, 4. JDC File 280.

(31) Staff of the MRU. January-December 1923. ISA M1670/130/33a/6420.

(32) See JA Memorandum submitted to the Palestine Royal Commission. Antimalaria and drainage work by Jewish bodies, pp. 16-18.

(33) Department of Health Annual Report, 1924, p. 66.



Map 1. Source: *Palestine's Health in Figures*. Report submitted by the Vaad Leumi to the UN Special Committes on Palestine. Jerusalem, 1947.

shaped pattern of Zionist settlement from the coastal area through the Jezreel Valley to the north of the country. This pattern, in turn, corresponded to the most malarious areas of the country. The staff of the MRU dealt with breeding places for mosquitoes and encouraged colonists to eliminate those places on their own.

Starting in 1926 and by 1928, due to the decrease in malaria morbidity in the country and to a lack of funds, the staff of the MRU was drastically reduced and the engineering section of the Unit was cut completely. Government sub-inspectors were specifically appointed for work in the Jewish colonies that the MRU staff had previously serviced (34). By late 1931, the MRU was disbanded and other Zionist agencies continued Jewish malaria work (35). The remaining employees of the MRU were absorbed into the Department of Health public health staff (36).

3.3. *Malaria survey section*

The second private malaria agency attached to the Palestine Government was the Malaria Survey Section (MSS). The MSS, initiated in 1922, was funded by the Rockefeller Foundation to undertake anti-malaria work during the Mandate (37). The MRU, the MSS and the Palestine Government collaborated on anti-malaria projects, but in contrast to the MRU, the Malaria Survey Section examined malarial incidence and prepared schemes for Palestine's population at large.

(34) Department of Health Annual Report, 1927, p. 25.

(35) Kligler was replaced by Dr. Shapiro as controller. Department of Health Annual Report, 1926, pp. 88, 91.

(36) Annual Report, 1930, p. 109.

(37) WEINDLING, Paul. Eugenics and the Welfare State during the Weimar Republic. In: Robert Lee and Eve Rosenhaft (eds.), *State, social policy and social change in Germany 1880-1994*, Washington DC, Berg, 1997, pp. 135-136.; WATTS, note 2, p. 272; BROWN, E. Richard. Public health in imperialism: Early Rockefeller Programs at Home and Abroad. In: John Ehrenreich (ed.), *The cultural crisis of modern medicine*, New York, Monthly Review Press, 1978, pp. 252-270.

Beginning in the 1920s, the Rockefeller Foundation became involved in malaria campaigns in Asia, Latin America, and the Middle East. By following the general orientation of the Rockefeller Foundation's health initiatives around the world, the MSS concentrated on «scientific medicine» (linking a disease to a microbe) over reducing socio-economic inequities as a way to reduce malaria mortality (38). It therefore performed tasks similar to those of the MRU: helping to devise malaria control operations, including both major and minor irrigation and drainage schemes, determining the prevalence of malaria in Palestine, supervising drainage projects, making field surveys of mosquito breeding ridden areas, carrying out flight distance experiments of mosquitoes, as well as constructing maps and plans for anti-malaria measures (39). Dr. P.S. Carley served as Controller of the MSS while Mr. J.J. Mioldazis was its engineer.

In the beginning years, the MSS staff worked with the Government Entomologist to make surveys of the country but did not undertake the drainage themselves (40). Later, after reductions in staff, they advised and assisted the local health department in its routine anti-malaria projects (41). Besides their cooperation with the Palestine Government, the MSS and the MRU corresponded, shared information and conducted surveys together as well (42). This cooperation continued

(38) BIRN, Anne-Emmanuelle. Eradication, control or neither? Hookworm vs. malaria strategies and Rockefeller public health in Mexico. *Parassitologia*, 1998, 40 (1-2), 139; GALLAGHER, Nancy. *Egypt's other wars: Epidemics and the politics of public health*, Syracuse, Syracuse University Press, 1990, pp. 11-28.

(39) See MSS work in Haifa and Acre, Beisan, Jericho, Sanour, Dead Sea, Huleh, and Mejdal. *Metoch din veheshbon shel halishka hareshit shel KKL el hacongress hazioni ha17 be Basel 1929-1931*. (From Minutes of the KKL Head Council to the 17th Zionist Congress in Basel), CZA A246/441; Proceedings of the Seventh Meeting of the Antimalarial Advisory Commission, May 24, 1923, 2. JDC Archives, File 280; Letter from Heron to General Director, Rockefeller Foundation and attached Annual Report 1923: Malaria Survey Section. April 28, 1924, ISA M1503/1/58 (54).

