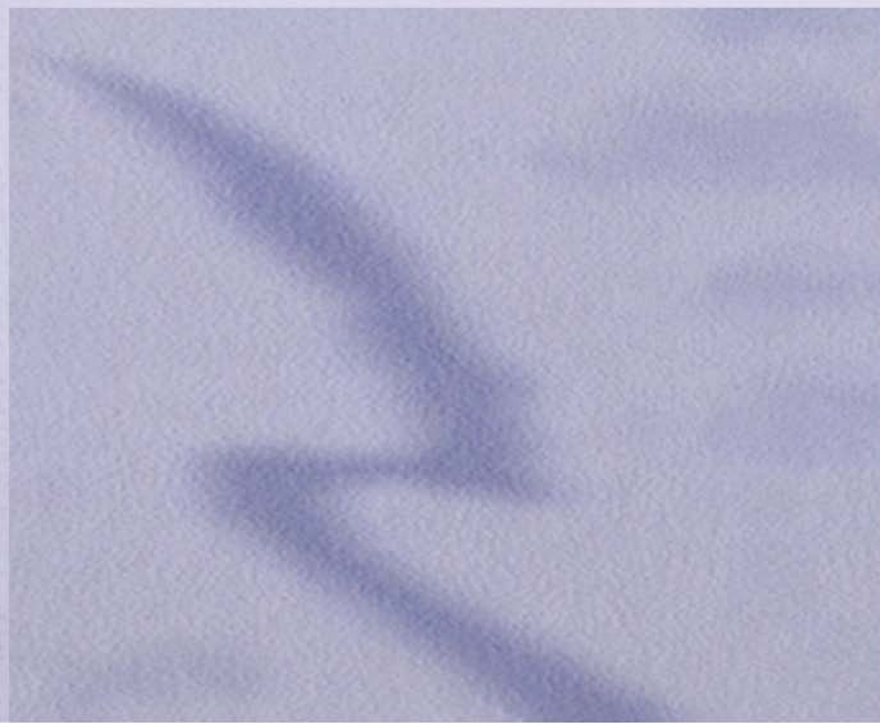


A Survey of Palestine under the British Mandate, 1920–1948

Dov Gavish

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A Survey of Palestine under the British Mandate, 1920–1948

This book is an historical study of the survey and mapping system of Palestine under the British Mandate. It traces the background and reasoning behind the establishment of the survey programme, examines the foundations upon which the system was based, and strives to understand the motivation of those who implemented it. There is special importance in understanding the system that was set up to survey and map the country, which has produced an authoritative cartographic document for reference at the negotiation table, on the wall of the war-room, or in the court of justice.

A Survey of Palestine under the British Mandate, 1920–1948 shows that the roots of the modern survey system in Palestine lie in the Balfour Declaration and its implications regarding land in Palestine. The system was established with the objective of surveying and mapping the area of the country, as demanded by the Zionist Organisation, in order to implement legally binding land settlement and registration of tenure rights and to establish the distribution of land ownership. The land issue was at the core of the mapping of Mandatory Palestine, and it remains the core issue at the heart of the Israeli-Palestinian dispute.

The book will be of great interest to historians of cartography and land survey, and historians of the British Mandate period and more generally of the administration of the British Empire. Scholars of land law, the land settlement of Palestine, and the Arab—Israel conflict, and military historians, will also find it of great value. With all material being presented in accessible form, and with no prior knowledge assumed, this book will also appeal more generally to students of the Middle East, geography, and politics.

Dr Dov Gavish is Director of the Aerial Photographs Archives, and lectures at the Department of Geography, Hebrew University of Jerusalem. His previous publications include *50 Years of Mapping Israel, 1948–1999* (with R.Adler); *Salt of the Earth: From the Palestine Potash to the Dead Sea Works*, *Land and Map: The Survey of Palestine, 1920–1948*; and *ManMade Birds on Our Horizon: First Flights Over Palestine, 1913–1914*.

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Frontispiece: Measurement taken from point 2'M of the Palestine major triangulation baseline, Imara lands, 1925 (source: J.H.Mankin photo collection in Palestine Exploration Fund archives, London).

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Preface

This book is an historical study of the survey and mapping system of Palestine under the British Mandate. It traces the background and the reasoning behind the establishment of its framework, examines the foundations upon which the system was based, and attempts to understand the motivation of those who implemented it. Today's map of Israel reflects to a large extent the geodetic, mathematical, and cartographic infrastructure inherited from the Mandate Survey Department, together with changes, adaptations, and improvements added by the Survey of Israel.

Studies of Palestine/Israel in the twentieth century in general, and of the British Mandate in particular, have focused on the operation of governmental systems in practice. Thus, in order to be able to present a cartographic document for reference at the negotiation table, on the wall of the war-room, or in the court of justice, there is special importance in understanding the system by which the country was surveyed and mapped. Maps are essential for touring and studying the country, planning its future development, and determining facts on the ground. Knowing the background of why and how a particular map was created holds the key to understanding it and enhances its usefulness, lest mistaken imputations be attributed to it. The recognition of the map's status makes it an historical, geographical, and legal document intimately connected with the country's history.

Research into the history of cartography is based on an integration of several interdisciplinary realms. The geographer is usually interested in what the map has to tell rather than in its history, the cartographer is concerned with how it is constructed, and the historian looks at maps to understand the past. The history of cartography addresses the history of mapping, the reasons and factors behind the making of the map, and the implications of mapping for the history of the country. It relies more on documentation than on maps. Studies of the history of mapping based on the maps themselves have been restricted to a chronological inventory of explorers, descriptions of existing maps and of their subject matter, and their technical and cartographic treatment. The contribution to scholarship and science of this type of research has been virtually exhausted, for there are graphic limits to what a map can tell us.

The basis of the historical-cartographic approach is the realisation that it is impossible to interpret a map without understanding the background and the reasons for its creation. Maps answer specific needs and demands, and their making entails factors and considerations that influence their production at all stages—from the initiatives behind them, through their production, and to their distribution and the determination of their uses. These factors are rarely evident in the finished cartographic product, and without seeking them out it is impossible properly to explain a map and its contents.

The British have a rich history of mapping the Holy Land, from the first half of the nineteenth century onwards. Their earliest efforts—the Admiralty charting of the continental shelf and the coasts, and the surveys and mapping by the Royal Engineers of

towns and the interior of the country—took place in the 1840s. These were not the work of inquiring travellers, but thoroughly planned undertakings. Subsequently, the British mapping of Palestine drew also on deep religious affinity with the land of the Bible and reflected evangelical as well as Imperial interests. It blossomed as scientific and scholarly research, and increasingly took on strategic and tactical significance until it became institutionalised in 1920. When the British were entrusted by the League of Nations with the responsibility for governing Palestine, they established a professional government department for surveying and mapping. They launched into this work as though what had been done previously belonged to a different country and age, as though Palestine had never been surveyed or mapped.

It is at this point that the present study begins. I have attempted to penetrate the reasoning that impelled the British rulers of Palestine to begin mapping the country anew in 1920 and understand how they went about it. What were the objectives of the mapping, its scope, and their achievements? Was this mapping Palestine oriented or was it motivated by Imperial considerations? Did it reflect the interests of a colonial ruler who aspires to imprint his character on the land and dictates arbitrary forms through his surveying and mapping methods? Did the British relate to Palestine as to an unknown colony that had to be learned, its resources exploited, its borders determined? Were there military reasons in the aftermath of the First World War, or did the strategic position of Palestine as a bridge between continents and outlying parts of the British Empire require the mapping of the country?

In fact, I doubt that any of these reasons were behind the mapping of Palestine. After all, the British knew the country well enough, in great detail—from the Admiralty surveys in the early nineteenth century, the surveys of the Palestine Exploration Fund in the latter part of the century, and much other mapping activity. They did not lack maps, for they themselves had mapped the country—most recently, they had mapped large parts of it in the course of the Great War, which had just then come to an end. There were no great resources in this poor land, the more so after the destruction wreaked by the war, and no special military importance attached to it at the time. Demarcating the boundaries of the Mandate with the maps of the Palestine Exploration Fund presented no difficulties, and there was no particular need to assert hegemony over the country since Great Britain was there by international agreement and enjoyed the goodwill of the population. The answer should probably be sought within the internal concerns of Palestine. Perhaps the British really believed that surveys and mapping were indispensable instruments of good, wellordered government.

The present study shows that the roots of the modern survey system of Palestine set up by the military government are to be sought in the Balfour Declaration and its implications regarding land. The system was formally established in July 1920 with only one objective: to survey and map the lands of the country as demanded by the Zionist Organisation, in order to implement legally binding land settlement and registration of tenure rights. Thus, the land issue was at the core of the mapping of Mandate Palestine. Though the survey was to earmark land for the Jewish national home, the British turned the survey from a Zionist project into an important administrative issue in all fields for the benefit of the development of the country and its entire population.

Two statutory bodies were set up to deal with land settlement: the Survey Department and the Land Settlement Department. But the system that was charged with land

settlement in 1920 lacked experience and failed even in its initial steps. When the system was restructured and revitalised in 1928, the British authorities did all they could to ensure its competent, professional operation within the limitations imposed by the circumstances in the country. The government's Department of Surveys—the Survey of Palestine—was the chief professional component of the system. It developed from that time as a department involved in all aspects of surveying and mapping, and as such was inherited by the State of Israel when the British left the country in 1948 at the end of the Mandate.

The Survey of Palestine was a prolific institution that produced many different maps. This study does not purport to catalogue the map production of the department, but to look at three levels of its work which were the basis of the mapping of Palestine: preparation of the geodetic foundation for the surveys; cadastral mapping for land settlement; and topographic mapping. Reliable geodetic groundwork ensured the thorough professionalism of subsequent surveys and mapping of the country; the surveys for land settlement were the essential precondition for its sound legal status and the basis for unambiguous land registration; and topographic mapping presented the shape of the land, the natural ground cover, and human-made landscape features as one integrated unit. In cartographic terms these three levels can be taken as the mathematical infrastructure for the survey of the country; for the large-scale, detailed mapping of lands; and for the mapping of the landscapes of Palestine to a practical, more compact scale.

Survey for land settlement is known in professional language as 'cadastral survey'. This term occurs repeatedly in this book, and it is as well to understand it. *Cadastré* is a French word that may have been derived from the Latin *capitastrum*, which originally designated a registry book for percapita tax. Today it refers to a system of registering real property in registry books according to a certain order, which may be related to as a repository of data on parcels of land whose size, form, and location are determined by official survey. Cadastral survey is thus an official, accurate, and systematic survey of land for division into permanent area units, and their registration by identifying numbers given to each parcel and block. Mapping—particularly mapping of property for land settlement—is an instrument of demographic, fiscal, land, economic, or security policies of a given government. In Israel there has always been considerable awareness of mapping and its various implications for national and current problems. This study probes the historical evolution of the country's map.

My research on the mapping of Mandate Palestine began years ago as a PhD dissertation at the Hebrew University of Jerusalem. Such an attempt at reconstructing thirty years of intensive activity was entirely dependent on archival sources. Here I came up against a disconcerting surprise: I was not able to locate the archives of the Mandate Survey Department. Although throughout most of its existence the Survey of Palestine functioned as an autonomous government department, there was no such record group in the Israel State Archives. Moreover, I found that former staff members of the department in Israel had not been party to, and did not know, the cartographic considerations of the British personnel who ran the department. Studies published in Israel on the period of the Mandate rarely mention the Survey Department, and the little that was written on surveys—mainly on land settlement—was not based on documentation.

I therefore had no choice but to use an indirect approach. From what I knew of archives containing British Government files, I assumed that documents on surveys in

Palestine would be found in London, in the records of the Colonial, Foreign, and War Offices. I did not expect to find the archives of the Survey of Palestine in England, for there was no indication that this material had been removed from Palestine, and indeed, later I also found documentary evidence for its having been left there. My archival work in England revealed a wealth of material, even though many important papers could not be located. In Israel I had recourse to the documents preserved there, and to the dedicated help of the archivists at the Israel State Archives, the Central Zionist Archives, the Survey of Israel, and the Yizhak Ben-Zvi Memorial Institute archives. In England I was kindly given office facilities in the University College (UCL) Geography Department, and the Department of Land Surveying at the North-East London Polytechnic. I also enjoyed assistance and was given access to the archives and libraries of the Public Record Office, the British Library and its India Office Library and Records branch, and the Royal Geographical Society Map Room. Additional help was received from the Directorate of Overseas Surveys—since then amalgamated with the Ordnance Survey; the Mapping and Charting Establishment of the Royal Engineers, now the Ministry of Defence at Tolworth; the Royal Engineers Library at Chatham; the Middle East Centre, St Antony's College, Oxford; and the Land Economics Department of Cambridge University. I am indebted to many people who extended to me valuable assistance and advice in the course of my work, particularly Mr Martin Lubowski of 'Search and Research', London, who worked hard at locating documents and individuals. One of these, Mr John Loxton, formerly of the Survey of Palestine, provided invaluable help. The military survey historian Dr Ian Mumford provided important professional comments and insights, and Mr Stephen Bank contributed biographical summaries of personalities mentioned in the book. My appreciation goes to the Israeli historian Mr Shimon Rubinstein, who showed me his manuscript paper 'At the Height of Expectations' and opened to me the window into the land question in Palestine during the First World War and right after. My sincere thanks go to Ms Rachel Kangisser and Ms Leah Engel of the Hebrew University map library; and to Ms Tamar Sofer and Ms Michal Kidron of the Geography Department, who drew maps to illustrate the text. The Institute for Research of the History of the Jewish National Fund, Land and Settlement provided the means for the present version and translation. I am grateful too to the Palestine Exploration Fund and its former Honorary Secretary, Dr Yolande Hodson, its Chairman, Dr Jonathan Tubb, the present Honorary Secretary, Dr David Jacobson, who have helped with the publication of this volume, and Ms Felicity Cobbing, the PEF Curator, who put in quite a lot of work to prepare the illustrations for publication. My thanks to them all. I also thank all those who granted permission to reproduce the illustrations in this book.

My Hebrew book *Land and Map: The Survey of Palestine, 1920–1948*, which presented this material and my conclusions to the Israeli public, was awarded the first prize for 1992 by the A. and J. Ben-Shemesh Memorial Fund for Land Legislation and Land Policy Studies.

This English version has been modified and adapted for a more general audience. The translation from the Hebrew is the work of Mr Joseph Shadur. It has benefited throughout from his knowledge of the period; his remarks, questions, and revisions find expression in the present volume.

Foreword

This study by Dov Gavish, an expert on cartographic history of the Hebrew University of Jerusalem, describes the survey and mapping of Palestine carried out under the British Mandate. It examines the background of the survey programme, and the reasoning that lay behind it and the mapping system that was adopted. The motivations of the colonial officials who were responsible for carrying out this programme and the manner in which they did so are also appraised.

The Palestine Exploration Fund (PEF) is delighted to sponsor this important publication. It is highly fitting that it should do so, because the PEF came into being in direct response to the Ordnance Survey of Jerusalem in 1864–65. That project was undertaken by a small team of Royal Engineers under Captain Charles Wilson, who later became Director General of the Ordnance Survey in Southampton and also Chairman of the PEF. The PEF has been devoted to the study of the Levant on scientific principles from its inception in 1865. As an important part of its activities, it was closely associated with the mapping of the southern Levant, taking the initiative for the landmark topographical survey of Western Palestine, from the Litani River in the north to Beer-Sheba in the south. One of the main fruits of this pioneering survey, which was undertaken over a six year period from 1871 to 1877, was a one-inch (1:63,360) PEF map of Western Palestine in 26 sheets, published in 1880. The PEF extended its survey programme to Eastern Palestine, or Trans-Jordan, under the able leadership of Claude Reignier Conder, who had previously headed the survey of Western Palestine. However, this expedition east of the River Jordan was abruptly halted within a year, in 1882, and only one sheet of the new map could be completed, covering a land area of some 1,300 square kilometres. However, it was to be followed by a remarkably comprehensive survey of the Negev accomplished in just six weeks by Captain Stewart Newcombe, Leonard Woolley, and T.E. Lawrence on the eve of the First World War, and again under the auspices of the PEF. This substantial legacy provided the foundations for the survey work done during the period of the British Mandate.

The Executive Committee of the PEF believes that Dr Gavish's work represents a valuable contribution to the history of the mapping of Palestine and, more widely, to the history of the British Mandate period. It will be of interest to historians of cartography and land surveys, historians of the Levant and those specialising in the administration of the British Empire. Scholars of land law, the land settlement of Palestine, the Arab-Israel conflict, and military history should also find it of considerable value. With the material being presented in an accessible form, with basic concepts clearly explained, this book should also appeal to students of historical geography, cartography, and political science.

David M. Jacobson,
Honorary Secretary,
Palestine Exploration Fund,
London

Part I
The historical background to
the survey of Palestine

1

The first maps based on original surveys

In the nineteenth century, after generations of primarily biblical and religious interest in the Holy Land, Palestine was subjected to intensive geographical, historical, and archaeological research and scientific study. During this period the cartography of the country entered the modern era. Explorers, travellers, and military officers began to delineate the land by modern surveying methods rather than from their impressions, secondhand reports, or interpretations of the sacred texts.

The new cartography reflected scientific developments in Europe in mathematical theory, geodesy, and map-making. Innovative printing technologies greatly improved the production and quality of maps and increased the opportunities for their distribution. Modern surveying methods were developed mainly in France, Austria, and Britain. Specialised surveying instruments were invented, and scientific mapping enjoyed the support and encouragement of governments. Along with exact measurement and advanced topographic mapping that served the needs of artillery in the Napoleonic Wars, cadastral surveying was initiated in Europe¹ to permit more equitable taxation of real estate, better administration of public and state land, and for engineering purposes.

The map drawn up by French surveyors in 1799, during Napoleon Bonaparte's campaign in Palestine, was the first to be based on original surveys of the country. It was contemporaneous with the modern mapping projects in other countries. About fifty years previously, in France, the first topographic mapping based on a triangulation system had been conducted, by César François Cassini de Thury. From 1747 to 1755, William (later, Major-General) Roy carried out the military survey of Scotland, thereby laying the foundation for the establishment, in 1791, of the Ordnance Survey. Topographic maps of Britain on a scale of one inch to the mile (1:63,360) began to be published from 1801. In the Austrian Empire the laying out of the first triangulation network was begun in 1806; and in 1807 a comprehensive land measurement project, known as Napoleon's Cadastre, was undertaken in Western Europe—France, Belgium and the Netherlands—for the purpose of reforms in real estate taxation. Cadastral surveys were also conducted in Austria (after 1867, Austria-Hungary), Switzerland, and in several German states. In Great Britain the passing of the Tithe Commutation Act of 1836, ending tithes on agricultural produce, entailed the appending of a map to those lands.

The increased recognition of the importance of properly surveyed maps brought surveyors and explorers also to Palestine. Surveying and mapping of Palestine before the mid-nineteenth century was of uneven character: it reflected random initiatives, followed no particular system, and lacked central direction. Maps drawn up at the time were mainly the work of perceptive travellers who had acquired some of the new surveying techniques. Modern cartographic work in Palestine received unprecedented impetus in the second half of the nineteenth century. Two missions were sent to the country to

implement narrowly defined objectives: one, headed by Captain Charles Wilson, for the mapping of Jerusalem in connection with the planning of drainage and water supply systems for the city; and the second, on behalf of the Palestine Exploration Fund (PEF),² for the systematic topographic mapping of the entire country and the recording of its ancient remains. These two cartographic projects became the foundation for the modern mapping of Palestine in the twentieth century. The maps of Palestine produced in the nineteenth century reflect the particular interests and professional capabilities of the map-makers, their methods of measurement, and the level of accuracy they achieved. Their motivation for mapping ranged from geographical curiosity, biblical and historical concerns, to adventurous enthusiasm and military objectives.

But the different mapping projects in Palestine can also be considered from cartographic and geographical viewpoints. For the first time, new surveying methods were applied, contributing to the quantitative topographical knowledge of the country and to cartographic and scientific quality, which brought about considerable improvement in presenting the natural and human-made features of the country in the new maps. It is thus possible on the basis of geodetic measurements to categorise nineteenth-century maps of Palestine as town maps, maps of coasts and seas, and maps of the country proper. There was also a fourth, cartography-related category of three-dimensional models and relief maps that were constructed from some of the survey maps, but these are not relevant to the present discussion.

Local maps: Jerusalem, and the coastal and inland towns

The principal aim of nineteenth-century surveying activity centred on the mapping of Jerusalem and of the coastal towns. The explorers and surveyors who came to the country were primarily concerned with the study of Jerusalem, and the profuse sequence of maps of the Holy City that appeared also served as a catalyst for the mapping of other towns in the interior of Palestine. The coastal towns were mainly mapped by British military expeditions in the early 1840s.

Four stages can be distinguished in the development of Jerusalem city maps in the nineteenth century:³ The first step may be ascribed to the German explorer F.W.Sieber, who in 1818 measured about 200 geometric control points as a basis for the new and corrected mapping of the city. However, the most important contribution was that of the English architect F.Catherwood. In 1833 he constructed a map from his sketches and measurements, drew a panorama of the city, and prepared a detailed plan of the Temple Mount and its sites.⁴ The second stage is represented by the map (scale 1:4,800) of two Royal Engineers, Lieutenants J.F.A.Symonds and E. Aldrich, from surveys conducted in March 1841, with particular attention to places of military interest. The third stage is the map of the Dutch naval officer Lieutenant C.M.W.van de Velde, which was based largely on the measurements of Symonds and Aldrich, the Swiss Dr T. Tobler (1845), and van de Velde's own corrections. The fourth, and by far the most important, work was the survey, in 1864–1865, by a party of Royal Engineers under the command of Captain Charles Wilson, who went to Palestine in the service of the British Ordnance Survey, but were funded largely from private sources.⁵ It was the first time that a practical mapping project in Jerusalem had been entrusted to a survey party, for Wilson was commissioned with the

preparation of a map to serve the planning of a municipal drainage and water supply system for the city. To this end he laid out a local triangulation network and mapped the city on a scale of 1:2,500 and its surroundings at 1:10,000. Wilson also worked in Jerusalem with the Swiss-German architect and missionary C.Schick, who had settled in the city in 1846. During those years an Italian architect, E. Pierotti, who worked for the Turkish administration, also mapped Jerusalem and several specific sites.

Maps of the coastal towns of Palestine were mainly drawn up during naval expeditions. The first known surveying maps, which show Haifa and Acre, were drawn up in 1764 by the hydrographer J.Roux and in 1772 by a Russian naval task force that set out for the eastern Mediterranean in the summer of 1769.⁶ Two British naval expeditions followed much later: in 1841 came the work of a team of Royal Engineers, as already mentioned, and then that of an Admiralty party in 1860–1862. The former followed in the wake of the Royal Navy fleet sent to help the Ottoman forces against Ibrahim Pasha and Muhammad Ali, the ruler of Egypt. Colonel R.C.Alderson, the senior Royal Engineers officer, was not at first issued with well-defined orders when he arrived in the region. Rather than waste time, he undertook the mapping of the fortifications along the coast of Palestine and Lebanon (the ‘Syrian coast’).⁷ Alderson and Lieutenant C.F.Skyring mapped Acre, Alderson mapped Jaffa, and Lieutenants Symonds and Aldrich went to Jerusalem to make a map of the city. The Royal Navy returned in 1860–1862 to survey the coast of the country. Commander A.L.Mansell measured and mapped the entire coastline from Jaffa to El Arish, and to the Ladder of Tyre (Ras en-Naqura; Rosh Haniqra) in the north, again drawing up plans of Acre (1:18,250) and Jaffa (1:5,693).

Other towns in the country were also the subject of nineteenth-century maps, but few of these were drawn up from geometrical measurements. They were mainly the work of explorers who had acquired some knowledge of modern mapping techniques but who never really pretended to be professional surveyors. Among these are the sketch-based maps of Hebron and Nablus by F.de Saulcy, G.Rosen, and H.Kiepert. In contrast, the town maps of Jaffa and other places drafted from surveys by Theodor Sandel of the German Templar colony in Jerusalem, the map of Bethlehem by L.Palmer, and maps of Haifa and Nazareth by Gottlieb Schumacher of Haifa were all of high professional standard.⁸

The need for city maps of Palestine for military purposes again became manifest during the First World War, mainly for planning the cities’ conquest. To this end, the British photographed Gaza, Beersheba, Ramle, and Nablus from aircraft, and for the first time in Palestine prepared city maps based on and drawn from aerial photographs.⁹

Surveyed maps and charts of the coasts, lakes, and the Jordan River

Maps based on original surveys of the marine environments of Palestine constitute a separate branch in the cartography of the country, since they were made for that specific purpose. They comprise surveys of the Mediterranean and Red Sea coastlines, usually carried out by the British Admiralty, or of the interior carried out by the Royal Engineers; and surveys of lakes and the Jordan River conducted by explorers and travellers with experience in map-making.

The measurements along the Mediterranean coast aimed at correcting the overly broken appearance of the coastline in earlier maps, establishing the correct bearing to true north and mapping anchorages and coastal fortifications. The earliest-known recorded surveys of the coastline were of Haifa Bay carried out in 1764 by J.Roux and in 1772 by the Russian Navy, as mentioned earlier.¹⁰ The British began surveys in 1840 by parties on both sea and land. The Admiralty surveyors worked along the Acre coast in 1840 and 1843, and the Royal Engineers, commanded by Alderson, surveyed and devoted special attention to the coastal defences. In 1847 the Admiralty surveyed the anchorage at Jaffa, and in 1862 the second naval survey under Commander Mansell¹¹ provided data on anchorages, inlets, and the depth of the sea bottom. Mansell measured and mapped the Palestine coast from El Arish to the Ladder of Tyre on a scale of 1:243,333. He also conducted bathymetric soundings along the continental shelf and marked out isobaths on his chart. The towns and anchorages along the coast—Acre, Haifa Bay, Jaffa, Caesarea, Athlit, and the Yibna coast (today, Yavne with the delta of Na'al Soreq)—were all mapped on a larger scale, with added panoramic views in silhouette of the country's coastline to assist navigators in identifying their position. Mansell's chart became the basis for all subsequent surveys of the coast. The data it contained were incorporated in maps of the First World War¹² and served the Royal Navy until surveys were renewed by the Admiralty survey vessel HMS *Endeavour* in 1930–1932.¹³

One of the important objectives of the coastal surveying and mapping of Palestine was the Gulf of Aqaba. The Gulf—a strategically important intrusion of the Red Sea into Ottoman territory at one of the apexes of the Sinai Peninsula and at the northwestern approaches to Arabia—was of great interest to British military intelligence. It seems that the first maps of the Red Sea ports were drawn up as early as the mid-eighteenth century, and later, at the turn of the century. The first Admiralty surveys of the Red Sea coasts were conducted in 1830–1834 and published in 1843, prior to the surveys of the Mediterranean coasts of Syria.¹⁴ The first survey of the head of the Gulf of Aqaba was made by the then Major H.H.Kitchener as part of Edward Hull's geological expedition to the Arava Valley in 1883–1884 on behalf of the Palestine Exploration Fund.¹⁵

Numerous survey ships were active in the Gulf at various times. In 1906 the surveyors of the administrative demarcation line between the Sinai Peninsula and the Hejaz vilayet—in effect, between Egypt and Palestine-Syria—had recourse to data gathered by the Austrian survey ship *Pola*, which anchored in the Gulf at the time.¹⁶ Two important maps of the area were prepared during the First World War. The first, in 1916, was based on aerial photographs taken by seaplanes brought to the Gulf in the hold of HMS *Raven II*;¹⁷ this map incorporated isobathic data gathered in 1915 by the British vessel *Minerva*. The second new map of the head of the Gulf of Aqaba was produced by the Royal Engineers in 1917—perhaps the first survey map of its kind in the history of Palestine cartography. This map, on a scale of 1:30,000, was superior to all preceding ones because it was carefully prepared to meet artillery requirements. It was based on trigonometric measurements, and the relief of the terrain was depicted for the first time by means of surveyed contour lines.¹⁸

The Jordan Rift and its lakes intrigued many explorers, some of them with cartographic experience. The American Edward Robinson, the pioneer of systematic biblical geography of the country, was the first to employ geometric methods in the measurement of the Dead Sea from a baseline at the coast of En Geddi.¹⁹ In 1848 a

United States Navy expedition for the investigation of the Dead Sea and the Jordan, headed by Lieutenant W.F.Lynch, arrived in Palestine. The expedition prepared two maps, one being of the course of the Jordan River from the Sea of Galilee to the Dead Sea, and the other being of the Dead Sea itself.²⁰ The most important contribution of the expedition was the determination of the depth of the sea bottom. Soundings at 166 points found the maximum depth to be 400 metres. One of the best maps of the Dead Sea to be published was drawn up by de Saulcy in 1853;²¹ it was followed by van de Velde's map, which included the depth soundings of the Lynch expedition.

The first geometric measurements of topographic elevations around the Sea of Galilee and the Dead Sea in relation to the Mediterranean sea level were conducted by the Royal Engineers in 1841. Later, Lieutenant R.E. Anderson, one of Wilson's men, mapped the Huleh Valley and the surroundings of the Sea of Galilee in 1865 on behalf of the Palestine Exploration Fund. And in January 1869 the Scottish traveller John MacGregor reached the sources of the Jordan, and in between his exciting adventures managed to measure and map the Dan sources, Lake Huleh and the swamps around it, as well as Lake Gennesareth—the Sea of Galilee.²²

Surveys of Palestine in the nineteenth century

The maps of Palestine produced from surveys in the nineteenth century can be divided into two groups: topographic maps and smaller-scale orientation maps. The map printed shortly after the turn of the century by one of Bonaparte's surveyors, Jacotin, and the maps of the Palestine Exploration Fund of the second half of the century were detailed topographic maps. During the seventy years between the appearance of these maps, several other surveys of Palestine were conducted, but to a smaller scale, such as the Royal Engineers map of 1841 and van de Velde's map of 1858.

Even though it did not encompass the entire country, Jacotin's map was the first modern map of Palestine that may be considered topographic. It was drawn up in 1799 by a small team of *ingénieurs géographes* who accompanied the French expeditionary force in its march from Egypt to the walls of Acre.²³

The French were the first to base their cartographic measurements on a triangulation system, and the first to mark out control points in Palestine. Jacotin constructed his maps from baselines measured from points near Alexandria and Cairo and on a coordinate system determined from a starting point of the tip of the pyramid of Giza. The sheets were drawn to a scale of 1:100,000—an entirely new scale in the history of cartography. The French maps of Egypt and Palestine were among the first in the world to be constructed to this scale. In 1790, when the French *Académie des Sciences* was asked to define a system of weights and measures, it proposed the decimal, or metric, system. The proposal was officially adopted by the French Government in 1799, the year of the mapping of Egypt and Palestine, which applied the new system well before it became legally binding in 1840.

The character of Jacotin's map was largely determined by the pace of the French Army's progress through the country and the route it followed, the time-frame, and the limited number of topographers. When Napoleon Bonaparte invaded Egypt in 1798, 150 scientists, engineers, surveyors, and scholars were charged with conducting scientific

studies of Egypt, but only a few of them accompanied the expedition that left Egypt for Palestine in February 1799. Gaza was taken on 24 February, Jaffa on 7 March, and on 19 March Acre was besieged. With the active help of the Royal Navy, the town withstood the French onslaughts until 20 May, when Bonaparte began his retreat from Acre and from all of Palestine. His remaining troops reached Egypt on 1 June 1799. The French surveyors therefore had only two months in which to work, which was insufficient for anything but hurried measurements. For this reason, apparently, Jacotin preferred to extend the area they mapped at the expense of scientific accuracy.

The military surveyors were unable to deviate from the actual route taken by the army and incorporated data culled from other sources, or on the basis of rushed and superficial impressions, as they also did in the mapping of Egypt. The map indeed includes erroneous data that even in earlier maps had been rendered more accurately. For example, the southern coastline of the country seems almost entirely imaginary in the map, despite the surveyors having passed very near to it in the course of their work. Relief is indicated by means of hachuring, which, although it does not convey any precise topographic information, does give the topography a certain plasticity that emphasises lines of drainage and the watershed. Jacotin's map provides information about inhabited settlements, and there are conventional signs for types of terrain, natural vegetation, and cultivation methods of the period. The published map is impressive mainly for its attractive cartographic treatment and its large scale of 1:100,000, which permits a detailed depiction of the landscape. The French map of Egypt comprises forty-seven sheets, of which six are of Palestine.

The combination of unsubstantiated information with hastily gathered survey data in such detailed topographic maps laid them open to sharp criticism. Jacotin's map was considered of lesser value than the more advanced contemporary European maps. Some critics regarded these maps of Palestine as military documents, and others described them cynically as 'a magnificent military sketch', a pejorative term that had been applied to General Roy's map of Scotland forty-three years before Jacotin's map of Palestine.²⁴

The first full survey of Palestine was conducted by an expedition of Royal Engineers in 1841, about forty years after Napoleon's campaign. At the initiative of Lieutenant Symonds, the surveyors prepared to work in Syria and Palestine. Symonds assumed responsibility for the mapping of Palestine; Alderson, Aldrich, and Skyring mapped the area within the triangulation network laid out by Symonds; Major Charles Rochfort Scott drafted the map. Symonds measured two triangulation systems, one from Acre to the Sea of Galilee by way of Safad, and the other from Jaffa to the Dead Sea via Jerusalem. The chains were measured from two baselines—near Acre and Ramle—and the two were connected by joint measurements to form one triangulation network. In this way, more exact positions of additional settlements and sites were determined, and the levels of the Sea of Galilee and the Dead Sea were calculated in relation to that of the Mediterranean. Nevertheless, the measurements of the depression of the Sea of Galilee (–100 metres) were far off the mark (approximately –212 metres). They cast doubt on the value of the entire work and gave rise to severe criticism. Symonds's survey work resulted in the printing, but not publication, of a map on the scale 1:253,440 (one-quarter inch to the mile) in 1846.²⁵

An orientation map based on surveys was that of the Dutch naval cartographer van de Velde, who travelled to Palestine in order to map the country on the strength of his

experience in the Dutch colonies. Van de Velde published a map in eight sheets in 1858 to a scale of 1:315,000, covering the country from Tripoli in the north to south of the Dead Sea. It was recognised as the best cartographic work on the country until the appearance of the map of the Palestine Exploration Fund. Van de Velde's cartographic experience enabled him only to construct his map from earlier ones, mainly the map of Symonds and that of his colleagues, Kiepert's (1841, 1852), Tobler's (1845), and de Saulcy's (1853), and to integrate his own observations. He explained that he did not intend to conduct triangulation measurements, did not have time for this, and lacked the necessary surveying instruments. Van de Velde's map represents a transition from the compilation stage—drawing up a map from various sources—to mapping based on original surveys.²⁶

In 1870, the year in which the Palestine Exploration Fund began its survey, yet another topographic survey was to take place. Captains H. Mieulet and I. Derrien of the French General Staff arrived in the country and began work in the Acre region as an extension of earlier work in Lebanon. They laid out a baseline, managed to survey an area of about 2,000 square kilometres, and prepared field sketches on a scale of 1:100,000. However, after three months in the field they were recalled to France when the Franco—Prussian War broke out. The little they managed to survey resulted in one sheet of Galilee on a scale of 1:100,000, and four sheets on a scale of 1:50,000.²⁷

The map of the British Palestine Exploration Fund in connection with archaeological investigations constitutes the high point in the surveying of the country in the nineteenth century.²⁸ After their earlier, partial surveys, the British explorers came to the conclusion that there was little point in carrying out disjointed studies of the Holy Land and that it was necessary to undertake a full systematic survey of the entire country. Among the early, tentative efforts were some of special geographical significance, which influenced the decision to establish the Palestine Exploration Fund.²⁹ The most important of these surveys was the Ordnance Survey mapping of Jerusalem by Captain Charles Wilson in 1864—1865. Wilson's second project, the levelling measurements, was a milestone in the geographical study of Palestine. Wilson's levelling from Jerusalem to the Dead Sea, from Jerusalem to Jaffa, and from Jerusalem to Solomon's Pools showed for the first time that the Dead Sea was 395 metres below the level of the Mediterranean. In 1865, as part of Wilson's survey, Lieutenant Anderson carried out tachymetric measurements from Baniyas to Hebron to obtain basic data about the relief of the land.

Upon his return to England, Wilson concluded his mission by recommending a full survey of the entire country, and indeed, additional survey expeditions were sent to Palestine and Sinai under the auspices of the PEF. In 1867 Captain Charles Warren arrived in the country in order to conduct excavations in Jerusalem. In the intervals of his archaeological work he surveyed areas in the coastal plain north of the Dead Sea, and the eastern Jordan Valley. Warren was the first to carry out a full survey of the Jordan Valley, and also surveyed Mount Hermon, the Beisan region, and other parts of the country. While still working in the coastal plain in 1867, Warren reached the conclusion that there was no value in the new maps because, even though sites were marked on them in correct relation to one another, they were totally misleading in their overall spatial context.³⁰ There was, accordingly, no point in continuing with sporadic, disconnected surveys without a country—wide skeleton framework on which existing and future surveys could be hung. Warren therefore proposed a systematic, geometric survey of the

entire country. In 1873, with hindsight, Wilson described his sense of the inadequacy of the accumulating, disjointed surveys:

It was felt that Biblical research had reached a point at which an accurate map was indispensable for its further progress, and that the strong tide of Western civilisation which had recently set in, would sweep away for ever many old names, traditions, and relics of the past, if they were not rescued by the speedy completion of an accurate and systematic examination.³¹

In 1870, when the PEF in London was informed of the difficulties in obtaining archaeological excavation permits for work on the Temple Mount, it turned to the recommendations put forward by Wilson and Warren regarding a comprehensive survey of all of Palestine, and resolved to carry out this project. That very year a mission under Captain R.W. Stewart commenced work, but in the course of the measurements the direction was given over to C.F.Tyrwhitt Drake, and later to Lieutenants Claude Regnier Conder and Horatio Herbert Kitchener.³² The survey began with the laying out of a triangulation network from two baselines measured between Lydda (Lod) and Ramle and in the Plain of Esdraelon (Valley of Jezreel; 'Emeq Yizre'el). The system was also based on control points established in the past by Symonds (1841), on Wilson's levelling (1865), and on Mansell's points along the coastline (1858). The lengths of the triangle sides in the hill regions were 8–12 kilometres, and in the coastal plain 16–20 kilometres. In addition, measurements were made to determine the elevation of trigonometrical reference points and inclinations of valley and ridge slopes. The cartographers represented topographic relief by means of a picturesque sort of coloured shading method, and integrated in this the data from the spot heights measured in the field. This was a technique inferior to that used in earlier maps of the country, in which relief had been represented more successfully, though not more accurately, by means of form lines.