(40) Department of Health Annual Report, 1922, p. 50; Department of Health Annual Report, 1924, pp. 2-3.

(41) Annual Report, 1927, p. 75.

(42) They cooperatively prepared a survey of Wadi Musrara in 1926. Annual Report, 1926, p. 92.

until 1928 when a Government Assistant Sanitary Engineer, trained in malaria work in the United States at the expense of the Rockefeller Foundation, took over the MSS work (43).

3.4. *Anti-malaria Advisory Commission*

The third organization, the Anti-malaria Advisory Commission, served as the umbrella organization for all malaria agencies in Palestine. It was set up in 1920 by High Commissioner Herbert Samuel and was presided over by the Director of the Department of Health, Colonel Heron. Leaders from the MRU and MSS were members of this commission. The commission reviewed completed work, scientific information and coordinated new malaria projects for Palestine.

4. *MAPS AND EXPERIMENTATION*

Besides carrying out drainage itself, the Malaria Research Unit and the Malaria Survey Section were the two main actors in malaria experimentation. Conducting experiments on the land and on the mosquito, like draining swamps, functioned to increase scientific knowledge about malaria qua science (44), and set out to decrease malaria morbidity by informing effective public health interventions. But it is also served as a scientific way of re-imagining the land that had significant ramifications for the topographical transformation of Palestine.

Surveying any particular area in Palestine included taking blood samples from inhabitants and performing spleen exams; studying soil conditions, discharges of rivers, springs, and flooding trends; taking evaporation measurements; determining species type and mosquito behavior; dissecting mosquitoes and counting mosquito larvae; measuring the flight distance of the mosquitoes; and experimenting with

(43) Department of Health Annual Report, 1928, p. 31.

(44) Thanks to the reviewer for this comment.

larvicides, fish, and mosquito repellants. Sometimes dynamite experiments were also included. Diagrams of mosquito species, their eggs, wings and larvae were also produced (45). These maps were commonly printed in English (although there are some in German and Hebrew) for the purposes of shared use with the British Government and distribution by the Department of Health to agencies abroad.

Gathering very specific data was touted as particularly important for Mandate Palestine since, in contrast to other malaria control projects around the world, as noted before, engineers generally ascribed to the widespread application of all available and affordable anti-malaria methods rather than relying only on one particular model (46). Joseph Treidel (1876-1929), a German Jewish land surveyor and hydraulic engineer in Palestine who had worked previously in German African colonies, stated in his address to the Zionist Organization of Germany:

«Just as the physician must diagnose the case of his patient in order that he may find the proper treatment, so it is the business of the engineer to ascertain the causes and origin of the swamps before any effective treatment can be established» (47).

Like diseases, he said, swamps have symptoms: a peculiar swamp smell, swamp vegetation and a high water table. Treidel noted that after conducting several experiments in Palestine, it was found that European methods of lowering ground water level would not work in Palestine. Similarly open ditch drainage was not recommended due

(45) KLIGLER, note 10, pp. 53-55.

(46) LEAGUE of Nations Health Organization Malaria Commission, p. 25; David Arnold, scholar of colonial medicine, argues that consideration of environmental and epidemiological specificities and the modifications to public health efforts made accordingly made medicine a comparative, rather than exclusively European exercise in the colonies. ARNOLD, note 2, p. 40.

(47) TREIDEL, Y. Technical problems in soil drainage: Address delivered before the Jewish Engineers Association on the occasion of the convention of the Zionist Organization of Germany. No date, 2-4. CZA J113/1430, p. 2; ARNOLD, note 2, 27; PENSLAR, note 20, p. 67; SHILONY Zvi. *Ideology and settlement: The Jewish National Fund, 1897-1914*, Jerusalem, Magnes Press, 1998, pp. 66-69, 96-99.

to growth of swamp grass. Planting eucalyptus trees and airing the ground were some adaptations often used instead in the Palestinian context. Installation of stone and clay pipes were others (48).

The types of experiments conducted and maps drawn reflect the key factors that determine the epidemiology of malaria and the mutual interaction, indeed dependence, between humans and the environment in the transmission of malaria in Palestine and in the production of a new, modernized land. Jewish scientists like Israel Kligler, recognized the human and environmental agencies involved:

«The configuration of the country, the character of the geologic formations, the volume and distribution of rainfall, the temperature and its seasonal variations —these are the physical facts which determine, to a greater or lesser degree, the distribution, prevalence and intensity of the disease. Of equal importance are the habits, customs and economic conditions of the inhabitants» (49).

Despite the recognition of understanding the habits, customs and economic conditions of the residents, in actuality oral histories —particularly of Muslims suffering from malaria— were rarely taken because they were thought to be unreliable and could not detect primary from secondary cases with precision. In this way, the gathering of scientific knowledge often made the human subject invisible; s/he was replaced by objective measures such as spleen indices and blood films. Countless surveys and analyses of spleens and blood took place throughout the Mandate period. Suffice it to say that just between 1922 and 1924, 30,000 blood films were examined in various laboratories across the country (50).

(48) Even earlier, from 1906-1909, Treidel surveyed the topography and hydrology of large areas in Palestine, creating a «Map of Estates» in order to find out the ownership status of certain estates, whether the landowners were willing to sell and what areas would be desirable for the Keren Keyemet L'Israel to purchase.

(49) KLIGLER, note 10, p. 1.

(50) PUTNAM, Persis. Malaria in Palestine: Statistical review, January 1928, 4. Rockefeller Archives RF1/1.1/825. Persis Putnam Folder #11. Surgeon Dempster devised the spleen-rate as index of malarial infection which was used until the

Like drainage interventions, spleen examinations done by the MRU of both Jewish and Arab rural populations in 1923 followed the N-shaped Jewish settlement schema (running north along the coast, southeast along the Valley of Jezreel axis and north along the shores of Lake Tiberias(51). Through the process of mapping swamps and spleens, a literal imposition of pathophysiology onto the physical geography of Palestine occurred; with statistical numbers symbolically representing pathological processes (enlargement of the spleen) map 2 and swamps, one of the environmental conditions causing malaria and the target of medical and engineering designs, constituting the analytical categories featured in the pictorial representation of Palestine.

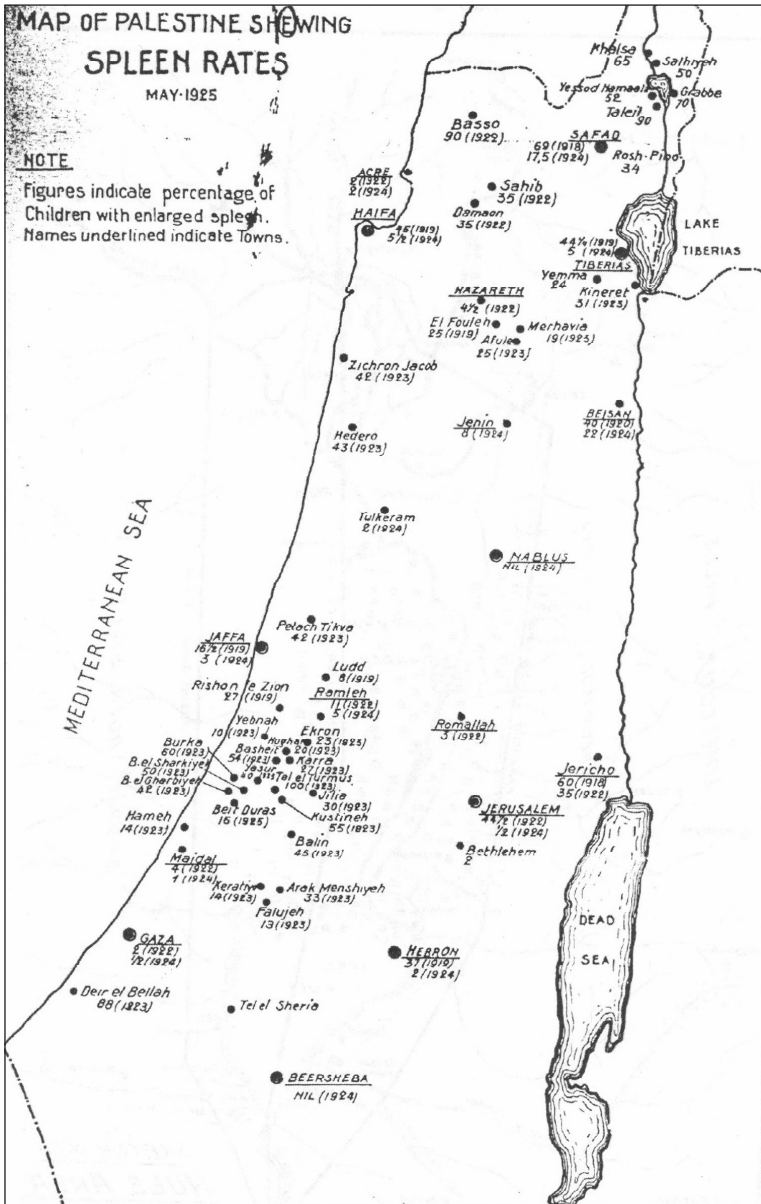
In addition, mapping the flight distance, soil conditions, incidence of malaria, and other scientific features of the land and the mosquito were central to malaria surveys. Maps showed, for instance, what parts of rivers should be straightened, re-channeled or diverted so as to create flowing, rather than stagnant water (52). Numerous maps were constructed that showed how channels would be built, pipes would be installed and drainage would take place. During a time when funds were limited for extensive drainage, mapping swampland allowed these agencies to engage in scientific work that assessed the eventual cost of malaria control without having to immediately expend money to actually drain malarious areas. During the Mandate period, the MSS made detailed maps and surveys of the various characteristics of the Sanour district, Jericho, Haifa, Huleh, Tantura, Jaffa, Beit Jebreen, the Dead Sea and other locales. The MRU constructed maps of Nuris, Nahalal, Rosh Pina district, and Beisan (53).