The cartographic result of the Survey of Western Palestine, which ended in 1877, was twenty-six sheets of maps produced on a detailed topographic scale of one inch to the mile (1:63,360) that was standard in Britain. The entire map encompassed all of the biblical land of Israel, 'from Dan to Beersheba', and its most important contribution was the detailed indication of historical and other significant sites of the country. Geodetic measurements and topographic mapping were of secondary importance and only served to locate the cultural assets of the past and present. The map was accompanied by three large volumes of memoirs with information and descriptions of finds derived from the fieldwork. During the next half-century, for lack of a more modern map the PEF map was considered the most reliable and served as a basis for adaptations of new maps compiled with reference to it.³³

During the First World War the PEF map was repeatedly revised and updated, and various versions, in several formats and different scales, were published by the Survey of Egypt on behalf of the British War Office. Both the British and the Germans had recourse to it in the preparation of new campaign maps, and after the war the PEF supplied these maps to the administration of the occupied territories in Palestine for various purposes.³⁴

Ottoman maps and survey programmes

In the Ottoman period, even in its latter years, no central authority existed for directing the mapping of Palestine. We have relatively little information on Turkish mapping activity in the country, and this may well reflect the actual level of such activity. There was a military survey department in Turkey, but its purview did not extend to Palestine until the final phase of the First World War in 1917–1918.³⁵ The only statutory initiative connected with mapping known to us resulted from the Young Turks revolution in 1908. In 1912–1913 land reform legislation was passed throughout the Ottoman Empire which included provisions for cadastral surveys for the registration of property rights.³⁶ However, the outbreak of the First World War, soon after the passing of these regulations apparently precluded their implementation in Palestine. Nevertheless, we do have documents that attest to the requirement of land measurement and mapping for land transactions and registration of real estate in Palestine. Certain Ottoman documents imply that the Sultan's private lands (*jifilik*) in the country were mapped for purposes of development.³⁷

The absence of an Ottoman mapping authority in Palestine was also felt in the realm of civil engineering. Although in the Ottoman administration of Palestine a Chief Engineer prepared maps for the projects in which he was involved,³⁸ the principle was that whoever initiated an engineering project was responsible for the measurements of the infrastructure, even if these had relevance to the entire country. Thus, the route of the railway from Jaffa to Jerusalem was surveyed by the Belgian partners in the enterprise in 1890, and the branch line of the Hejaz railway in Palestine by German and Italian engineers in 1905. And even the measurements of the administrative demarcation line between Egypt and Palestine in 1906 were carried out by the Survey of Egypt, with the agreement and signature of Turkish officials.³⁹

Along with the various mapping projects in the country, an alternative framework came into being to provide surveys and mapping for the needs of the population. Construction projects, planning of residential neighbourhoods and settlements, parcelling of land units, acquisition of land, swamp drainage—for all these, professional measurement was indispensable to the preparation of detailed plans. These tasks fell to experts from all sectors of the population, among them engineers, architects, and surveyors (where these were available), many of them having acquired the necessary skills through practical experience. They worked privately or as employees of technical offices of institutions, companies, and local and regional authorities. Their names and some of their work reflect their varied origins and the great demand for modern plans. Among them were many European Jews associated with the new Zionist colonies, some working for Baron Rothschild's officials in surveying Gedera, Petah Tiqva, Rehovoth, and other *moshavot*,⁴⁰ and there were several German surveyors from the Templer colonies in Haifa, Jerusalem, and Saron. They were drawn into this work by the pressure of need and circumstance, but operated without the control of any central survey authority.

However, in 1909 the Turks decided to map their entire territory (using the Bonne projection), and the General Staff of the Ottoman armed forces established a topographic

commission as a cartographic office. Surveying, influenced by French professional practice, began in 1910. Because of the vast extent of the territory under Ottoman control, the Turks established a rapid preliminary system of triangulation of the second order. The areas surveyed included extensive areas in European Turkey, Anatolia, the Caucasus, the Black Sea coastal regions, the Dardanelles, Medina in the Hejaz, Syria, and Palestine. Reflecting the practice of other armies all over the world, they also produced Turkish versions of existing maps gathered from foreign sources. The major Ottoman series was a topographical map to a scale of 1:200,000. The military grid was not overprinted on the sheets of this map.

When the war broke out, the Turkish military survey teams measured control points from Syria as far as Medina in the Hejaz. During 1917 they were busy preparing twelve sheets, five of which covered various parts of Palestine: Gaza, Jerusalem, Haifa, Jaffa, and Nablus. From the spring to mid-summer of 1917 they began work on the Jerusalem and Gaza sheets, and completed the preparations for the Nablus sheet in 1918, on the eve of the general retreat before the advancing British forces. In November 1918 they returned to Istanbul. We do not know whether, or to what extent, these maps were used by Turkish units on the Palestine front. It seems that the maps were completed and printed after the war. They are not mentioned in official British accounts of the Palestine campaigns.⁴¹

Maps of the First World War, 1914–1918

The First World War brought to Palestine two armies—British and German—with extensive knowledge and a long cartographic heritage. Both sides had evinced vivid interest in the country long before the war, and had at their disposal a good cartographic infrastructure. However, the existing maps of Palestine did not answer the requirements for the planning of military operations, and both armies had to prepare suitable tactical maps as best they could. Under the pressure of circumstance they constructed such maps by a combination of methods, partly from existing maps and in part from new surveys.

In meeting immediate war needs, the British had recourse to the Palestine Exploration Fund survey maps, and to the maps of Sinai and southern Palestine of the Geographical Section of the General Staff drawn up by, among others, Captain (later, Colonel) Stewart Francis Newcombe, RE, of the Military Intelligence staff in Cairo. The maps, on a scale of 1:125,000, were published up to the very eve of the war;⁴² and many other war maps were prepared during the course of the hostilities.

The Germans, although their maps were generally inferior to the British ones, also made an important contribution to the mapping of Palestine. They mainly used published British maps or classified maps that were captured during the fighting. Their concerns before the war had been more for the extension of their economic and military influence in the Ottoman Empire. Military mapping did not figure prominently in their considerations—perhaps because Palestine in any case belonged to their Turkish allies, and possibly because they knew that most of the work had been done for them by the PEF. The main German undertakings were the mapping of southern Palestine and northeast Sinai in 1915, and their war maps prepared at a later stage of the war.

According to Friedrich Frieher Kress von Kressenstein,⁴³ who commanded the Turco-German troops in their drive to the Suez Canal in January 1915, the map he had available was that drawn up by Hans Fischer in 1909⁴⁴ for the German Palestine Society (*Deutscher Palästinaverein*) on the basis of earlier maps—among them Alois Musil's inept cartography.⁴⁵ When at the beginning of the hostilities it became obvious that a better map was essential, Newcombe's new map still being secret, a German officer, Major von Ramsay, was charged in 1915 with the preparation of a map of southern Palestine and Sinai on a scale of 1:250,000. This map was printed in 1916 in a set of four sheets with legends in German and Turkish; it covered the area from Jerusalem and Jaffa in the north to the line connecting the Gulfs of Suez and Aqaba in the south, and the Hejaz railway on the east. This map too was mainly compiled from earlier maps, but with the addition of many details. Von Ramsay's map was reissued in a second edition in the course of the war, but now incorporating data from Newcombe's map, which had in the meantime fallen into German hands.⁴⁶

In the winter of 1917 the Germans decided to change the system of assistance to the Turks. They formed a special task-force named 'Jilderim' under the command of General E.von Falkenhayn. The units in this force were organised along German military principles under German officers (rather than under Turkish officers as previously). Among them were also survey and mapping units similar to such units operating in Europe. The Prussian Survey Company (*Vermessungs-Abteilung* no. 27)⁴⁷ was formed on 1 October 1917 and arrived in Palestine at the end of the year.⁴⁸ It only began actual work on reaching Jerusalem on 12 October 1917, less than a month before the Turkish retreat from southern Palestine. The military situation forced reliance primarily on existing maps, such as the PEF map, and also on aerial photographs.⁴⁹ This German military field survey company managed to operate for about ten months, until the war's end. In this period it produced thirty-nine sheets of central Palestine on a scale of 1:50,000, and seven sheets on a scale of 1:25,000 of the region of the defensive lines from the western Auja to Jerusalem. In June 1918 this unit also published a map on a scale of 1:100,000, which was a reduced version of its 1:50,000 map.

The British were better organised and showed more intelligence in their mapping than the Germans. They were under less pressure and were more open to cartographic initiatives deriving from the war needs. In his summarising report of October 1918, Captain H.Hamshaw-Thomas, who introduced many of the cartographic and photographic innovations in the headquarters of the Palestine Brigade, wrote that at the beginning of 1917, when the Egyptian Expeditionary Force entered Palestine, it became clear that the character of the front had changed.⁵⁰ The army was no longer fighting in virtually uninhabited open areas with sparse landscape features, as in north Sinai, but now faced defensive lines based on key towns. From now on, the army had to force a way through trenches, built-up obstacles, and populated areas, and lacked detailed maps that showed every feature of the terrain. For this kind of warfare and tactical operations, the PEF maps the army had used until then were of no use. They were unsuited to artillery range-finding, to trench warfare and combat patrols, or for spotting targets identified by aerial photography. The GHQ Topographical

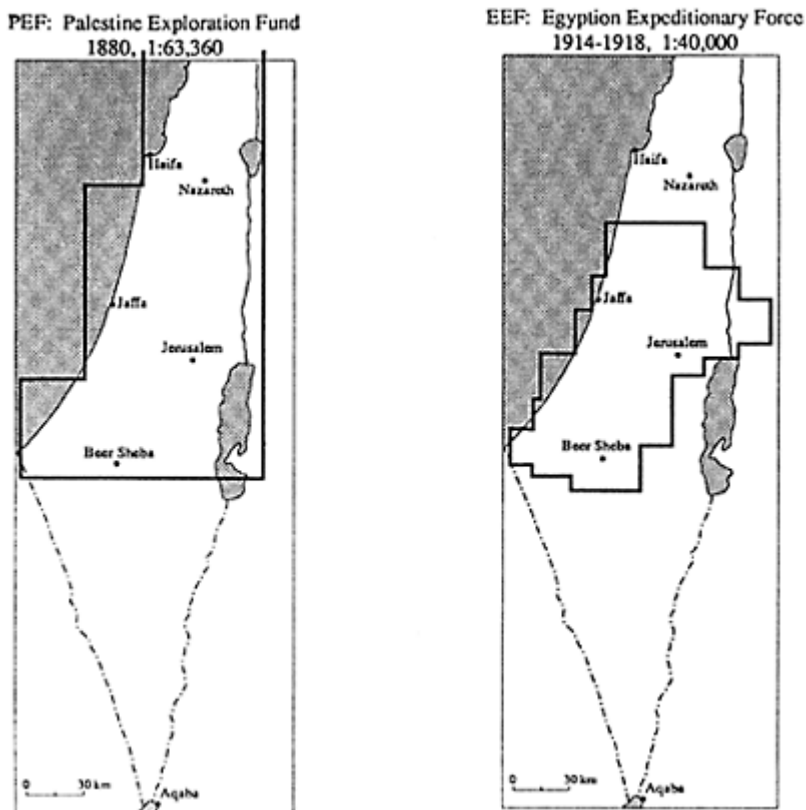
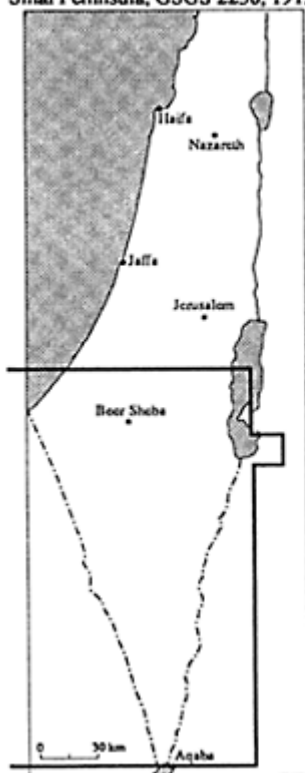


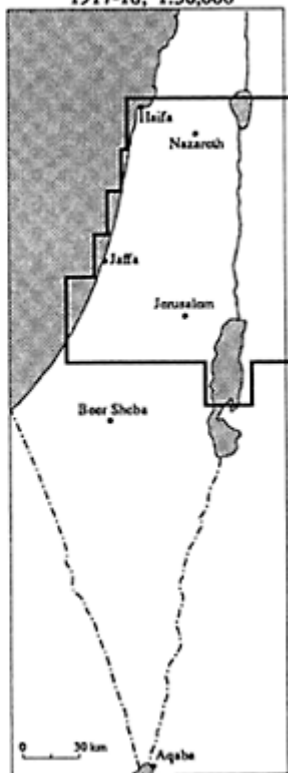
Figure 1.1 Series of topographical maps of Palestine at the end of the First World War (source: Gavish, ‘World War I Battle Maps’, p. 201).

Section, relying mainly on the staff of the Survey of Egypt, was charged with the preparation of detailed large-scale operational maps even before the area fell to the British. In order to deal with this problem, new methods were devised from the early autumn of 1916 for mapping with the aid of aerial photographs.⁵¹ In an effort to give the mapping activities greater impetus, the War Office in London on 14 March 1917 ordered the formation of the 7th Field Survey Company, Royal Engineers, which constituted a significant expansion of the initial surveying unit.⁵² The company continued with the work it was already involved in, but now increasingly incorporated data from aerial photographs. In this way a series of 1:20,000 scale maps was prepared of the area between Gaza and Beersheba to an unprecedented degree of detail, and mapping was begun of a standard

Africa 1:125,000
Sinai Peninsula, GSGS 2230, 1915



German Military Maps
1917-18, 1:50,000



1:40,000-scale series. The new maps immeasurably improved the organisation of tactical intelligence—particularly of aerial intelligence—since targets could be marked on them with great precision. For the breakthrough battles of Beersheba, a still more detailed series of maps was prepared on a scale of 1:10,000, but because of the very large number of sheets it was decided to make do with the 1:20,000-scale maps. After the successes at Beersheba the surveyors stopped this detailed mapping and returned to the original 1:40,000 version. The unit laid out a triangulation network on baselines measured near Rafah and at Auja, north of Jericho; elevations were measured trigonometrically, and for the first time the relief was indicated on these maps by a combination of contour and form lines. In all, the British surveyed and mapped an extensive area, including 1,280 square kilometres with the help of aerial photographs between Gaza and Beersheba, and 3,840 square kilometres by means of aerial photographs in the rest of the area, including about 3,000 square kilometres that was mapped while this region was still in Turkish hands. This 1:40,000 series of May 1919 comprised twenty-six sheets. Another sheet, 'Parts of Nimrin B-7 & Salt C-7', was prepared for the region east of the Jordan from north of the Dead Sea in June 1918 as a record of Allenby's failed breakthrough to es-Salt in March 1918. The standard mapping on a scale of 1:40,000 encompassed the central regions of Palestine and was only completed to a distance of 50 kilometres beyond the front line - the line of the 'Two Aujas'—and included Allenby's range of

breakthrough in the western Auja sector (today, in Tel Aviv). For the area north of this line, the Hadera-Samaria line, the army relied on the PEF maps updated by means of aerial photographs in the interval before the last offensive against the Turks, in September 1918.

Towards a new cartographic organisation

By the end of the First World War, Palestine could boast a respectable history of geodetic inventory, rich cartographic coverage, and a considerable choice of various types of maps. These maps can be categorised according to their characteristics and contents in order to point up their successes and deficiencies. But taken as a whole, in the perspective of history they show the continuity and steady improvement in representing the face of the land; for after all, every successive mapping project constituted a cartographic advance in the study and knowledge of the country.

The survey and mapping work that preceded the First World War was of threefold significance: geographical, cartographic, and geodetic. The geographical contribution derived primarily from the fact that the maps had entailed field surveys. Second, the surveys covered the entire country, including the important towns and the various landscape units. In this way, knowledge of and familiarity with the Holy Land was broadened, and was increasingly based on investigated, substantiated data. The cartographic contribution is expressed in the significant advance in representation of the ground surface and the replacement of imaginary maps of the country. Gradually the recognition seeped through that there must be an intimate connection between the map and the essential needs of the country.

Alongside the cartographic improvements, the geodetic methods that were first applied in Palestine from the early nineteenth century on can be summed up. From that time to the end of the First World War, triangulation, levelling, and measurements of valley and ridge lines were conducted, as were astronomical observations and bathymetric soundings, and surveys from aerial photographs. The innovations in surveying techniques and field mapping contributed to the familiarity with the country in its true proportions. The more the map was improved upon mathematically and in its content, the more it became a historical and visual document that reflected the appearance of the land more accurately. The map of Palestine had become a scientific and graphic instrument for tracing the developments in the country's eventful history.

Two main constraints beset all survey and mapping work: chance and time limitations. The mapping teams that came to the country were uncoordinated, and the cartographic objectives were determined by the interests and predilections of individual explorers or groups. In addition, the map-makers were restricted in the course of their work. If we have come to regard country-wide, national topographic mapping as the main milestone in the evolution of the mapping of Palestine—from Napoleon Bonaparte's map to the maps of the First World War—it is difficult to evaluate all these maps according to common standards of measurement, gathering of data, and graphic representation. Nevertheless, all the maps have one thing in common: they were all prepared in a hurry—and this apparently is the key to the uneven accuracy of the work and reliability of the sources, poor representation of the relief, and crude cartographic treatment.⁵³ The PEF

map was surveyed in the course of six years, from 1871 to 1877, by intermittent spurts of work, and was prepared without contour lines. Even with today's technology, this is too short a time to carry out a full, detailed, and accurate topographic survey. The campaign maps of the First World War, which are closer to us in time and spirit, mainly because of their indications of the relief by means of contour lines (to meet the requirements of artillery), offer no more than what a unit of military field surveyors was asked to provide within a short time for current war needs, even at the cost of geometric and cartographic accuracy. And indeed, this mapping project was stopped at the arbitrary line that met the immediate needs of the British Army.

Ostensibly, when the Survey Department of the Government of Palestine was established in 1920, there were in the country a large number of maps of various kinds.⁵⁴ What, then, was lacking in the field of cartography that necessitated the establishment of this special department?

Considering that in Palestine there had been no central Ottoman surveying authority, but only a varied selection of maps of diverse origins for what normally would be expected of a central or governmental mapping establishment, it is difficult to point out a precise deficiency. However, we know that the Mandate survey establishment was set up in order to conduct cadastral mapping for land administration.

Even though Palestine was a country with a dynamic real estate market, and a considerable part of its Treasury's revenue was based on landed property, there was no cadastral mapping. It seems that under Ottoman rule, land ownership maps were prepared only when both parties to a transaction were interested in a map, or had to attach a map to the acquisition contract, or if the representatives of the government demanded such a map as a condition for transfer of ownership. We have no other information on this matter. The Survey Department of the Government of Palestine was therefore set up not to fill the lacunae or to improve the existing situation, but to do everything afresh according to a standardised geodetic infrastructure that would serve as the basis for continuous, regularised work in the future.

The accumulation of old cartography was essentially a haphazard hotchpotch of various sources. Each map that served as source material for a subsequent one passed on features of previous maps. The maps were intended to fill voids in biblical and geographical knowledge, and as such enriched the store of data; but they could not serve the needs of comprehensive, practical activity. Nor was the Palestine of the First World War the country of Napoleon Bonaparte's campaigns; it was not even the country it had been at the time of the Palestine Exploration Fund survey. F.J.Salmon, who headed the Mandate Survey Department in the 1930s, thought that 'the Palestine surveyed by Kitchener was more like Crusader Palestine'.⁵⁵ It was therefore necessary to ignore what had been done in the past and start again in order to meet the vital needs of the country effectively. For the first time in Palestine there was an opportunity to set up a central, professional authority to direct and coordinate all mapping, create a unified, standard surveying infrastructure, determine measuring standards, supervise the level of performance, and lay down the basis for continuity and permanence. None of these fundamentals existed in Palestine before the British Mandate.

2

The transitional period

From the land problem under the military administration to the survey system of the Government of Palestine

The military administration in Palestine, 1917–1920

The First World War ushered in a new era in the government of the country. Exploration gave way to military campaigns, and the romantic bent of Britons for the East and the Holy Land was tempered by responsibility for administering a conquered land facing difficult problems of subsistence and subjected to sharpening nationalist conflict.

On 31 October 1917 two historic events took place that radically changed the course of the country's history. In London the War Cabinet confirmed the text of the Balfour Declaration, and in Palestine General Allenby launched an all-out offensive on Beersheba, a tactical move that led to the conquest of the south of the country and the liberation of Jerusalem from Turkish rule. With the conquest of Jerusalem in December 1917, Allenby established a military government over those parts of Palestine that had been conquered and appointed his Chief Political Officer, Brigadier-General Gilbert Clayton, to head it. It soon became obvious that the administrative tasks were too complex and confused to be dealt with by the command of the British Egyptian Expeditionary Force (EEF). Allenby decided to set up a special authority for the occupied areas headed by Major-General Arthur W. Money, who took charge in April 1918.¹ Six months later, on 23 October 1918, after the conquest of the north of Palestine and Syria, and the end of the war with Turkey, Allenby announced to the War Office in London that he had extended the military administration over all the conquered territories and intended doing so for areas to be subsequently brought under his control.² On 27 October 1918 the order was issued establishing the Occupied Enemy Territory Administration—South (OETA S), one of the four administrations of the occupied areas.³ Palestine, with the autonomous *sanjaq* of Jerusalem and the *sanjaqs* of Nablus and Acre, was included in OETA (S).⁴ On 30 October the military government was officially empowered by the armistice agreements signed in Mudros⁵ between the Ottoman Empire and the Entente Powers.

In order not to leave an administrative gap, Allenby ordered the military government to comply with the 'Laws and Usages of War' as laid down at The Hague in 1907.⁶ This international convention aimed at protecting the population in conquered areas by applying those laws that had been in force there before the conquest, for an interim period until the formation of a permanent government—unless there was an absolute impossibility of doing so. During this period no radical changes in the law of the land were to be made so that the population could continue to run its life as much as possible without disturbance. On 27 January 1919, Major—General Louis Bols, the EEF Chief of Staff, repeated Allenby's order that the Turkish administrative framework must be

maintained and public services were to be continued. Among these services Bols included the Land Registry Office (*tapu, tabu*), which was paralysed at the time, but did not mention any office of surveys, there being no such department in the Turkish administration.⁷ Nevertheless, the administrative officers could not ignore the matter of surveys, because they fully recognised the necessity of mapping for planning their work and for the administration of the real estate market and mapping of the country. In direct, practical terms this amounted to a lack of maps for the day-to-day running of interior affairs; and indirectly, following the Balfour Declaration, raised the question of defining and determining lands on which the Jewish national home was to be established.

The shortage of maps for administrative purposes

The imposition of military government in Palestine occurred during wartime. The authorities concentrated on the rehabilitation of the administrative frameworks, so as to assure the continuity of civilian life. Under these circumstances it was not to be expected that any attention would be directed to mapping the country—except mapping for military purposes, which went on as long as the hostilities continued. It would have entailed diverting for such work the army's surveyors, who were busy demarcating the northern border of the country after the war.⁸ Also, after the war ended, the administration did not get around to mapping because it had more important things to do, and because it did not have at its disposal the financial means to carry out any mapping. Moreover, setting up a civilian mapping unit, with all its legal implications, would have contradicted the order to observe the existing Ottoman laws (which, however, did not relate to this).

Civilian mapping has entirely different objectives from those of military mapping, deriving from the great variety of potential applications. Civilian map-makers usually strive to learn more about the country's resources and its physical and cultural attributes in order to use these rationally for development, physical planning, and administration. The existing maps of Palestine were not suitable for administrative purposes, and both the military government and the civilian government that took over from it in 1920 had to cope with this lack of maps. Available documentation shows that the officers of the military government improvised solutions, searched for maps in every office and drawer, and made do with what came to hand in overcoming this cartographic want. The few documents cited in what follows show that even the PEF maps and the war maps were used to the utmost as long as they were in stock in the country, in Egypt, and in London. To meet the needs the authorities turned also to other sources. Thus, for example, during the war, in January and August 1918, British Military Intelligence asked the Palestine Office of the Zionist Organisation in Jaffa to provide it with maps and plans of the settlements and towns in the country. Among these were the maps of Tiberias (1:40,000) and Haifa (1:2,500 and 1:25,000), the map of the projected railway line between Yazur and Rishon le-Zion (1:40,000), and others.⁹ Also, a few single maps of Jerusalem (1:5,000, 1:10,000, and 1:15,000) that were gathered from different places were warmly welcomed by the GHQ OETA (S) in March 1919.¹⁰

Akiva J. Ettinger, who had just become head of the Directorate of the Agricultural Settlement Department of the Zionist Organisation, had to work hard to retrieve the maps

taken from the Palestine Office; in April 1919 he finally received just a few of them from the OETA (S) Public Works Department (PWD). The PWD was requested to undertake mapping work for the administration of development and maintenance in the conquered territories and for building necessary military installations. For this purpose the War Office in London adopted for Palestine the framework set up in Mesopotamia, where a senior Royal Engineers officer was appointed to head a combined military and civilian PWD and to serve as Chief Engineer to GHQ.¹¹ Thus, the Chief Engineer for Palestine was responsible for civilian and military engineering projects, including supervision of land required by the army; for determining locations of army camps; for planning of railways, roads, and tracks; and for preparing surveys, large-scale surveying, and mapping for water supply, drainage and sewage works, and the like. But the PWD—OETA (S) was not set up for the production of maps, and so had to be satisfied with what it could obtain from the Palestine Office of the Zionist Organisation and elsewhere.

When the civilian government began operating in July 1920, the Land Registry Office (*tabu*) was reopened, having been inactive during the period of military government. The Registrar of Lands, F. Ongley, soon found that without maps it would be very difficult to keep track of everything concerning land transfers. He requested all the *tabu* offices that had just reopened to let him know what maps they had. They had none. Ongley then asked the PWD to let him have a few copies of the PEF maps, but had little luck there either. In October he applied to the Egyptian Survey Department in Giza. The Acting Director, Louis B. Weldon,¹² sent him a catalogue of wartime military maps, and from this Ongley ordered sets of the military maps of Palestinian cities: Beersheba, Bethlehem, Gaza, Haifa, Hebron, Jaffa, Nazareth, and Tulkarm.¹³

The requests to the Survey of Egypt apparently proved burdensome, and the civilian government preferred contracting with the Vester Company—the economic branch of the American Colony of Jerusalem—to represent it and obtain the maps of the Survey of Egypt in Palestine.¹⁴ Indeed, Ongley, Albert Abramson, the Chairman of the Land Commission set up by the High Commissioner in August 1920,¹⁵ and Maurice C. Bennett, the Director of the Land Department, were all referred to Vester.¹⁶ Thus, all the government offices requiring maps were forced to purchase maps of Palestine of British production from a commercial company.

The supplies of the Survey of Egypt apparently could not meet the demand, and the lack of maps plagued the administration of Palestine for some time. Even the Admiralty was requested to provide the results of its marine surveys to the OETA (S) HQ.¹⁷ In September 1921 a special request was made to the PEF office in London, which responded by sending a supply of maps to Palestine for administrative purposes.¹⁸ In that year, Colonel Newcombe, who was in command of the Royal Engineers, took a little time out from his negotiations with the French over the demarcation of the northern border of Palestine. He did not remain inactive, but devoted his free time to the preparation of a proposal for a railway line from Haifa to the Huleh Valley, on the basis of the PEF maps.¹⁹ These maps were also used by the surveyors who demarcated the northern border in 1923–1924,²⁰ and by the engineers of the Northern District PWD and the Royal Air Force when looking for sites suitable for landing fields in 1923.²¹

Even after the Palestine Survey Department had been set up, it was still many years before maps could be printed locally. Until then, the government received important cartographic assistance from the Survey of Egypt. This help comprised printing of maps,

advice, and the loan of experts and equipment. PEF maps, maps of the First World War, and various administrative maps were printed in Egypt for the Government of Palestine. Among these were maps of Palestine to a scale of 1:250,000 of October 1918, the administrative map of the Geographic Section of the General Staff (GSGS),²² and the 'Environs of Jerusalem' map to a scale of 1:10,000 of November 1917, which served to prepare the plans for the preservation of internal law and order in Jerusalem when Arab-Jewish confrontations became imminent.²³ The latter map was also included in the *Guide-Book to Jerusalem and Environs* published by the Vester Company in 1920 for tourists coming to the city.²⁴ The 'Plain of Jaffa' map to a scale of 1:6,000 of June 1918, which was appended to the report on the Arab riots in Jaffa in 1921, was also printed in Egypt.²⁵ In addition, maps published by various commercial firms were being used in the country at the time. In August 1921 Pinhas Ruthenberg submitted his plan for a hydroelectric power station at Jisr Majami, at the confluence of the Yarmuk and the Jordan Rivers (Naharayim), with a beautifully executed map to a scale of 1:750,000 that was produced by the Geographia Company in England: 'Utilization of Water Resources in Palestine Jordan Valley—Scheme of Works'.²⁶ And at the end of 1925 a report on the geology of Palestine was published with a map by George Phillip.²⁷ Within the framework of the discussions with the Zionist Organisation on the allocation of state domain lands for Jewish settlement, the Palestine Land Department prepared, in August 1926, a special, large 1:250,000 map, 'Map of Palestine. Land for Jewish Settlement', suitable for small-scale reproduction. This was the administrative map published by Bartholomew's in Britain.²⁸ These are but a few of the examples illustrating the shortage of maps characteristic of the period of transition from military to civilian government in Palestine.

Surveying and Ottoman land laws

As we have seen, various surveying and mapping initiatives were undertaken during the Ottoman period—mainly by non-governmental actors—for the construction of buildings, the planning of settlements, or for the division of lands on a limited, local basis. Land allocation had economic and legal implications of great concern to the State, which no ruling administration could ignore. The government was well aware that of all property, land was the most stable, and could continuously enrich the Treasury with income from land transfers, property taxes, and taxes on agricultural produce.

A close connection between land and land measurement has existed from the dawn of history. The division (parcellation) of land was carried out for the determination of taxable units, ownership and tenure, and for cultivation and irrigation. With time, records and documents on land transactions accumulated into large volumes of inventory—land registers—or ownership records, or cadastres in which was recorded all the information on division of landed property.²⁹ The entries in land registers, which among other data included descriptions of parcel boundaries, areas, and valuations for taxation assessment, necessitated measurements in the field and descriptions that would permit their ready identification, verbally or by means of maps. This was the basis for the close relationship between surveying and land-related matters in many countries, among them Palestine and Israel in the twentieth century.

The first comprehensive registration of land in Syria and Palestine apparently dates to 1313 during the rule of the Mamluk Sultan en-Nasir Muhammad ibn Qalaun. Later, several other cadastral surveys were conducted, among them one in the first decade of the seventeenth century, and another in the days of Muhammad Ali, in the first half of the nineteenth century. As in other realms, the experience gathered in land surveys in Europe gradually began to penetrate the Ottoman Empire. In 1848 the Ottoman authorities employed three Prussian engineers in a cadastral survey that began in Lebanon; and at the end of the nineteenth century a land registration project on European models was undertaken in Egypt, entailing a combination of surveying and mapping of parcels.³⁰

The basic Ottoman Land Code, which was in force in Palestine at the outbreak of the First World War, had been adopted on 21 April 1858.³¹ The law was applied in different ways throughout the Empire, in accordance with the prevailing situation and local customs, including in Palestine and Transjordan. The Turkish Government did not limit itself to the basic law, which mainly purported to give it control over state land (*miri*) and proceeded to legislate series of regulations regarding land, such as the Tapu Law of 14 December 1858,³² which laid down the foundations for the system of registration in the land registers and for the issuing of deeds (*kushan*) without which no land transaction could be confirmed. In this way was established the special authority of the Imperial Registers (*daftar khani*) to administer the land books. In 1875 a regulation was passed for registering *mulk* lands (in full private ownership) in the Imperial Registers rather than in religious courts, and two years afterwards *waqf* (religious endowment) land transactions were added to this provision. But all these organisational laws and regulations lacked one essential condition, without which the *tapu* books could not reflect a true picture of land titles, either physical or legal: the obligation to measure and map the lands in question that would replace the ambivalent verbal descriptions. This was the background to the initiative of the Advisory Committee on Settlement of the Zionist Executive for inviting Joseph Treidel, a Jewish surveyor from Berlin, to survey and map the *jiflik* lands of Beisan, the Huleh Valley, and Jericho, and to conduct the survey and mapping of all the lands of Palestine in 1904–1909.³³

After the Young Turks Revolution and the changes in the Ottoman Government in 1909, a proposal was advanced for reforming the Ottoman Land Code. In 1912–1913 new provisional laws were passed, without, however, being confirmed by the Parliament in Istanbul, and the reforms were never enacted. The laws, such as the Provisional Law of Survey and Registration of Immovable Property, were intended gradually to move the Ottoman land laws in a more rational direction, among other things on the basis of cadastral surveys of village boundaries and the ownership boundaries of parcels of land for registration of titles and land settlement.³⁴

The Ottoman laws, and among them the Land Code, derived from the sanctity of Muslim religious law.³⁵ For this reason, the British avoided abolishing them absolutely, and preferred to circumvent them by new legislation.³⁶ Paragraph 46 of the Palestine Order in Council, which was published upon the confirmation of the Mandate by the League of Nations on 24 July 1922, stated that the Ottoman legislation and laws in force on 1 November 1914, when Turkey entered the war, would remain valid as long as they were not superseded by new legislation.

In this way the validity of the Ottoman land laws was upheld, together with all the amendments and additions that were promulgated from time to time. But since the Turks

did not have time to implement the Ottoman cadastral law of 5 February 1913 and to carry out a cadastral survey of Palestine, it was not affected by the Order in Council of 1922, and did not bind the British authorities.³⁷ This was the situation in the country that led Arthur Ruppin, the Director of the Zionist Organisation's Settlement Office, to lament the bitter experience of the Zionist land and settlement experts under the Ottoman administration: 'There were to be found neither exact lists of lands (cadastre) nor land registry books in the European sense. It is unthinkable that precise land registry can exist without land surveys, which are the basis for it.'³⁸

Thus, the impetus for the modern mapping of the country was the need for a cadastral survey. With the conquest of Palestine the British authorities had to address the land question, and this took on particular urgency with the Balfour Declaration in 1917. Towards the move from military administration to a civilian government, the military authorities worked out a programme for a modern cadastral survey on the basis of exact measurements in order to settle the land question. The renewed British concerns with the cartographic needs of the country, with the attendant measurements and mapping for the anticipated cadastral survey, led the government to establish the Survey of Palestine as a fully fledged department.

The Balfour Declaration and the land question

On 2 November 1917 the British Government published a proclamation signed by the Foreign Secretary, Arthur James Balfour, which stated that

His Majesty's Government view with favour the establishment in Palestine of a national home for the Jewish people, and will use their best endeavours to facilitate the achievement of this object, it being clearly understood that nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities in Palestine, or the rights and political status enjoyed by Jews in any other country.

The Balfour Declaration and the conquest of southern Palestine by the British forces awakened aspirations among the Jewish inhabitants of Palestine; the Zionist Organisation intended doing all in its power to take advantage of this historic promise. At the time of the Balfour Declaration the Zionist leadership, headed by Dr Chaim Weizmann, conceived a plan for uplifting the spirits of the Jewish population in Palestine and ameliorating its economic condition in order to prepare the country for the absorption of many Jewish immigrants. To advance this programme, on 6 November 1917 Weizmann proposed the despatch of a special mission to Palestine to study the situation at first hand and to work out a practical plan,³⁹ and on 27 November the Political Committee of the Zionist Office in London formed the Zionist Commission for Palestine. Its declared objective was to assist the military authorities in dealing with all matters relating to Jews and the establishment of the national home.⁴⁰ The Cabinet's Middle East Committee gave its approval on 19 January 1918, and the commission, under Weizmann's leadership and with William Ormsby-Gore MP as Political Officer and liaison between the Zionist Commission and the military authorities, began preparations for going to Palestine.⁴¹

Weizmann formulated the commission's objectives on several occasions,⁴² differentiating between the immediate needs to be addressed and actions that could be postponed until the end of the war. The latter included immigration, land acquisition, settlement, and the development of natural resources. The plans for setting up a wide economic infrastructure could not be implemented during the war, and therefore Weizmann recommended studying the problems and, for the time being, conducting surveys and planning for the future.⁴³ In the light of the historic opportunity for implementing the Zionist vision, all the plans had both a symbolic and a practical aspect, but land matters had special significance, for, clearly, without ownership of the land there could be no national home and no return, no settlements, and no development of agriculture. But the land question in Palestine was a highly sensitive issue that required the special attention of the authorities and the Zionist leadership.

Local British officialdom, which tended to be largely apathetic towards, if not opposed to, the Balfour Declaration, dealt with the land question in a statutory manner during the transition period: by means of the official proclamation not to change laws and practices in force in the country at the time of the conquest; and by an absolute prohibition on land transfers, especially those to which the official proclamation did not apply.⁴⁴ The meticulous observance of the existing land laws was an obstacle mainly to the Jewish *yishuv*, for the Hague Convention prohibited the transfer of enemy assets, interpreted here as prohibiting the allocation of Ottoman state lands to Jews for the establishment of the national home. Hence, legal land transactions that were at an advanced stage of implementation were also stopped. The proclamation left in force governmental regulations and arbitrary decrees of local Turkish governors that discriminated against the Jewish population in land matters.⁴⁵ Although the imposition of the prohibitions on land transfers also derived at least in part from the Zionist leadership's apprehensions at extensive speculation in land, the main problem was the paralysis of the Land Registry offices. The retreating Turks hid or took away with them part of the Land Registry records and threw into disorder the entire system that might have made possible the tracing of land transactions and registration.⁴⁶ The British closed the Land Registry offices and halted all real estate activity until these could be reopened.

The Zionist leadership addressed the land question in three ways: by attempting to convince the Arabs and the authorities that there was no intention of dispossessing the Arab population of lands belonging to them; by urging the prevention of land speculation by both Arabs and Jews; and by circumventing the legal obstacles of the status quo regulations. All three levels constituted one integrated policy aimed at obtaining from the British the state domain lands, uncultivated lands, and abandoned lands, so that these would be at the disposal of the Jewish *yishuv*—even if only for temporary cultivation as a stage in implementing the Balfour Declaration, and until the advent of a civilian government with authority to abrogate the status quo regulations. In this way the Arab population would not be harmed, the speculative real estate market would remain calm, and the freeze on transactions of registered lands would not be affected.

Regarding the question of privately held Arab land, Weizmann was guided by Akiva J. Ettinger and Shmuel Tolkowsky, the advisers to the Zionist Organisation in London on land matters. They urged Weizmann in his contacts with the British to relate exclusively to state and vacant lands that were not privately owned, so as to remove all suspicion concerning the dispossessing of Arabs.⁴⁷ Indeed, on 2 March 1918, just before the Zionist

Commission left for Palestine, the Foreign Secretary, Balfour, gave Weizmann a letter of recommendation to Allenby to assist the Zionist Commission in studying the economic potential of the country, in particular to conduct a survey of lands and identify the state domain lands, the vacant uncultivated lands, and abandoned lands.⁴⁸ Along with delineating the objectives of the Zionist Commission, the problem of preventing speculation in land was also discussed. Interest in land acquisition caused price rises and stimulated a speculative real estate market. Now that there was a possibility of allowing Jews to acquire land for the establishment of the national home, there was a real fear of wild speculation, including speculation by private Jewish real estate dealers who would compete without coordination with the institutions of the *yishuv* over a limited market.⁴⁹ The meeting on 27 November 1917 that decided on the formation of the Zionist Commission also recommended an immediate request to the government for cessation of all real estate transactions in Palestine in order to prevent speculation, and to avoid seriously damaging the future development of Jewish settlement. On 16 January 1918 Weizmann put on paper the programmes of the Zionist Commission that were approved by Balfour. Among them were proposals for regulations to be promulgated by the military authorities forbidding land transfers as long as the country remained under military occupation.⁵⁰

At a joint meeting in April of the Zionist Commission and the representatives of the Provisional Council of Jews of Palestine, the effects of the prohibition on land transactions was discussed. The consensus was that the benefits of the prohibition outweighed its negative effects on the Zionist interest, and that it should even be extended.⁵¹ Only at the end of 1919 did Allenby's Political Officer, Colonel Richard Meinertzhagen, succeed in changing this attitude in order to stimulate the rehabilitation of the Palestinian economy.

Both Arabs and Jews were well versed in the ways of circumventing the decrees of the Ottoman authorities, and there was a strong incentive to evade the decrees of the new rulers too. Among the Jewish leadership there was opposition to engaging in indirect land deals, which was against the law and against its spirit.⁵² But the Muslim landowners had no qualms about making use of the *waqf* laws to transfer land rights, or mortgaging them for their livelihood, because the economic conditions in the country had forced many of them to borrow money to survive or to buy their way out of the Turkish military draft, all their debts being secured by land.⁵³

The unrelenting pressure of the Zionist Organisation and its emissaries, the disorder that pervaded the entire real estate market in Palestine, and the apprehension about under-the-table deals that would also harm the interests of the authorities finally led the head of the military administration, Major-General A.W. Money, to take several steps. The first, on 24 June 1918, was a proclamation announcing the reopening of courthouses in the country. Paragraphs 22 and 23 of the proclamation specifically stated that the courts were not competent to decide cases of land or real estate transactions.⁵⁴ Two more proclamations were issued in November 1918 prohibiting all land transactions in the *sanjaqs* of Jerusalem (effective retroactively from 1 December 1917), Acre, and Nablus during the transitional period while no solution was found to the reopening of the *tabu* offices.⁵⁵

The Zionist Commission had arrived in the country on 4 April 1918 at a difficult time for the British forces. Allenby was at the time withdrawing from a failed attempt to reach

Amman, and his advance in the Jordan Valley was very limited. Earlier, the Germans had launched their winter offensive in France, and Allenby was asked to allocate troops for the Allied forces on the Western Front.⁵⁶ The conditions in Palestine were thus unpropitious for conducting the land survey Allenby had been asked to facilitate.