parasitaemia index in late 1940s emerged. See WHITCOMBE, Elizabeth. The environmental costs of irrigation in British India: Waterlogging, Salinity, Malaria. In: David Arnold and Ramachandra Guha (eds.), *Nature, culture, imperialism. Essays on the environmental history of South Asia*, Delhi, Oxford University Press, 1995, p. 251.

(51) Parasites and spleen rates in rural Jewish Palestine, p. 1. ISA M1670/130/33a; KHALIDI, Rashid. *Palestinian identity: The construction of modern national consciousness*, New York, Columbia University Press, 1997, p. 98.

(52) Annual Report, 1927, pp. 76, 82.

(53) Department of Health Annual Report, 1924, p. 72.



Map. 2.

A map of all the watercourses and swamps in the Beisan area, for instance, was constructed in 1922. It studied and mapped the area so that «definite geographic and topographic information would be available...» so that in the final report on Beisan, «accurate estimates of the cost of control work [could] be made» (54). The Government praised the work of the MRU in 1923, for instance, by noting that the anti-malarial work accomplished by the MRU had been of the «greatest value» in its ability to provide «invaluable information as to the best and cheapest methods of controlling malaria under varying conditions, and the knowledge acquired of the various Palestine anopheles, of their seasonal prevalence, distance of flight and relative importance as carriers of malaria». According to the director of the Department of Health, such work provided «a scientific basis for anti-mosquito measures» (55).

For Palestine, as elsewhere, mapping and surveying the land as part of finding out the causes and characteristics of the swamps eventually effected substantial topographical change. Through monthly and yearly surveying of its ecological and biological environments, the space of Palestine was continually reconstructed, and «reobjectified» (56). As drainage plans were completed or morbidity rates fluctuated, new maps and tables were produced that showed the changing epidemiology of malaria, as well as the country's new topographies and new areas of control. Ways of seeing and transforming Palestine were continually revised.

Prevalence statistics gathered and maps drawn as part of survey work were communicated by the MSS and the MRU to the Government

(54) Letter from Carley and Mioldazis to Heiser. July 19, 1922, p. 1. Rockefeller Archives. 148/1964.

(55) Department of Health Annual Report, 1923, p. 26.

(56) YOUNG, Allan. Mode of production of medical knowledge. *Medical Anthropology*, 1978, 2 (2), 99-100. Doctors made monthly and yearly reports in Jewish settlements which were then submitted to the Department of Health for the annual report. See all Department of Health Annual Reports. ISA. See RABINOWITZ, Dan. *Overlooking Nazareth: the ethnography of exclusion in the Galilee*, Cambridge, Cambridge University Press, 1997, p. 16.