Since there was no alternative to a survey for identifying the lands, determining their legal status, measuring them, and staking them out, the Zionist Commission pursued other strategies for establishing claims to lands pending a comprehensive cadastral survey. During these spring days of 1918, under pressure of the economic plight of the country and with the intent of providing agricultural produce for the British Army, several projects were advanced by Zionists for surveys entailing detailed investigation and mapping of lands.⁵⁷ These included a plan for growing winter crops in the ‘south’ of Palestine (at the time, the area between the parallels of Ascalon and Beersheba);⁵⁸ plans for cultivating *waqf* lands in Wadi Rubin (Na’al Soreq); and an ambitious proposal by the agronomist Aaron Aaronsohn, which more than any other aimed at circumventing the legal obstacles. It would have put extensive tracts of the southern part of the country at the disposal of the Zionist undertaking, in the hope that after the war the Zionist Organisation would be able to receive some of these lands for settlement.⁵⁹ The implementation of these plans was resisted by functionaries at OETA and the Cairo Headquarters, who, on administrative and legal pretexts, did all in their power to frustrate the Zionist initiatives. But even before many of the impediments to implementing these ideas were removed, and before the necessary financial and human resources could be marshalled, the Entente powers in Europe recovered their position, and in June 1918 Allenby could resume his efforts and end the war in Palestine within a short time. There was then no further interest in Aaronsohn’s plans for the breadbasket of southern Palestine.⁶⁰

The implementation of the programmes for the economic rehabilitation of Palestine, among them planning entailing lands, was predicated on Zionist capital and manpower. It became necessary to bring to the country a specially trained advance group that would include engineers, to be at the disposal of the Zionist Commission for planning and immediate action. Thus, again the subject of surveys and mapping of Palestine became a matter of urgency, this time on the initiative of practically minded American Zionists. While the Zionist Commission was on its way to Palestine at the beginning of 1918, the Association of Zionist Engineers in the United States, having received a list of the specialised engineering professions required, organised a group of fifteen engineers to go to Palestine on 1 March for a period of six months. Among the fifteen engineers were three surveyors, two of them topographers, and one hydrographer.⁶¹ On 26 April Weizmann telegraphed to Jacob De Haas, the Secretary of the American Zionist Federation, commended the idea of the Engineering Unit, and requested that the ‘agricultural engineer and surveyors [be] sent immediately in advance of remainder to take up urgent work’, namely, the land survey,⁶² as outlined in Balfour’s letter to Allenby.⁶³ In another telegram Weizmann urged the immediate despatch of ‘a Sanitary Engineer, a Topographic Surveyor, a Construction Engineer and an Engineering Secretary’, and repeated his request on 12 July for top-notch sanitation and surveying engineers to prepare a drainage scheme for the Jewish quarter of Jerusalem’s Old City.⁶⁴ On 26 May 1918, Israel Sieff, the Secretary of the Zionist Commission, submitted to Ormsby-Gore a list of five experts required to assist the Commission in its investigations,

among them an agricultural engineer, a surveys and measurements engineer, and a topographer-engineer. In January 1919 the engineer G. Wilbushewitz asked the Zionist Commission to find surveyors in the regiment of the American Jews who had volunteered for war service in Palestine with the British forces.⁶⁵

The British and Zionist initiatives for a cadastral survey

It was the Zionist Organisation that early in 1918 initiated and demanded the undertaking of surveys and planning for ascertaining the resources of the country, whereas the authorities delayed action in order to protect Arab interests. But in June 1918 it suddenly became known that a sharp turnabout had occurred in the outlook and approach of the British military administration. At the initiative of Clayton, the Chief Political Officer, Weizmann met Emir Faisal on 4 June for discussions on ways of Jewish–Arab cooperation. Weizmann later reported to Allenby on the results of this meeting, and took the opportunity to raise other matters. He gained the impression that Allenby was sympathetic to the land programme of the Zionist Commission and was prepared to agree to a technical and legal land survey, including the legal examination of the validity of all land title deeds in Palestine. Weizmann reported this to a conference of the Jewish Council in Jaffa on 17 June. The minutes of the conference were seen, as usual, by General Clayton. He used his official authority to delete from them certain classified, sensitive passages, and some that were embarrassing to the authorities. Among these paragraphs was also one which according to Clayton did

not give the full sense of the Commander-in-Chief's statement which was to the effect that the legal and technical survey of Palestine was necessary as soon as it was practicable to carry it out. But that it was a Government matter in which the Zionist Commission could not expect to take any official part.⁶⁶

Weizmann did not give in, and returned to the matter of the technical and legal survey in his letter to Ormsby-Gore on 8 July 1918.⁶⁷

It therefore became clear for the first time that the military government differentiated between a limited land survey undertaken for specific purposes only, and a survey that had legal force for deciding the future fate of lands and thus had to be a project of the government and not of any one interested party. Although the Zionist leadership had also earlier sought to identify the State lands and the abandoned lands, this was a long way from a full, comprehensive cadastral survey. Here, then, was the first official intimation that the government would exercise authority for settling the land question in Palestine. Behind the unremitting perplexities of whether to issue this or that permit for surveys initiated by the Zionist leadership, the realisation was crystallising that there had to be fundamental land reform in Palestine on the responsibility of the authorities. Moreover, the military administration made preparations for a cadastral survey and even found a model it considered suitable for Palestine. The model was Sudan, where apparently the land problem had been similar in many ways to that in Palestine. Clayton requested that

this passage too be deleted from the minutes of the Jewish Council conference of 17 June.⁶⁸

In the meantime the war came to an end. The Zionist Organisation turned to current problems more urgent than the land issue, but did not for one moment relinquish its aspirations for gaining control over all the state domain and vacant lands. In October 1918 the Zionist leadership began to prepare the Zionist claims to be submitted to the peace conference, including land claims. To this end, Weizmann formed an advisory committee headed by Herbert Samuel to ‘formulate demands which would allow Jewish development in Palestine under British Trusteeship’.⁶⁹ At the same time, on 1 November 1918, a year after the Balfour Declaration, Weizmann sent a document to the Under-Secretary of State for Foreign Affairs, Robert Cecil, in which he enumerated ten proposals regarding the Jewish population of Palestine in the spirit of the understanding that had been achieved between the Zionist Commission and the military government.⁷⁰ The fifth proposal dealt with the land question:

5 That a Land Commission be at once appointed (of which representatives of the Zionist Commission shall be members) for the purpose of inquiring into and dealing with all questions relating to the tenure and ownership of land in Palestine.

- a A preliminary survey, and eventually when circumstances will permit, a cadastral survey of the land.
- b An examination of the land Registers which are still to be found and a verification of all titles to the land.
- c A classification of all crown lands, waste, uncultivated and partly cultivated lands.
- d An examination of the present Laws affecting land in Palestine, and the preparation of proposals for such modifications in such Laws as may be necessary or desirable to bring the land laws of the Country into a form more consistent with modern requirements.

The proposal on land matters shows that the Zionist Organisation did not respond to Clayton’s hints and was not ready to forgo its active involvement in a cadastral survey that could prove fateful to the entire Zionist undertaking in Palestine. On the contrary, the Zionist Organisation continued to demand the implementation of a cadastral survey, including measurements, registration, verification of title deeds, and investigation of the legal status of the lands. It even went so far as to propose, for the first time, modern agrarian reform of the kind practised in the best-governed countries. In Zionist circles there was great concern that what Zionists considered bogus Arab claims to state lands would be supported by the British, to the detriment of the Zionist contention that there was enough land for the establishment of the Jewish national home on most of the country’s lands, which were state domain.⁷¹

In reacting to Weizmann’s ten points of 19 November, Clayton rejected the Zionist proposal,⁷² and generally dismissed every suggestion that held any suspicion of Zionist participation in the administration of the country. Regarding lands he replied:

Land Commission, land settlement and Cadastral survey are amongst early requirements of the country, but are properly the duty of whatever provisional civil Government may be set up hereafter rather than of military administration which is bound by law and usages of war to

maintain as far as possible the status quo in occupied enemy territory in matters relating to law and taxation. The Cadastral survey would entail expense which present revenue of O.E.T.A. is unable to support. There must be no question of Zionist Commission participating in any land commission or contributing to its expense as this would entail their taking part in the administration. In the meantime the military administration is carrying out preliminary work and investigations which are possible in existing circumstances.

Clayton therefore hinted again that the military administration was preparing for a cadastral survey to be conducted in due course. But the Zionist leadership did not relent, insisting that it take an active part in this. The *Memorandum of the Zionist Organisation Regarding Palestine*—the Zionist proposals to the peace conference—was ready on 3 February 1919. The section on land began with the demand to conduct a cadastral survey:

Recognising that the general progress of Palestine must begin with the reform of the conditions governing land tenure and settlement, the Mandatory Power shall appoint a Commission (upon which the Jewish Council shall have representation) with power:

- a To make a survey of the land and to schedule all lands that may be made available for close settlement, intensive cultivation and public use.
- b To propose measures for determining and registering titles of ownership of land.⁷³

The cadastral survey and land prohibitions

The idea of conducting a cadastral survey in the region was not new, and Allenby's staff officers must have known about it at first hand in Egypt and Sudan. And indeed, it turned out that the accumulated experience in these countries came to be relied upon more and more as the professional model for the administration of Palestine in everything connected with the implementation of the survey. At the beginning of 1919 the first concrete move was made within the framework of 'preliminary work' alluded to earlier by Clayton. The first step entailed the sending to Palestine of Judge G.W. Williamson, head of the Sudan Land Registration Department, so that he could outline the system for implementing the cadastral survey. Immediately thereafter, in April 1919, the Director of the Egyptian Cadastral Survey, V.L.O. Sheppard, arrived in the country to contribute his experience.⁷⁴ Among several other experts sent to Palestine by the EEF Headquarters in Cairo to assess the economic situation and the land potential was T.W. Brown of the Egyptian Department of Agriculture, who published his report on 12 January 1919.⁷⁵

The subject of the survey was also raised in another way: in February 1919, Lord Curzon, the British Foreign Secretary, sent a special envoy to the Middle East to 'know more about the working of the O.E.T.A.', with special attention to the efficient use of British Government funds.⁷⁶ This was Walter R. Lawrence, formerly of the Colonial Service in India, who for the duration of his mission was given a military rank in the Royal Air Force. In preparation for his trip, Lawrence met Weizmann and Herbert

Samuel in London, and on his way to Palestine conferred in Paris with T.E.Lawrence and Captain James Rothschild, who served as assistant to Ormsby-Gore (the British Government's Liaison Officer with the Zionist Commission). At these meetings Walter R.Lawrence cautioned that 'before they run the great risk of bringing in the Jews to Palestine a Cadastral Survey is essential'.⁷⁷

T.E.Lawrence inclined positively towards Zionism in the belief that the impetus of Zionist development would benefit the Arab world.⁷⁸ He understood early on that the land problem was fundamental to the achievement of some arrangement between Arabs and Jews. Lawrence, who had served as translator at the meeting on 11 December 1918 in Cairo between Faisal and Weizmann, apparently recalled the latter's proposal for a reform of the land laws.⁷⁹ Like his colleagues who served in the Middle East, T.E.Lawrence was acquainted with the cartographic attainments during the war, which benefited from the use of aerial photography for obtaining rapid results and revising the older maps. As early as April 1916, Captain Lawrence, then in Egyptian Intelligence, while on a visit to Mesopotamia, had suggested the loan by Egypt of a section to assist the compilers of trench maps from air photos, based on the experience in Gallipoli and Sinai.⁸⁰ Now, at the Paris meetings, he raised—apparently for the first time—the idea of speeding up the solution of the land problem in Palestine by conducting a cadastral survey with the help of aerial photographs, and so advancing the economy of the country. He suggested to Walter Lawrence that he meet in Cairo with Ernest Dowson and his assistant and discuss with them the feasibility of an aerial cadastral survey.⁸¹ Dowson had been the Director-General of the Egyptian Department of Surveys for ten years (1909–1919) and had been involved in all survey activities in Egypt since 1898. He was Chief Adviser to the Government of Egypt on the cadastre, and was later to provide important advice to the Government of Palestine on cadastral reform.

Walter Lawrence stayed three weeks in Palestine in April 1919, visited several *moshavot* (smallholder settlements), and generally formed a positive attitude to Zionism. He recorded his impressions in a travelogue⁸² and presented his official conclusions in a report sent on 13 May from Haifa to General Allenby.⁸³ On the whole, his approach was superficial and he did not come near the roots of the land problem, but as a result of his talks in London, Paris, and Cairo, and his visit to Palestine, Lawrence recommended conducting a cadastral survey in order to alleviate the enmity between Jews and Arabs. ('The Zionists may fret at the delay, but in their own interests the Cadastral survey is essential.') He also thought that a cadastral survey would enable the setting up of an immigration authority under whose auspices new immigrants would come to the country and would receive land for settlement, on the model of the Indian immigrants and the refugees in Kashmir. To advance the implementation of the survey he raised the possibility of using aerial photography, but warned that 'the Record of Rights should be done carefully and slowly'.

Allenby completely ignored these considerations in his comments on the Special Envoy's report which he sent to London.⁸⁴ Lawrence apparently leaked to the Zionist Organisation his opinion on the survey question while he was still in Palestine, for on 16 April, a month before the report was published, the subject was raised in the advisory committee to the Zionist Organisation in London. Herbert Samuel, who headed the committee, reported that Lawrence indeed considered the matter of the aerial survey, but

in effect did not insist on implementing it immediately for fear that the Arabs would raise difficulties.⁸⁵

The prohibition on land transactions and the closure of the *tabu* offices points up the tragedy of impoverished Arab villagers who could barely eke out a living from hard labour on the land, and whose main income derived from agriculture. Since the only asset they possessed was no longer negotiable, the *fellahin* desisted from improving the land, the crops suffered, and the villagers sank into debt and mortgages. The British authorities understood that they could not maintain the freeze on land transactions for long—also because the Financial Officer of the administration was largely dependent on income from land deals and taxes on agricultural produce.⁸⁶ Under Ottoman rule the largest part of the government's income derived from the agricultural sector by way of taxes on crops and the tithe of 12.5 per cent on the gross crop.⁸⁷ By 1 March 1918 the military administration had begun to collect taxes according to the Ottoman regulations that were in effect at the outbreak of the war, although the economic plight of the landowners and the *fellahin* was taken into account to avoid the crass exploitation and injustice that had characterised the Turkish tax-collecting system.⁸⁸

It took only a few months for the OETA officials to grasp that the prohibitions on land transactions were hurting the agricultural, primarily Arab, population of the country. In order to stimulate the economy and bolster the sense of security of the cultivators, and encourage the marketing of their produce at reasonable prices, the authorities decided to depart from their policy and proposed two remedial steps—without the knowledge of the Foreign Office in London. These were to grant loans to private farmers—which could only be made available against mortgages on the land or future crops; and to allow limited, controlled transactions of private land only, and so avoid Zionist opposition. On 29 April 1919 the intention was made known that the government would grant credits to cultivators (mainly to save the Jaffa citrus groves) by means of the AngloEgyptian Bank.⁸⁹ An announcement to that effect was relayed to the Zionist Commission in May, and on 19 July Clayton confirmed to the Foreign Office in London that preparations were being made to allow land transactions.⁹⁰

The second step—selective permission for land transactions—was to be implemented under the Transfer of Land Ordinance of 1919. The first draft of the ordinance was published in July,⁹¹ but under pressure from the Zionist leadership it was decided on 10 September 1919 to postpone its enactment.⁹² Fearing that the way would be opened to land speculation, the Zionist Organisation rushed to halt the change. In August, at the request of Lord Curzon, who had just been appointed Foreign Secretary, Weizmann elaborated his contentions in detail in a letter to the Foreign Under-Secretary, Ronald Graham.⁹³ Weizmann explained that he understood the need to loosen the restrictions but feared that considerable parts of the land would become *waqf* land, and so be removed from governmental supervision. And in view of the possibility that the League of Nations Mandate would be confirmed within a few months, he suggested that the new ordinance come into force after 1 January 1920.⁹⁴ It was indeed postponed, and was published only after the administration passed into civilian hands.⁹⁵

On the face of it, these proposals undermined the land policy of the Zionist Organisation, for at its insistence the administration had closed the Land Registry offices and prohibited land transactions. But in effect these measures were yet another indication that the authorities assumed the initiative in land matters. They came in the wake of the

allusions to an impending cadastral survey, went on to the granting of agricultural credits, and led to the proposal of renewing limited real estate market activities, leading up to the transfer of powers to a civilian government.

In the meantime, in July 1919, Colonel Richard Meinertzhagen had been appointed Chief Political Officer for Palestine and Syria in place of Clayton in Allenby's headquarters, and commenced work on 1 September. Meinertzhagen had deep emotional convictions in favour of the return of the Jewish people to the land of Israel, and had in the past kept abreast of Jewish affairs. His involvement in Palestine began in May 1917 when he was appointed head of the Field Intelligence branch on Allenby's staff. He was in close touch with Aaron Aaronsohn and the Nili group who had spied on the Turks for the British, and was also a member of the British delegation to the Paris peace conference. His grasp of the problems of the country, the appreciation he had for the Zionist movement and his struggles against the antagonism towards Zionism in British circles brought him close to the Zionist leaders, Weizmann in particular, who also intervened on his behalf in securing the appointment in Palestine.⁹⁶

Meinertzhagen felt keenly the difficulties in Palestine, and being a man of action resolved to act in all possible ways: in London, Cairo, and among the Zionist leadership. As he noted in his diaries, he pursued a long-term aim: to put an end to the military government, to transfer the responsibility for Palestine from the War Office to the Foreign Office, and to bring to the country a civilian government as quickly as possible.⁹⁷ Meinertzhagen did all he could to circumvent the staff officers who acted against the Zionist initiatives, but felt that the Zionists too bore responsibility for the situation that had arisen. To help advance the realisation of their vision, he urged them to soften their opposition in order to end the economic paralysis. He therefore asked Weizmann to come to Palestine and see the situation at first hand. Weizmann acceded to this request and visited the country in October–November 1919—to the dismay of the staff officers in Cairo, who, in the spirit of Clayton's views, opposed Zionist involvement in the administration of the country. Weizmann saw the results of the economic stagnation imposed on the country as a result of the status quo policy and the land transfer prohibitions that resulted from the delay in giving over the government to civilian administration. Weizmann and Meinertzhagen agreed to renew the agricultural credits programme and to reopen the Land Registry offices.⁹⁸ At the same meeting, so it was believed in the Foreign Office,⁹⁹ Weizmann changed his mind and even put forward several proposals to ease the land problem.¹⁰⁰ On 10 November, Meinertzhagen rounded out the picture in a despatch to Lord Curzon in which he complained in dismay, 'general stagnation is writ large on the face of Palestine'. In order to change the situation he proposed a programme of seven points essential to the success of Zionism, including 'the opening of the Land Registries on a limited and strictly controlled scale'.¹⁰¹ In January 1920 he again insisted that 'the foundation of all serious preparatory work is the re-opening of the Land Registries'.¹⁰² And indeed, on 10 February 1920 it was announced in London that Weizmann had agreed to allow 'smaller land transfer immediately'.¹⁰³

Weizmann now addressed the question of a cadastral survey to be conducted forthwith, even before the Mandate was entrusted to Britain. On 2 February he sent the Foreign Secretary a report on the activities of the Zionist Organisation and its programme for Palestine. Regarding the land problem, Weizmann wrote:

The present uncertainty of land titles is...rious impediment to economic progress, both from the Arab and Jewish point of view. A cadastral survey is essential for the prevention of tax evasion and as a basis for taxation reforms. As long as the uncertainty of land titles exists, it will be difficult for the Zionists to take effective steps to acquire considerable areas of either public or private lands. One of the first measures required to facilitate the Zionist programme and to lay the necessary basis for the economic development of the country therefore is a cadastral survey.¹⁰⁴

Weizmann did not write in the letter that the Zionist Commission had seen what was coming and three weeks previously had begun to discuss a plan for training Jewish surveyors, so that when the time came these could take part in the government's cadastral survey.¹⁰⁵ Now that the discussions for the granting of the Mandate and the transfer of powers from the military to the civilian authorities were imminent, the Zionist institutions proposed in a memorandum to the peace conference that the British



Figure 2.1 Surveyors' course of the Zionist Commission in Jerusalem, 3 August 1920. E.Krause, the Director of the course, is seated in the centre of the first row (source: J. and S.Prushansky, Tel Aviv).

Government appoint a land commission, whose first objective would be the survey and registration of lands.¹⁰⁶ Weizmann also proposed to the advisory committee that assisted

him in formulating the claims at the peace conference the adoption of the idea raised subsequently, on 16 April, for conducting the land survey by means of aerial photography.¹⁰⁷ Weizmann added explanations for this suggestion in his letter to Curzon:

The making of a cadastral survey has been greatly simplified by modern improvements in the art of aero-photography. One of the leading experts and inventors in this field is now in Palestine and the Zionists would be pleased to place him at the service of the Government. He has with him the most modern photographic appliances and equipment and would be prepared to undertake this work at once.¹⁰⁸

Weizmann did not specify who this expert was. But he apparently knew that, at the time, official trials were being made for an aerial cadastral survey of Palestine, perhaps at the recommendation of Walter Lawrence, or from the supportive attitude of the Egyptian Survey Department.

Preliminary discussions on the formulation of the Mandate over Palestine started in 1919, and Allenby, Weizmann, and Meinertzhagen apparently initiated the invitation to Herbert Samuel to make an exploratory visit to Palestine in order to advise on future policy before the question of the Mandate was decided.¹⁰⁹ Samuel, who at the time headed the advisory committee to the Zionist Organisation which discussed planning the economic activity in the country, came to Palestine in the capacity of Economic Adviser to the OETA command. He investigated the financial and administrative situation in February—March 1920 and submitted his conclusions to Allenby on 31 March. Samuel stated his opinions on the manner of OETA's administration, the level of its staff, the budget, the problem of land taxation, the economic resources, the lack of a cadastral survey, and on the permission to engage in land transactions. Regarding the cadastral survey, Samuel restated that 'A cadastral survey of the whole country is an obvious necessity', and noted that 'Preliminary steps have been taken with a view to such a survey being begun at earliest moment that the political conditions allow.'¹¹⁰ As to the budget, Samuel presented a memorandum to Major-General Bols on 19 February 1920 in which he detailed 'the chief purposes for which capital expenditure is needed...out of capital account', including the cadastral survey. The cadastral survey was listed first among the land and agricultural items. In his comments, Samuel emphasised that 'this is clearly a charge which falls upon the Government', adding, 'it may be found possible to pay out of annual revenue for comparatively small expenditures, such as is involved by the cadastral survey'. But it was the duty of the government to provide full funding for the 'Cadastral Survey—the Whole'.¹¹¹

Samuel was not content with a repetition of previously known information. On his way back to London in April 1920 he stopped in Cairo to meet E.Dowson, who in the meantime had become the Financial Adviser to the Government of Egypt. Samuel, who probably was aware of the proposals made by T.E.Lawrence, W.R.Lawrence, Weizmann, and Colonel S.F.Newcombe, who proposed in January 1920 to map the area between Gaza and Jaffa by means of aerial photography asked Dowson to explain to him the method of conducting a survey by this method on the basis of the experience gathered in Egypt. Dowson presented Samuel with a detailed document in which he described the Egyptian experience in a positive way and listed the advantages and limitations of aerial

photography, including the significance of aerial surveys as applied in Palestine and the possibility of Egypt and Palestine cooperating in the cadastral survey of the latter.¹¹²

Officials of the Foreign Office in London appended handwritten marginal remarks to the correspondence between Samuel and Dowson. One supported experimentation and cooperation with the Royal Air Force (RAF) and the Survey Department; another, Major H.W.Young, who during the war had served in Mesopotamia, mentioned that aerial photography had been used extensively in Iraq for cadastral purposes. From certain documents it turns out that, in effect, the connection with the RAF was already established, when, at the end of February—three weeks after Weizmann's letter to Curzon regarding the aerial survey¹¹³—Brigadier—General A.P.Wavell, of the Egyptian EEF General Staff, instructed the Officer Commanding RAF in the Middle East to help the Director of the Egyptian Survey Department conduct a full aerial survey of Palestine.¹¹⁴

About a week after the exchange of letters between Dowson and Samuel, the British General Staff sent several comments regarding Weizmann's report of February 1920 to Curzon;¹¹⁵ and Meinertzhagen, who in his direct letters to London accused the military bureaucracy of hostility to the Zionist idea, continued his open attacks. On 9 April 1920 he wrote to the British Resident in Cairo with a copy to London, 'There is no lack of land, only a lack of will to allow Jews to possess such land. A cadastral survey...will soon revolutionize, democratize and improve the land question in Palestine.' And in another passage he added, 'There is no reason why a cadastral survey should not be commenced forthwith on an extensive scale. It is most necessary', but immediately remarked cynically, 'I doubt whether these [surveys] can be undertaken under the present political conditions. They would be inevitably misconstrued and I consider they had better await the mandate.'¹¹⁶ Another reaction from the General Staff stated:

The necessity for carrying out a Cadastral Survey so as to remove the uncertainty of Land Tithes, and for a revision of the incidence of taxation is undoubtedly pressing.

The preliminary steps for carrying out the Survey are in the process of being prepared by the Military Administration, though the work on the scheme cannot be undertaken in its entirety...until peace with Turkey has been signed.

Until such a Cadastral Survey has determined the ownership of land, it is very difficult to give any opinion as to the possibility of transferring waste and State land to Zionists.¹¹⁷

According to the same document, the immediate plan of the General Staff was to give effect to the Transfer of Land Ordinance 1919 and to appoint a special land commission whose responsibilities would include a cadastral survey, the preparation of tax reform, and the transfer of state and uncultivated lands to be implemented after the inception of the Mandate. In an interview he granted to the newspaper *Mar'at esh-Sharq*, the organ of the Jerusalem Arab Nashashibi faction, in the wake of Samuel's visit to the country, Major-General Bols also informed the Arab population of the intention to conduct a cadastral survey and the setting up of a special commission for this purpose. In explaining the meaning of the visit of the 'English official', Bols reassured his

interviewer that the government had no intention to found in Palestine a Jewish government; and regarding the government lands, he declared that the question 'of these lands will not be resolved until all these lands will be surveyed anew'.¹¹⁸

On 14 April 1920 Meinertzhagen again explicitly attacked the military administration in Jerusalem in a message to London. This was what he saw as the background of the free hand the Arabs had been given to attack the Jews of the city that same month. The next day he was obliged to resign at Allenby's request. From now on, it remained for Bols himself to complete the preparations for the promised cadastral survey.

The establishment of the Palestine Department of Surveys

At the San Remo conference in April 1920, which decided the fate of the Ottoman Empire, the British were entrusted with the Mandate over Palestine. The British Government appointed Herbert Samuel High Commissioner for Palestine.

Now, in the final hour of the military administration, the way was clear for the enactment of regulatory measures regarding land and surveys. On 1 April 1920 the OETA command began preparations for transferring the administration and formed several departments that had not existed previously, such as the Agriculture and the Survey Departments.¹¹⁹ Nevertheless, although the steps pertaining to land were postponed until the formation of the civilian government, survey matters were immediately advanced. The first step was taken on 19 May 1920, with the announcement in the *Official Gazette* that a special Department of Surveys, which until then had been a function of the Legal Branch of the military administration, now existed in Palestine and that it would come under the Financial Department.¹²⁰ The new hierarchy recalled the situation in Egypt, where the Survey Department was part of the Ministry of Finance.

The second step was taken that same month, when the command of OETA (S) for the first time published the Cadastral Survey Ordinance (1920). This ordinance was intended to make surveys in the Gaza and Beersheba districts possible by giving the surveyors authority to enter private lands in order to measure and stake out boundaries of parcels, with the aim of implementing a cadastral survey.¹²¹

We have only fragmentary information on the details of the activities of the Palestine Survey Department during the final days of OETA (S). An Australian Surveys Officer, Major C.V. Quinlan, Officer Commanding Survey Section of the Royal Aircraft Establishment and the Australian Survey Corps from 1913 to 1916, was temporarily seconded from the Sudan Surveys Department in order to set the Palestine surveying activities in motion. Quinlan began work in June 1920, and that same month asked the OETA Finance Department to publish a tender for surveyors on behalf of 'Department of Surveys, OETA (S), Gaza'.¹²² This was published in the *Official Gazette* of 25 July 1920. Other information on the department is connected with discussions held in 1922 between Winston Churchill and Samuel and the Army Council regarding coverage of the financial deficit left by the military administration. In the statement of expenditure for 7 November 1917 to 31 March 1920 submitted by Samuel there is no budgetary item dealing with 'Survey'. For the period between 1 April 1920 and 30 June (the last day of the OETA administration), however, a 'Survey' item appears with the following budgetary movements: income, 115,340 Egyptian pounds; expenditures, 9, 427,920 Egyptian

pounds. Apparently the latter sum exceeded the anticipated expenditure by E£694,417.¹²³ We have no further information regarding this sum; possibly it was used for the cadastral survey.

The administrative and legal bases for conducting surveys were laid down by the establishment of the Survey Department and the enactment of the Cadastral Survey Ordinance. Major-General Bols, the head of OETA and Chief Political Officer, sent a situation report in a special despatch (signed by ‘Captain D.A.P.O. for Major General Chief Political Officer’) to the Foreign Office in London—also in reference to Meinertzhagen’s explicit and aggressive letter of 9 April 1920.¹²⁴ This document detailed the logistical programme for conducting a cadastral survey in Palestine—the plan that had repeatedly been discussed during the past year in the military administration, and which was raised to the status of an operational plan for resolving the land question in the country. The programme allocated funding and manpower resources and outlined the technical methods for the survey, its objectives, and the pace of implementation, so that the beginning of the work would be promising and well organised. In effect, it was a programme for mapping rather than for



Figure 2.2 Major Cecil V. Quinlan
(source unknown).

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GENERAL HEADQUARTERS
EGYPTIAN EXPEDITIONARY FORCE.

P.O.70 C.P.O.276/1. 19th June 1920.

E. 7728
JUL 5 1920

My Lord,

In connection with Colonel Meinertzhagen's

despatch No.P.O.48 C.P.O.276/1., I have the honour to inform your Lordship that the following steps have been taken with regard to the Cadastral Survey of Palestine:-

- (1) Provision of a sum of L.E.20,000 for the Survey Budget 1920-21. This sum is considered sufficient to make a small start on the Cadastral Survey, and it is hoped to increase it later when more money is available. The Survey Budget only provides for the technical part of the Survey - no provision being made for land registration or settlement.
- (2) An officer has been loaned from the Sudan Survey Department as Director of Surveys. This Officer (Major C.V.Quinlan) has after negotiations with the Survey of Egypt secured on loan a small personnel of British and Egyptian Surveyors who will begin work in the Gaza District with Gaza as Head Quarters. A start will be made first week of June and the necessary equipment has already been collected at Gaza.
It is proposed to carry out a detail survey by plane-table and chain on a scale of approximately 1/2500 based on triangulation and traverse surveys. For the present the survey of privately owned lands, or Government land will only be undertaken, but at a later period consideration will be given to the question of town surveys. Use will be made where possible of existing surveys carried out during the war, and available materials with respect to these have been collected. Work will for the present be confined to the maritime plain extending from RAFFA northwards.
- (3) Some considerable difficulty has been experienced in securing personnel - none being available in the Sudan and only a few in Egypt. The Staff loaned from Egypt for 6 months consist of two British officers, 1 Syrian Draftsman and four Egyptian Surveyors.
It is hoped to augment this staff later by the addition of suitable Palestinians who will undergo a course of training locally, and also a few will probably be sent to Egypt to be trained - the Survey Department of Egypt having kindly agreed to do this for the Administration. Some delay will be involved owing to the fact that men have to be trained, but this unfortunately cannot at present be avoided.

Figure 2.3 The 'Bols despatch', - apparently the first (known) document to give details of the initial operation of the Survey Department, 19 June 1920 (source: PRO FO 371/5139/E7728).

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- (4) The Survey Department of Egypt have rendered every assistance with regard to loan of personnel, and purchase of equipment, and have also agreed to carry out on re-payment computation work as required, also printing and reproduction of maps and plans, thereby saving this Administration a considerable expense, both as regards the employment of a special computation staff, and also the instalment of a costly plant for the reproduction and printing of maps.
- (5) Particular attention will be paid to the permanent marking of all lands surveyed - cut stone and screw-piles being used for this purpose. It is hoped that by the use of these marks that the necessity for expensive re-Surveys such as have been rendered necessary in the Sudan, Egypt and elsewhere, will be obviated.
- (6) The important question of land registration and settlement is now being dealt with and as soon as officers are available, work on this will proceed conjointly with the Survey.
- (7) It is considered that for a few months progress must be necessarily slow - on account of the small personnel available and the fact that local Palestinians have to be trained, but before the end of the year when operations are in full swing rapid progress should be made.



CAPTAIN D.A.P.O.
FOR MAJOR GENERAL
CHIEF POLITICAL OFFICER.

HIS BRITANNIC MAJESTY'S SECRETARY OF STATE
FOR FOREIGN AFFAIRS,
FOREIGN OFFICE,
LONDON.

settling the land problem, which was mentioned in paragraph 6 of the despatch as pending final organisational arrangements.

For lack of a more formal document, the Bols despatch may be taken as the 'foundation charter' for the Survey of Palestine.¹²⁵ It dates from before 1 July 1920, when Herbert Samuel arrived in the country and received 'One Palestine, Complete' from Major-General Bols. (Samuel signed the receipt chit after adding to it 'E. & O.E.'- errors and omissions excepted.)

Part II

The survey system

3

Organising the system

Administrative organisation

Major-General Bols's despatch of 19 June 1920 to the Foreign Secretary (see Figure 2.3, pp. 45–46) outlined the initial steps of the cadastral survey of Palestine. In the first stages of organisation of the Mandate institutions two views were expressed regarding surveys: one held that the survey organisation was to carry out the cadastral survey and to serve only the needs of land settlement and that its work would be ended with the completion of this project. Accordingly, the question arose whether to give the Survey Department permanent government office status.¹ On the other hand, there were some in the Government of Palestine and in London who regarded the Survey Department from the beginning as an essential department with an ongoing purpose, like other departments of the government. Consequently, it would have to be built up from the bottom so as to carry out all the government's functions connected with surveys, mapping, and map production.² The Bols despatch dealt with seven subjects:

- 1 allocation of budgets for the first year of operation, 1920–1921;
- 2 organisation of the survey: recruiting personnel, determining the geographic extent of the survey, the commencement of work,³ and the technical direction for the working methods;
- 3 training of manpower;
- 4 ensuring the assistance and professional backing of the Egyptian Survey Department;
- 5 instructions regarding the marking of surveyed areas;
- 6 implementation, in parallel, of land settlement and registration;
- 7 relating to the pace of work in the early stages.

Together, these paragraphs reflect the basis for assessing the working methods of the survey organisation—in relation to its own work and to the parallel systems with which it was to operate.

The second item of the document concentrates on those subjects that had immediate bearing upon the professional organisation of the survey system in its first stages: recruiting of manpower, equipment, geographic deployment, and administrative implications of where the work was to begin and continue in the future.

Manpower

The personnel at the disposal of the Government of Palestine came from British Imperial reserves. For the Survey Department, the idea of looking for professionally qualified local personnel did not even arise, except for junior and inferior positions. Samuel's misgivings when he was desperately looking to recruit surveyors for work in Palestine show that it was unthinkable to him that senior personnel of the Survey Department, like all senior officials in the other government departments, be anything but British; in this case, with previous training in surveying before they came to Palestine.

The recruitment of manpower for carrying out the survey work reflects the entire British governmental system of administration in filling senior posts in a government being built up from its foundations. When the headquarters of the Egyptian Expeditionary Force in Cairo initiated the survey for land settlement in Palestine, it relied on the knowledge and experience gathered by Britain in Egypt and Sudan. Once a survey in Palestine was decided upon, British experts from Egypt and Sudan travelled to the country, accompanied by junior workers who were not necessarily British. During the first visit in 1919, the Director of Land Registration of Sudan, Judge Williamson, and the Director of the Egyptian cadastral survey, Sheppard, went to Palestine.⁴ After them, Major Quinlan was sent in June 1920 as the Director of Palestine Survey in order to organise the beginning of the work around Gaza.⁵ That same month, Judge R. Wedd of Sudan was suggested for the Land Settlement Court in Palestine.⁶ This affinity between Sudan and Palestine was not fortuitous. In October 1920 the authorities in Cairo took money-saving measures and integrated the Palestine Agency in Cairo with the Sudan Government,⁷ in the belief that doing so would make it possible to solve administrative problems more easily.

Besides this, those concerned considered that the land problems in both countries were similar in background, perhaps because of the Islamic laws and their effect on land matters. In the minutes of the meeting of the Jewish Council in Jaffa on 17 June 1918 (at which Weizmann reported on his meetings with Faisal and Allenby), in which Clayton censured the allusion by Allenby to a cadastral survey, Clayton also deleted a reference by Weizmann to the connection drawn by Allenby between the state of the land problems in Palestine and those in Sudan.⁸ Even the land reform arrived at subsequently in the Land Settlement Ordinance of June 1928 was based on the Sudanese law of 1925.⁹ Nor was the connection with Sudan one-way, for when experience had been gathered in Palestine in dealing with Islamic laws, the Sudan authorities requested, and obtained, legal counselling from Palestine.¹⁰

The Survey of Egypt assisted its counterpart in Palestine by placing at the disposal of Quinlan an advance party with which he could begin working in Palestine, and promised liberal help with loans, acquisitions, and funding. The help took the form of manpower, equipment, processing of data, and map production and publication services.¹¹ In this way the Palestine Survey Department was saved all the immediate chores of setting up a suitable working framework; it had all its sections and offices already in the first stage. The advance party was lent for a period of six months in the expectation that within that time a surveying staff of Palestinians would be trained. None of this took the slightest

account of the fact that the Zionist Commission was at that very time engaged in training about thirty Jewish surveyors in a special course.¹² Thus, the first team to start survey operations in Mandate Palestine was made up of foreigners: the Director, who was an Australian serving in Sudan, two British officers serving in Egypt, a Syrian draughtsman, and four Egyptian field surveyors.

Along with the beginning of work by these members of the team, efforts were made to recruit senior and junior professional and field personnel. The process of recruiting professional workers for a government technical office illustrates the way the Imperial system operated, and in particular the difficulties affecting the system in Palestine, including the new Palestine Survey Department. The authorities could draw on two reserves of manpower. One comprised senior and junior staff from Britain from among those who had graduated from colleges in the United Kingdom, or those serving in the British colonies; the second was made up of local Palestinians who were candidates for special training to fill specific needs at lower levels.

Government officials and army officers throughout the Empire showed interest in the new positions offered by the Government of Palestine, and in the employment conditions published by the High Commissioner, the Foreign Office, and the Crown Agents for the Colonies in London.¹³ All the applications were channelled through the Crown Agents. It so happened that the High Commissioner proposed a candidate named A.R. Boyce, also from the Colonial Service in Sudan, as the first Director (Surveyor—General) of the Survey of Palestine—under conditions of employment that the Foreign Office promptly quashed.¹⁴ Samuel offered the position to Boyce in October 1920, included him in the list of senior officials before the appointment was confirmed,¹⁵ and offered him liberal terms—perhaps because he (Samuel) regarded the position as being of key importance, or because he understood that only in this way was it possible to secure the best people for service in Palestine. But in the Foreign Office and the Crown Agents there was apprehension at creating a hierarchy earning attractive salaries in Palestine. Boyce played into their hands, for he demanded remuneration even greater than that offered by Samuel. He was immediately sent a reply to the effect that the Foreign Secretary assumed that without an increase in salary he was not interested in the position, and Samuel was informed that his candidate refused to accept his conditions.¹⁶

The Foreign Office officials allowed themselves to forgo Boyce's services because in September they had proposed to Samuel their own candidate, Major Cuthbert Hilliard Ley, formerly a surveyor in the colonies and lately in the British Ordnance Survey, whom they were trying to place in one of the colonies. Samuel confirmed Ley's appointment on 30 October, and on 2 November 1920 Ley accepted the offer (under more modest conditions than those offered to Boyce). Ley, an officer in the Army Reserve, like other former military personnel, obtained the agreement of the War Office for this civilian appointment in Palestine, and left for Palestine at the end of November.¹⁷ After a preparatory week with the Survey of Egypt, Ley reached Palestine to take up his position as the first Director of the Palestine Survey Department, which became an official government department in January 1921.¹⁸ Ley was appointed for a two-year trial period retroactively from 1 July 1920, the day the civilian Government of Palestine took office.¹⁹

From documents dealing with the organisation of the Government of Palestine in 1921, it appears that there was still no certainty as to whether the Survey of Palestine

would continue to function as a permanent department or would be integrated into other departments once the cadastral survey was completed. Although Samuel's first budget proposal in February 1921 provided for the appointment of a permanent staff, all the early appointments to the Survey of Palestine were provisional.²⁰ It was the Colonial Secretary, Winston Churchill, who pressed Samuel in July 1922 to provide for a permanent survey staff in the Government List, since for many years to come there would be a need for a Survey Department in Palestine.²¹

When Ley arrived in Palestine, the senior staff of the Survey Department numbered three—all of them British.²² With the active help of Herbert Samuel, a desperate effort was made to recruit additional personnel. On 18 and 22 February he applied to the Foreign Secretary, Curzon, in a concentrated effort to secure three senior surveyors.²³ Samuel insisted on demanding a Cambridge-educated Survey Inspector, or one trained in one of the London universities, or that the vacant position be advertised in *Nature*. Samuel also requested an Assistant Inspector and Sub-Inspector. For these posts he advertised in a long list of institutions, such as the War Office, the Ordnance Survey, the School of Military Engineering at Chatham, the Universities of Manchester and Birmingham, the Cambridge Engineering College, the Civil Engineers' Employment Bureau, with the High Commissioners of Australia and South Africa, and, of course, among the Royal Engineers. This request evoked many marginal comments in the Foreign Office file, all of them to one point: the supply of surveyors was usually rather tight, and at the inferior salary conditions offered in Palestine there was no chance of filling these positions, for the Crown Agents found it hard to provide even junior surveyors for difficult tropical regions where far better remuneration was offered than in Palestine. The doubters left no prospect for the Palestine officials save for the slight chance of recruiting an army officer between assignments, or the alternative of training at their expense in the Ordnance Survey candidates who had no surveying background but might wish to work in a country as attractive as Palestine.²⁴

On 23 March 1921 a married candidate was suggested to Samuel for the position of Sub-Inspector, and on the 28th the High Commissioner replied that under the harsh conditions of Palestine he would prefer a single man; in any case, Samuel refused to pay for the travel expenses of the wife to Palestine. Nevertheless, it was decided to refer the candidate to Palestine after a training period in the Ordnance Survey for work in one of the African colonies. Within less than a month, Samuel informed the Colonial Office that the new man indeed met with difficulties in maintaining his wife, and that from now on only a bachelor would be considered for the position of Sub-Inspector.²⁵

The Palestine bureaucracy did not restrict itself to the imperial reserve only, and organised the training of local manpower. On 28 February 1921 Samuel reported to Churchill that the training programme for local personnel was proceeding, apparently while actual work was being conducted in the field.²⁶ On 3 May 1921 a discussion was held in the Advisory Council to the High Commissioner regarding the Surveyors Ordinance and the chances of setting up a surveying school, and for licensing unqualified surveyors from among those who had field experience under the Ottoman regime.²⁷ The local people were not considered for senior positions, merely to bolster the field crews. Some of the graduates of the Zionist Commission surveyors' course were unemployed or had given up hope of obtaining work in the field, and a second course was not started in view of the poor salaries in inferior posts offered by the government.²⁸

The senior survey staff who worked in Palestine during the twenty-eight years of the Mandate consisted of professionally trained, experienced men who had served in the British colonies. Most of the British surveyors came from the Surveying School of the Royal Engineers, but a minority were graduates of British universities who had received some training in the Ordnance Survey. However, the rich cartographic experience amassed in the colonies was not solely of a military character; in some of the colonies, cadastral surveys were regarded more as civilian exercises, whereas topographic surveys were considered as serving mainly military purposes.

The army surveyors served many years in military as well as civilian frameworks at home and in various colonies, and gathered extensive experience. Every country would have preferred such experienced professionals over novice surveyors who wanted to obtain their professional education at home, at government expense. The surveyors who came to Palestine contributed their vast knowledge and experience. In this way, ideas penetrated Palestine and spread by means of Colonial Office appointments, as when the experts from Sudan and Egypt were invited to help out. Ley brought with him extensive geodetic experience, which was of great help in laying out a reliable geodetic infrastructure of triangulation networks for cadastral surveying. Frederick John Salmon, who came to Palestine at the end of his colonial service, gave of his vast experience in topographic mapping. And Andrew Park Mitchell, who had less professional expertise but many years' work of surveying in Egypt and Transjordan, activated the entire system on the basis of the infrastructure prepared by his predecessors, and added to this, in particular, the military mapping of the Second World War years, which adapted the 'civilian' topographic maps of Palestine to military topographic needs.

Not all the survey employees who came to Palestine were chosen because of their high professional qualifications. Some of them were accepted because they happened to be on the spot and were willing to work for lower pay than was available in other colonies. Nevertheless, such personnel were not taken on regardless of wider considerations. We know of the complaints by Samuel and Ronald Storrs, the Governor of Jerusalem, regarding the professional level of many of the British officials in Palestine.²⁹ In a special document of 1926 regarding appointments of surveyors in the Empire, Palestine was among the colonies offering positions.³⁰ The directives in this document stated explicitly that appointments to senior positions would be made from among the senior staff. In special cases other requests were considered, but for the junior positions reserved for Britons, the candidates were required to sit for examinations and to be interviewed by selection committees, were subjected to medical examinations, and were expected to have had professional training in the Ordnance Survey. After surveyors had been accepted for work, their level of performance came under constant scrutiny, and it seems that the advancement of professional staff, including surveyors, was controlled and more meticulously effected. This becomes clear from some of the documents, such as the positive evaluation by Ley of the work of Stanley H.Lanfear and Walter S.S.Moffatt;³¹ or the negative assessment of one E.J.Davies, who was considered talented and knew Arabic, but was not trustworthy. His work had to be constantly checked, he was incapable, and he lacked the readiness to guide, train, and manage Palestinian employees, and so was not welcome in the country. The criticism did not spare candidates of social standing. In 1927, High Commissioner Plumer, Plumer's representative in Transjordan, C.H.F.Cox, and E.Dowson recommended the appointment of a Major T.Haycraft to head

the Topographic Survey of Transjordan. This young officer was the son of Thomas Haycraft, the Chief Justice of Palestine. But Colonel Winterbotham, the chief of the Geographic Section of the General Staff, rejected the appointment and informed the Colonial Office that he would not confirm it since Haycraft's work had not been satisfactory during his service in India, and the Ordnance Survey refused to accept him.³²

The Directors of the Survey of Palestine

During the twenty-eight years of the British Mandate, six Directors headed the Survey of Palestine:

Major C.V.Quinlan	June- Dec. 1920	Director
Major C.H.Ley	1920– 1931/2	Director
R.B.Crusher	1931– 1933	Acting Director
Lieutenant Colonel F.J.Salmon	1933– 1938	Director and Commissioner of Lands and Surveys
J.N.Stubbs	1938– 1939	Acting Commissioner of Lands and Surveys
A.P.Mitchell	1940– 1948	Director

Cecil Verdon Quinlan (1880–1947)³³ came from a background in surveys in the Gold Coast of West Africa, in Malaya, and in Sudan. Despite reservations regarding the worth of his African diploma as licensed surveyor, on 17 March 1913 Quinlan was appointed Officer Commanding the Survey Section of the Royal Australian Engineers with the rank of Lieutenant. When the Australian Survey Corps was formed, he served as Officer Commanding from July 1915 to January 1916 with honorary rank of captain. In January 1916 Quinlan joined the Egyptian Expeditionary Force and served in Sudan and Palestine, where he became Staff Officer. In June 1920 he was appointed as Director of Surveys of Palestine, most likely as a provisional post, since he was based in Gaza and served only six months.

Cuthbert Hilliard Ley (1872–1948)³⁴ was first commissioned in 1892 and served at first in Jamaica, where he conducted topographic surveys of the coastal region in 1896–1897. He then went to South Africa but became very ill and was repatriated to England. He returned to South Africa after three years to survey in the Western Transvaal and the Orange River Colony. He retired from military service in 1907 and began triangulation surveys of the Fiji Islands. Again because of bad health he returned to England, joined the Ordnance Survey in 1912 and served there throughout the war. He served in Palestine until August 1931, when poor health again forced his return to England. That summer Ley was to speak on the survey work in Palestine at the Second Conference of Colonial Survey Officers, but was not able to appear in person.³⁵ He resigned his post in Palestine in April 1932.

Robert Barker Crusher (1877–1962) worked on the Ordnance Survey from 1895 to 1900, and from there went to South Africa, where he served until 1903. In 1904–1905 he was seconded to the Anglo-Portuguese Commission for demarcating the frontier north and south of the Zambezi. In 1906–1908 he served in the Canadian Survey, then worked in Ceylon in 1909–1912. In 1913–1914 he returned to the Ordnance Survey in Southampton. During the First World War Crusher served as military surveyor, and after the war in the Ordnance Survey in the York region. In 1921 he was appointed Chief Draughtsman in Palestine and in 1924 Assistant Inspector of Surveys.³⁶ When Ley retired, Crusher served as Acting Director of Surveys for twenty months from August 1931 to March 1933, and then as deputy for Salmon. He retired in 1940 after nineteen years in Palestine.

Frederick John Salmon (1882–1964)³⁷ served in the Ceylon Survey from 1908 to 1930. During the First World War he was foremost among those promoting cooperation between surveying and artillery on the Western Front. He was particularly active in the massive printing and distribution of updated maps in the field units and in updating tactical maps with the help of aerial photography.³⁸ In December 1918 he was accepted as a Fellow of the Royal Geographical Society. In 1930–1933 Salmon directed the Lands and Survey Departments in Cyprus, and at the end of 1932 was appointed Director of the Palestine Survey, beginning work there on 27 March 1933. Salmon initiated and was the prime mover of the beginning of modern topographic mapping of Palestine. In 1935 he was appointed Commissioner for Lands and Surveys and a member of the Advisory Council to the Government of Palestine. He retired on 13 July 1938 after a thirty-year-long career of service in surveying throughout the Empire. His cartographic collection is kept in the archives of the Royal Geographical Society in London.

James Nelson Stubbs (1889–1972)³⁹ was an Australian who went to Palestine with the Australian Light Horse Division during the First World War and continued to serve there in the OETA from 2 January 1920 in senior positions connected with land matters. On 1 April 1922 he was appointed Director of Lands, and in 1925 also Controller of Mines and Acting Commissioner of Lands and Surveys in place of Albert Abramson. On 1 March 1935 he became Director of Land Registration, standing in for Salmon as Commissioner of Lands and Surveys. On Salmon's retirement, Stubbs replaced him until 1939, even though he was not a qualified surveyor by profession. Sir Ernest Dowson accused Stubbs in 1938 of knowingly paralysing the Palestine Survey.⁴⁰

Andrew Park Mitchell (1894–1975), the last Director of the Mandatory Survey of Palestine, was a student at the University of London when the First World War broke out. He saw service in India and Egypt, and as a pilot in France, where he was shot down and taken prisoner by the Germans. In November 1919 Mitchell began work in Egypt, gaining extensive experience as Chief Inspector Cadastre. In 1922 he organised a survey expedition along the Upper Nile in Uganda. In 1926 he was recommended for the post of Director of the Transjordan Survey (he was fluent in Arabic) and in 1927 was confirmed in this appointment. Mitchell was appointed Director of the Survey of Palestine in 1940 and served there until the end of the Mandate in 1948. He subsequently went to Nigeria (1948–1953) and from there to Uganda (1954–1957), and also served in the Survey Inquiries in Cyprus (1958) and in the Seychelles (1959).⁴¹

Geographic deployment

Those who planned the cadastral survey did not leave to the Palestine authorities even the geographic decision as to where the surveyors were to start work. Paragraph 2 of Bols's despatch to the Foreign Secretary of 19 June 1920 stated that the survey was to begin in the Gaza region. Also, the Cadastral Survey Ordinance of 1920 laid down that the survey would be carried out in the Gaza and Beersheba Sub-Districts. And, as we have seen, when the government published in the *Official Gazette* job openings for survey workers, in the first month of the work those interested were instructed to apply to the Survey Department, Government of Palestine, Gaza.⁴²

We have no direct explanation of why the survey should have been begun in Gaza. Interestingly, the agricultural and land experts of the Zionist Organisation also proposed to survey in that region, or to begin there. One hint is found in paragraph 2 of the Bols despatch, which states that, as far as possible, use will be made of the surveys conducted in that region during the World War. British military mapping of Palestine began there because it was a continuation of the military mapping of north Sinai and because the conquering armies moved in from that direction. The army survey units concentrated their intensive survey and mapping activities in the Gaza sector throughout the first ten months of 1917, while the British forces were immobilised on that front.

Cartographic and geographic reasons may, perhaps, also be adduced for beginning the survey of Palestine in that region, although it is doubtful whether the cadastral surveyors thought about them at that early stage: the line connecting Rafah, in the southwestern corner of the Land of Israel within the biblical 'from Dan to Beersheba' borders, with the Dead Sea passes through the widest part of the country. The nineteenth-century PEF maps also covered the country from this line northwards. In any case, from there the survey and mapping work could proceed northwards in a systematic manner. Thus, the 'Ali el-Muntar hill, which dominates Gaza, became the true origin and was given the reference values 100–100 in the country's rectangular grid, a convenient beginning figure for ensuring that the entire area of the country destined for mapping would be within a positive coordinates grid (see Figure 4.8, p. 84). The main triangulation network of Palestine did not extend south of Beersheba, and the series of topographic maps to a scale of 1:100,000, which was first prepared in the 1930s, covered only the country north of its 'wide midriff. Thus, the preparation of the geodetic infrastructure for the mapping of Palestine was apparently intended exclusively for the area to be included in the cadastral survey.

In addition to these cartographic and geodetic considerations there were also political ones that derived from the conduct of the cadastral survey under Zionist pressure. The Bols despatch, which serves us as a documentary basis for the inception of the Survey of Palestine, states that the survey was to encompass privately owned and state land, and that its extension to urban areas would be considered at a later period; and that in the first stage the survey would concentrate exclusively on the coastal plain, from Rafah northwards. The import of these directives was that they did not advance the Zionist interest as such, but reflected the necessity of this project for the population in general. There was little chance for earmarking land for the Jewish national home in the coastal plain, where the greater part of the country's agricultural land was to be found. The land in the coastal plain was largely state domain, in private hands, or already owned by

Jews—privately and institutionally. And since a considerable part of the State land was *miri*—held privately in perpetuity—the Zionists hoped in vain for an arrangement that would give them control of state domain and uncultivated lands for implementing the national home promise. It also turned out that all the other state lands in the mountain regions, and the vacant lands, were appropriated already. Under these conditions, with every passing year there was a loss of land potentially available to the Zionists without its legal status being determined.

Two later documents contain remarks regarding the two determinations of the type of land ownership and the geographic site of the survey. In 1938 Dowson wrote in his comments on the Report of the Palestine Royal (‘Peel’) Commission that, barring exceptional cases, under the situation inherited from the Turkish administration all the agricultural land in Palestine was *miri*.⁴³ In the second document, dated 31 August 1945, after twenty–five years of survey work the Acting Director of the Land Settlement Department wrote to the Chief Secretary of the Government of Palestine:

Until a year or two ago, the greater part of the land being settled was in the coastal plain or in the wider valleys where mainly the Arabs had sold their rights to the Jews and Zionist organisations. Now settlement is leaving the plains and open valleys and is busy amongst the hill and mountain villages.⁴⁴

In retrospect, throughout almost all the years of the Mandate, land settlement was implemented mainly in the agricultural regions of the country, which were easy of access and where the survey work was simpler and more rapid than in the mountainous parts. This was represented to the public as a great advance of the land settlement problem, and the land there in any case fell to the Zionists or was already held by them. After the land settlement reform of 1928, and after the 1930 Hope-Simpson Report, the cadastral survey continued to focus on the coastal plain. Except for a few essential cases, the survey did not extend to the mountain regions.⁴⁵

The location of the Survey of Palestine

Of all the offices of the Government of Palestine, the Survey Department was the only one never to be based in Jerusalem. The directive to survey the coastal plain first influenced the location of the permanent home of the Survey of Palestine. While this would seem to have been a marginal factor, it was very important from the surveying point of view, for it determined that the department would not be in the capital with all the other government offices.

From its inception, the Survey of Palestine had the status of a full government department and not that of a section or division of another department⁴⁶—except during a short period when land and survey matters were under a joint Commissioner. Nevertheless, this department was physically separated from the rest of the government functions in Jerusalem, and efforts to move it there never materialised. From the moment that a cadastral survey was decided upon, it was clear that the Directorate would have to be located near the region surveyed. But at that time there was no head office, only local

ones near the work areas—in July 1920 at Gaza, where Major Quinlan sat; and in September, in Jerusalem under Captain C.D.Day. In November 1920 it was decided to set up a central head office, and the Directorate of the Survey moved to Jaffa, into the former German consulate building, where it remained until 1931.⁴⁷ In a broadcast over the Voice of Jerusalem on 27 March 1941, in one of the radio talks to mark twenty-one years of the British Mandate, Mitchell, the last Director of the Survey of Palestine, explained that setting up the Survey's headquarters in Jaffa derived from practical considerations, since it was the most convenient location for the control and supervision of the work in the field.⁴⁸

The matter of the physical location of the Survey of Palestine, away from the main government offices in Jerusalem, was occasionally raised as a result of the repeated checks on the achievements of the survey in relation to the progress of the land settlement. Dowson expressed his opinion twice in two years regarding this, and the second time arrived at a conclusion contrary to his previous one. In December 1923, in a report to the government's Chief Secretary, Gilbert Clayton (formerly Allenby's Chief Political Officer), Dowson enumerated the considerations that ought to determine the placing of the head office and the district offices of the Survey, and discussed the possible effects on the conduct of the work, and the essential connection between survey work and land registry and its offices.⁴⁹ Dowson had in mind the British Ordnance Survey, which was no longer located in London but in Southampton. Apart from considerations of convenience, of concentrating all government offices in the capital, Dowson adduced differences between the regular government offices and the Survey Department. He did not think that the latter could manage with a regular office structure, since it had a large production section dependent on water supply, and required storage space for raw materials and a large archive for keeping the original cadastral maps in a suitable manner under special conditions. For this reason, Dowson also proposed considering additional factors, such as allocating more economical places and suitable buildings, climatically controlled conditions, and security provisions in case of war or disturbances in the country. The economic consideration apparently eliminated Jerusalem as a possibility, since there were neither suitable buildings nor cheap land for building, and no foreseeable viable prospects for the future development of the department; moreover, Dowson did not think it advisable to add to the existing congestion in Jerusalem.

However, two years later, in 1925, Dowson emphatically changed his mind regarding the location of the Survey of Palestine, since four years of surveying work had not produced the anticipated results.⁵⁰ The Government of Palestine's Treasurer asked for Dowson's comments on Ley's budget proposal for the fiscal year 1925–1926.⁵¹ The memorandum he wrote began with an apology for having delayed his comments by two weeks because of the difficulties in communication between Jerusalem and Jaffa, and the need to move between the two cities in order to discuss budgetary matters with the Treasurer and the Director of Surveys. He insisted (in paragraph 8) that it was essential to transfer the Directorate of the Survey to the capital, if only to tighten the links with the government and with the Land Registry Department, since there was no other way to cope with the widespread disarray in the organisation of the surveys and in land settlement and registry. Everything was in a shambles—not only the contacts of the Survey with the capital, but also the contacts between the Directorate of the Survey and the field,

between the productive part of the Survey and supervision and control. The contact with the field did not suffer because of the location of the department, but communication between departments of the government was indeed basically lacking in efficiency. Elsewhere Dowson stated that despite the need to move the Survey Department to Jerusalem, he was aware that there was no appropriate building in the city, and that as long as the government persisted in renting buildings for its offices, it was hard to imagine that a special facility would be set up in Jerusalem for the Survey's headquarters. Nevertheless, Dowson appended an unequivocal recommendation to begin construction within one year, at an estimated cost of around E£30,000, to be taken from the budget and not from the loan schedule of the Government of Palestine. Hence, Dowson recommended that in the forthcoming budget an initial sum of E£5,000 be allocated for this purpose.⁵² The request, with its considerable budgetary appendage, did not please the senior officials in the Colonial Office in London. L.H.Holmes of the Middle East Department remarked in a marginal comment that to their great relief Dowson did not propose to implement his recommendation under the present budget, and emphasised the difference in views between Dowson and Ley, who rejected the idea of moving to Jerusalem.⁵³ They were aware of Ley's views since he had added his comments to Dowson's document.

The differences in outlook between Dowson and Ley stemmed, among other things, from their basic approaches regarding the purpose of the Survey of Palestine. Dowson, who visualised an important, permanent department, advocated the allocation of the large sum of E£80,000 per year—four times Ley's budget; while Ley did not budget for a permanent building for the 'Directorate of the Cadastre' since he believed that it was necessary first to decide where such a building was to be located. In earlier discussions two sites were proposed: Jerusalem and Mount Carmel. Ley preferred Haifa over Jerusalem since the only advantage of the capital was that the government was there, but Jerusalem was inconveniently located. Ley thought it would be easier to control the technical aspects of the Survey from Mount Carmel. He even found another advantage for the Haifa location: the situation of the Department of Agriculture there (that office was shortly thereafter transferred to Jerusalem). But Ley feared the expense of moving the head office to Haifa, just as he was apprehensive at the cost of a special building. He preferred remaining in Jaffa and expanding as needed also into other buildings in the vicinity of the German consulate. He thought that the present quarters provided sufficient space for the projected supervision and draughting sections, and in the courtyard there was room for the production and printing sections, for a map store, and other functions. The place was free of dust and had a plentiful water supply. It was in the centre of an agricultural plain, convenient of access to the public and for the conduct of fieldwork while the land settlement process was going on. And above all, the move of the department to Jerusalem or Mount Carmel entailed an estimated expenditure of E£20,000, whereas the organisation of the Department in Jaffa, according to Ley's modest conception, would cost only E£6,500.

The discussion regarding the location of the Survey of Palestine was reopened in 1928, when it was recalled that the rental contract for the building of the German consulate was to expire on 31 May 1929 and the owners were not ready to renew it. Now, from lack of choice, Ley was more prepared to look for a new home, for he hoped at this opportunity significantly to enlarge the area at his disposal. To this end, he turned his

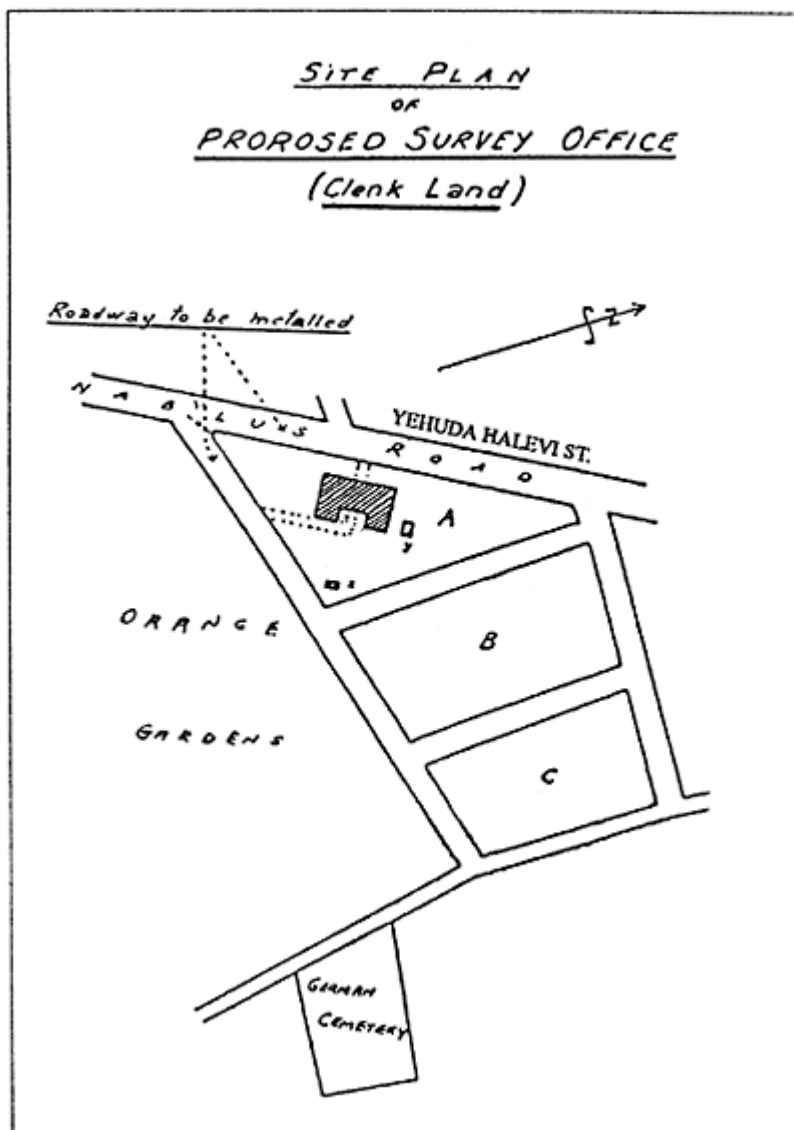


Figure 3.1 Site plan for the projected Survey Department building in the lands of the German Templer colony, Sarona (now in Tel Aviv) (source: ISA, RG 12, M/4122).

attention to a new building and the adjacent empty lot in the King George Avenue in Tel Aviv.⁵⁴ According to the calculations of the Public Works Department, Ley demanded an area of 1,140 square metres, as against the 344 square metres he currently had.⁵⁵ The cost of the new building was estimated at £6,840, a sum that again raised the question whether it would not be more worthwhile to design a building for the specific needs of the Survey Directorate, and so save much money. Among the other options was the acquisition of the 'Engineering Office Building' recently completed by the Solel Boneh Company, or the Greek school, or a building belonging to the Church Missionary Society (CMS). Each of these proposals entailed large financial investment. Ultimately the economic and professional considerations prevailed, and in September 1928 the decision fell on the construction of a specially designed building for the Survey of Palestine.⁵⁶ The intention was to erect this building on a plot known as 'Clenk Land',⁵⁷ between the German cemetery of Sarona and the Nablus Road (now, Yehudah Halevy Street, where the Survey of Israel is housed to this day). In October the Chief Secretary of the Government of Palestine applied to the Colonial Office with the request to confirm an allocation to the PWD for 1929 for the construction of the building. Among the arguments put forward in the despatch, it was stated that the department should remain in Jaffa as long as the land settlement process was going on in the vicinity, and there was



Figure 3.2 Permanent building of the Mandate Survey Department at Sarona (Tel Aviv)—today the home of the Survey of Israel (source: J.Loxton, Taunton, UK).

thus no choice but to set up a special building for the Survey. At that time the government had at its disposal a plot of land that had been acquired earlier for rerouting the railway

that passed through Tel Aviv. This plan was postponed for some reason, and it was now proposed to allocate the land for the Survey of Palestine building, which would enjoy a convenient site in the region of the survey, convenient access by the public, and easy movement of equipment by road and rail transport. Even so, all the programmes were qualified by ‘ifs’ and ‘whens’ as to the eventual move of the Survey Department to the government compound in Jerusalem, at which time the new building would serve the district offices of the Survey of Palestine, or would be sold without loss.⁵⁸

The new home of the Survey of Palestine was inaugurated on 1 January 1931.⁵⁹ During the construction the name of the Department was gradually changed in documents to ‘Survey of Palestine—Saronā’. Less than three years later, the PWD was requested to enlarge the building, but in 1935 the question of moving to Jerusalem was reopened. Salmon, the Director of the Survey from 1933 to 1935, was appointed Commissioner of Lands and Surveys and a member of the Advisory Council to the High Commissioner. He again raised the matter of the move to Jerusalem and sought to estimate the cost of a plot of 30–4 dunams suitable for the construction of the department’s head office⁶⁰ within the framework of the government compound that was planned for Julian’s Way (today, King David Street, on the site of the present Hebrew Union College institute).⁶¹ The Central Housing Commission even rushed to find a suitable use for the Saronā building—the head office of the Veterinary Service laboratories. The discussions regarding the move of the Survey to Jerusalem continued until the outbreak of the Arab revolt in 1936 and then ceased, never to be resumed. Clearly, it was out of the question to paralyse the work of the Survey of Palestine for such a move during the disturbances in the country, at a time when the department was largely involved in working for the army. Accordingly, the PWD was invited in July 1937 to carry out renovations of the Tel Aviv building in order to allow the work to proceed unhindered, and in October 1938 steps were taken to ensure the security of an establishment that had become a sensitive security asset.⁶² The repairs and additions made during the Second World War brought the floor area of the building to 3,000 square metres.⁶³

Thus, the site of the Survey of Palestine was determined by its close proximity to the heart of the region of the cadastral survey, even at the cost of efficient communications with the other government departments and offices. The Survey of Israel is today located in the same place, at the corner of Yehudah Halevy and Lincoln Streets in Tel Aviv.

4

Geodetic and cartographic considerations

The geodetic infrastructure and base measurements

The professional organisation of the surveying system is the key to reliable mapping. In Palestine, as everywhere, the first organisational step entailed the establishment of a suitable geodetic infrastructure of base measurements for all the planimetric and altimetric surveys and mapping.¹ The system was built up step by step from three groups of surveys: layout and measurement of triangulation points; the measuring of spot heights according to the precise levelling method; and the determining of a geodetic projection for the country. These stages were linked to each other in a skeleton framework, independent in their own place and integrated in one system. All the fixed points in the field were tied mathematically into one national net. They served as control points in a joint reference system for all the survey projects throughout the country. Without such a net there could be no common basis for surveying.

The basic measurements of control points were intended almost exclusively for the cadastral survey, so that large-scale maps could be prepared in order to show the boundaries of landed property at a degree of precision suitable for appending as graphic descriptions to the *kushans* (title deeds).² Survey is the technical term for determining the location of objects by measurements in the field, as distinguished from measurements drawn up on scaled paper sheets so as to graphically depict the area surveyed. The methods of surveying vary with the scope of the project. Generally, they are linear for direct determination of distances. But in the past, in areas where direct linear surveys were difficult to carry out, the linear survey had to be supplemented by trigonometrical surveys for determining distances by geometrical calculations. The siting of points surveyed by the trigonometrical method is determined by calculating the values for sides and angles of triangles. This is the triangulation net. In the past it was easier to measure angles rather than distances between points in the field. It was done by means of an optical surveying instrument that read angles (a theodolite); the distances between the points could then be calculated trigonometrically. Therefore, when angles are measured in a complex chain of connected triangles, and the distance of one single side is measured in one of these triangles, the length of all the sides of the other triangles in the net can be computed.

That single side, the length of which is measured with great precision and upon which depends the calculation of all the sides of the triangles in the net, is the baseline. The length of the baseline, the method of measuring it, and the rate of permissible error depend on the type of triangulation, the objectives of the survey, and the stipulated level of precision. When the survey of a given area is about to be completed, a new baseline is measured out near its other end to which the net is tied. This is the control, or check base. Its length is determined in two ways: by direct measurement in the field, as in the case of the baseline; and by calculating the length trigonometrically, as one of the sides of the

triangles. In this way, two values are obtained which permit control of the level of precision at the closing of the triangles in the course of surveying the net. Further details are given in the ‘Triangulation survey’ section (p. 68).

As was stated in paragraph 2 of Bols’s despatch of 19 June 1920 to the Foreign Office (see Figure 2.3, pp. 45–46), a preliminary investigation was conducted in the south of the country, in the vicinity of Gaza, in order to determine whether it would be possible to use the triangulation net laid out by the British forces during the First World War. The check showed that the geodetic infrastructure laid down three years previously might have served the purpose and the military objectives at the time, but was unsuited to the precise geodetic system predicated by a cadastral survey.³

Accordingly, a five-point geodetic master plan was worked out (of which we know from reports composed subsequently):⁴

- 1 A suitable national coordinates grid was decided upon for the country. The grid was based on a meridian line passing through Jerusalem and a transverse geodetic projection tangential to this meridian, from which the cartographic projection of the map of Palestine would be made.
- 2 A major triangulation net of 100 fixed points would be laid out. Considering the size of the country, the major net would be of second-order precision with 15-kilometre-long measured sides of the triangles. The net would hinge on two measured lines: a baseline in the south of the country and a check line in the north, and would be anchored on a spatial system of geographic coordinates by means of astronomical observations.
- 3 A secondary triangulation net of 2,000 measured points with sides about 5 kilometres long on average, a distance about a third of that of the major net, would also be laid out.
- 4 By the traverse method, a net of some 12,000 control points and polygons would be measured at distances not to exceed 400 metres between points.
- 5 A detailed cadastral survey would be carried out by the plane table method.

Other fragmentary information seems to indicate that from the beginning the intention had been to lay out first- and second-order triangulation nets within six months of work. But Ley considered that in such a limited time-span no more could be expected than the surveying of points of second and third order, two baselines, seventy-five fixed major triangulation points, 1,500 points of third order, and astronomical observations—all these in eighteen months of work under favourable weather conditions.⁵ In view of the land values and the interests of the owners of the smallest parcels, it was also decided that in positioning points for determining property boundaries a mean error of 1 metre would be allowed, and that in order to achieve such an order of exactitude the field survey would be conducted on a scale of 1:2,000.⁶ The Survey of Palestine generally followed this triangulation programme, but between April 1929 and November 1933 improved the survey in the mountain region. The department added a special secondary net known as topocadastral triangulation that was intended to improve the measurements by increasing the density of fixed points in the mountainous parts of the country. These points were intersected from a third-order triangulation net.⁷

The methodological implication of this programme was that the survey work had to proceed from the general to the specific, from the area at large to the smallest of parcels, and never in the opposite direction. In order to map the small parcels in the entire system

it was necessary to build the triangulation system, layer by layer, of increasingly denser nets. For this reason, a more complicated and demanding geodetic survey method was adopted for Palestine. It was based on triangulation layers and not on traverses and offsets from the higher-order triangulation net, as in other countries. This derived from the assumption that the cadastral survey had to be much more accurate than topographic mapping, and reflected the approach that the geodetic base of the country was from the beginning intended to answer cadastral needs.⁸

The working programme, as designed by Ley, lacked one of the essential links for completing the geodetic infrastructure, a link that was added to Palestine only after his departure: the net of spot heights surveyed by precise levelling. The systematic surveying of continuous spot heights began only in May 1934, under Salmon's direction, when the lack of benchmarks crucial for engineering projects was particularly felt. These marks were needed specifically in the survey of water resources of Palestine carried out by the Survey Department. The net of benchmarks dovetailed with the triangulation nets and added an important element to the topographic representation of the ground surface.

The basic measurements in the country were conducted in a geodetic framework tied to the globe in accordance with the mathematical principles of the Cassini-Soldner projection, which had been adopted as the most suitable for Palestine.

Triangulation survey

The actual preparations for setting up a triangulation system commenced only in February 1921 after the Survey Department moved to its new home in Jaffa; the survey began in May 1921.⁹ The first step was for the survey parties to lay out geodetic points throughout the entire country, to measure their values, and to provide mathematical bases for the survey nets. The geodetic points required for mapping are classed in three categories:

- 1 Fixed points, or trigonometric stations, are determined by trigonometric methods and must be in sight of each other for the surveying observations. These imaginary lines form the sides of the triangles of the observation net. The data obtained are the position of the points in planimetric coordinates. The elevation of the points is determined in relation to the datum (reference) level, which is the mean sea level (MSL).
- 2 Spot heights are determined by precise levelling and not necessarily in relation to the trigonometric net. The topographic heights are measured in relation to the MSL along fixed runs in the field.
- 3 Gravimetric points, for the determination of the figure of the Earth.

The net of fixed points therefore constitutes a basic national skeleton system into which tie all the survey and mapping projects throughout the country. In order for these separate projects to tie into the national net accurately and easily, the density of the measured points must be increased by splitting the major triangulation into secondary nets with triangles having shorter sides: these are the third- or fourth-order triangulation nets, and so on. Besides the measuring of triangulation nets, the number of triangulation points can

be augmented so that in the detailed cadastral survey stage several points tied to the national reference net can be included in every map.¹⁰

When, in 1921, the measurement of the triangulation net and the control points was begun in Palestine, the survey staff numbered eleven senior surveyors and twenty-four junior personnel, and work was carried out simultaneously at all target sites. Two parties were detailed to lay out the major triangulation net. A reconnaissance crew identified the sites for trigonometric stations in the coastal plain, and in September their measurement began. The second party set up the stations and constructed beacons—cairns, stakes, pipes with concreted land anchors—that were set up permanently to mark the trigonometric stations, or fixed points. Between June and October one field party conducted the measurements for the secondary net, and a party of apprentices was busy between August and December in measuring the control points, as part of their training as surveyors. In March 1921 the possibility was considered of measuring the baseline in the southern part of the country near Beersheba; but in the end it was measured in October along 4,730.6 metres in the Imara lands, near today's Kibbutz Urim (note the frontispiece). At the same time, the possibility was investigated of measuring the check baseline of the system in the vicinity of Jenin.¹¹ In order to calculate the topographic height of the triangulation points, the MSL was measured on the Gaza beach, and the altimetric measurements were connected to the Imara baseline by precise levelling. In 1921 it was still too early for commencing a detailed survey for a cadastral programme, but the basis for this work was prepared by the plane table method.

Towards the end of 1922 the net of fixed points was deployed over most of the north of the country, and the measurements were closed to the check line sited in the Haifa Bay, east of Acre, and not in the Jenin region as planned originally.¹² The map of triangulation points of 7 December 1922 shows that from the beginning there had been a clear intention to lay out the net only in the areas that were to be subjected to the cadastral survey in the future. No points were measured south of Beersheba; the Judaeen Desert and the Judaeen mountain region were left out, and so was the Huleh Valley, which at the time had still not been included definitively within the territory of the Palestine Mandate. Although the agreement between Britain and France on the boundary between Palestine and Lebanon-Syria was signed in Paris on 23 December 1920, it was confirmed only in March 1923, and the transfer of powers to Britain was implemented on 1 April 1924. The demarcation of the border from Ras enNaqura (the Ladder of Tyre; Rosh Haniqra) to Samakh was completed in the summer of 1925.¹³

In 1923 the major triangulation net of ninety-five fixed points was completed and marked in the field, but the measurements in the Galilee and Mount Carmel were still unfinished. In that year the gaps were closed, and fixed points were measured also in the mountain area north of Ramallah (the Beth-El Mountains) and the Jericho Valley, and in March 1925 the triangulation of Hebron was begun.¹⁴ In April 1924, after the Huleh Valley became part of Palestine, the northern frontier was finally demarcated to form the Huleh Salient (the 'Finger of Galilee'), and the Survey Department added five new points to the major triangulation net, and forty-three to the secondary net of third-order triangulation so as to cover the 'newly acquired territory' by the survey.¹⁵ In this way the number of points in the major triangulation net reached 100, with point 100 sited, surprisingly, in Syrian territory, at what today is known as Mitzpeh Gadot above the old custom house at the Bridge of Jacob's Daughters (Jisr Banat Ya'aqub) across the

Jordan.¹⁶ In 1925 the surveyor John Mankin, who surveyed these points in coordination with the Syrians, proposed improving the major net by establishing an additional fixed triangulation point in Syria, on the plateau northeast of 'Ein Gev, but this was rejected.¹⁷

In 1923 it became clear that the measurement of the check line at Acre was being delayed and was not being carried out properly. In consequence, the Acre line was cancelled and it was decided to establish instead a check baseline south of the Sea of Galilee, near Samakh.¹⁸ In December 1924 Mankin was ordered to move his surveyors' camp from Athlit to Samakh and to begin measuring a check line.¹⁹ This line was also measured from Afiqim to Deganiya A, a length of 2,901 metres, in the same plain where previously the baseline between points 1200 and 1201 had been measured in connection with the Beisan *jiftlik* land settlement surveys in 1922. From the beginning, the two

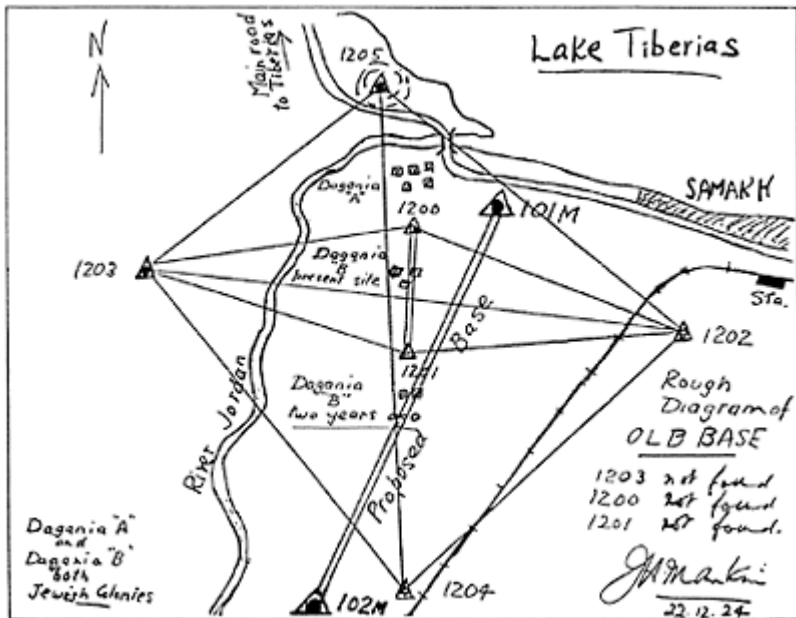


Figure 4.1 Baselines of two triangulation nets in the lands of Samakh, Deganiya A and Deganiya B, 22 December 1924; the sketch shows that in the two years since the measurement of the first baseline, Deganiya B moved to a new location (source: Field Book of J.H.Mankin, 24 December 1924, Letter T/4/184, SoI/C/14, Tel Aviv).

stations of the new line were marked 101M and 102M on the national major triangulation net. Later, however, they were given the numbers 66M and 67M of the points that had been planned but cancelled with the abandonment of the Acre line.²⁰ In the closing survey that was conducted some time afterwards at the Samakh baseline, there proved to be a discrepancy between the computed trigonometric values and the actual measurement of the check line, and to straighten matters out the Egyptian Survey Department was called in to assist in conducting a professional check.