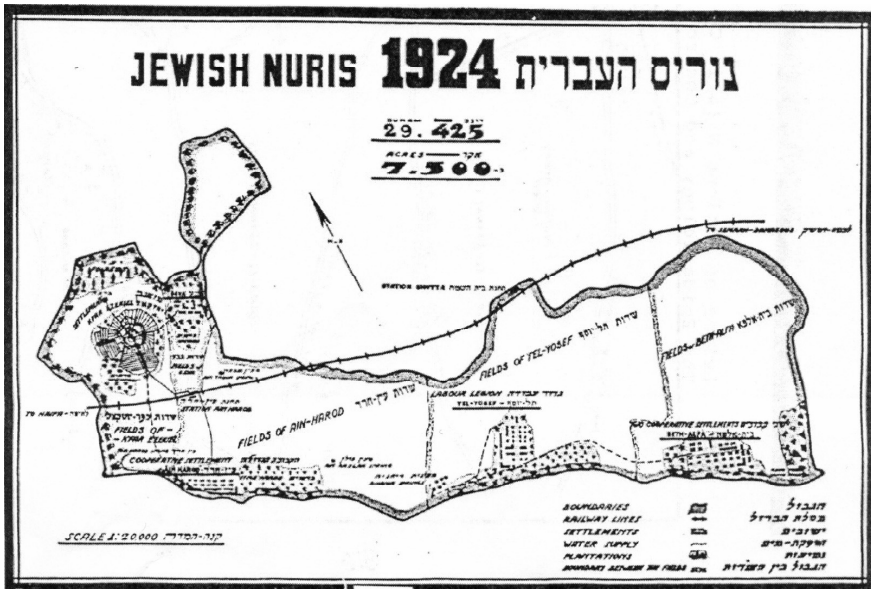
and reported in the Department of Health Annual Reports. For their part, Zionist land purchasing agencies used scientific information to evaluate new locales for Jewish settlement and to further their national project. Armed with the knowledge of anopheles mosquito flight distances, for example, the Keren Keyemet L'Israel (Jewish National Fund/KKL) in the late 1920s set out in its drainage work to eliminate any swamp that stood three kilometers to the west and two kilometers to the east of any Jewish settlement. These measurements were calculated according to wind direction and strength in the summer that could extend the flight distance of the anopheles. The KKL made sure to divert rainwaters within ten to twelve days after the rainy season so that no swamp area formed could remain. This length of time was based upon scientific data which asserted that it took that many days for the anopheles to develop (57). Surveying the land before Zionist settlement and considering the environmental and malaria characteristics of Palestine—as the KKL here did—was a provision insisted upon by Dr. Israel Kligler, head of the MRU. It reflected his belief, shared by others, that scientific analysis of the land was the only way to correctly transform and modernize Palestine.

Certain maps plainly expressed the transformation facilitated by applying colonial science and technology. Trying to show the results of swamp drainage for Jewish settlement in Nuris, the two maps included in a pamphlet *Jewish Nuris: How the Keren HaYesod is populating historic rural districts in palestine* (1925) (58) construct the landscape of Nuris with what they exclude as much as what they include (59). The first map of 1921 depicts Nuris before drainage with the sole presence of swamps (map 3). This is done in order to highlight the image of swamps as empty, waste lands and to emphasize its deviance from the second map. In stark contrast, the second map of 1924, after drainage had occurred,