The survey check

The Egyptian surveyors came in 1925 to conduct a geodetic-mathematical check of the survey work in Palestine.²¹ Dowson, who in those days was involved in preparing the cadastral reform in Palestine, suggested that the check be entrusted to his colleague F.S.Richards, the Director of the Computations Section in the Survey of Egypt.²²

First among the matters Richards was requested to comment on was the question regarding the quality of the major triangulation net upon which all the surveying and mapping in Palestine was to be based.²³ In the summary of his investigations, Richards commended the work and even mentioned the names of the two surveyors who had been responsible for setting up the system, Walter S.Moffatt and John Mankin.²⁴ Richards did not restrict himself to checking the system of calculations of the survey observations, but also checked the observations of these two surveyors, who apparently appeared before him in surveying exercises in the field. With rare candour, he declared Mankin's work superior to that of Moffatt, and so concurred with Ley's opinion. Richards stated that he could not suggest any improvement in technique, for 'the measurements of the Major Triangulation net of Palestine are of so high a level of exactitude to suffice for all purposes of the cadastral survey and the registration of property rights'.²⁵ As to the mathematical discrepancy between the measurements in the field and the calculations in closing the loop at the Samakh line, Richards recommended an adjustment, and this was done. The computations were conducted in 1926–1927, along with astronomical observations.²⁶

In 1938 Salmon, the Director of the Survey Department at the time, had occasion to praise the quality of this geodetic work. In a report he submitted to the Royal ('Peel') Commission, he wrote:



Figure 4.2 Surveyors of the Egyptian Survey Department conducting a check measurement of the triangulation net of the Imara baseline, between points 1'M and 2'M, 1925 (source: J.H.Mankin photo collection in Palestine Exploration Fund archives, London).

No survey work is perfect and there will always be some discrepancy between the measured length, position and bearing of the check base, and these values as calculated from the triangulation system. The errors thus observed must be distributed throughout the system by a long and precise mathematical process which in the case of Palestine involved 231 differential equations and took 520 man days.²⁷

Summary of the triangulation survey

While the net was being closed, and in view of the intention to extend the cadastral survey to the mountainous regions, it was decided in April 1929 to employ a more rapid surveying method. It entailed fixing control points resected from third-order triangulation points so as to save on work entailing chain surveying, which was more suitable to open, level ground. In this way, additional fixed points were added to the special topocadastral trig network.

In the annual report of the department's Director for 1930–Ley's last report before his retirement—a summary of the first decade of work of basic geodetic measurement from

Dan to Beersheba was presented: the major triangulation net covered an area of 14,750 square kilometres, and ten years of triangulation had involved 20,973 points of calculated coordinates and landmarks determined graphically—altogether 43,871 points throughout Palestine.

The publication of the summary data in that year was intended perhaps to bolster professional pride but was certainly not divorced from the events of the times. In that year the country was subjected to political turmoil in the wake of the Arab disturbances of 1929, and the publication of the Hope-Simpson Report in October 1930 with its far-reaching and controversial recommendations with regard to the ‘absorptive capacity’ of the country on the basis of the data provided by the Survey of Palestine.²⁸ It seems that by publishing the data of his summary Ley intended replying to his critics by claiming that in ten years of work the Survey Department had made a substantial geodetic effort, and one deserving of recognition, at the advancement of the land settlement and the solution of the land problem in Palestine.

In 1935 it was decided for the first time to deviate from the traditional ‘from Dan to Beersheba’ map of Palestine and to extend the triangulation net southwards to the Negev and the Sinai border. The intention—or geodetic challenge—was to effect a junction with the Egyptian triangulation net, whose points had reached the Palestine border two years earlier.²⁹

In those years the planned work on the basic triangulation net was in effect completed, and most of the effort was turned to speeding up the process of land settlement. The geodetic stage had been anticipated, for as early as 1931, in a report on the development of agriculture and land settlement, Lewis French, the Director of the Development Department of the Mandate government, wrote that the triangulation system intended for the land settlement would be brought to a close in 1937.³⁰

On 31 March 1938 Salmon published the summaries of the areas covered by the triangulation nets, according to which the major triangulation covered over 15,350 square kilometres.³¹ These data are the last published on behalf of the Survey of Palestine until the end of the Mandate. During the last ten years of the Mandate government over Palestine, almost nothing more was done on the geodetic infrastructure, excepting military work during the Second World War. The Directorate of Surveys, Middle East HQ published lists of the triangulation points in Palestine during the war, mainly for the artillery units. From the list of the major triangulation, there were in Palestine about 140 points, encompassing 17,654 square kilometres of the country’s area, of which several were points whose values had not been definitively calculated, and twenty more points tied to the national net that had been positioned outside its borders, in Transjordan and Sinai.³²

In the layout of the triangulation nets during the British Mandate, Palestine north of Beersheba was completely covered by the addition of third- and fourth-order networks, and by an almost complete skeleton of the major triangulation net. This net is identified in the topographic maps of the country by the prefix M before the ordinate number of the triangulation points.³³

Joining the triangulation net to the neighbouring countries

One of the means of control over the accuracy of a national triangulation net is its juncture to nets of neighbouring countries. The Survey Department wished to check the precision of its observations according to the surveys of the French in Syria and the Egyptians in Sinai. Ley had already proposed setting up a geodetic tie with the French net in the summer of 1923;³⁴ in August 1924 Dowson argued at the Colonial Office that before the triangulation system could be accepted as the basis for a

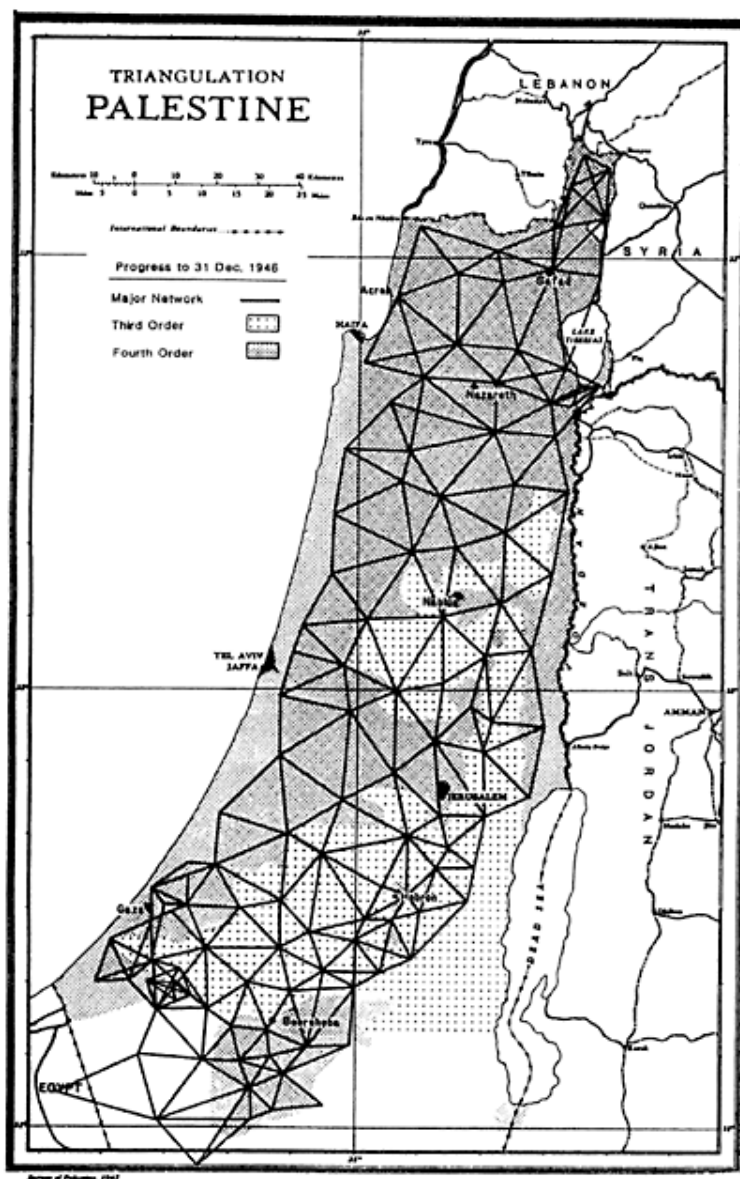


Figure 4.3 Triangulation system in Palestine at the end of the Second World War, 31 December 1946 (source: Pal. Govt, Annual Reports of the Director of Surveys, 1940–1946, Map 3).

cadastral survey, it was imperative to tie it to, and bring it to the level of, triangulation in the neighbouring countries, 'for triangulation is to a land survey as a foundation is to a house'.³⁵

On 21 November 1924 the head of the *Bureau Topographique en Syrie* visited Palestine in connection with the Newcombe-Paulet Northern Boundary Demarcation line. During the visit, views were exchanged regarding the junctions of the two survey systems when the Syrian chain survey from Haleb to Mount Hermon would reach the border of Palestine in April 1925. Both sides regarded this tie-up as important beyond just a check of the local surveys, for the junction of the systems would in the future be part of a continuous land connection between Europe and Africa.³⁶ But the French survey was delayed and with it also the junction. In the meantime, this did not prevent the Survey of Palestine from conducting a plane table survey towards the demarcation of the northern border. In the end, the line was marked from Ras en-Naqura to Samakh in the summer of 1925 in cooperation with the French, with the Palestine survey party setting up thirty-eight boundary pillars of the form devised in Palestine, and the French putting up the same number of boundary markers of their own design.³⁷

The junction between the French and the Palestine nets was finally effected in 1928, by observations to the two points of the major triangulation net: to Point 73 at Safad and Point 38 at Hunin (Margaliot).³⁸ The French observations were conducted from Mount Hermon, from Tell Abu Nida (Har-Avital), from Kafr el-Ma on the Golan Heights, from Jebel



Figure 4.4 Survey post on Jebel Jarmaq (Mount Meron) for the geodetic junction between Palestine and Syria and Lebanon, October 1928 (source: J.H. Mankin photo collection in Palestine Exploration Fund archives, London).

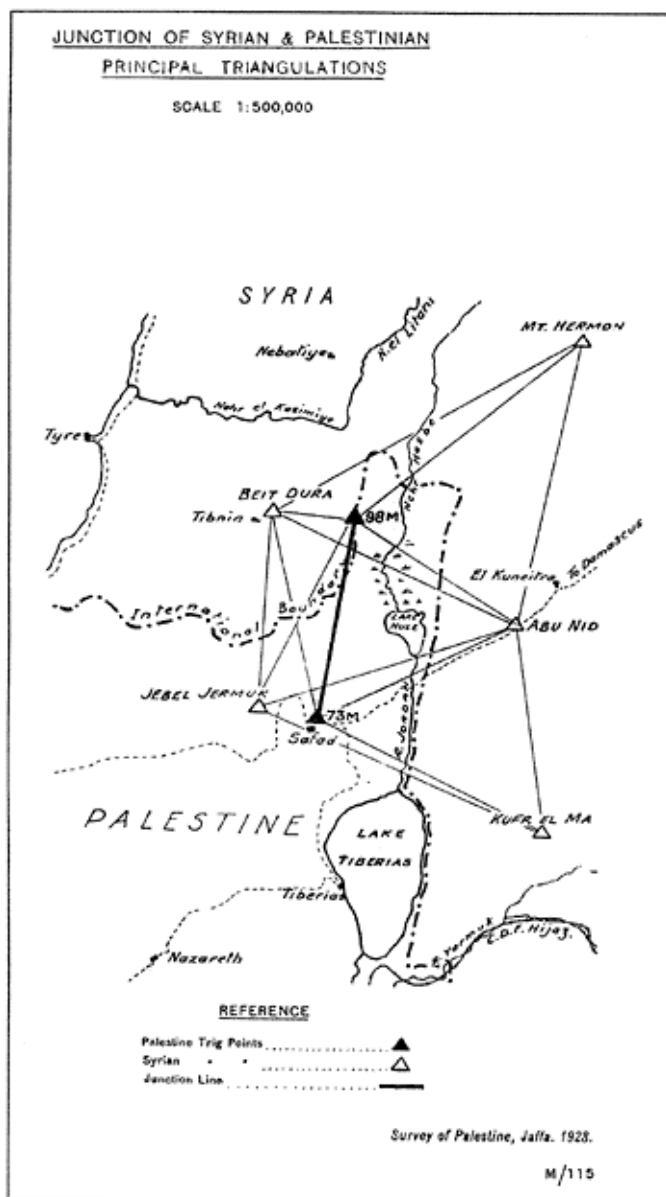


Figure 4.5 Junction of Syrian and Palestinian principal triangulations (source: Pal. Govt, *Annual Report of Director of Surveys, 1928*, diagram 1, pp. 6–7).

Beit Dawara north of Tibnin in Lebanon, and from Jebel Jarmaq (Mount Meron) in Palestine. In the course of these surveys the data concerning the geographic longitude and latitude, the astronomic azimuth, and the calculated running distance between the two points were checked. The calculations were done in Paris and discrepancies were discovered between the surveyed and the calculated data. There was thus a need to return to the field and revise the survey in Palestine, though in fact their revision was carried out only after the establishment of Israel.³⁹ Further computations to strengthen the geodetic tie with Syria were conducted at other points during the Second World War at the request of the British Army, aiming at one continuous geodetic system in the entire region.⁴⁰

In 1927 there was a desire to bring about a similar tie with the Egyptian net, but the Survey Department had to wait until 1933, when the Egyptian desert triangulation reached the Palestine border. As has been mentioned, in 1935 points were measured south of Beersheba, and in 1936 reconnaissance parties were sent out to establish the junction with Egypt. However, the work was delayed in June 1937, when the parties were transferred elsewhere for urgent tasks. The preparations were resumed in 1938,⁴¹ but on the eve of the Second World War the work was still far from implementation.⁴² A military geodetic tie with Egypt was effected in 1941, in a roundabout way, by a South African military survey unit that conducted a geodetic chain survey from Beersheba to Sinai and the Gulf of Aqaba (Elat) and north to Transjordan, and closed its geodetic surveys with the Palestine major triangulation net near Jericho.⁴³ This marked the completion of British military triangulation in Palestine, which had opened in the Rafah Approaches during the First World War and was closed there during the Second World War.

The last of the geodetic ties between Palestine and its neighbours was the junction with Transjordan. In the discussions on the establishment of an independent survey department for Transjordan, Dowson suggested in August 1927 that Palestine and Transjordan have one triangulation system, for to his mind there was no justification for two separate nets of two small countries under one Mandatory umbrella.⁴⁴ The two systems were indeed linked during the Second World War. The candidate for heading the Transjordan Survey Department was Andrew Mitchell. Dowson recommended that Mitchell be seconded for six weeks to Ley in Palestine before going out to Transjordan so that he could benefit from Ley's experience and lay the basis for professional cooperation between the two departments. Eventually Mitchell inherited Ley's and Salmon's position and became the last Director of the Survey of Palestine. During the Second World War Mitchell assisted the military Directorate of Surveys Middle East in extending the triangulation net of Palestine to Transjordan, and from there to Syria, in order to establish a geodeticmathematical continuity between the two countries with the British invasion of Syria and Lebanon from Palestine in 1941.⁴⁵

Measuring topographic spot heights and benchmarks by precise levelling

The measuring of topographic spot heights of triangulation points in the field is done in two ways: trigonometrically and by precise levelling. In the trigonometric method the elevations are calculated according to readings of vertical angles in the course of

planimetric observations to determine the positions of triangulation points. In the precise levelling method the elevations of points in the field along selected runs are determined by means of a levelling instrument that permits more accurate measurement than the trigonometric method. In the precise levelling method heights are measured from a base point of established topographic height, by measuring the elevation differentials from point to point and calculating the height of the new point in reference to the measured height of the previous point. These elevation points join to make up measured lines that are resected or measured in circular loops to obtain checks on the accuracy of the measurement and the closing of a series of measurements. Like the triangulation points, the elevation points are also marked in the field as benchmarks cut into the margins of roads, culverts, and the like.

The basic starting point for measuring heights is the mean sea level. In 1921 the MSL was measured for the first time at the Gaza beach and precise levelling conducted to the baseline at Imara. From then until 1927



Figure 4.6 Levelling survey in the Kabara swamps, 1925 (source: Photo by Z. Oron–Oroshkes, CZA Subjects/102).

no further country-wide levelling surveys were conducted in Palestine. In 1927 a medimarmetre was installed in the jetty wall of Jaffa, and in August 1928 another such instrument was installed in the customs jetty at Haifa. By means of these instruments a divergence was discovered between the heights at the two measuring stations and the spot heights arrived at by chain surveys from the Imara baseline: a difference of +90

centimetres at Jaffa, 110 kilometres from the starting point at Imara, and a difference of +1.20 metres at Haifa, at a distance of 173 kilometres.

In May 1927 another medimarmetre was installed at the Dead Sea shore, and the shore point was tied to the triangulation net. The calculations showed the level of the Dead Sea to be -392.3 metres below the level of the Mediterranean (in June 1927). Allowing for an error of 1 metre that was carried forward from the triangulation net, the elevation of the Dead Sea surface was established at -393.3 metres—which compared well with the reading of -393.8 metres obtained by Wilson from the precise levelling survey he had conducted from Jaffa to the Dead Sea sixty-four years earlier.⁴⁶

In 1928 a recording of the level of the Sea of Galilee was begun, the first systematic monitoring of the seasonal variations in the level of the Sea of Galilee and the Dead Sea as a result of climatic factors. At Jaffa the medimarmetre was replaced by a tidal gauge that could be read more easily and conveniently, and since the readings at Haifa and Jaffa were almost identical, and the differences between them were ascribed to the winds, it was decided to close the Haifa station in August 1930.⁴⁷

Even before systematic surveys were conducted in Palestine by the precise levelling method, several surveys for special purposes were carried out, such as a levelling of 119 kilometres in the town planning regions of Jaffa and Tel Aviv in 1927, and a levelling 71 kilometres long along the course of the planned water pipeline from Ras el-'ZEin (Rosh Ha'ayin) to Jerusalem at the request of the PWD in 1934. This latter project was undertaken in accordance with the recommendations of the HopeSimpson Report in 1930, in connection with which French (the head of the Development Department) proposed in November 1931 to conduct a hydrographic survey in Palestine with the help of the Survey Department.⁴⁸ Because of its involvement in this effort, the department diverted its resources to survey runs by the precise levelling method. Only then, in May 1934, were systematic surveys undertaken with the aim of providing data for the development of water supply systems, irrigation networks, and the sinking of wells. The intention was to establish in Palestine twelve to fourteen fundamental benchmarks—half of them incised in stone and the rest set up in public parks on top of concrete pillars sunk into the ground and marked with bronze plates, from which heights could be measured for surveying purposes.⁴⁹

Field surveys by means of the precise levelling method are usually conducted in closed runs of loops that start and end at the same point.

The first precise levelling according to the new plan was done between Jaffa and Haifa, in the framework of the hydrographic survey, and as part of the first levelling that was to be measured along 166 kilometres of the Tulkarm–Haifa–Jenin–Tulkarm loop. In 1935 the first circuit was completed. Surveying of the second one was begun in the stretch between Jaffa and Jerusalem and finished in 1936; and surveying of the southern circuit, towards Gaza, was commenced. In the framework of the second loop a branch from Jericho to the Dead Sea was surveyed; for the first time since Wilson's survey in 1864, the surface of the Dead Sea was tied to the main network by precise levelling. This survey aroused great interest in London, and Salmon was asked by the Palestine Exploration Fund to prepare a special report on the fluctuations in the level of the Dead Sea and their topographic elevation in 1927–1935.⁵⁰ This survey was conducted against the background of the disturbances of 1936. Out of security considerations, an Arab party worked on surveying the loop, while Jews were employed at the precise levelling survey

of water sources.⁵¹ In 1936 all the material that had been gathered in the framework of the hydrographic survey was given over to the Development Department, but this was not the end of the work.⁵² In 1937 a branch from Beisan to the Huleh Valley was surveyed by precise levelling, also as part of the irrigation projects, and on the same occasion an additional branch, from Rosh Pinna to the Bridge of Jacob's Daughters, was surveyed to form a junction with the Syrian Bench Mark L'9 fixed by the French. The closing differential between the Palestine and the French-Syrian surveys was only 8.1 millimetres, a remarkably good result considering the different survey bases of the two systems, one in Haifa and the other 135 kilometres distant in Beirut.⁵³

Altogether, until the outbreak of the Second World War in 1939, four complete loops and a fifth, unfinished loop were surveyed in Palestine. The work on the fifth loop was only carried out in the short stretch between 'Afula and Nazareth, and this too under police escort to deter Arab opposition. In 1940, precise levelling surveys were still completed between Jerusalem and Nablus in order to divide the second loop. Until 1943, precise levelling surveys totalling 1,027 kilometres were carried out in connection with town planning. This ended the precise levelling activities of the Mandate Survey of Palestine until 1948.⁵⁴

Evaluation of the base measurements

The greater part of the geodetic base measurements during the British Mandate was completed by the mid-1930s. The Survey of Palestine was then already in the full swing of its cartographic work, producing a variety of maps for different purposes. In effect, the department began to carry out survey projects in the country at the government's behest even before the base measurements were begun. These tasks were imposed on the department prematurely: they impinged on its untested and uncrystallised capabilities, and gave rise to criticism of its performance soon after its inception. Nevertheless, these activities did not seriously impede the fundamental infrastructure work conducted in the country, which was deservedly esteemed and praised. When in 1940 the Directorate of Surveys, Middle East Forces HQ was established to deal with the anticipated war needs, a review of geodetic and cartographic activities showed that, alone of all the countries in the region, Palestine had a triangulation net of the first order.⁵⁵ Salmon, who took over the department in 1933, did not stint on praise. While still serving in Ceylon, he wrote in an article on surveys that in carrying out good topographic mapping there could be no compromise on incomplete triangulation, and the aim must be for the main system to be of first—order precision.⁵⁶ And in a public lecture delivered in London in 1938 he declared that his predecessor in Palestine, Major Ley, had completed the triangulation of that country, which was one of the finest he had ever worked with—even though it was of secondorder precision.⁵⁷ H.G.Le Ray, whose position was to be phased out at the end of the cadastral survey, reaped most of the praise. He headed the Computation Section and was responsible for the mathematics of the triangulation nets and their adjustment.⁵⁸ In 1935, at the Conference of Empire Survey Officers, Le Ray presented the complex mathematical structure and explained his working methods, which in Palestine he had managed to bring to a degree of precision on a large scale (1:1,250–1:12,500) that very few countries in the Empire could match. The secret of the success was the system

adopted by Ley of deploying three triangulation nets instead of restricting himself to one main net and internal surveys within the triangles, and the meticulous implementation of the complicated and complex calculations. In the discussion that followed the lecture, the Director of the South African Survey Department expressed his utter amazement at the perfect system by which the survey check was conducted in Palestine. And G.T.McCaw of the Geographical Section of the General Staff and the Secretary of the Colonial Geophysical and Mapping Committee remarked that suddenly, one day, the triangulation of Palestine was completed without prior discussion and he thought that the Palestine Survey was too modest in calling its triangulation principal rather than first order as it deserved.

Richards, the Director of the Computation Section of the Survey of Egypt, in his report for 1925, went out of his way to state that Le Ray's success was largely due to five mathematicians ('computers'), all of them Jews and very good, three of whom could be entrusted with the most complex calculations.⁵⁹ These five were, in order of rank, B.Goussinsky, J.Sharir, E.Shisha, S.Jabotinsky, and Dr D.Liebrecht,⁶⁰ who proudly proclaimed it to be a 'Jewish section'.⁶¹

The geodetic projection for Palestine

The land of Israel occupies a very small area on the globe. A single country, groups of countries, or the entire surface of the globe can be represented by means of different methods of cartographic and geodetic projections. A projection is the transfer of a point from one plane to another. Mapping theory entails ways of projecting parallels and meridians from the global surface of the earth upon the flat map.⁶² Cartographic projections enable large parts of the globe to be represented on small-scale maps, as in atlases, so that a general idea can be obtained of the parallels and meridians on the map. By means of geodetic projection the geographic graticule is exchanged for a rectangular coordinates grid, so that triangulation points can be defined and elements in the field located by values of the national grid.

More than it influences the outline of the country's map, the choice of the projection dictates the essential geodetic attributes for precise work. Hence, the choice of a suitable projection for Palestine depended on the geometrical characteristics of the projection, the size of the country, its elongated, narrow north-south form, and the purposes of mapping—in this case cadastral. The mapping of Palestine was also influenced by the cartographic traditions in the colonies and by consideration of the available mathematical tables compiled and calculated beforehand in Britain and other countries.

We do not know what prior considerations led the British to select any particular geodetic projection for Palestine. The decision narrowed down between two projections: Gauss-Conformal, known as Transverse Mercator Projection, and Cassini—Soldner, since these were accepted as convenient projections for both cadastral and topographic mapping. In 1922 the survey experts in Palestine fixed upon the Cassini geodetic projection⁶³ with rectangular coordinates as calculated by Soldner⁶⁴ as the projection for Palestine, based on the Jerusalem central meridian.⁶⁵ The Cassini projection had been used by the British since 1745, and it was commended by the leading British survey

experts as the typical example for a field projection serving practical field surveys.⁶⁶ This projection was considered easy for computation and suitable for areas of restricted size.⁶⁷

From its geometrical attributes and its transverse construction, the Cassini projection answers the geodetic needs of Palestine within a strip 50–80 kilometres wide on both sides of a central meridian, usually passing through the centre of the area to be mapped.⁶⁸ The British bestowed this honour on Jerusalem, so that the meridian became the central longitudinal line, even though it did not divide the country down the middle. The meridian of Jerusalem goes through the Jaffa Gate, and the main triangulation point 82'M, which became the reference point of the system, was fixed higher up, on top of the Mar Elias monastery hill south of Jerusalem.⁶⁹

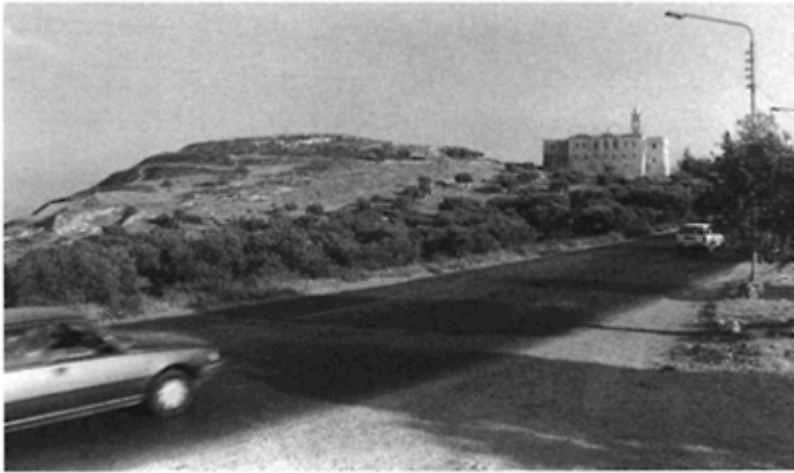


Figure 4.7 Mar Elias Monastery south of Jerusalem; triangulation point 82'M was positioned on top of the hill (source: Photo by D.Gavish).

In the geodetic projection, importance is given not to the transfer of the elliptic geographic graticule of meridians and parallels, but to the replacement with a rectangular national grid system. The Surveys Directorate decided that the grid would encompass all the parts of the country to be mapped—which did not include the Negev south of Beersheba. Therefore, its staff established a trigonometrical station at the top of the 'Ali el-Muntar hill, which dominates the town of Gaza, in the heart of the area that was the first to be mapped in detail, and gave it values of 100–100 in the national grid. This point became the true origin of the Palestine grid.⁷⁰ In this way the zero point, or the false origin, of the Palestine axial system was 100 kilometres west and 100 kilometres south in north Sinai, near Jebel Maghara. The choice of the true point of origin was not a good one because it left the southern Negev with negative values south of the zero line. Thus, for example, Elat would have been given a negative northern coordinate of –116. In order to avoid negative values, the British set the value of the zero line at 1,000, so that any

place south of the line would have positive values; Elat would thus be at 884 of the northern coordinate.

When Richards conducted the check of the surveys in Palestine in 1925, he argued against this peculiar layout of the national grid. He remarked that the zero point of the main axes ought to have been at the intersection of the geographical coordinates 34° longitude and 29° latitude, which fall in south Sinai, so that all of Palestine would be within the positive values of the national grid. Richards also commented on the determination of the central meridian of the projection at Jerusalem, which it would have been better to move eastwards, for example to the Jordan Valley, so that in due course it would be possible to extend the grid system to Transjordan.⁷¹ These comments had no practical connotations, since the entire system was already in operation. The episode is mentioned here only to illustrate the absolute professional independence of the Directors of the Palestine Survey Department, despite the prestige of the Survey of Egypt, which assisted the local department in its first steps.

Standardisation of measures

Surveys and mapping work are by nature based on yardsticks. When the British took over the administration of Palestine they inherited two handicaps in this respect: the absence of standard weights and measures, and the lack of any appreciation of the importance of measurement and the size of a given area in the registration of lands. Both these factors greatly hampered the British in administering the economic life of the country, and this frequently found expression in documents dealing with land transactions.

Walter Lawrence, who was sent to Palestine in February 1919 to inspect the operations of the OETA administration, illustrated the absence of standards in a report to Allenby by enumerating the maze of weights used in the country, varying from region to region and from one type of merchandise to another.⁷² Everyone concerned with these matters repeatedly stressed the prevailing disorder in all matters relating to land measurement and land registry, which meant that no one could find his or her way in the confusion of verbal descriptions of parcel boundaries.

The importance of standardisation of measures derived from the existing lack of correlation of linear and area measures whereby all such measurements must be based on the same linear units. The basic, generally accepted linear unit in the Ottoman Empire was the *dera'a*, the ell or pic.⁷³ There were two kinds of ell: the regular, 67.7-centimetre ell such as that used for measuring woven textiles; and the building and land ell (also known as 'pace'), 75.8 centimetres long, by which land was measured. From the area measure of the land ell (75.8×75.8 centimetres) was derived the basic area and building measure *pic*, which equals 0.575 square metre.⁷⁴

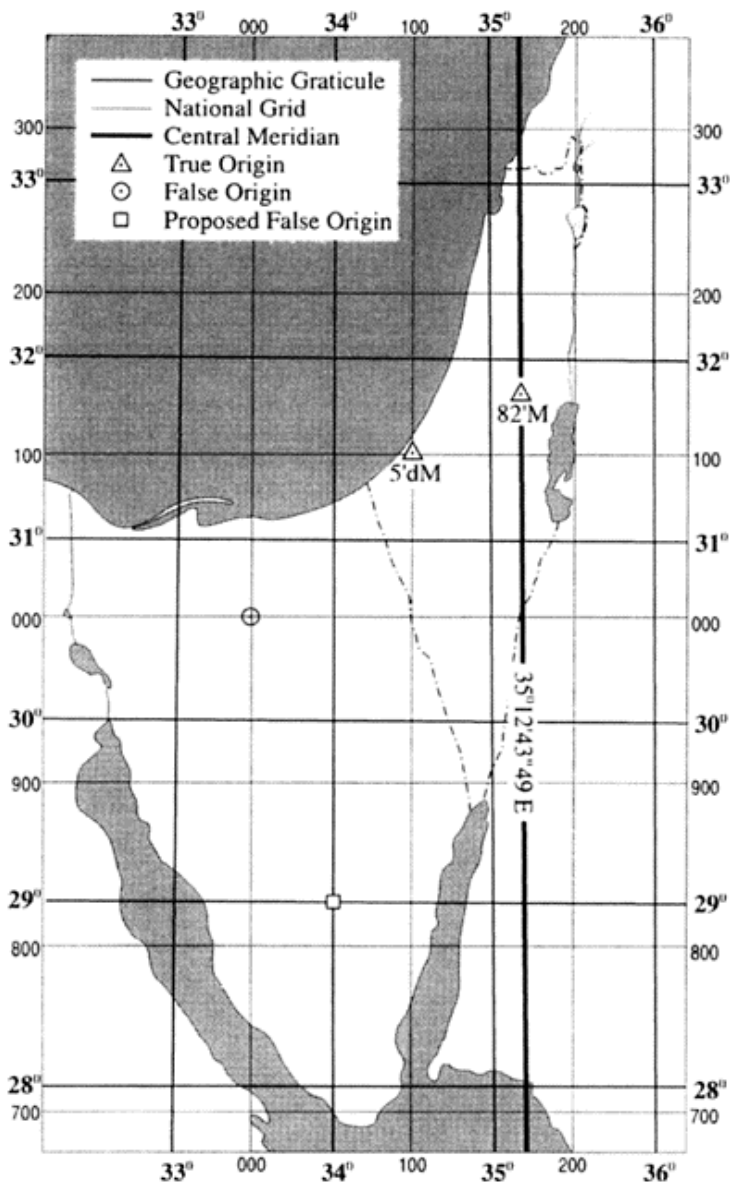


Figure 4.8 System of reference of the Palestine grid (source: After N.Kadmon, *The Israel Grid and the Universal Transverse Mercator Grid*, SoI, 1975).

After the publication of the Ottoman Land Code of 1858, the Turks tried to introduce some order in the realm of measures, and in September of that year passed special legislation that made the metric system mandatory throughout the Empire.⁷⁵ Among other provisions, the law stated that the area of one *dunam* equals 2,500 square metres, and that one *evelik* equals 100 square metres. But the enforcement of this law was repeatedly put off and never implemented.⁷⁶ The area units used in Palestine were conditional; they reflected local usage long accepted by the population⁷⁷ and varied with the economic value of the plot, the rate of ploughing, the quantity of seed required per dunam or per unit of *jiftlik* land, and what could be ploughed by a pair of draught animals and provided an annual crop.⁷⁸ The *jiftlik* unit depended on the quality of the land: 70–80 dunams of choice land, 100 of average land, and 130 dunams of barren land. The dunam unit was an area of 40X40 ells, or 1,600 square ells. As stated, a square ell equalled 0.575 square metre, and so a Turkish dunam (0.575×1,600) equalled 919.3 square metres, as compared with a metric dunam of 1,000 square metres.⁷⁹

With the inception of the civilian government in Palestine on 1 July 1920, a standardisation of weights and measures was anticipated as one of the essential conditions for efficient administration and for simplified day-to-day economic intercourse between the authorities and the people, and between the people themselves. In order to investigate the situation and propose suitable remedial action in the different realms, the Agriculture and Fisheries Department set up a Weights and Measures Commission,⁸⁰ which met for the first time on 30 July 1920. It was chaired by Albert Abramson (who immediately thereafter was appointed also to head the Land Commission). The other members of the commission were J.B. Barron,⁸¹ R.A. Harari, and E.R. Sawyer,⁸² and they were joined by V.A. Van Vriesland⁸³ and a Mr Salameh representing the Jewish and Arab populations.

The commission met alternately in Jerusalem, Haifa, and Jaffa so that local interested groups (such as the chambers of commerce and the banks) could voice their opinions. In this way the Commission's members were apprised of the views and local customs regarding weights and measures in the northern and central parts of the country and could gain insights into the significance of standardisation and its implications. Thus, in Haifa the people feared adverse effects on the trade with the Hauran and Damascus if Jerusalem standards were imposed on them. In effect, however, there was no real difference of opinion, for everyone supported the introduction of the metric system. But whereas the representatives of Jaffa demanded unreserved acceptance of the metric system for all purposes and without concessions to any of the old practices, the people of Haifa and Jerusalem proposed to maintain some of the weights and measures that were so deeply ingrained in their localities. Nor was the dispute serious with regard to the dunam. The representatives of Nablus, Haifa, and Jerusalem favoured the standard dunam of 1,000 square metres, a tenth of a hectare, whereas the representatives of Jaffa and Nazareth did not attach any special significance to this. But at the last meeting sharp criticism was voiced of the metric dunam which the Commission could not disregard: the head of the Department of Trade and Industry, R.A. Harari, opposed it because this particular square area unit would have sides of impractical dimensions: 31.62×31.62 metres.

In the end, the Weights and Measures Commission decided on a compromise by which the area unit would be derived from the square metric area, the decare and the hectare; 'dunam' would not be a term of official standing or a statutory area unit, but only

known and accepted as equal to one-tenth of a hectare—accepted but not obligatory. The acquiescence of the commission to Harari's objections complicated the situation instead of resolving it, and thus led to repeated demands for standardising also the metric dunam as a legal area-unit measure. In effect, two units of measure were established: a linear unit and an area unit, each with a different basis of calculation, for the linear unit was metric while the area unit remained the dunam, which was not necessarily metric.

On 5 January 1921 the subject was raised at the Advisory Council to the High Commissioner.⁸⁴ Samuel placed before the council the recommendations of the Weights and Measures Commission and the objections that had been raised. In consideration of the latter, Samuel expressed apprehension at the reactions of the populace, which would thus suddenly be exposed to many changes in its long-accustomed ways. But Suleiman Bey Nasib, the representative of the Arab Christian population, supported the metric system, and David Yellin, the Jewish Vice-Chairman of the Jerusalem municipality, assured Samuel that the changes would be readily accepted, as had been the changeover to the Egyptian pound, which had displaced all the other currencies in the country.

It was essential to institute the standard of measures without further delay, since the situation in the field had become intolerable. Although the Turkish dunam equalled 919.3 square metres, in practice absurd situations arose. Some would have it that the Turkish dunam 'fluctuated between 900 and 1,000 square metres'.⁸⁵ And indeed, in the reasoned proposal for standardisation of measures prepared by High Commissioner Plumer in 1925, he described the need of the standard for simplifying the land settlement and agrarian relations, and adduced several examples of the distortions created by the lack of standards, such as the dunam of tobacco, which was taken as 900 square metres.⁸⁶ Dowson, who advocated the standardisation of area measure in Palestine to 1,000 square metres for the dunam, drew the attention of the High Commissioner to the absurdity of a situation in which, in the absence of a fixed standard, the Survey Department could in effect adopt any other value for units of area in settling village *musha'* lands.⁸⁷ Moreover, instead of the Survey Department calculating the area in metric dunams of 1,000 square metres, the issuing of *kushans* continued according to the Turkish dunam. In order to bring home the urgency of implementing the proposal for standardising the metric dunam, Dowson presented in his report of 1925 a table of areas registered in the Land Registry and the tax rolls. In both offices the entries were in Turkish dunams and in units of square *pics*. Comparison of the two registration entries revealed totally different dimensions for the same registered areas, and showed that there was no connection between these data and the facts in the field. No one in either of the offices had detected that the conversion coefficient of the *pic* to the 'old' dunam in each parcel was not fixed but lacked all cohesion even within their respective registers.⁸⁸ Dowson again reverted to this table when commenting on the chapter dealing with land in the Peel Commission's Report in 1938.⁸⁹

These confused data induced the Palestine Survey Department to adopt the metre as the linear unit at the beginning of its work, and the metric dunam unit only after it was standardised. In the regulations that complemented the Land Surveyors Ordinance of 1925, item 17 set down that the scale of the survey plans was to be metric.⁹⁰ Far from home, it was apparently easier for the British to adopt and implement what surveyors had known for a long time: only the metric system offers an unequivocal, standard linear unit that precludes any argument.⁹¹ But as to fixing the area unit—of such importance to

taxation and land transactions, to the estimate of crops, to cadastral registry, and to land settlement—there was a delay as a result of the indecision of the committee.

In 1923, Gilbert Clayton, the Chief Secretary of the Government of Palestine, asked Dowson to recommend steps for advancing the survey of the country. Dowson submitted his proposals in December 1923, and in his *Notes on Land Tax, Cadastral Survey and Land Settlement* he also referred to the question of the dunam.⁹² He assumed that the Weights and Measures Commission had avoided standardising using the metric dunam in response to the feelings of the rural population. Although there was reason to retain the dunam as a traditional and accepted unit of area, the commission had not really understood the roots of the concept: originally, the dunam—like the jugum,⁹³ the acre, and the feddan—was not a defined area but a unit of ploughing in a given time-frame. In Egypt, Palestine, Iraq, and other countries it was customary to differentiate between the actual size of a piece of land and its economic value,⁹⁴ and so the farmer practically concerned with the land did not care about the measured dimensions of his holding, and even less so about the unit of measure employed, as long as his land was not tampered with and its boundaries were respected. Therefore, Dowson recommended the immediate standardisation of the dunam as equal to 1,000 square metres instead of trying to arrive at an average representative value for the Turkish dunam, which in any case was only slightly smaller than the metric dunam.

A year later, in November 1924, Dowson returned to the matter of standardisation in land measurement in a letter to the Government of Palestine,⁹⁵ in which he urged it not to delay any longer the legislation regarding the legal dunam or the ‘national’ dunam, even before the proposal for comprehensive weights and measures legislation was completed. Dowson’s recommendations were discussed and accepted in the session of the High Commissioner’s Advisory Council on 26 February 1925. Samuel issued instructions to prepare forthwith the legislation for standardising the dunam, which would in the future be integrated in a comprehensive law of weights and measures.⁹⁶ The implementation of the legislation fell to Lord Plumer, who succeeded Samuel as High Commissioner. On 21 September Plumer despatched to L.S. Amery, the Colonial Secretary, the Draft Ordinance to Provide for the Introduction of a Standard Measure of Land.⁹⁷ Although the proposal did not make the use of the standard dunam of 1,000 square metres mandatory, the government offices and institutions were obliged to adopt this unit of area, so that everyone would become used to it as a step towards its full acceptance. The reason for the loose form employed in the legislation derived from the government’s obligation to observe earlier agreements and contracts that referred to the accepted Turkish dunam—particularly the GhorMudawara Agreement signed in November 1921, which promised the transfer of state lands to the ownership of Arab villagers at payments per Turkish dunam—there being no intention to harm the villagers or alter the conditions of such agreements.

Amery replied to Plumer on 10 November 1925, acquiescing to the standardisation of the measures in Palestine as soon as feasible in view of the land registry question. But his advisers proposed that setting the metric standard in Palestine be done not by special legislation for land measurement, but as part of a Weights and Measures Ordinance. They also proposed that at this opportunity the Standard Metre be duplicated and be sent for safe-keeping to the Government of Palestine.⁹⁸

The Weights and Measures Ordinance was brought up for discussion in the High Commissioner's Advisory Council at the end of December 1926.⁹⁹ It was referred to London for confirmation and enacted in 1928.¹⁰⁰ The use of the standard dunam was not made mandatory, but was adopted by the government and the local authorities as the accepted unit of area in the economy and in documents and permits. If the use of the metric unit in linear measure was taken for granted in surveying and mapping (even though in internal departmental work the British surveyors were tempted to use Imperial measures), it was still necessary to draw the attention of the public to the 'new dunam' as laid down by the non-obligatory legislation. Hence, from that time the Survey of Palestine was forced to print on its maps a note qualifying which dunam was employed in calculating the various tables of lands. In effect, the obligation to inform the public in this respect was imposed on all the offices of the government to avoid unintended pitfalls.¹⁰¹

As a marginal observation to the foregoing discussion of standardisation of measures, one wonders why the British in Palestine adopted the metric system instead of imposing their own. Apparently the British themselves were ready for a change. The surveyors were the first to be exposed to the vagaries of the Imperial system of measures, which made their work quite difficult, and often expressed their envy of countries employing the metric system. Many articles were written, in jest and anger, in condemnation of the conservative adherence to the traditional measuring units, not to mention the method of chain surveying.¹⁰² Far from home, it was easier for them to implement the metric system, although in the past the British system had been introduced to some of the colonies. India, for example, only freed itself from units of Imperial measurement in December 1956, when it went over to the metric system as a manifestation of its independence, in the declared hope that this would considerably contribute to rapid development of the Indian economy.¹⁰³ However, in the 1930s the Colonial Survey Committee did all it could to institute the metric system in mapping in the African colonies.¹⁰⁴

The situation in Palestine was different. Here the inhabitants of the country themselves determined the standard measuring unit. In order not to upset the economic frameworks, the British authorities were prepared to adopt measuring units in use by the population, on condition that these were logical and systematic. The Weights and Measures Commission was set up to study popular feeling in this matter, and recommended instituting the metric standard, but was unsure in the case of the metric dunam. In the end, both the metric linear unit and the metric dunam were adopted as standard units, in keeping with the preferences of the population and with the open support of the senior British officials and experts who served in Palestine. It is used in Israel to this day.

Scale of the maps of Palestine

The determination of a standard scale for the maps of Palestine constitutes an issue in its own right among all the searching and debates regarding the form of the country's survey maps. With the commencement of work in the field and the production of maps, the Directorate of the Survey



Figure 4.9 The Surveyor John H.Mankin at work with a plane table in the south of the country (source: J.H.Mankin photo collection in Palestine Exploration Fund archives, London).

Department had yet to formulate guidelines for determining the scale of its maps. At first, the system that prevailed in Egypt was applied in Palestine, along with the basic scale of the maps. As work progressed, the differences between Egypt and Palestine became evident, and in the Survey of Palestine discussions were held regarding a suitable scale hierarchy for the landscape of the country, and the size of the field sheets to be mounted on the plane table for topographic and administrative maps. The main question hinged on the choice between a cadastral and a topographic scale. The decision was made only in 1928 in the wake of the land settlement reform. It was determined then that there would be one basic scale of 1:10,000, from which would be derived cadastral scales in one direction and topographic scales in the other, usually in even multiples:

1:100,000←1:50,000←1:20,000←1:10,000→1:5,000→1:2,500→1:625

In retrospect, four factors may explain the considerations weighed by the decision-makers in determining the scale for the maps of Palestine. The first and most important was that in Palestine the cadastral survey preceded the topographic one. In professional terms, large-scale, detailed mapping comes before mapping on a smaller scale. The second factor was that according to this system, the smaller-scale topographical mapping was to be a by-product of the larger-scale cadastral survey.¹⁰⁵ The third factor was that the basic scale at which the field surveys were conducted determined the hierarchy of the scales of the country's maps. In the early 1920s this was a scale of 1:2,500, the basic scale of the Ordnance Survey of Great Britain. This was the basis for the maps of 1:10,000 and 1:20,000. After the 1928 land settlement reform, the scales for the large-scale Land

Registry maps and for administrative and topographic maps of smaller scales were derived from the 1:10,000 scale. Finally, the last consideration was that at no stage of the cartographic work was the possibility raised of instituting Imperial scales in Palestine. On the contrary, F.J.Salmon, who headed the Survey of Palestine in the 1930s, even before taking up his post expressed determined opposition to British scales and preferred the decimal scale in round numbers.¹⁰⁶

When the Survey Department began its cadastral work in the Gaza region, before a comprehensive investigation of the condition for the cadastral survey had been undertaken, 200 field sheets were surveyed to a scale of 1:2,000, by the traverse and chain survey methods—the accepted methods in use in Egypt and introduced by Quinlan, the Temporary Director of the Survey.¹⁰⁷ The city mapping of Jerusalem, which began in August 1920, and the mapping for the irrigation of State lands in Jericho in the spring of 1923 were also conducted on the same scale. The surveys connected with the Ghor-Mudawara Agreement were also done on a multiple of this standard scale, 1:4,000. The field mapping was of course to culminate in the preparation of the maps for printing and distribution, and the initial intention of the Survey Directorate was that the scale for mapping in the field would also be the scale of the final, printed maps.

The work was carried out by the sheet system, by which mapping continues uninterruptedly from sheet to sheet. This method has a disadvantage in that the parcel of land to be registered can be split up over several sheets. Only after the 1928 reform was it decided to draw up maps by the block system, in which every block had its own map.

It soon became apparent that the survey system employed in the field did not suit the situation in Palestine. The work proceeded too slowly and cost too much. The system was adapted to a country like Egypt where the economic value of the fertile, cultivated land far exceeded that of the land near Gaza or Jericho, and there was no justification for continuing with it. For Palestine, a smaller scale had to be considered, and the work in the field was modified accordingly.

The discussions around the standard scale to be adopted for Palestine focused on the following questions: what is the suitable scale for the cadastral field survey in the cultivated plains of the country, and for the rocky mountainous regions? What is the desirable scale for the final printed maps? What is to be the basic map from which the series of topographic maps could be prepared and what is the desirable scale for this series? The common denominator for all the proposals and solutions offered was that the scales must all be multiples or fractions of 1:10,000.

Scales of the cadastral survey maps

Dowson, in the first report to Clayton in December 1923 on the agrarian regime in Palestine, related to the scale to be adopted for the national map series, and recommended 1:10,000 (which is close to the British six inch to the mile scale). From the report it appears that Ley had already adopted this scale earlier, especially for regions of Palestine that did not require detailed mapping, such as forests, uncultivated lands, swamps, and areas of sporadic cultivation. Dowson proposed a larger scale of 1:2,000 for mapping the densely cultivated regions, and a scale of 1:1,000 or 1:500 for built-up areas.¹⁰⁸

When Dowson invited F.S.Richards in 1925 to conduct a mathematical check of the cadastral survey in Palestine, he asked him to propose a system of scales to be implemented in the mapping of the country for cadastral and topographic purposes, and in consideration of the nature of the topography between the coastal plain and the rocky mountain regions.¹⁰⁹ Richards found it difficult to advise, but analysed his recommendations as follows. He differentiated between the scale of a field sheet and the scale of the final printed maps. He took into consideration the characteristic long, narrow shape of the parcels of land in Arab villages and the accepted methods of measuring and calculating areas; he distinguished between mapping in the plains and mountains; and stated his views regarding the cost of the work. Richards narrowed down the choice for field mapping to two scales, 1:1,000 and 1:2,500, and finally recommended the latter as the standard scale for field mapping and 1:5,000 for printed maps. He openly weighed the advantages of each of these scales. He thought 1:1,000 to be most suitable for mapping an area rich in details that could not be represented in smaller-scale maps, and pointed out that this is also an open scale, pleasant to the eye, in which many details can be shown without crowding the map. It was preferred for delicate, accurate plotting that made possible measurement and computation from the map, and the graphic computation of the area of a parcel without referring back to the field books. It could be conveniently revised and updated, and the permanent markers on the ground could be reconstructed from it. In cases of disputes, the survey to a scale of 1:1,000 would reinforce the legal contention for settling and registering of the land.

As opposed to these advantages, Richards also enumerated the deficiencies. Work on such a large scale required double the investment in time in drawing up the maps; compared with the 1:2,500 maps, the calculation of areas would be five times more expensive on the larger scale, and the number of maps of a scale of 1:1,000 six times greater than for 1:2,500 maps of the same area. But the main argument against it was the method of working in the field: field surveys on a scale of 1:1,000 entailed traverse survey, while on a scale of 1:2,500 the plane table method combining chain survey between points was employed. The difference in working methods tilted the decision towards the smaller scale, for in Palestine there was no justification for investment in traverse survey. In Egypt, where the value of land was much higher than in Palestine, and the parcels smaller, such an expensive survey and mapping on a larger scale was reasonable, but in Palestine a more economical investment was called for that was also quicker, and advanced by making use of the plane table. And as to the long, narrow parcels typical of the country, Richards argued that these should each be mapped on one sheet by the block system, without spilling over onto neighbouring sheets, and that this would be possible only if the smaller scale of 1:2,500 were adopted.¹¹⁰

In January 1927, in a publication describing the work of the Survey of Palestine, Ley stated that the scale of 1:2,500 was adopted for the country as the standard scale for all purposes. On the one hand, it was the scale for mapping most of the agricultural areas in the plains of the country and representing these on a printed map, and on the other hand, it was also the basic scale for reducing the topographic maps to scales of 1:20,000 and even 1:100,000. Although this scale suited all the ancillary purposes of registry surveys of property in gardens, villages, and built-up areas, larger scales of 1:1,250 and 1:625 would be used where greater detail was required.¹¹¹

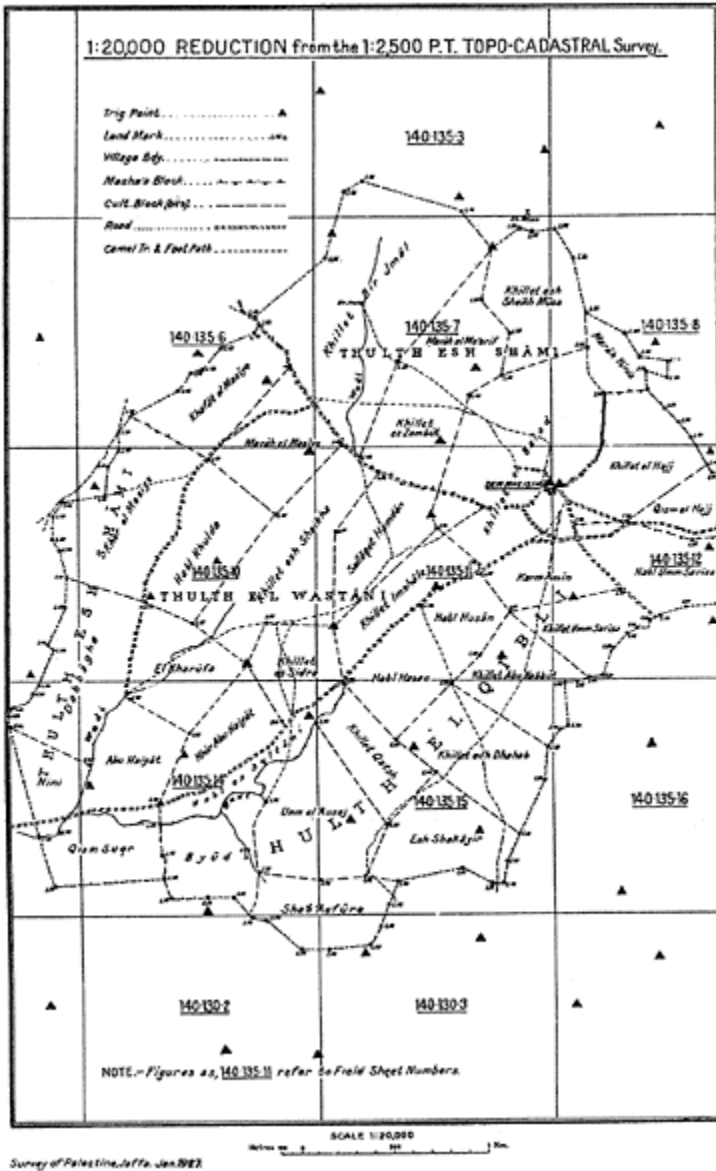


Figure 4.10 The first version of the 1:20,000–scale topocadastral map (reduction). The lands of Dei Muheisin village (today, Beqo’a) were surveyed and mapped to a basic scale of 1:2,500: the individual field sheets, which are

numbered here, were reduced and joined to each other to form a complete 1:20,000-scale map (source: Ley, *Note on the Technical System*, 1927).

Ley's publication appeared at the time of a special conference called by the High Commissioner, Lord Plumer, on 21 February to discuss the planned reform in the land laws and the land settlement issue.¹¹² One decision was to give precedence to faster field mapping on a scale of 1:10,000 over the slower and more detailed mapping on a scale of 1:2,500, which was delaying the progress of land settlement. The aim was to conduct a two-pronged topocadastral field survey for both topographic and fiscal mapping that would integrate village boundary markings and the internal division into blocks of equal productivity for tax assessment purposes.

Indeed, in the wake of the land settlement reform of 1928, the working method was changed. A preparatory topocadastral field survey on a basic scale of 1:10,000 was carried out and the maps were later reduced to 1:20,000; on confirmation of the accuracy of the block boundary markings, they were prepared for distribution as a provisional series. The fiscal blocks in this series, on a scale of 1:20,000, became the framework for the preparation of detailed registry block plans on a scale of 1:2,500. In areas of dense detail around the built-up areas, and within these, surveying continued as in the past by the chain method and entries in field books on scales of 1:2,500, 1:1,250, and 1:625.¹¹³ Considering that the size of the field sheets could not be changed according to the proportions of each block, the dimensions of the printing sheet, the convenience of working, and the method of storage of the maps in the future, a standard field sheet of 70×60 centimetres was adopted. Since enough space had to be left on every sheet for the title, marginal notes, and for registry blocks of uneven proportions, there remained only about one-quarter of the sheet for the map itself. In order to limit in advance the size of the registry blocks, no more than a hundred parcels in each block were to be included in each map. Thus, on each 1:2,500-scale map, up to 650 dunams could be mapped; on a scale of 1:1,250 about 156 dunams; and on a 1:625-scale map about 40 dunams.¹¹⁴

Scale of the topographic map

As we have seen, in 1927 Ley confirmed that the field sheets on a scale of 1:2,500 were to be the basis for the topographic map of Palestine, after being reduced to 1:20,000. This was the accepted system in Britain, being derived from the French reduction of the Napoleonic cadastre maps of 1:2,500 and joined together in sheets of 1:10,000.¹¹⁵ The 1:20,000-scale map became the basic map for administrative (but not topographic) purposes in Palestine. However, if necessary it could be adapted to topographic needs by adding contour lines interpolated between spot heights and triangulation points of known elevation, or contour lines copied from other sources such as the First World War maps on a scale of 1:40,000. Ley added that in the Survey Department the preparation of a general topographic 1:100,000-scale map of Palestine in the form of half-degree sheets was under consideration.¹¹⁶

In 1931 Ley published a special, additional report implying that the idea of preparing a topographical series, based on a reduction of 1:2,500-scale maps to 1:20,000, had been

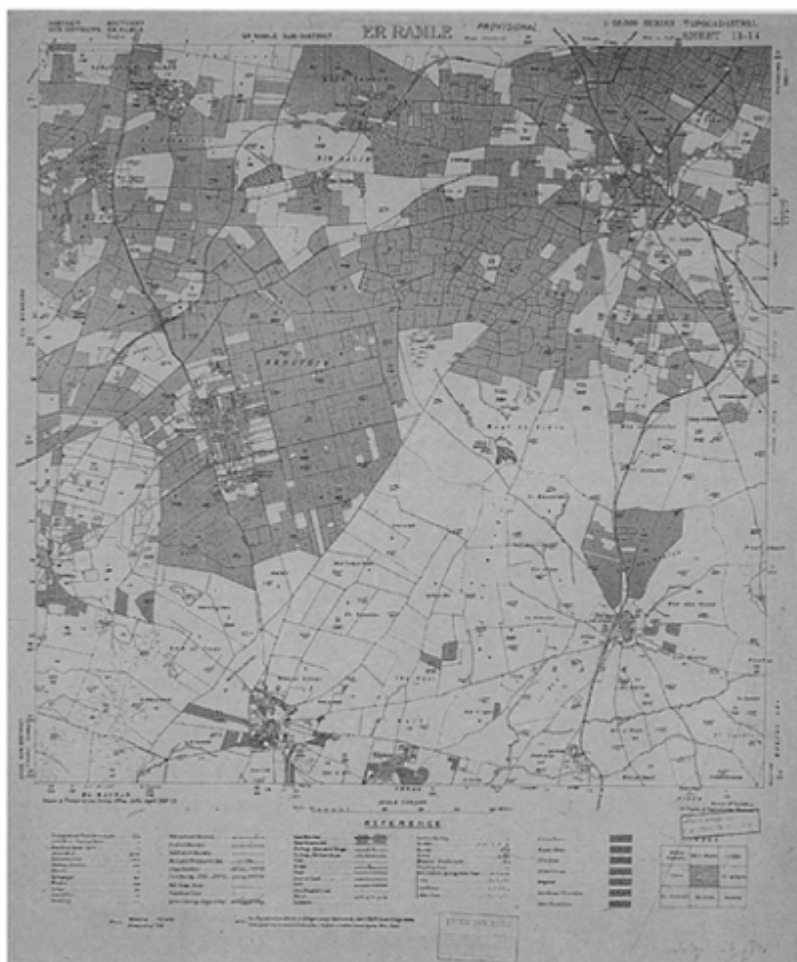


Figure 4.11 Rehovoth, part of ‘Ramle’ map (provisional edition), Sheet 13–14 in the 1:20,000 topocadastral series, April 1930. The map is printed without contour lines and coordinate grid; on a ground-cover background are drawn the jurisdiction boundaries, the boundaries of fiscal blocks, block numbers in roman numerals, and block areas in metric dunams (source: ML).

abandoned. The change occurred in 1928 when the preparations for instituting the reform in the land settlement were in progress. The preliminary field survey was to be on

a scale of 1:10,000 for later reduction to a 1:20,000 series.¹¹⁷ This decision created the two first national series: the 1:10,000 topocadastral series and the 1:20,000 topographic series. The topocadastral series based on field surveys and in which the boundaries of the fiscal blocks were marked represented a bridge between the cadastre and the topographic map.

The idea underlying the proposal for a 1:10,000 series and a 1:20,000 series was practical and simple. Each 1:20,000 sheet comprised four 1:10,000 maps. A standard sheet of 1:20,000 measuring 50×50 centimetres covers an area of 100 square kilometres, and every sheet on a scale of 1:10,000 represents 25 square kilometres. By this method, the sheet of 1:10,000 was also divided into four quarters, and four topographers working from one surveyors' camp were sent out to the field. Each of them was charged with mapping only 6.25 square kilometres by means of the plane table method. The adjoining quarters formed a complete sheet on a 1:10,000 scale. In the Survey Department the 1:10,000 quarter-sheets were further processed and the village lands were presented as separate, individual village maps of the general series. This was the basis for the large series of 1:10,000-scale village maps.¹¹⁸

At the end of 1933 the Survey of Palestine began training its personnel in rapid topographic mapping in the vicinity of Jericho for revising and surveying contour lines for a new series of topographic maps of fourteen sheets on a scale of 1:100,000. This series had been proposed previously in 1925 by Richards and in 1927 by Ley, but it was Salmon who carried it out when he assumed the directorship in March 1933. The mapping was based on field surveys on a scale of 1:50,000 reduction of 1:10,000 maps, and the addition of contour lines surveyed by special parties at vertical intervals of 25 metres. Salmon was opposed to this scale. In 1937 he wrote to the engineer Hillel Birger, who initiated topographic training in Palestine and who had proposed issuing topographic maps in a Hebrew edition,¹¹⁹ saying that the proper scale for maps of Palestine was 1:50,000, but that the department lacked the means to deal with the fifty-six sheets this entailed, as opposed to the fourteen sheets of 1:100,000. Salmon reiterated this view in a lecture he delivered in London in June 1938 and stressed the impossibility of making one map answer all purposes. One of the main drawbacks was the excessively small scale. In many parts of Palestine it was necessary to represent many details and include many names, some of which would have to be tiny. Even though the fieldwork was conducted on a 1:50,000 scale, the Survey of Palestine did not have the time, money, or manpower to produce maps of that scale. Salmon decided to publish only one map—of the environs of Jerusalem—on a scale of 1:50,000, for the use of tourists and to show what such a map would look like.¹²⁰

The accepted topographic scale in the Survey Department was thus 1:10,000–1:50,000–1:100,000. Only during the Second World War were objections raised by the Survey Directorate, Middle East. There was no intention to reverse the system or to change it fundamentally; the army had no interest in the civilian system and only sought to adapt it to military needs at minimal cost. The army preferred to work with operational maps on a scale of 1:25,000 because it had instruments graduated to this scale but not to 1:20,000. To speed the production, it urged the Survey of Palestine to reduce the 1:10,000-scale maps to 1:20,000 and to grid them with the usual Palestine grid, and then to reduce these to 1:25,000. Regarding tactical maps there was uncertainty, for the army wanted maps of 1:50,000 and the Survey of Palestine had field sheets of that scale that

had served as the basis for the 1:100,000 maps. Nevertheless, it was decided that in view of the lack of manpower and equipment, and the time constraints, the army would not be given the maps it wanted, but only the 1:100,000 series¹²¹

The first survey: the map of Jerusalem, 1920–1921

Along with the geodetic preparations for the base measurement and the lands survey, the Survey Department began to take on various mapping tasks at the request of the government and its offices. These mapping projects were a touchstone for the professionalism of the directors and the



Figure 4.12 Staff of the Survey Department in Jerusalem, 1921; the British Field Inspector W.H.Giles in the centre, an Egyptian draughtsman is to the left, and an Armenian clerk to the right; Jewish surveyors are in front and in the back rows (source: J. and S.Prushansky, Tel Aviv).

capability of the department, and became the basis for its staff training programmes.

In August 1920, about a month after it was set up, the new and inexperienced Survey Department was charged with its first cartographic task: the mapping of Jerusalem outside the Old City walls. The newly formed civilian government continued in the steps of the military administration and evinced sensitivity first and foremost to Jerusalem. In March 1918, while the war was still going on, the military government invited William H. McLean, the town planner of Alexandria and Khartoum, to prepare a town plan for the city.¹²² The head of OETA requested the Royal Air Force in July 1919 to photograph Jerusalem from the air in connection with the town planning, and in February 1920 the city was again photographed.¹²³ At the end of 1919 Patrick Geddes arrived to prepare the second town plan, on the basis of McLean's work, and to plan the Hebrew University at Weizmann's invitation. Geddes asked for the aerial photographs to be placed at his disposal and apparently used them in his designs.¹²⁴ After the change in administrations, the civilian government decided to redraw the plans for Jerusalem on a practical rather than a romantic basis, reflecting the concerns of those who were to run the life of the city, and not focus only on its architectural attributes.

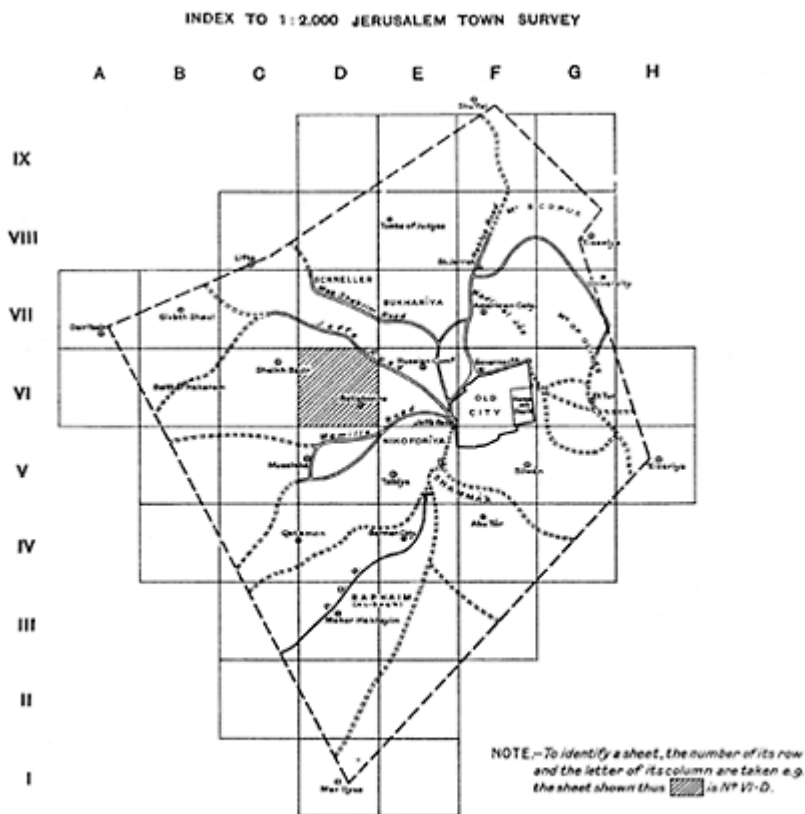
As a first step, the Survey Department was commissioned with detailed urban mapping on a scale of 1:2,000 of an area of 13 square kilometres stretching west and north of the Old City. According to the agreement with the Jerusalem municipality, the department was to see also to the survey and mapping of an additional 3 square kilometres.¹²⁵

The Survey of Palestine at that time had no office and no permanent headquarters. Quinlan, the Temporary Director, was in Gaza in the region where the cadastral survey began. It was therefore decided to establish a local survey office in Jerusalem, a sort of regional branch of the department, in order to conduct the urban survey. At the head of the Jerusalem branch was Captain Day, who established his offices in the Lazarist monastery (today in Agron Street), and heading the survey section was W.H. Giles. The surveyors were 'locals'—a euphemism employed by the British to cover the fact that they were Jewish graduates of the Zionist Commission's land surveying course who had finished their studies in Jerusalem in August 1920.¹²⁶

The geodetic surveys began in October 1920 with the measuring of a local baseline 500 metres in length, and twenty-six third-order triangulation points, which encompassed an area of about 100 square kilometres. The geodetic check base was measured in January 1921 and the field surveys were concluded in October 1921. The task proved harder than anticipated because of the difficult terrain, the winter weather, and the inexperience of the surveyors. Perhaps because of this it was difficult to supervise the work, and the results did not come up to the desired level of precision. In August 1921 a surveyor who had just come from England was put in charge of the Jerusalem team by the Survey Department, and in September he was reinforced with two of the surveyors from the Northern Boundary Demarcation Commission, who were released from that work. From the testimony of the Jewish surveyors, these Britons carried out their work with tact and patience. They had the surveyors check their own work so that they would discover their errors themselves and correct these, and more than once the same areas had to be surveyed again.

From time to time, the municipality added new demands, and the surveyors had to supplement many details, such as adding contour lines at vertical intervals of 4 metres,

requiring precise levelling along about 62 kilometres. In plotting the contour lines, the editors of the map made use



Printed by the Survey of Egypt. (25/195)

Figure 4.13 Index to 1:2,000
Jerusalem Town Survey, 1920–1922.

of contour lines copied from the 1:40,000 topographic map that had been drawn up during the First World War. In July 1922 the survey was completed. An Egyptian draughtsman was brought in from the Survey of Egypt to draw up the map from the field plots and prepare it for printing. The preparations were finished in September 1922, and a draft map was submitted to the Governor of Jerusalem, Sir Ronald Storrs. Storrs referred the map to the newly formed local Names Committee, set up to name the streets of the city.¹²⁷ The sheets were then sent to Cairo for printing. In the following years the department added more surveyed sections to the map and updated it. In 1923–1924 another 3,000 dunams was surveyed in Jerusalem at Storrs's request, and the administrative boundaries of the city were marked on the map. Yet another 20,200

dunams was surveyed in 1924 with contour lines around the city, and with this the mapping of Jerusalem was completed. In 1925 Jerusalem was again photographed from the air, and a mosaic was prepared from the photos for the use of the city officials and the city's planning needs.¹²⁸ The maps (in forty-six sheets) were printed in the summer of 1925 by the Survey of Egypt and appeared on a scale of 1:2,000. The government offices, the municipality, and the public were supplied with 6,000 such printed copies.

This cartographic success encouraged Ley (who at the end of 1920 had been appointed the first Director of the Survey of Palestine), and in September 1925 he persuaded the High Commissioner, Lord Plumer, to use the map of Jerusalem for commercial purposes, both at its original scale and in a reduced version. This is probably the reason why all the sheets were sent to the Ordnance Survey at Southampton, where they were reduced to one sheet of 1:10,000. Ley proposed that the map be printed in thousands of copies and sold to tourists in Palestine and to those interested in the country in Britain and elsewhere. The Governor of the Jerusalem Sub-District and the Government of Palestine Treasurer received this idea with enthusiasm.¹²⁹ Twenty years later, in 1945, the Survey of Palestine divided this map into six sheets, which were sold to the public in two forms: in one sheet and in six. With the establishment of the State of Israel, the Mapping and Photographic Service of the Israel Defence Forces, from August 1948 onwards, printed the set of six maps.

The series of 1:2,000 maps went through several revisions over the years, as in 1927, when Jerusalem was included in the mapping programme of the towns of Palestine for purposes of assessment of urban properties. The revision encompassed 30,000 dunams and required the reprinting of twelve out of the twenty-one city maps.¹³⁰ Nevertheless, because of the rapid development of Jerusalem, these maps became obsolete faster than they could be updated. This is borne out by the files of the Jerusalem City Engineer: in 1940 the patience of the District Commissioner came to an end, and he reprimanded the City Engineer for submitting town plans for approval on the basis of these 'ancient maps', which no longer reflected the changes on the ground.¹³¹ In the first four years of the Survey Department's work, two other survey and mapping projects were conducted in Jerusalem: the mapping of the Ophel and the revision of the map of the Old City, which had been drawn up by Charles Wilson in 1864–1865. These two survey projects were restricted in their scope and were marginal in terms of the time devoted to them. With the completion of the fieldwork for the new Jerusalem map in 1922, the surveyors were requested by the Department of Antiquities to survey the area of the biblical Ophel hill south of the Old City for the renewal of excavations at the site. The results of the survey were published in a 1:1,000-scale map.¹³² From criticism published in the *Palestine Exploration Fund Quarterly Statement*, it would appear that the 1:1,000 map was in effect an enlargement and update of Sheet V-F of the set of Jerusalem maps of 1:2,000.¹³³ The revision of Wilson's Old City map began in Jerusalem in 1923. The department returned to update this map again in the following years but not to map it anew, since it was found to be good and highly accurate. The map was again revised and updated after the Six-Day War in 1967, and printed and distributed by the Survey of Israel.

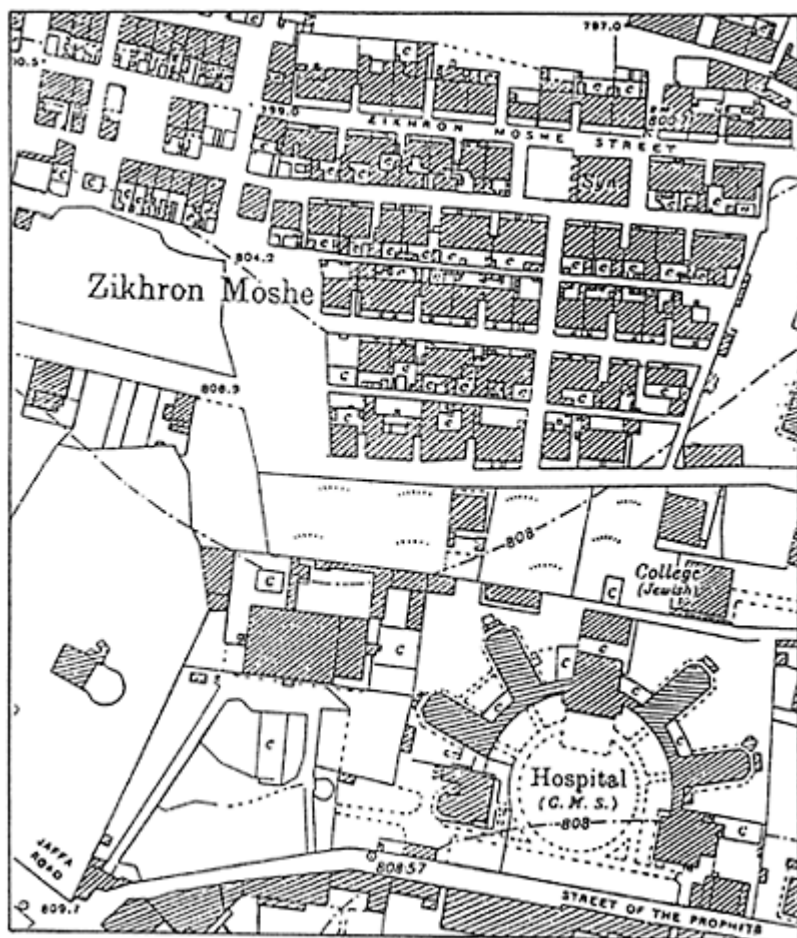


Figure 4.14 1:2,000 map of Jerusalem, section of Sheet VII-D (source: ML).

Part III
The cadastral survey

5

The survey and land settlement systems, 1920–1927

The survey system

The initial survey activities took place in 1920–1927, from the time that the government's cartographic branch was established until the institution of reforms in the system of land settlement. It was a time of searching for suitable working methods, in both the professional and the administrative fields. Most of the work of the survey parties was devoted to the cadastral survey. It was to occupy the Survey Department for many years, and has not been completed to this day. At the same time, the department was requested to take part in special projects that required preparatory mapping work, as is to be expected of a country's Survey Department.

Thus, the Survey Department provided survey and mapping services for the land settlement, the assessment of properties, the mapping of towns and villages, demarcating the borders of the country, irrigation projects, updating of maps and reissuing them, and conducting surveys for governmental study commissions—most of which were termed 'Special Surveys' in the official reports. There was particular differentiation between the cadastral survey for which the department was originally established, and the special, short-term surveys.

Endless discussions were held behind the scenes regarding the future of the department and its administrative status. On the one hand, the department devoted itself to professional work, excelled in its dedicated performance, and did not hesitate to expose itself to technical and conceptual criticism that helped it gain experience and professional competence. Thanks to its high professional level, it had no trouble coping with the surveying objectives that were dictated by the 1928 reform in land settlement, so that there was no need to set up a new framework. But the department lacked an overall conception of its purpose and its national import. The men who headed the Survey of Palestine in its early years regarded it as a temporary body that would be phased out after the completion of the cadastral survey. According to Dowson and Ley, this approach did not prevent them from adopting a superior attitude and to divorce themselves administratively from the other government bodies that were also involved in or concerned with the cadastral survey—particularly the Land Registry Department.¹

Being a new creation, the Survey Department had an advantage over its counterpart in the cadastral project. The Land Registry Department, which took over the Ottoman system, became entangled in a contradiction of purposes: it had to continue with its ongoing work, which, had been interrupted by the war, while striving to free itself—unsuccessfully—from its Turkish heritage with its disordered Land Registry books.

The combined framework that was set up to implement the cadastral survey depended on the cooperation of the Land Registry, Land, and Survey Departments, as well as with

the government Treasurer. But this did not happen in the early years of the Mandate, and their poor performance prepared the ground for a reform of the cadastral system, which had its roots in the Ottoman era. The price of the initial lack of coordination was the wasting of about ten years of valuable work. The reform was implemented from 1928 on, with the proclamation of the Land Settlement Ordinance. This opened a new era in the administration of the real estate market in which the Survey Department had a central statutory status. The Land Settlement Ordinance 1928 recognised the map, for the first time, as a prime statutory tool indispensable for any land settlement and registration. Only then did the Survey Department, which had been set up in 1920 expressly for the cadastral survey, arrive at the stage where a special law gave its work legal basis, reflecting the most advanced approach to a country-wide land settlement.

The establishment of the land settlement system

The foundations laid down by the OETA command for dealing with the land problem in Palestine were acceptable to the High Commissioner who assumed office in July 1920. Clearly, in order to advance the matter, the government needed above all the administrative tools for carrying out the land settlement. Indeed, in its first years the government devoted much attention and acted energetically to the creation of these tools, by legislation and by setting up government bodies to implement the cadastral survey. But this entailed two contradictory constraints: whereas the government was determined to carry out the survey and registration of the lands, it would not admit that it was unprepared theoretically, legally, and practically for undertaking such a project.