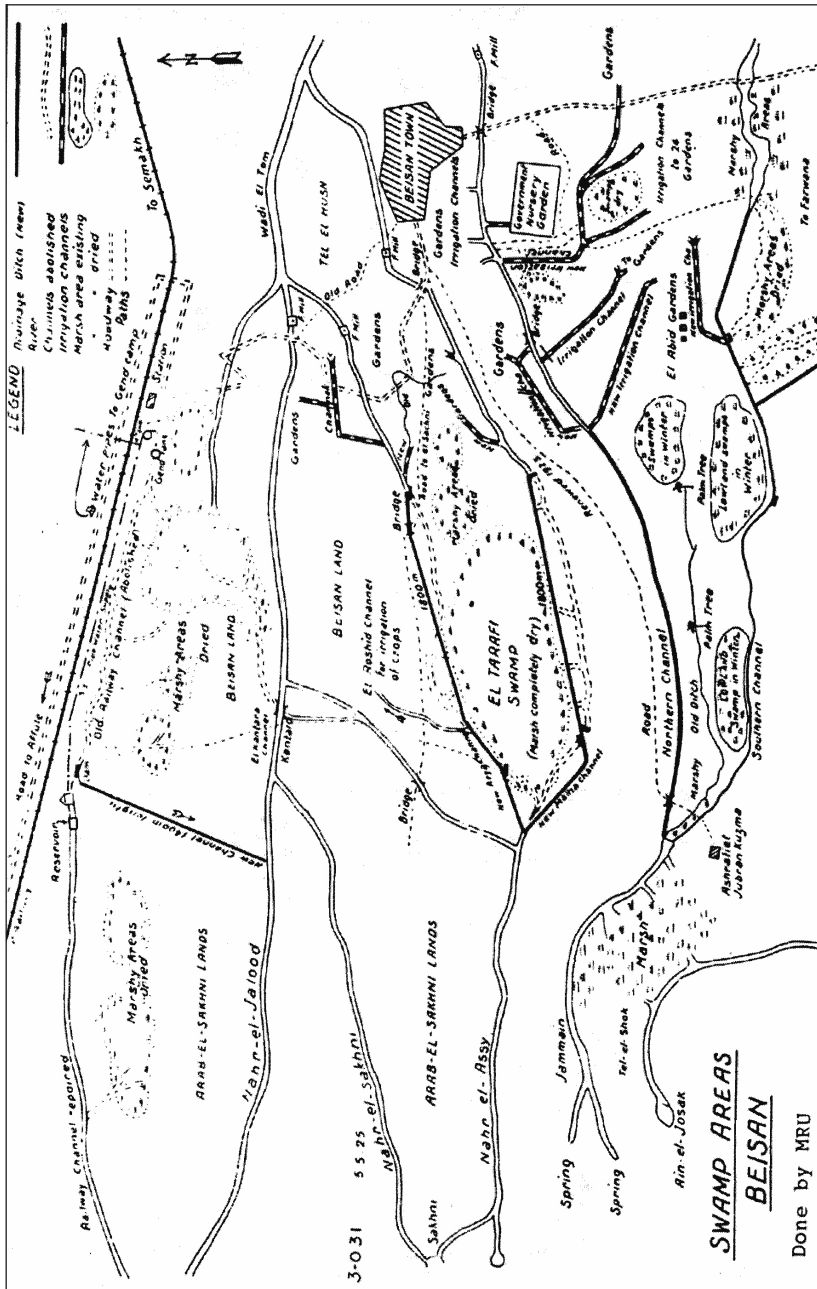
(57) Metoch din veheshbon shel hanhala mirkazit leKKL (Out of Minutes of Central Executive of KKL), 1924-1925, p. 1. CZA A246/441.

(58) ETTINGER, J. *Jewish Nuris: How the Keren haYesod is populating historic rural districts in Palestine*, London, 1925, pp. 4-5.

(59) KEARNS, Robin; GESLER, Wilbert. Introduction. In: Robin Kearns and Wilbert Gesler (eds.), *Putting health in place: Landscape, identity and well-being*, Syracuse, Syracuse University Press, 1998, p. 7.



Map 3. Source: Ettinger, J. *Jewish Nuris: How the Keren HaYesod is populating historic rural districts in Palestine*. London, 1925.



Map. 4. Source: League of Nations Malaria Commission Report, 1925. Also in KLIIGLER, note 10.

displays a vibrant area, divided and organized according to a grid, with controlled springs, fields, forests and several areas of settlements. Obviously intended and perhaps successfully effected, the juxtaposition of these two maps is meant to show the industriousness of the Zionist settlers and their ability to modernize and develop Palestine through the application of scientific technology and nationalist dedication. The second map illustrates the striking transformation of Palestine's topography that came as a result of drainage interventions.

Malaria maps, in particular, textualized scientific knowledge in visual form. They contributed to the cognitive and practical reshaping of Palestine from an imagined wasteland to one envisioned as a productive, modern land that resulted from European scientific endeavors. They did not only serve representational purposes but also practical ones. They reflected in pictures the coordinated work of the various scientists working on malaria control and the tangible results they either expected or effected. They also served purposes of academic exchange and comparisons commonly made amongst international, colonial medical/scientific professionals during this period. Indeed, the purely scientific drive underlying this enormous accumulation and analysis of data was to gain a precise understanding of Palestine's material world, its ecology and inhabitants, in order to apply that knowledge toward specific ways to combat malaria (60).