The establishment of a framework for land settlement had commenced under the previous military administration; the Survey Department set up before the civilian authorities took over was the first executive government body to deal with the cadastral land survey. According to the principles of administrative continuity,² the civilian government published the Cadastral Survey Ordinance on 25 July 1920, the first legislation dealing with the land survey, and signed in May by Major-General Bols, the head of OETA.³ In the first days of the civilian government the Land Transfer Ordinance, first mooted at the end of 1919 but postponed through Weizmann's influence,⁴ came up for renewed deliberation. In July the government began discussions directed at the establishment of a Land Court.⁵ The second government body to deal with this issue, set up on 18 August 1920, was the Land Commission, headed by Major Albert Abramson.⁶ Two other members of the commission were Faidi al-Alami and H.M. Kalvarisky. The commission was charged with investigating the problems concerning lands, to identify state domain lands, to administer these, and to propose such measures as were warranted. Among the important subjects dealt with by the commission were the state domain lands settlement in the Jordan and the Beisan Valleys in accordance with the GhorMudawara Agreement of 1921, and the Jewish Colonisation Association lands at Athlit, the Kabara swamps, and Caesarea. The commission was to safeguard the interest of the government in the State lands and to see to their development, leasing and concessions.⁷ In view of the importance of these matters, the Land Commission recommended that the High Commissioner set up a Land Department as a special government office for dealing with all land-related matters in an integrated manner.

The discussions were concluded in September 1920 and the Land Transfer Ordinance was signed and gazetted on 1 October.⁸ This ordinance superseded and invalidated the two proclamations of 1918 that prohibited the transfer of lands, and paved the way for the renewal of such activities subject to government endorsement for each transaction. All transactions valued at over E£3,000 had to receive the special approval of the High Commissioner. These conditions were imposed to prevent speculative deals, and to accustom and force the population to register all changes of land ownership in one central location. This obviously entailed the reopening of the Land Registry offices, after most of the registry books, which had been removed by the Ottomans at the time of their retreat, had been located and returned to their former place.⁹ The announcement of the reopening of the Land Registry offices was made simultaneously with the proclamation of the Land Transfer Ordinance. The ordinance laid down the obligation to register all the changes in the property rights deriving from land transactions. The Land Registration Department, headed by F.Ongly, was thus the third governmental body involved with the cadastre project. In accordance with paragraph 16 of the Land Transfer Ordinance, the government published a separate tax table in which were listed all the various acts for which fees had to be collected, such as sale, exchange, gifts, rents, mortgages, bequests, and the like. Point 18 of the list dealt with survey fees:

18 If an application for the survey of a property is allowed by the Registrar, or if the Registrar directs that the survey of the property shall be made, the fees payable shall be fixed by the Registrar in each particular case. The fees shall as a rule include P.T. 50 for each day on which the Surveyor has been employed, as well as the cost of the Surveyor's transport and his travelling allowances. When the Surveyor requires assistance, the fee charged shall cover the remuneration and expenses of the assistant.¹⁰

Here the Cadastral Survey Ordinance and the Land Registry were tied together for the first time. Although there was still no obligation to survey land for registration, the Registrar was given the authority to demand the dimensions of the holding. L.B.Weldon, the Director of the Egyptian Survey Department, and E.Dowson remarked at the time that the Government of Palestine still did not understand that land surveying was a basic problem, since an exact map was the precondition for every system of land registration.¹¹

On that same day, 1 October 1920, the Mahlul Land Ordinance was published, relating to lands given over by the State for agricultural cultivation but which for various reasons had not been cultivated for three years and which, according to Ottoman law, reverted to the State.¹² It was followed in February 1921 by the Mewat Lands Ordinance, which was intended to prevent unauthorised occupation of waste lands outside village domain.¹³ Although the Survey Department had commenced operations in July 1920, the British documents indicate February 1921 as the beginning of the cadastral survey.¹⁴ This date apparently reflected the institutionalised organisation of the department, after the appointment of Ley as Director at the end of December 1920, and the move of the department to Jaffa.

The fourth official body to be connected with the cadastral survey—the Land Court—was established in April 1921, with the publication of the Land Courts Ordinance, which announced the establishment of a special judicial framework, underlining the importance

the government attached to the land settlement problem.¹⁵ The intention was for the courts to accompany the surveyors from district to district in order to clarify and determine all claims and disputes regarding boundaries of parcels and property rights, so as to arrive at settlement as quickly as possible.¹⁶

The activation of these new government bodies was also reflected in the budget proposals for 1921–1922 sent by Samuel to London in February 1921.¹⁷ According to the estimates of expenditures for salaries and activities, E£15,110 was allocated to the Land Registry offices, which had only just been opened to the public after three years of inactivity. The Land Department and the Land Commission together were allocated E£7,000, mainly for the delimitation of *mewat* (undeveloped) lands and for the settlement of the Mudawara lands. Only E£2,135 was provided for the Survey Department to pay the salaries and petty expenditures of the permanent senior officials of the department. The compilers of the budget expressed the hope that the expenses of the permanent survey staff would in the future be covered from revenue, while the costs of the cadastral survey and of recruiting surveyors would be paid out of the government Treasury. This latter expenditure was estimated at E£50,000 per year for the six to eight years during which these surveys were to take place. Soon thereafter, Herbert Samuel rolled the estimated cost of the survey of E£400,000 over to the contemplated loan items he expected to receive for the funding of infrastructure activities in Palestine.

In 1921 a serious attempt was made to train local personnel and to recruit senior surveying staff either through the Crown Agents or with the help of other governmental bodies and institutions in London.¹⁸ Along with the search for workers and their training, the surveying profession was given legal standing in order to assure control and supervision of the level of performance and to prevent unqualified persons from taking part in the cadastral survey.¹⁹ The Surveyors Ordinance was confirmed on 10 May and gazetted on 1 June 1921. That month, Samuel reported to the Colonial Office on the activities of the Land Commission and the progress of the Survey Department. This continued with the triangulation measurements in the Gaza and Beersheba Sub-Districts, but proceeded only very slowly because of difficulties in training new personnel.²⁰ In November 1921 Samuel concluded the negotiations with the Arabs regarding the lands in the Jordan and Beisan Valleys, and the most extensive settlement of state domain lands ever to be undertaken in Palestine was launched.²¹

By the end of 1921 it became evident that the Land Registry offices had not been flooded with requests for registration of land transactions, as anticipated. Only 3,361 transactions were registered, entailing 117,460 Turkish dunams, including 62,634 dunams acquired by the Jewish National Fund and the Palestine Land Development (Hakhsharat Hayishuv) Company.²² Although no official explanation was offered, some sectors of the population clearly did not place much faith in the system, or abandon the traditional practice of agreeing on private transactions of land without registering them. On the other hand, experience in these matters was beginning to accumulate, leading eventually to some adjustment of the law.²³

It seems, therefore, that the main intent of the government at that point was to organise the survey and land settlement system procedures before they could be given content and meaning. In line with this approach, towards the end of the first year of operations, the government's Chief Secretariat conducted thorough discussions of the system. However, attention was given not to the direction and development of the cadastral concept but only

to questions of reorganising the government offices, which by now had proliferated to seven bodies dealing with land or land-related matters. The aim was to institutionalise the system hierarchically and to define the connections between the Departments of Agriculture, Surveys, Land Registry, Land, and Land Settlement, and the Land Commission and Land Court.

The deliberations, in October 1921, hinged on two points: the change required in the organisational structure of the government departments, and the crystallisation of new concepts regarding tax on rural property. In the organisational discussion most of the participants tended to differentiate between the Department of Agriculture and the other bodies. Only E.R.Sawer, the Director of that department claimed, on the grounds of his experience in South Africa, that the responsibilities of the Land Commission should be vested in the Agriculture Department because it had the responsibility for settling the immigrants coming to Palestine. J.N. Stubbs, of the Land Registry, tended to agree with Sawer. But Anderson, who was to be appointed Land Settlement Judge, opposed this on the grounds that the Department of Agriculture would be fully occupied for many years with research and studies regarding the agricultural potential of the country, and that it must be allowed to dedicate itself to these tasks. Edward Keith-Roach, the Assistant Chief Secretary who chaired the proceedings, came to the deliberations with preconceived ideas. He proposed that if it were generally agreed that the Department of Agriculture should be separated from the other departments, and separation between the other bodies was undesirable, the former would remain independent and all the latter would be amalgamated into one department with a single policy regarding all land matters in Palestine. Keith-Roach's proposal was adopted, but with one significant amendment: the Survey Department and the Land Court would also remain independent bodies. From what took place during these discussions, it is clear that at this critical stage of the cadastral project, upon which all hopes were focused, the government was floundering in a total lack of comprehension of what this entailed.²⁴

In the course of the discussion, Keith-Roach presented the plan of the Chief Secretariat for the conduct of the cadastral survey by the newly amalgamated department. According to this programme, the Survey Department was to complete the second- and third-order triangulation within six months. Immediately on completing the survey in the first district, while the surveyors proceeded to the next district, the cadastral surveying section was to enter the field under the directorship of the Land Department. The Land Registry clerk, carrying all his registry and tax (*werko*) books, was to join the surveyors of the cadastre. The plan proposed delegating to this official the authority to determine the boundaries of parcels at the sites. In cases of opposition to his decision, or if he could not arrive at a decision, he was empowered to fix temporary boundaries and to leave the final decision to the Land Court, which would follow in his wake. There would be no appeal against the decision of the judge, unless he himself decided to refer the case to the Court of Appeals. Once the judge handed down his final verdict, the parcel had to be immediately marked on the map prepared by the cadastral surveyor, and entered in the Land Registry books. In the course of time, the District Governors were to be given the following documents dealing with the settlement of lands under their jurisdiction:

- 1 a large map of the entire district under their jurisdiction on which the state domain lands are indicated in blue, uncultivated lands in red, etc.;

- 2 a full file of 1:500-scale series of maps showing the boundaries of all the parcels in the district;
- 3 the Land Registry books for this land;
- 4 the tax rolls, in which it was easy to find the amounts of the ‘tithes’, collected by the Government every year, or the estimate of crops in kilograms, or the sum of money determined upon as tax.

The Chief Secretariat envisaged depositing in each district the full historical documentation on all the lands and all the scientific findings from soil tests of the Department of Agriculture. A full documentation of all state domain lands would also be placed at the disposal of the Land Commission, so that when the question of settling immigrants on the land should arise, the local authorities would be coordinated with the Land Department regarding the demarcation of state lands available for settling. Once the work had proceeded as planned, and the system was operating properly, only then would the Departments dealing with land and tax registration be abolished. Their staffs would then be moved administratively to come under the District Officers, but professionally they would remain under the Land Department and the regional Treasury official as required. In order to prepare the Regional Officers for their responsibilities, the programme proposed sending them for training in the Land and Tax Departments, as was the practice in India and Sudan, so that they could gain first-hand experience in two most important functions: registration of land, and tax collecting. Only when this programme was implemented and instituted throughout the country would it be possible to commute the imposition of the Ottoman tithes on crops to a property tax on land. This change would save the government the expense of the Tax Commissions travelling around the country and the annual disputes and haggling over the levies. Changing the system would mean that owners of uncultivated land would also pay tax according to the market value of the real estate, which might induce them to devote these lands to agricultural production instead of awaiting speculative price rises. Finally, changing the system of taxation was intended to encourage the farmers to gather the produce of their labour when the time was right, rather than awaiting the coming of the commission and depending on its schedule.

Whether this proposal was intended as a practical programme or a tentative idea, it obviously did not reflect serious consideration of the complex problems it sought to address. Keith-Roach’s proposal showed no professional understanding or awareness of the rich Imperial experience— certainly not the experience in Egypt, where there had always been readiness to help institute a sound land system in Palestine. It is therefore not surprising that the most immediate reaction to the Chief Secretariat’s proposal came from the professionals of the Survey Department. Ley stated that the Survey Department would lay the basis upon which the work of the other departments would be conducted. He also demanded that during the first three years his department be left alone, since its work would be purely professional and scientific, and for that reason had to be independent and free of all outside influences. Ley also added a surprising argument, apparently unfounded, to the effect that there was no sense in changing the current organisational structure, according to which the Survey Department was subordinate to the government’s Attorney-General. If indeed this contention had a basis in fact, it is reminiscent of the situation of the Survey Department during its first days, in 1920, when it was under the Legal Branch of the OETA command.

The Director of Surveys totally rejected, from professional considerations, the idea that the cadastral work should begin before the base measurements in the field had been completed in the coastal plain. When the Survey Department went on to measure the secondary triangulation net and to begin detailed field surveys, only then would it be appropriate for parties of regional surveyors to work with the regional Land Registry offices under the professional supervision of the Survey Department. Ley also rejected the contention that there was any administrative waste in maintaining the independence of the Survey Department, and expressed apprehension that the amalgamation of the departments would place his department at a competitive disadvantage in recruiting and training competent staff. Finally, he expressed surprise that the plan of the Chief Secretariat ventured into professional details without appropriate knowledge and without consulting him. It was not to be expected that in Palestine there would be a higher level of triangulation than second order, and there was no chance of the survey being completed in less than 18 months. Moreover, there was still a need to survey denser nets so that the distance between triangulation points in the field would be about 400 metres. Only after concluding the mathematical work, in the spring of 1923 at the earliest, would it be possible to begin with the cadastre although an effort would be made to begin working in the Gaza region as early as 1922.

Ley could not resist ridiculing the proposal of the Chief Secretariat concerning the ‘file of maps’ to a scale of 1:500 to be deposited with the District Governors, and the ignorance of those who had thought it up. If the Ramle or the Tulkarm Sub-Districts, which extended over an area of 1,000 square kilometres, were mapped at that scale, these maps would themselves cover an area of 4,000 square metres, in about 30,000 sheets that would have to be hung on a wall measuring 200×200 feet (about 60×60 metres). He added that the cost of such a survey, the drawing, and storage of the maps for the entire country would bankrupt the Treasury, even before providing for the revision of the maps every few years. Hinting at the frivolousness of the plan, he asked, ‘Has the magnitude and nature of these future Survey necessities been realised?’²⁵

On 31 October 1921 the Financial Secretariat reacted negatively to the plan for amalgamating the departments, and that same day the Attorney General, Norman Bentwich, also stated his opinion. He did not refer to Ley’s response, but supported his view that it was necessary to maintain the independence of the Survey Department as long as it was engaged in scientific and mathematical work of the triangulation survey. Only when the cadastral work began could the responsibility for the work be transferred to the Land Department.²⁶ The concluding discussion was held on 7 November under the chairmanship of the High Commissioner. Five decisions were taken regarding interdepartmental connections and subordinations, and two decisions regarding the independence of the departments. The two bodies that emerged with their full independence intact were the Survey Department and the Land Court.

From then on, the independence of the Survey Department was subjected to constant criticism, in view of the failure of the cadastral survey in its first years, and the non-fulfilment of the condition for amalgamating the department with the unit for Land Settlement in the Land Department once the triangulation survey was finished. It was but one of the examples of a situation in which every government department manifested its aspiration not to be interfered with. But the decision of the Advisory Council sheds light on Ley’s limited approach. He claimed in many instances that the Survey Department

was in effect a temporary department. The understanding in the government's discussions was that after the completion of the base measurements there would only be a need for a small section within the Land Department for the cadastral survey, and that the Survey Department proper would cease to exist. Thus, Ley remained true to the spirit of the discussion at the time of determining the aims of the project and the budget, and preferred to maintain the professional independence of the operation he headed for the short time he had to carry out the technical work.

On 22 November 1921 Samuel appointed a special body that was to examine another facet of the cadastral survey and bring about a reform in the tithe tax system on rural property: the Tithes Commission. The commission submitted its report at the end of February 1922, in which it reviewed the historic and religious background for levying the 'tithe' on land and the collecting methods employed by the Ottoman regime, the OETA command, and the Government of Palestine. The commission also delved into the difficulties that stemmed from the system of land ownership, such as the *musha*.²⁷ In its recommendations the commission placed great importance on the survey work, without which there was no chance of extricating the system from the distortions of taxing crops:

The need of a rapid and correct Survey is urgent. Without it an absolutely indefensible tithe without dispute as to areas or boundaries is impossible. Nothing tends to encourage improvements and interest in land so much as a sense of security of tithe.

The Government badly needed every *grush* [penny] it was possible to collect in order to finance its budget. But it fully intended to institute a drastic change in the Ottoman system of property taxes, so as to do away with its iniquities and to spur on the local economy: 'Increased productivity is urgently needed to bring down the cost of living, increase the revenue, and rectify the adverse trade balance. It cannot be obtained without security of title and these can only be guaranteed by a survey.' Therefore, the commission recommended speeding up the cadastral survey of Palestine in order to institute a system of taxation on land rather than on the yearly crop. While awaiting the reaction to the recommendations of the commission from London, the government in Palestine initiated an additional move to advance the cadastral project, when in the middle of 1922 it proposed the enactment of a Draft Land Valuers Ordinance following the Cadastral Survey Ordinance 1920.²⁸ In August 1922 Churchill replied to Samuel that he supported the replacement of the tithe tax by a tax on land based on surveys, as would be recommended by the commission.²⁹

As a result of the discussions on the reorganisation of the government departments, certain changes were instituted in 1922. The Departments of Land and of Land Registry were united into one department under James N. Stubbs as Director of Lands. The Land Commission in effect ceased to exist in its original form, although it continued to function, but with the limited powers of an advisory committee. All its executive functions were relegated to the Land Department, including the administration of the state domain lands.³⁰

Surveying the State lands in the Jordan and Beisan Valleys

In February 1922 the Survey Department assumed responsibility for surveying, demarcating, and mapping the state domain lands according to the Ghor-Mudawara Agreement of land settlement. The agreement was signed on 19 November 1921 between the Government of Palestine and the representatives of the *fellahin* and the inhabitants of these areas, known as the ‘Jiftlik of the Beisan Valley’.³¹

This agreement had technical as well as political significance. It proved how cadastral survey and land settlement could serve as an instrument of government intervention in the Jewish-Arab dispute; and it provided an opportunity for the survey and the settlement frameworks to apply the theory of the cadastral survey in a specific undertaking of limited scope, before turning to the country-wide survey.

The survey of the Beisan lands was the first complete cadastral project to be carried out by the Survey Department, apart from the national cadastral survey it had already begun; and in retrospect it was evaluated as a touchstone of its capabilities in crystallising the programme for land settlement and registration and for training survey crews. It was the first combined project in Palestine for defining the land property rights and lands survey.³²

Unrelated to the survey project, the Beisan lands episode was loaded with political sensitivities, for to both the Jewish and the Arab populations of Palestine it was a testing ground for the intentions of the government regarding the implementation of the Balfour Declaration. According to the Declaration, which was confirmed in the League of Nations Mandate, the British government undertook to assist the establishment of the Jewish National Home, with the proviso that ‘nothing shall be done which may prejudice the civil and religious rights of existing non-Jewish communities in Palestine’. Article 6 of the Mandate charged the government with realising this promise by encouraging the dense settlement of Jews, including settlement on state land and uncultivated land not required for public purposes. The Zionist leadership hoped therefore to receive state domain lands, particularly the largest continuous blocks of land that were fit for agricultural cultivation and settlement. The former Sultan’s lands in the Beisan Valley were one of the two largest blocks of land in the country, and among the few that were well watered. The second block was in the Huleh Valley, but the concession for drainage and reclamation of these wetlands for cultivation had been in the hands of the Lebanese land dealers Sursuq and Bayhum since 1911, and they had no intention of ever carrying this out, being only interested in money. Only in 1934 did the Jewish institutions succeed in acquiring the Huleh lands for a very high sum.³³

The Jewish institutions were interested in surveying the Beisan lands as early as 1905 and in leasing them in 1913. The Zionist Commission again raised the question of acquiring the State lands at Beisan, Caesarea, and Haifa Bay even before the establishment of the civilian administration, but the military government and Major-General Bols were opposed to this.³⁴ In 1920–1921 the unrest in the country was exacerbated by the refusal of the Arab leadership to take part in the administration of the country, as long as the government did not rescind its commitment to the Jews according to the Balfour Declaration and the articles of the Mandate. Samuel sought ways to placate

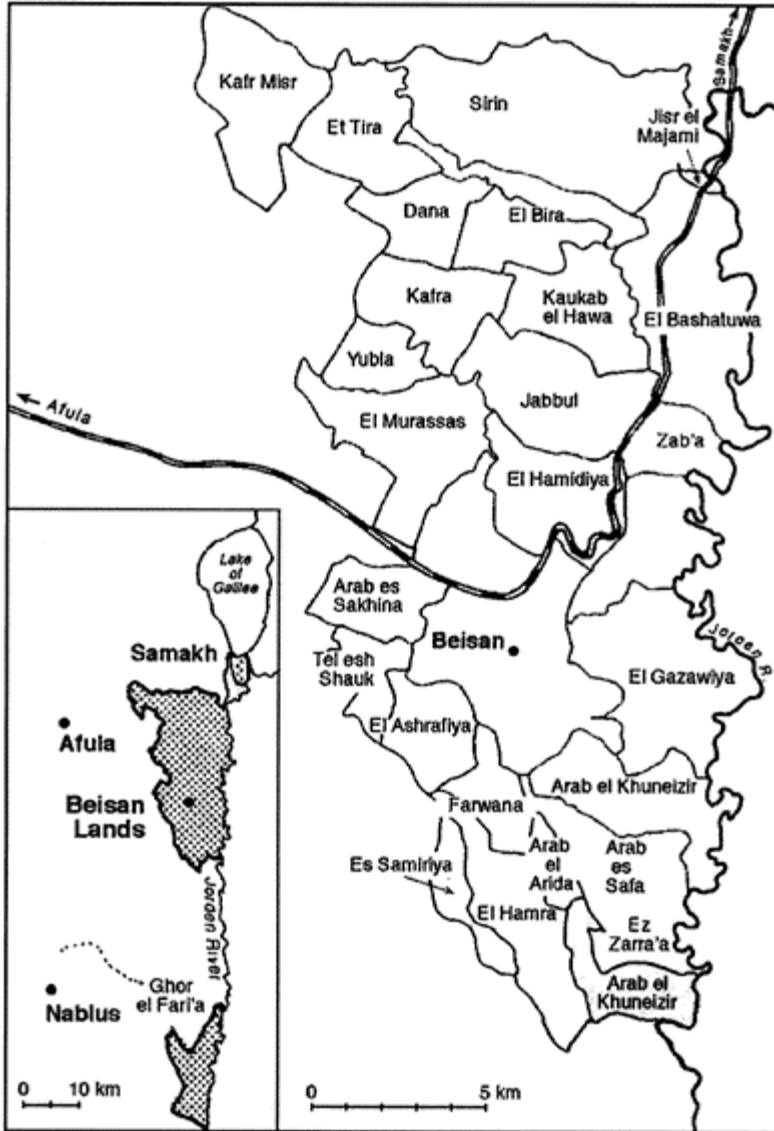


Figure 5.1 The Beisan lands (sources: PG 388 (14 September 1933): 1187–1190; Pal. Govt, *Annual Report of the Director of Surveys*, 1928, p. 3; Pal. Govt, *Annual Report of the Director of Surveys*, 1933, diagram 1; Map of

Palestine, Index to Villages and Settlements, 1:250,000, (1946).

the Arabs and to mitigate their opposition, and he saw fit to satisfy them, among other ways, by promoting the land settlement in the Beisan region. Still in 1920, he offered to lease the lands to them, but the villagers refused, for fear that their signature would be interpreted as acquiescence in the historic ownership of the Turkish Sultan of these lands.³⁵ When in April 1921 Samuel visited Beisan he was met by a stormy demonstration and was unsuccessful in convincing his listeners that the administration had no intention of removing them from their lands.³⁶ And then, ignoring the protests of the Zionist leadership, the government offered the villagers the chance to acquire the lands in perpetuity. As a preparatory step, the government publicly announced on 10 November 1921 the setting up of a commission headed by Abramson for identifying and demarcating state lands.³⁷ Immediately thereafter, on 19 November 1921, the special agreement was signed between the government and the representatives of the population for the sale of the lands and the granting of *kushans* to the new landowners certifying their holdings as land in the *miri* category. This was the Ghor-Mudawara Agreement.

The Mudawara lands had formerly been owned privately by the Sultan. After the Young Turks Revolution in 1908 they were expropriated and transferred to the State Treasury (the Arabic word *mudawara* means ‘transferred’ or ‘turned around’).³⁸ Paragraph 14 of the agreement stipulated that a Demarcation Commission be set up in order to define and mark the areas in question. The commission had legal status: it was empowered to hear the claims of those concerned, to resolve disputes, and to implement the settlement. In January 1922 the Survey Department was invited to join the commission, and began work in February.³⁹

The Beisan lands in effect encompassed a larger area than the name suggests. The eighteen village lands and three tribal lands included in the settlement were listed in the appendix to the agreement. These lands stretch in the vicinity of Samakh, the Jordan Valley (Ghor), the town and valley of Beisan, the heights of eastern Lower Galilee and the Ghor Fara (today, the region of the Adam Junction).

Before the beginning of the survey in January 1922, it was understood that the Turks had fully mapped the *jiftlik* lands in Palestine. The British authorities found in Beisan an Ottoman document which indicated that on 25 November 1906 forty-eight maps of the Sultan’s lands had been transferred to Beirut by Muhammad Haled, an Ottoman state lands official. The British were able to trace these maps and found that they had been moved from Beirut to Damascus and placed in the care of a Dr Kruger, a German who headed the Department of Agriculture. Seven maps were found in Beirut and eighteen more were located in Damascus, together with complete lists of all the series of maps, including maps of Beisan. While the Government of Palestine asked the French for these maps, or for official copies, it turned out that forty of the maps were in the offices of the Jewish Colonisation Association in Haifa, and Kalvarisky agreed to place them at the disposal of the government.⁴⁰ It is not known whether the Turkish maps were used to delineate the State lands, but in the absence of an existing land settlement a new cadastral survey was decided upon, based on the division of the lands and their demarcation by detailed mapping. In order to avoid duplication of mapping in the independent framework of the Beisan land settlement and as part of the national project, the survey was to be

carried out according to all the geodetic rules and would be based on major and second-order triangulation nets that would in the future tie into the national net.⁴¹

In January 1922 Ley ordered the senior surveyor, Moffatt, to stop his work on the major triangulation net in the coastal plain and to move his surveyors' camp to the Jenin region. There he was to locate a suitable flat area for measuring the northern baseline of the national net, and to reconnoitre the area in preparation for the extension of the major net in the direction of the Jordan and the Beisan Valley for a 'special survey task'.⁴² The intention was to move the base measurements south to serve the needs of the land settlement project in the Beisan Valley. However, the Jenin line was not measured, and the major triangulation net was surveyed and closed in the Samakh region, at a later stage, unrelated to the Beisan settlement. Instead of the original plan, a special triangulation net was measured for the Beisan settlement, from a baseline measured south of the Sea of Galilee, between Deganiya A and B.

The Survey and Land Settlement Departments regarded the fundamental work of the land settlement in the country as of the greatest importance—as providing guidelines for the working methods to be adopted throughout the entire country. When Richards was asked to check the survey system in Palestine in 1925, Dowson instructed him to devote a special chapter to the Beisan land settlement. From this report we know how the survey was conducted in that project.⁴³ The first stage opened with the planimetric mapping of the topographic features to a scale of 1:4,000, without contour lines. The boundaries of cultivated blocks were also demarcated. Afterwards, the block areas were calculated and the data sent to the Settlement Commission, which decided on the size of the parcels and the ownership in each block, and the data were returned for mapping. The blocks and the internal divisions into parcels were drafted on the maps. The organisation of the block maps reflected lessons learned from the system of the initial cadastral surveys in the Gaza region. If in the course of the mapping, a registration block straddled the borders of two or more sheets, it was redrawn as one unit on one sheet; that is, one sheet to each block. The entire area was split up into smaller, secondary units by lines drawn in parallel and in the same direction as the block boundary demarcations. The secondary units were subdivided into ownership units by means of calculations and by trial and error. At this stage the maps showing the parcels and the allocation of ownership were drawn up, and the points from which the parcel boundaries were measured were marked on them. After this preparatory cartographic work, the maps were sent to the field with all the accompanying documents, for demarcating the parcels.

In February 1922, Ley and the representative of the Land Department, Maurice C. Bennett,⁴⁴ reached an agreement for allocating two parties of surveyors and a professional instructor to this survey project—despite apprehension that this diversion of resources would impair the flow of work on the national cadastral survey. Work began on 10 February 1922 in the Samakh lands.⁴⁵ At first, a close triangulation net was measured out from the short (1,200-metre) baseline between the two Deganiyas, and until the end of 1922 the measurements were tied to the national major net. The continuation of detailed survey work and the division of lands were delayed while various directives from the Settlement Commission were being awaited, such as instructions as to the system of survey and on the manner of dealing with *musha* land.

In the meantime, after some personnel changes, the leading team was fixed. In July 1922 a new Assistant Inspector, C.J. Bishop, came to the Survey Department from

England, and notwithstanding his limited experience was put in charge of this survey project.⁴⁶ In August, with the approval of the High Commissioner, Bennett appointed the Settlement Officer, I.N.Camp, to head the Demarcation Commission.⁴⁷ The implementation of the Beisan lands survey and settlement can be attributed to Bishop and Camp, especially the latter, who headed the project and dealt with its entire vicissitudes. Camp was appointed the first Land Settlement Officer in Palestine on 1 July 1920. In 1925 Dowson lauded his work for the patience with which it was carried out, his knowledge of Arabic and of the Ottoman land law, and his ability to gain the confidence of those with whom he conducted negotiations.⁴⁸

The surveyors came up against many difficulties in the course of their work. The local inhabitants could not understand what good would accrue to them from this project, and repeatedly damaged or displaced the field markers. The surveyors had to be protected from attacks against their persons and property. But worst of all was the harsh climate of the Ghor, especially in the summer and autumn months, when even the pack animals gave out. Despite the difficulties, the workers stuck to the job, and by the end of 1923 had completed a special triangulation net over 304 square kilometres, including 210 square kilometres of an even denser net. The standard mapping of the whole region was done on a scale of 1:4,000, but where needed, the State lands in the periphery of the villages and in the gardens were mapped to 1:500, 1:1,000, and 1:2,000 as well. In that year the detailed mapping of 125,000 dunams was completed, and in May 1924 all the mapping of the area included in the agreement was finished: 220,000 dunams.⁴⁹

By then, part of the land settlement had also been completed, and the parcels were transferred to the new owners. In 1925 came the first public announcement from the head of the Demarcation Commission that extensive tracts of the settled areas had passed from the new owners to 'speculative hands', who paid the full amount of settlement costs to the Arab owners. In 1926 it was reported that about half of the entire area was already distributed and given over to the new owners. In all the coming years until 1931, there were reports of the continuation of the land settlement work, and of projects that were by-products of this. One of these was conducted at the behest of the government's Development Department in 1932–1933, when in the villages south of Beisan contour lines at vertical intervals of 2 metres were surveyed for irrigation purposes in fourteen blocks encompassing 83,000 dunams.

In the survey of the Beisan lands, several lessons learned from the work in the south of the country were applied, mainly in the realm of cooperation between the Survey and the Land Settlement Department, which had proved a total failure in the South. Nevertheless, the system was still unwieldy and far from satisfying the pace of a survey on a national scale.

When Richards of the Egyptian Survey Department investigated the working methods in Beisan, he made a significant remark that aimed at improving the national land settlement process.⁵⁰ He proposed a complete reversal of the current working order. Instead of starting with surveys of land and later correcting the maps according to the reservations of the villagers and the settlement officials, Richards proposed, on the strength of the experience in Egypt, to begin by hearing the villagers out and trying to persuade them to divide their parcels in an efficient manner. For example, if a parcel was more than 1 kilometre wide, the villagers ought to be persuaded to shorten it. The official boundaries of the block and the parcels should then be marked permanently on the

ground, at intervals of 200 metres between markers. Only at that point should the area be measured and mapped to a scale of 1:2,500 according to blocks, each to its own sheet, and with care being taken to demarcate the block boundaries in straight lines connected to the permanent markers. In a marginal note, Richards admitted being told that if his idea were implemented, the village strongmen would impose their will to obtain the fertile parcels, instead of having the allocations made by the commission. He nevertheless recommended that the villagers themselves decide on the division of lands before the survey in order to reduce their opposition and avoid excessive friction with the Settlement Officers, and to simplify the procedures.

The cadastral survey

As we have seen, the military government and the Cadastral Survey Ordinance 1920 had determined the location of the commencement of the survey in the vicinity of Gaza. The survey was conducted by means of the plane table method on field sheets to a scale of 1:2,000. At the same time, the base measurements for the triangulation net, the first mapping projects of Jerusalem (from August 1920), the survey of state domain lands in the Jordan and Beisan Valleys (from 1922), and the survey of the State lands in Jericho (in 1923) all continued. After the first spurt of energy, the work became more systematic on completion of the triangulation net in the coastal plain. In the first years, the cadastral survey work was conducted mainly in the southern coastal plain, and gradually advanced towards Jaffa, Tel Aviv and northwards (Table 5.1).

Table 5.1 Field surveys and detailed mapping, 1921–1927

<i>Year</i>	<i>Region</i>	<i>Scale</i>	<i>Area in Turkish dunams</i>
1921	Gaza vicinity, Jerusalem	1:2,000	No data
1922	Beisan	1:4,000	No data
1923	Jericho	1:2,000	No data
1924	Deir Suneid, Muharraqa, Huj, Deir el-Balah	1:2,000	120,000
	Khan Yunis, Rafah, Sumsun, Bureir	1:2,500	101,000
	Dunes area	1:5,000	56,000
1925	Bureir, Beit Tina, Beit Irja	1:2,500	81,940
	Orchards at Jaff a and Tel Aviv	1:2,500	18,680
	Twelve villages in the vicinity of Jaffa	1:2,500	103,000
	Caesarea (Kabara	1:2,500	18,000

Concession)			
	Southern Palestine	1:5,000	17,000
	Jaffa Sub-District	1:5,000	1,000
	Caesarea	1:5,000	30,000
	Lydda, olive groves		12,000
1926	Jaffa Sub-District (without Petah Tiqvah)	1:2,500	400,000
	Jaffa Sub-District	1:5,000	49,000
	Jaffa Sub-District: gardens and orchards		74,000
1927	Mount Carmel [all areas from now in metric dunams]		37,000
	Jordan Valley	1:5,000	150,000
	Coastal plain south of Rehovoth	1:10,000	320,000
	Haifa, Hadera, Tulkarm, Herzliya	1:2,500	36,500
	Yazur, Saqiya, Kafr Ana	1:500	No data
	Acre	1:2,500	No data

Source: Government of Palestine, Annual Report of Director of Surveys, 1921–1927.

The annual report of the Survey Department for 1925 stated that from 1922, 1,338,672 dunams of agricultural land had been surveyed. The 1929 report stated that since 1923, 2 million dunams had been surveyed in southern Palestine, 70 per cent of this land being suitable for cultivation (cereals), 9 per cent being occupied by orchards and groves, 15 per cent being sand dunes, and the remaining 6 per cent being uncultivated grazing land.

The pace of the survey work in the first years did not reflect a successful cadastral project, and none of those involved in it had reason to be satisfied with the results. In his report for the first three years, Ley summarised the difficulties he had encountered.⁵¹ A great part of the professional efforts had been devoted to the survey of Jerusalem and other work; it had been difficult to organise working parties and to recruit instructors and efficient inspectors, and to train surveyors and draughtsmen from among the local inhabitants. There had been delays in obtaining equipment; everywhere there had been distractions that hampered the work: the topography, the climate, the population, and the languages of Palestine; the system of land tenure and of cultivation, and the ignorance of the peasantry, who were unable to identify their lands unequivocally and indicate their boundaries; the low ability level of the surveyors and their high cost; and the problems of securing the men in the field from attacks by robbers and gangs. The last point referred to an incident that had occurred two months previously, on 3 August 1923, when a band of armed Bedouins robbed a surveyors' camp near Beit Durdis, about 12 kilometres east of Gaza (today, between the kibbutzim Gevim and Mefalsim). The camp was in the charge of the Survey Inspector Lanfear, the only Briton in the party, who was armed but had been the only one to run off to 'alert help'. One of the workers was killed in this attack.⁵²

Only after the survey parties emerged from the area of minuscule plots of gardens and orchards of the villages and townlets between Gaza and Rafah, and entered open country did the work proceed more easily and also cost less. The question of cost attended all of the survey work and was raised in every report and discussed at every opportunity, for there was great apprehension at the budgetary restraints affecting the government. In all the reports, those involved strove to explain the worthwhile nature of the investment by stressing the great advantages of the project. Thus, for example, in his report for the three years 1920–1923 Ley wrote that the cost must be seen against the indirect benefits of the settlement, including the increased value of the land and the profits to the government as a result of the survey work.⁵³ Another report stated that 23 per cent of the area was found to be cultivated along *musha*‘ principles, and 20 per cent of the area would apparently accrue to the Government, for the land would be transferred to its ownership as a result of the settlement.⁵⁴

The Survey Directorate’s conclusions from the experience accumulated in 1921–1923 left their mark. The Government of Palestine was beginning to seriously weigh the achievements in the third year of work as against the expectations. A rather sad picture emerged of the state of the survey and the land settlement. The survey projects were implemented despite the difficulties in each place, but nothing much happened in the realm of the settlement, which in effect was non-existent. The settlement that should have been carried out according to law in the region of Gaza and Beersheba did not materialise. Every department did as it saw fit, as though the matter was an internal affair. The Survey Department contributed its part in survey and mapping, but those who should have conducted the investigation of the property rights and carried out the settlement and the registration never arrived in the field. Moreover, since the time of the military administration, everyone regarded the cadastral survey as highly important and placed on it their hopes for a change in identifying and administering the lands of the country. It was somehow forgotten that the survey itself would not create the settlement or the registration of lands, but was only the basic groundwork for this. The Survey Department, which worked to its utmost capacity, became the main target of the blame for the lack of progress of the cadastre. The criticism of the government was mainly directed at the independent status of the department, but also served to vent frustrations deriving from the failure of the project, and from the Zionist pressure on the government for not giving over the Beisan state lands to Zionist settlement. Weizmann wrote to Lieutenant-Colonel F.H.Kisch, the chairman of the Palestine Zionist Executive, in 1923:

As you will see from my Memorandum to the Government, I attach very great value to the question of Government lands, in which the Administration has utterly neglected us. Before I left, Deedes mentioned to me a possibility in the south of Palestine; the survey at that time was not complete.⁵⁵

What was the Land Registry Department doing all this time? The Land Registry offices were opened to the public on 1 October 1920, and the registration of land transactions then began. The forms used were drawn up by Judge Williamson of Sudan, and were apparently found to be unsuited to the system in Palestine.⁵⁶ Despite the desire to improve the entries in the registry books, the officials continued, as in the past, to register

the deeds of sale and enter the transfers, disregarding systematic surveys. Under the pressure of changes and time there was no alternative but to enter the changes in land ownership almost without any thorough check of rights of tenure. The registry officials tried to work according to the deeds of sale submitted to them, and as far as possible devoted time also to checking the changes in the boundaries of the parcels, according to the maps they were entitled to ask for under the tax schedules published in accordance with the land transfer ordinances.