5. *MALARIA AND THE DISCOURSE OF DEVELOPMENT*

The act of gathering this scientific knowledge had political ramifications in that it was then used by political leaders in debates about the general development of Palestine. Scientific surveys, particularly ones about malaria, possessed strong political currency and were integrated into general policy debates about the rightful ownership

(60) Malaria surveys and the statistics within them were one component of an enormous collection of medical statistics produced and used by both the Palestine Government and the Zionist Health Council (Vaad HaBriut). Letter from Dr. Ratner to Vaad HaBriut. June 24, 1927, CZA J1/3005.

of the land. Scientific information gathered in malaria surveys and maps by the MRU and other subsequent Jewish malaria institutes, along with the drainage measures done by them, were used by the Zionist political leadership to make a general political claim that they were the most effective agents in the development of Palestine. These political actors capitalized on the strong cultural and political authority of statistics and science to make their claims. Especially during times of tension, the use of scientific information served as a valuable tool for the Zionist leadership to manage British limitations upon their endeavor in later years. The use of scientific data and rhetoric reveals the merit of malaria work as a political justification for increasing Jewish immigration and settlement. It also reflected their belief in modern development so central to the broader colonizing ethos of the period.

Perhaps the most striking and simple example of malaria maps used in political debates is a map entitled «Jewish Antimalaria Control in Palestine» (see Map 1 in this article). The map was included in a document called «Palestine's Health in Figures» submitted to the UN Special Committee on Palestine in 1947. This map, constructed by the Malaria Research Station at Rosh Pinna, shows the main Jewish settlement areas with a superimposition of highly malarial infected places for 1920, albeit seven years before the Station's establishment (61). It was used to sharply contrast the low malaria incidence in Palestine in 1947, thereby showing to the Special Committee how much the Zionists had done to improve the health of the country and to control malaria in the land. Tables accompanying the map show the decrease in malaria in the Huleh, Beisan and Emek Hefer areas as a result of Jewish anti-malaria work (62).

(61) The Malaria Research Station did not exist in 1920 so they constructed this map using older malaria statistics. *Palestine's Health in Figures*, Report Submitted by the General Council (Vaad Leumi) of the Jewish Community of Palestine to the United Nations Special Committee, 1947 CZA Library; Also reprinted in YEKUTIEL, Fritz. *Infective diseases in Israel: Changing patterns over thirty years*. *Israel Journal of Medical Science*, 1979, 15 (12), 977.

(62) *Palestine's Health in Figures*. Report submitted by the Vaad Leumi to the UN Special Committee on Palestine. Jerusalem, 1947, p. 13.

At one and the same time, the map illustrates in broad view the work of Jewish agencies (MRU) in anti-malaria control and the epidemiology of malaria among the Jewish population of Palestine. It also reflects Jewish settlement and N-shaped purchase patterns that partially came about as a result of the low population density of Palestinian Arabs in the valleys and coastal regions partly because of malaria. Implicit in the map is the agenda of getting rid of the diagonal lines, those denoting malaria. Palestine is reconstructed here according to the analytical categories of malaria incidence and Jewish settlement; the attempt to translate the image of an ideal Palestine into reality is carried out through drainage measures (63).

Maps accompanied other documents in development and policy debates about Palestine. A memorandum submitted to the Government by the Jewish Agency to the Royal Commission in 1936, for instance, stated that Jewish colonization was carried out in areas infested with malaria «where cultivable areas had become waste marsh land due to centuries of neglect» and that the process of reclamation had «favored Arab as well as Jewish lands...» (64). The Memorandum also noted that Jewish malaria agencies expended more money than Government or Arab parties in the eradication of malaria. The Palestine Government challenged the claims of the Jewish Agency, stating that it had omitted mention of Arab participation in the Malaria Research Unit's works. For example, the Jewish Agency memorandum stated:

«It is evident from this map (map not given) that, with few exceptions (...) Jewish effort has been chiefly responsible for rendering large sections of uncultivable, malaria-infested regions healthy and habitable».

The Government refuted:

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- (63) See similar map of Palestine within League of Nations report that details spleen rates for different years between 1918 and 1925. It is very likely that the MRU produced this map and it was then submitted to the Report. League of Nations Health Organization Malaria Commission, no page.
- (64) Antimalaria and Drainage Work by Jewish Bodies, p. 1. CZA Library.

«In referring to the useful work accomplished by the Malaria Research Unit under Government direction it is regrettable that the Jewish Agency thought it fit to conceal the fact that successful cooperation had been obtained between Arab villagers or land owners and the Jewish settlers in work which was to the mutual benefit of both communities» (65).

Like the Department of Health, Dr. Tawfiq Canaan, President of the Palestine Arab Medical Association in the 1940's, challenged the Zionist assertion that they had improved health conditions for the Arab population and that they were the chief actors in the development of Palestine. In a report called the *Hygienic and Sanitary Conditions of the Arabs of Palestine*, Canaan stressed that Palestinian Arabs were involved in and promoted the development of the country through swamp-drainage efforts as well. He said:

«The Jewish organizations have also drained some swamps, especially those in their colonies. But it must be said on the basis of the above-mentioned data and figures [referring to statistics on number of labor days offered by Arab community from 1931-1939 for anti-malaria efforts] that the Arabs have done, under the leadership of the Public Health Department, their share in this sanitary work» (66).

It must be noted, however, that the participation of Palestinian villagers in anti-malaria work was not the scientific, research work conducted by sections of the MRU and the MSS, but rather the implementation of drainage plans on the ground. Palestinian Arab medical professionals engaged in scientific work through their positions as Government medical officers but again did not have a separate research agency. Still, statistical, scientific data, including maps, about anti-malaria work were used by all parties in political battles over

(65) Palestine Health Department. Comments on Memorandum submitted by JA to Royal Commission. 1937, 5 PRO CO 733/345/10.

(66) PALESTINE Arab Medical Association. *Hygiene and sanitary conditions of the Arabs of Palestine*, Jerusalem, 1946, p. 6.

the country. Scientific knowledge became key for presenting political positions and for justifying colonization and settlement.

6. *CONCLUSION*

Anti-malaria work in Palestine encompassed scientific, development and political agendas. Scientists involved in this work were interested in finding out more about the nature of mosquitoes, swamps, climate patterns, soil types and other environmental knowledge necessary for disease eradication. Understanding the relationship between a human and his environment, and between environmental vectors and the spread of disease, were key points of inquiry in colonial medicine of the late nineteenth and early twentieth century.

Furthermore, malaria control around the world at the time was thought to be a way of reviving or improving the land for intensive agricultural use. Considering that backdrop, scientific information gathered and shared between the anti-malaria agencies in Palestine was used to correct Palestine's perceived status as a wasteland and to create a modern land. All types of maps —spleen maps, contoured maps, swamp maps and drainage maps— allowed engineers to gain knowledge of Palestine's landscape in order to intercept what they saw as pathological processes and to transform the land according to modern, scientific principles. Placing scientific knowledge onto a visual grid through malaria maps formed yet another way to manipulate and redefine and re-envision the landscape. This new way of seeing had practical ramifications in swamp drainage projects for which scientific information provided the background. Malaria maps, for instance, served as tools to help determine future Zionist settlement and legitimated past settlements by showing the difference in the land's development pre- and post control. These anti-malaria efforts radically transformed the topography of Palestine into a land that has no marshes today.

Politically, administratively, structurally and scientifically, the Zionist malaria project in particular cannot be divorced from the Jewish settlement and development initiatives that it facilitated. Zionist national,

non-scientific agencies used the products of scientific mapping and information along with the subsequent success of anti-malaria control to claim that they had contributed the most out of all communities in Palestine to the land's development. These maps, supplemented by pictures and films of industrious, blossoming Jewish settlements in once-existing marshlands, were also used in propaganda to promote the Zionist cause at the time (and after) (67). Indeed, swamp drainage and the myth of malaria remains a powerful symbol of the strength and stamina of the Zionist endeavor in contemporary Israeli public consciousness.

Taken together, these points show that the malaria project in Palestine cannot be separated from the general political debates and demographic transformation of Palestine during the Mandate period. Moreover, the malaria project in Palestine is an instructive case study for its ability to demonstrate the complex intersections between the country's environmental, scientific, public health and political histories.

(67) See Nuris map (Map 3) analyzed in this article distributed by Keren HaYesod as proof of the benefits of Jewish settlement. See also SUFIAN, note 17; Also <www.spielbergfilmarchive.co.il>. My people's dream. Kol-Or Palestine American Production Company 1934.