The use of maps, from providing coordinates for objects in the field to updating and correcting them, requires close contact between the registry and the survey. In place of such cooperation there was in the department a feeling of helplessness resulting from the absence of a legally laid down procedure for conducting investigations, for settling property rights, and for the juridical connection between the two departments. Ernest Dowson reported in 1923 that until the end of that year not even one acre of land in Palestine had been settled, for lack of a man who had the training, the knowledge, and the authority to carry out a cadastral investigation and to determine the property rights to land. Without special legislation, there was no value in mapping, for it had no legal authority. Even for the little that had been done—the plans submitted to the Land Registry—the Director of Land Registries admitted to Dowson that it was impossible to identify and locate the plots of land they were supposedly representing. Therefore, according to Dowson, when the time came for preparing in Palestine the legal basis for a proper cadastral survey, it would be necessary to survey everything all over again in accordance with the law. Under these conditions, not only the survey but also the investigation of property rights was done without authority, and thus was a blatant waste.⁵⁷ The only project to be conducted according to special legislation was in the Beisan region, where there was cooperation between the survey parties and the Demarcation Commission of the Land Department. Until 1927 this remained the only Sub-District in the country in which *kushans* were issued on the basis of a land settlement carried out in accordance with survey and registration of ownership in the Land Registry books.⁵⁸

In 1922–1923 the Government of Palestine tried to enlist outside help, such as the advice of Colonel Newcombe, Commanding Royal Engineers in Palestine, an intelligence officer and an experienced surveyor who had drawn up the map of southern Palestine in 1914, and that of the Director of Surveys from Bombay, who happened to stop over in Palestine.⁵⁹ However, at the end of 1923 the government finally grasped that it was impossible to rely only on a reorganisation of departments, a matter that repeatedly cropped up as the subject of ineffectual discussions at every opportunity, and was even presented in the budget proposal for 1923–1924.⁶⁰ Instead of an administrative solution, there had to come a change in the conception of the entire system and a readiness to learn from the beginning how to run the cadastral project of registration and land settlement. This task was assumed by Ernest Dowson.

The ‘years of abortive effort’, 1921–1924

At the end of 1923, Samuel and Clayton invited Dowson to investigate the situation in which the land settlement project had become bogged down, two and a half years after its

inception.⁶¹ Dowson's background for the job was ideal: he had served in Egypt since 1898 and had been involved in the Egyptian cadastral survey that was carried out in Lord Cromer's days by Henry Lyons.⁶² In 1905 he became the Director of Topographic Surveys, and in 1909 was appointed the Director-General of the Survey of Egypt in place of Lyons. During the fighting in Gallipoli, Dowson resorted to aerial photography for mapping.⁶³ In 1917 he was appointed chairman of the government commission to study the system of land registry, whose recommendations for reform by the Torrens system (see p. 147) were accepted and adopted by the Government of Egypt. V.L.O. Sheppard also participated in the same commission. In those years Sheppard was appointed Director of the Cadastral Survey, after devoting many years to studying various methods of land registry in Egypt. The work of Dowson and Sheppard brought their professional outlooks close together, and united their common interest in investigating cadastral systems and the keeping of land registry books. From then on, and throughout the rest of their lives, both men devoted themselves to working together, privately and on behalf of the Colonial Office, to advance and improve the methods of administering landed property in various countries. In 1919 Dowson was appointed Under-Secretary of Finance, and a year later, Financial Adviser to the Government of Egypt. In November 1923 he retired from the service, and Sheppard was appointed in his place as Director of the Survey of Egypt.

Dowson was thus expert in survey matters, land settlement, and financial administration, and responded willingly to Samuel and Clayton's appeal to advise the Government of Palestine in land matters. It was not the first time he had found himself in this position: Walter Lawrence had consulted him in 1919, and Herbert Samuel in 1920, and both had sought his advice in planning aerial surveys for accelerating the cadastral survey in Palestine.

Dowson arrived on his first visit to Palestine on 1 November 1923 and remained for only five days. It was an exploratory trip, and through efficient organisation he was able to meet all the officials of the administration who were concerned with land matters at the centre and in the districts, to visit the Survey Department, and to see how the survey was being carried out in the field. On 7 December he sent Clayton a comprehensive report, the first of its kind in Palestine, entitled 'The Tax on Land, the Cadastral Survey, and the Land Settlement', covering the past, the present, and the future.⁶⁴ The report revealed a floundering cadastral project in its first three years.

Dowson attributed the failure mainly to a reluctance to learn from the experience of others, a trait of every organisation that does not admit to its own lack of experience until the negative results hit it between the eyes. He did not criticise the directives of Judge Williamson and Sheppard, whose professional knowledge was not susceptible to criticism, since their reports had simply vanished.⁶⁵ Dowson never saw Williamson's report, but knew that his formulas had been rejected in Palestine. He did see Sheppard's report, since his friend gave him a copy, but all he had to say about it was that he was convinced that no one in Palestine related to it.⁶⁶ From Dowson's criticism it may be understood that in Palestine too independent a road had been followed, that the cadastral project had been rushed into without proper preparation and training, and, most serious of all, without preparing the legal foundation for land settlement, for giving juridical authority to the activities in the field that would also obligate the government's departments.⁶⁷ In his opinion there was no hope of a land settlement worthy of the name,

when the agrarian system—the only national economic asset in the country—dragged along the old, unwieldy and corrupt Ottoman tax structure. There was no hope for a land settlement that did not free itself from the uneconomical antiquated system of land tenure, did not encourage growth, and perpetuated a system that did not in any way assure the rights to landed property.

Setting up the suitable executive bodies in itself could not guarantee to the government that the situation would be remedied. The Land Registry Department lacked professional and legal training for conducting investigations of property rights, and only registered land transfers regularly. The Survey Department did the best it could to survey and map the areas, but the maps did not serve the purpose for which they were intended. The Land Registry and Survey Departments had bad relations with each other, were situated in different cities, and were uncoordinated—all that when the obligation of proof for identification of the property and their registration was upon the government.⁶⁸

Thus, all that had been done in Palestine was for nought; it had been a vain effort and a waste of resources and time. If in Egypt twenty years passed after the right conclusions were drawn in 1879, in Palestine there was no such reserve of time. Dowson understood that what was required there was rapid work at low cost; he greatly deplored the time that had gone by uselessly, and in his writings repeatedly described the first critical years, which he labelled ‘years of abortive effort’, that had led to failure.⁶⁹ But at this time, at the end of 1923, Dowson was still in the first stage when he had to whip, spur, and persuade the system to relate to the subject with all due seriousness.

At the outset of his report of 1923, Dowson drew comparisons between the land regime in Egypt and that of Palestine, and reached the conclusion that the latter was at the same stage that Egypt’s had been in the early days of Muhammad Ali’s rule, a hundred years before. He then went on to analyse one by one the weaknesses of the registry and land transfer systems. He demanded the adoption of the most advanced method in the world for land settlement and assuring property rights, known as the Torrens system. He related to the organisation of the framework towards the conduct of a cadastral survey, delved into details of the surveying work through the demarcation of boundaries of the holdings and the standardisation of measures, and even dealt with the question of the legal languages in Palestine and their use in the land settlement documentation and the maps.

On the assumption that the Torrens system would be adopted in Palestine, Dowson devoted a special chapter to the way the cadastral survey should be conducted. The Torrens system is based on organising land registry books by blocks and parcels as immutable units, and entering the rights in them. This method was proposed instead of the system of registration by names of the landowners, which vary and are not unambiguous. Under the Torrens system, the cadastral map is an integral part of land settlement and registration documentation, hence the importance of the survey and mapping work.

Dowson examined the maps that had been prepared in the survey in the Gaza region and proposed a programme for continuing the mapping, in coordination with Ley and his assistants, Giles and H.J. Miller. He described the details of the work under the Torrens system and determined that mapping must be topographical on a large scale so that when the time came, it could be converted to a cadastral scale. The cadastral maps would show the area of the villages, all the topographical details, the secondary divisions of the lands,

and the boundaries of holdings that were not visible or marked in the field such as in *musha* holdings. He stated that there was no alternative to a land settlement conducted in the field, on site, and thus laid down the required working procedure demanded of the Settlement Officers, who must leave their offices for the field, and each decision they made have marked immediately in the field and on the maps, and entered in the books.⁷⁰

For the first time, the Government of Palestine was presented with a comprehensive document that incorporated all the questions relating to land in one logical framework, and pointed to possible ways for building a sound system for land settlement. Dowson wanted to prevent the cadastral project from assuming an interpolative character and so proposed substantive changes in organisation and action. He deprecated half-measures that wasted resources and entrenched the dysfunctions of the past along with the disorder of 1923. In order to implement the needed reform and to apply the Torrens system in Palestine, Dowson recommended that the Government of Egypt be requested to send over Sheppard, who had devoted fifteen years of his professional life to the study of the various systems for registering land and had applied these in Egypt. The conclusions of Egypt were relevant also to Palestine, despite the differences in the physical conditions between the two countries, and despite Egyptian real property laws being based on the Swiss code and not the Ottoman one; Egypt and Palestine had a common background in Islamic law and traditions, and in the Ottoman Imperial connection.

The Torrens system had first been proposed in Egypt in 1904–1908, but was impeded at the time because of the administrative jungle of the capitulatory system. The system was enacted only in 1917–1920, when Egypt became a British protectorate, after a renewed discussion in the commission headed by Dowson and of which Sheppard was a member. In the years that the method was discussed in Egypt, rich experience accumulated, and Sheppard was the right man to contribute of his experience and to place it forthwith at the disposal of the Government of Palestine.

Dowson's document had repercussions in both Palestine and London. It was clear to all that the investments in the cadastral survey had gone down the drain. Even Kisch, the chairman of the Palestine Zionist Executive, described in his diaries Clayton's hard reaction to Dowson's conclusions, perhaps because Clayton had been among the first British administrators in 1918–1919 to promote the conduct of a systematic, full cadastral survey of Palestine.⁷¹ The government accepted the report and announced on 23 May 1924 to the Colonial Office that it adopted the conclusions.⁷² Dowson was informed of this in June, and the Government of Palestine invited him for a working visit to the country. Samuel allocated £100,000 from the Loan Schedule of Palestine for the first stage of the work and agreed to support the recommendation that the task be given over to Sheppard, and failing this to Dowson himself.

Samuel's announcement was received with mixed reactions in the Middle East Department of the Colonial Office. G.L.M. Clauson, K.V. Vernon, and Colonel Young were joined also by Keith-Roach (the Assistant to the Chief Secretary), who happened to be in London. Suddenly Keith-Roach was offered a convenient opportunity to lash out at the Government of Palestine and to vent his ire upon Ley, who in October 1921 had reacted with unabashed disdain to his proposals for making the system more efficient. In a marginal comment Keith-Roach wrote on the title page of the file:

I think it certain that 80% of the money spent by the Survey Department in Palestine might just as well have been thrown into the sea, and all the work done by these numerous Commissions and people who have been going round drawing travelling allowance is so much trash.

He scoffed at the absurdity that in a country the size of Wales there were two departments dealing with the same thing—one in Jaffa and the other in Jerusalem. Three years previously he had done all he could to bring about the amalgamation of the Survey, the Land Registry Departments and the Land Commission. This union succeeded only in part, since the Survey Department remained independent. However, the heads of the departments—Stubbs, who from April 1922 had been Director of the Land Department, and Ley—were not fit to institute the reform proposed by Dowson. Although both were officials of the first rank, Stubbs, according to Keith-Roach, was ‘not big enough’ to head the amalgamated Department for Lands. And as bad luck would have it, Ley was ‘unfortunately somewhat mad’. As if this were not enough, he had ‘misconducted himself with his German cook’ and had been forced to marry her—which apparently made an English gentleman unfit to serve in the Survey Department. Nor did Herbert Samuel come off unscathed at the hands of his official:

The High Commissioner is afraid to take bold action, and insist on the amalgamation of these two Departments under a really efficient Head. I do not think it is much use throwing these papers back at Palestine. It would be much better...us to take some sort of action this side, and...it might be time saved if we were to have a chat with Mr. Dowson and get him to tell us frankly his own views.⁷³

Vernon and Young agreed with Keith-Roach; the two met Dowson twice, on 8 and 10 July, and even obtained his agreement to go again to Palestine after cancelling a previous commitment.⁷⁴

In the meantime, under the impact of Dowson’s remarks things had moved in Palestine: in March 1924 the discussions began in connection with the change in the Surveyors Ordinance of 1921, which should have prevented the submission of unauthorised surveys to the Registrar of Lands.⁷⁵ In November the Instructions to Registrars were published,⁷⁶ and in order to fund Dowson’s plan Samuel took steps in good time to increase the budget for the cadastral survey.⁷⁷ Dowson’s report was distributed among the district governors and the heads of government departments, and their comments were sent for consideration to London.⁷⁸ The High Court judge and the President of the Land Court directed Samuel’s attention to the misunderstanding between him and Dowson regarding the function of the court, and this too Samuel referred to the Colonial Office.⁷⁹ Even before returning to Palestine, Dowson intervened in everything he thought relevant and essential, such as the matter of tax on crops or the Tobacco Ordinance; and immediately on arrival deepened his involvement, such as by influencing Lord Plumer to standardise the dimensions of the dunam by legislation.⁸⁰ From now on, every action taken by the Government of Palestine in land matters was brought to Dowson’s knowledge and bore the imprint of his inspiration.

Dowson left for a second visit to Palestine on 1 November 1924. Before his departure, he reiterated his conditions and principles, so that he would be allowed to act as he saw fit.⁸¹ He intended staying in Palestine about four months, but would shorten or extend this period as required, in the hope that by the spring of 1925 he would be able to gather sufficient background material for the preparation of the reform programme. Dowson did not conceal the fact that he placed his hopes above all on the survey system, for without being sure of its quality there was no hope for the cadastral project. He aspired to studying the system in all its inner workings, from the stage of the initiative and the base measurements to the stage of presenting the finished cartographic product as a public document of legal authority. He therefore again asked the Government of Egypt to allow Sheppard to join him, and also asked for the help of the mathematicians of the Egyptian Survey Department in checking the triangulation measurements, which he defined as the foundation stone of the survey. He also wished to invite W.H.Crosthwaite, formerly the Controller of Printing to the Egyptian Government and Map Officer to HM Forces at the time of the conquest of Palestine, to check the process of map production, for the maps and documents were the embodiment of all the work, time, and money invested in the cadastral project.

In the Colonial Office there were doubts whether, in view of the tension in Egypt regarding demands that Britain withdraw her military forces from Egypt and Sudan, Sheppard would be seconded to Palestine.⁸² Dowson persisted, and announced that he intended to clarify with Sheppard himself the chances of obtaining help from Egypt. 'If we cannot get Mohammed to come to the mountain I hope we can do a great deal in the way of taking parts of the mountain to him,' he quipped; either the experts would come from Egypt to Palestine, or the questions would be sent to Egypt. If that too did not help, there would be a need to bring someone from England to conduct a general check of the triangulation measurements.⁸³ Samuel indeed asked the British High Commissioner in Egypt for assistance.⁸⁴

In January and February 1925, two experts in whom Dowson had full trust, Crosthwaite and Richards, arrived in Palestine. The former remained only a short time but managed to visit the Survey Department in Jaffa and to examine the system of draughting and the possibilities of printing directly from the field sheets. It was Crosthwaite who succeeded in obtaining from Egypt an agreement to print there the maps of Jerusalem and Jericho that had been completed at that time, and he also intended to ascertain whether it would be worthwhile to have the Palestine maps printed by the Ordnance Survey or by private British firms.⁸⁵ The intention to print maps in Britain apparently had special significance, for Young of the Colonial Office took pains to draw the attention of Colonel H.St.J.L.Winterbotham, the head of the Geographical Section of the War Office, to this matter.⁸⁶

On Sheppard's orders, Richards, the Director of the Computation Section of the Survey of Egypt, left for Palestine on 30 January 1925. In Jerusalem he met Dowson, who on 2 February gave him a list of nineteen subjects dealing with the gamut of the surveys in Palestine that he desired to be investigated, and asked to be presented with a detailed recommendation.

We have no information concerning Dowson's work in the four months that he was in Palestine—except from his many writings. He was involved in the system and came to know the people in it, and thoroughly investigated each of the government units dealing

with the subject of land in every district. He checked the way the land settlement was being carried out in Beisan, investigated the delimitation of the forests of the country and their protection from trespassers, and studied the work of the unofficial land registry in the Jewish colonies. He checked the technical aspects of the cadastral survey project and the extent of its suitability to local conditions, and clarified every detail with Ley. But Dowson placed the main emphasis upon an in-depth study of the roots of the land problem and on gathering data on its sources, so that he would be able to base his recommendations for instituting a cadastral reform on the conditions specific to Palestine and its population. In the light of his active involvement, and after Samuel had apparently given up hope of obtaining the help of Sheppard, Dowson himself was offered the job of ‘reformer’ that he had recommended, so that he could also be responsible for implementing it. Shortly before returning to London on 16 March 1925, Dowson set down on paper his conditions for taking up the appointment as Adviser on Cadastral Matters to the Government of Palestine, and the appointment was confirmed in London.⁸⁷

From failure to reform, 1925

Dowson’s visit to Palestine in the winter of 1924–1925 not only resulted in the alliance between him and the government in the matter of the reform, but also produced extensive writings describing in meticulous detail important issues in the history of surveying, the regime, and the land administration in Palestine. These essays deal with all the fundamentals of the land problem in its non-political and non-agrarian aspects; that is, in matters of surveying, budget, land ownership, land tax assessment, land legislation, and the way to achieve a change in land settlement and assure land tenure rights.

The first document touching on this period is Richards’s report. Richards remained in Palestine until 9 February 1925, studied every detail of the survey framework, and submitted his recommendations to Dowson on 1 May 1925.⁸⁸ The purport of his answers to Dowson’s nineteen questions was that Palestine had a reliable, professional survey infrastructure, and his recommendations were received with relief.⁸⁹

After the investigation of the mathematical foundations of the system, upon which the cadastral survey was to rely, Dowson could devote his energies to other details. He devoted attention to the budget, structure, and working methods, the quality of the staff, cooperation with other departments of the government, the physical location of the Survey Department, control of the system, and, above all, clarification of the Director of Surveys’ ‘philosophy of life’ regarding the objectives of the department that he headed. Dowson presented the entire picture when the Treasurer in Jerusalem passed on to him, in February 1925, the budget proposal prepared by Ley for the working year 1925–1926. At his office in the Lands Department in the Greek Orthodox Mount Zion Convent, Dowson analysed the budget proposal for the Survey Department in a voluminous four-chapter composition in which he opposed the full weight of his prestige to Ley’s approach and views.⁹⁰ The point of his harsh criticism was aimed at the conception of the objectives of the Survey Department as purely cadastre related, and at the flawed relations with other departments of the government. The criticism was openly presented in consultation with Ley, who responded to it in an appendix to the material Dowson sent to London.⁹¹ The bulky despatch shocked the ‘Palestinians’ in the Colonial Office: Holmes, Vernon, and

Young. They expressed their reactions in seven pages of marginal comments that dealt sharply with the ‘profusion of words’, in the awareness that this was only the first course of the full report Dowson owed them from his trip to Palestine. Holmes noted that it was clear Dowson and Ley did not see eye to eye regarding the most important problems, and that generally they disagreed on the future development of the Survey Department, as emerged from the disparity between Dowson’s budget of E£80,000 and Ley’s of E£20,000.⁹² Vernon wrote to Young:

It seems to me that we have rather put our money on Sir Ernest Dowson as an expert, and that we find Mr. Ley displaying just those qualities which Sir E. Dowson warned me were his defects, namely, an adherence to the idea of a purely routine Survey Department which puts together the materials for maps, and does nothing else, and a tendency to obstruct any proposals for work of a wider or more adventurous description. I do not think, as a general principle, that it is sound to call in the advice of an expert and then listen to criticism of his proposals from a comparative amateur.

Young restricted himself to presenting the position of the Colonial Secretary, Amery, namely that Dowson’s final report be patiently awaited before Ley was judged.

Dowson disagreed with Ley’s budget on many points. Beyond the details, Dowson saw in it a structural conception devoid of vision, and a faulty systematic approach. Dowson aspired to the establishment of a large, central national institution that would take upon itself every survey task, and the mapping and the production of maps of Palestine. In contrast, Ley envisaged but a small, modest technical department with the limited objective of carrying out the cadastral survey that would not hurt the business of private surveyors in the country.⁹³ Ley thought that once the cadastral survey was completed, the ‘Cadastral Department’ would be pared down into a Post-Settlement Department’, with monitoring and updating functions serving the needs of the Land Registry Department.⁹⁴ Ley even went so far as to say that in such a small department there was no need for a staff on a high level. He was prepared, for example, to forgo the services of the Chief Mathematician, Le Ray, who was responsible for the complex and intricate calculations of the bases for the major triangulation net, and who was third in the hierarchy of the department.⁹⁵

In the end, Dowson’s conception was accepted out of practical considerations and as the cartographic needs of Palestine grew. His extensive professional experience in a veteran, well-organised survey department (if not the outpouring of written words)⁹⁶ served to convince those concerned that even in the first years of the Mandate administration Palestine needed a national survey capability that would be the cartographic arm of the government, as was the case in the advanced nations of the world.

The worst thing in Ley’s budget, to Dowson’s mind, was his deficient organisational conception. Instead of the Survey and the Land Settlement Departments acting in close cooperation with each other, the gap between them would widen in the future. Dowson accordingly examined the proposed budget estimates and the two budgeted bodies—Survey and Land Registry—in the light of the set goals, and not according to the level of

activity of each unit.⁹⁷ Dowson intended to deal first with the Land Registry budget, for every change there would immediately affect the improvement of the existing legal regulations, the implementation of the survey and the settlement, and the preparation of a new land law, on which depended the reform in settling tenure rights. But because at that early stage it was not yet possible to effect a fundamental change in land registration, he turned instead to deal with the Survey budget.⁹⁸

Dowson identified four realms of weakness in the Survey Department: an incomplete work programme; poor cooperation; the inability to print maps; and a shortage of field workers.⁹⁹ Regarding the programme of work, Dowson admitted that at that time the triangulation measurements had not been completed, nor were the nets closed, and surveying of control points was not finished. He urged that the work be speeded up by reinforcing the staff. However, his main criticism was of the ‘spirit of work’. Surveying was not to be regarded as the final aim—not in topographic mapping in areas where there was constant economic development, certainly not in the cadastre in which the surveyors had constantly to move throughout the country, to survey and measure, to revise former measurements, and to gain the trust of the public regarding the government’s determination to bring about a permanent land settlement.¹⁰⁰

The inadequate level of cooperation between the Survey and the Land Settlement Departments was already a matter of common knowledge. It was too bad, according to Dowson, that the cadastral responsibility had been imposed on two independent bodies, each of which had gained much experience, and it was not to be expected that suddenly the spirit of uniting their efforts would descend upon them spontaneously.

In the absence of such unified effort, the artillery of Survey have been shelling the hills while the infantry of the Land Registry have been independently attacking in the plains. And although useful progress has been made by each in certain directions the main battle of reducing the chaos of land rights in Palestine to order remains on the balance very much where it was seven years ago.¹⁰¹

The only way to correct the situation was to combine the forces by means of the Budget. In order to improve the coordination between the departments, Dowson recommended moving the Survey Department from Jaffa to Jerusalem and improving the internal relations in the department between the directorate and the field crews. He demanded the appointment of a Deputy Director, whose main function would be administrative rather than professional and who would regularly visit the survey parties in the field. Ley agreed with Dowson in this matter and suggested his senior aide, Giles, as contact man between the head office and the field.

The establishment of a government Survey Department without a mapprinting unit was beyond the ken of Dowson, and he lashed out vigorously against this deficiency. There was no alternative to a map that conveniently presented the maximum information, and there was no value to a map that was not printed and distributed at large. Compared with the costly fieldwork, copying a visual document was cheap and publicised the results of the survey. Hence, a Survey Department that did not print its maps kept from the public information gathered at its expense, and moreover information that lost value with every day that passed. Dowson agreed that topographic maps could be printed

abroad, despite the inconvenience and the time lapse between the survey and publication, but he absolutely rejected such a practice in the case of maps intended for registering land, since the maps and the registration were complementary elements of a document that might have to be consulted or updated at any time. Therefore, Dowson insisted that a section for the printing of maps be set up without delay, as an essential function of the cadastral survey and as a highly desirable capability in any national survey department.¹⁰²

At the time of Dowson's stay in Palestine, the junior field staff numbered about thirty men. He proposed that in the coming fiscal year this number be doubled to around sixty, who would be absorbed by ten senior workers of the department. This large numerical proportion of senior to junior staff was required in the first years when the foundations for a national survey were being laid down. But this proposal had of course a considerable budgetary implication, which reminded Dowson that the whole financial basis for activating the Survey Department was still unresolved—whether from the capital or the loan reserves of the Government of Palestine. He pointed out that if on the other hand the investment in the survey be increased by adding staff and speeding up the work, the return rate and the economic benefits to the State would also be enhanced.¹⁰³

Dowson then went on candidly to explain his views of the continuation of the survey under the existing conditions. He was not thrilled by the process of land settlement in the Beisan region, for he feared that this was a passing project, isolated from the framework of a country-wide settlement. But he could not stop the survey, and therefore supported the continuation of the Land Commission's work so that it would gain experience in demarcating boundaries of the villages and holdings, investigating claims in the field, demarcating forest reserves, and assessing land taxes. To this end he recommended that two such commissions be set up, to be headed by select British officials who knew Arabic and were familiar with the ways of the country, and with them also Palestinian clerks, such as those attached to the commission in Beisan—except that these commissions worked without pay, and in the new budget Dowson generously allocated them E£1 per day to cover their expenses.¹⁰⁴ After enumerating the weaknesses of the Survey Department, Dowson passed to a meticulous analysis of the actual budget proposal and the details of implementing it, which in part have been discussed in the foregoing chapters.

On returning to England from his second visit to Palestine, Dowson plunged into the study of the history of the Ottoman land regime, and, as he was wont to do, learned it by writing about it. Following Richards's

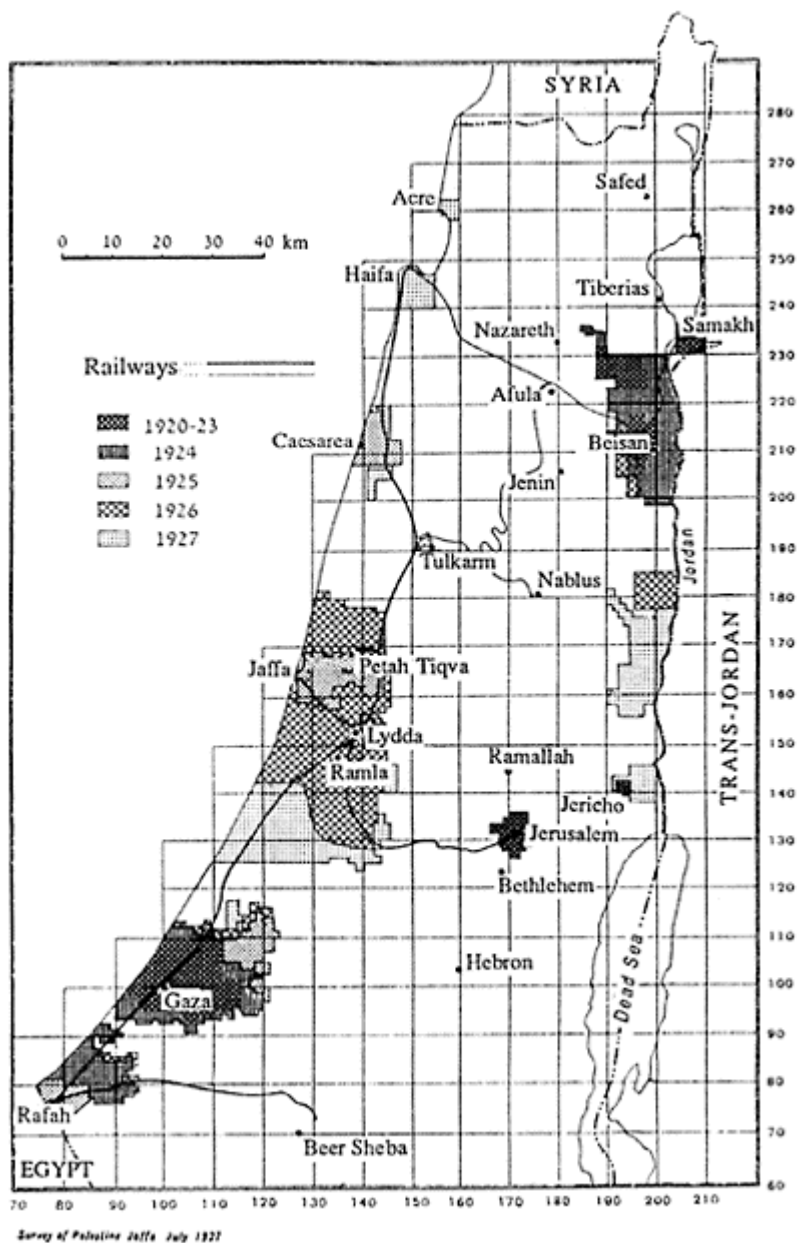


Figure 5.2 The cadastral survey of 1920–1927 (source: Pal. Govt, *Annual Reports of the Director of Surveys*, 1922 and 1923).

report and the analysis of the budget proposal, it took Dowson eight months to produce two additional papers: the first was intended to achieve an understanding of the land regime's roots in Palestine,¹⁰⁵ and the second was the report of his second visit to the country in 1924–1925.¹⁰⁶ In the interval before the publication of this report, Ley seems to have undergone a professional change of heart in his outlook. Encouraged by the publication of the new Land Surveyors Ordinance 1925,¹⁰⁷ which superseded the Surveyors Ordinance 1921, and spurred by Dowson's whiplashes, Ley attempted in May 1925 to follow the recommendations by increasing the number of field survey workers and begin training them towards the implementation of the reform.¹⁰⁸ It was at this time that he persuaded the new High Commissioner, Lord Plumer, to market the department's map of Jerusalem for commercial purposes.¹⁰⁹ Eventually, in 1938, Dowson was to say kind words about the change in Ley's outlook, and for having used well the period of indecision between 1924 and 1927 to prepare the Survey Department for the smooth and efficient resumption of work with the institution of the reform. For this the department also earned the respect of the Royal Commission in 1937.¹¹⁰

The men of the Colonial Office in London also did their best not to waste time while awaiting Dowson's conclusions. In October 1925 they discussed with him the budget and his recommendations, which exceeded those of the Director of Surveys fourfold. They dealt with Samuel's request for Dowson's return to Palestine for the continuation of the work; considered the intentions of the Colonial Office regarding the independent Land Registry books of the Jewish colonies; and asked Dowson to repeat and briefly clarify his programme. Young warned Dowson against recommending a budget that had no economic basis, or a trip to Palestine that was not properly justified, and in effect sent Dowson home to reconsider, and restate what he had to say more concisely ('in no more than eight pages!').¹¹¹ However, on 3 November 1925, instead of submitting an operational report for reform of the land settlement, Dowson sent him a huge academic paper of eighty-five pages on the history of the land regime in Palestine. The officials of the Middle East Department of the Colonial Office lost their self-control. Plumer too expressed his wrath in a private letter to J.Shuckburgh in the Colonial Office:

Agriculture and a land policy are the crying needs here...at all turns I am met with the response it all depends on Sir E.Dowson's report ...when we shall get it—the report—goodness only knows...can you do anything to hasten it?

To this Young remarked in a desperate marginal note, 'What can I reply?,'¹¹²

On 5 December 1925 Dowson at last sent the long-awaited report to the Colonial Secretary. The paper was divided into two chapters. The first was a short, comprehensive memorandum of eleven pages on the land regime in Palestine and on the main objectives of his mission and his conclusions. It concluded with the declaration that all that had been done until then in Palestine illustrated the failure of the British administration to mend the distortions of the Ottoman system, and unless the necessary steps be taken, justified criticism would continue.¹¹³ The second part contained eighteen items and three appendices concerning the system, its function and its ills.¹¹⁴ He discussed the history of lands, the importance of fiscal reform, the failures of the Ottoman land registry system, the evolution of the work since the opening of the *tabu* offices in 1920, and the sad

results. He dealt with the problem of tenure and cultivation of the lands, the lessons and the aims of the reform, the recommended methods of work of settlement and fiscal surveying; analysed the Beisan agreement and the problem of the independent registry books of the Jewish colonies; and lastly returned to the problem of the budget. Dowson went into detail on many issues that have only marginal bearing on the subject of the survey, therefore only two of the relevant points will be examined here more fully: one touching on surveying, and the other Dowson's evaluation of the registry books of the Jewish colonies.

Paragraph 14 of the report dealt in detail with the fiscal survey, which combined land survey work and assessment of land and buildings.¹¹⁵ Dowson proposed to first conduct a fiscal survey in Palestine before going on to a cadastral survey and land settlement because it would be easier and quicker to implement and would not entail such detailed preparations. A proper tax system had to be based on registry of property and identification of owners—information obtained in the process of land settlement; but because this was a very slow procedure, Dowson proposed inverting the order and aiming at an assessment of holdings that would be done rapidly before the actual settlement. In this way, the land settlement would be based on fiscal preparatory work. In the urban areas he anticipated no difficulties in marking the properties and identifying those who occupied them, if not the owners; in the rural areas the question of ownership could be overlooked, for the objective was to allocate and demarcate the blocks of land of equal value for taxation. According to Dowson, the system of land taxation would be received with satisfaction by the villagers, since they were accustomed to division of lands by the *musha'* system. The division of lands would in good time also serve the purposes of the land settlement, and therefore was to be carried out on the basis of village units. For this purpose it was necessary to delimit and demarcate the village areas, to describe them on a map by means of topographic details, and to divide the areas into secondary units of equal value for assessment purposes. In this way, the fiscal reform would come before the cadastral one, and the government would be freed of the pressure it was now subjected to because of the delays in the cadastral project, and would benefit from the change in the system of levying property taxes.

The operational significance of Dowson's proposal was very important for the survey, for adoption of these procedures would have enabled the Survey Department to work with great élan, independently of the complicated and cumbersome cadastral project, and to map the urban and rural settlements of the country within a few years.

As to the attitude of the Jewish population to the reform, Dowson believed in their bent for system and order and stated that they welcomed the cadastral reform and wished to institute an efficient land registry and a change in the tax system. Although Dowson expressed his views openly, this would not prevent the Jews from demanding the best of both worlds when the time came, but at least there was a concerted Jewish interest in supporting the reform. This was not so on the Arab side. The owners of large holdings, who squeezed the tenants and the small farmers and appropriated public land, clearly had no interest in changing the situation. Nor did the village headmen have cause to support the reform, for fear that they would lose the source of their authority, which was entrenched in the collection of taxes and the apportioning of lands held in common. Even the villagers found reason to oppose the demarcation of lands since this would prevent them from trespassing on state lands. And what possible interest could the Muslim *waqf*

authorities have in the delimitation of lands, when they too benefited from the uncertainty and insecurity of private property rights?¹¹⁶

Beyond the support for the cadastral reform, Dowson wondered why the government ignored the benefit that would accrue to it from the Land Registry if it were to adopt the colony records of the Jewish settlements. The Jews complained, rightly, that their reliable and lucid books were not legally recognised, yet the government Land Registry was ‘unreliable and incomprehensible’. It must be admitted, Dowson stated, that this argument was justified and that the transfer of the Jewish land registry books to the government would bring much advantage to the official register.¹¹⁷ Dowson’s criticism in this matter had immediate results. In February 1926 the Government of Palestine published the Amended Land Registry Ordinance 1926, by which every person, village, or local council that had unofficial land registry books was obligated to give these over to the Registrar of Lands.¹¹⁸ This ordinance also applied to the private record books of the German Templer colonies, Sarona and Wilhelma.¹¹⁹

Dowson did not change his mind about the contribution of the Jews to the Land Registry even years later. In a paper he wrote in 1938, in response to the Royal (Peel) Commission Report, he stated, ‘The establishment in Palestine of a national home for the Jewish people accentuated the urgency of the reform and imposed a higher standard of performance than might otherwise have been necessary.’¹²⁰



Figure 5.3 Surveyors’ camp in southern Palestine (source: J.Loxton, Taunton, UK).

The legal and administrative preparations for the reform, 1926–1927

The reports and investigations of Dowson had a cumulative effect that tipped the scales in favour of the reform in the settlement of tenure rights. Dowson returned to Palestine for the third time in 1926, at Plumer's request, in order to transmute his recommendations into an operational programme. In March, seven meetings at the highest level were held with the High Commissioner and his Advisory Council at which Dowson had to defend his reform programme and persuade the Government of Palestine of the beneficial implications of his proposals. In April 1926 Plumer despatched the summaries of the discussions to London, writing:

I have come to the conclusion that settlement work of a systematic and comprehensive nature should be begun as soon as possible, and a reliable record of rights over land be thereafter maintained. By no other means, it seems, can the tangled aftermath of Turkish practice be swept away, and a sure basis provided for agricultural development, reform of land taxation, definition of State Domain and the introduction of an agricultural credit system. The system of land registration must be considerably recast, it must be based upon survey, and embodied in law and regulation, and personnel must be habituated to its use.¹²¹

And Plumer added that the Attorney-General was taking steps to prepare the law, and that to assist him the help of Frederic M. Goadby and Moses J. Doukhan, the most senior experts on land matters in Palestine, had been placed at his disposal.¹²² Goadby was a barrister in England and Egypt with knowledge of Ottoman law, and the Director of the Mandate Government's Legal Studies. Doukhan was the Legal Adviser for Land Registry in the Department of Lands, and a Lecturer in the Government Law School founded by Norman Bentwich in Jerusalem; in the preceding year, 1925, he had published a study of land laws in Palestine.¹²³ Goadby and Doukhan were asked to summarise the history of land legislation in the country as a guide to the Land Settlement Officers. They presented their joint work of 400 pages to Bentwich in the autumn of 1927, and in 1935 published it as a book that expanded on the subject and reflected the developments that had in the meantime occurred in the land system with the institution of the reform.¹²⁴

Dowson left the country on 26 June 1926 for the summer months. Before his departure, he left directives regarding the immediate measures to be taken in his absence and an estimate of their cost.¹²⁵ His demands made a long list: completion of the legal paper on the state of the present law governing real estate; acceleration of the preparatory topographic mapping of the entire country for the fiscal survey; and deciding on the location of the Survey Department during the coming five years in anticipation of its having to leave its Jaffa premises. He demanded the appointing of Settlement Officers for conducting the land settlement in the Jaffa Sub-District; the transferring of surveyors engaged in land settlement from the Survey Department to the Land Department provided they remained subordinate professionally and technically to the Survey Department. He suggested the selecting of several registration blocks in the Beisan Sub-District to train

there men for the Torrens land titles system; and increasing the land settlement staff in the Beisan Valley.

Before Dowson had even left Palestine, Plumer asked the Colonial Office to allow his return in October 1926 for another eight months of work. And indeed, Dowson did return yet once more.¹²⁶ The High Commissioner was firmly resolved that Dowson was to be directly involved in every detail of the reform, and to this end he was to be in the country when his recommendations were being effected and written into law. Dowson and Plumer fully agreed on the advantage of an outside expert to steer the work between the government bodies, which over the years had developed sensitivities impeding their ability to work in harmony with each other, but which willingly cooperated with an expert brought from outside the framework. Thus also evolved the concept that the system would be headed by a commissioner with wide powers to direct the administrative changes entailed by the reform. The commissioner, whose status was to be above that of the government department directors, would be a member of the High Commissioner's Advisory Council and party to its discussions of subjects related to his responsibilities. In his summarising despatch Plumer proposed that Dowson himself be appointed Commissioner of Lands on his return from England, and in an appendix to the despatch was a special document instructing the Commissioner of Lands (Sir E. Dowson) on behalf of the High Commissioner to organise the measures for bringing about the full settlement of the property rights in Palestine. Dowson was to provide technical assistance to the Attorney General and to advise the Land and Survey Departments in coordinating their systems among themselves and in their contacts with the District Governors. He was to supervise the land settlement in Beisan and to instruct the workers in the procedures of survey and registration, to organise the Land Settlement offices, and to determine the time for the commencement of the work and estimate the budget and the time of its conclusion.

Besides marshalling all the forces for instituting the reform, Plumer and Dowson intended to pave the way for instituting a permanent position of commissioner in the government.¹²⁷ Dowson became the first Land Commissioner in Palestine in September 1926 as a provisional appointment, and in January 1927 prepared a document that analysed and detailed the responsibilities of the commissioner, the qualifications required of him, and his place in the government hierarchy.¹²⁸ Plumer and Dowson tailored the position to the measure of Abramson, the Governor of the Northern District at the time, who was well versed in the ways of the country and knew the survey frameworks, the settlement, registry, and taxation. In his paper Dowson warned that for the good of the country and for the success of the project he was opposed to the appointment of a British official foreign to the country for this important post, even if he had extensive experience in this field and would be brought specially to Palestine. On 8 April Plumer confirmed the position, and on 7 July 1927 the Colonial Office ratified the appointment of Abramson as Commissioner of Lands.¹²⁹

In the winter of 1926–1927 the government organised to secure the required budget, amalgamate the departments involved in the reform, appoint Land Settlement Officers and Land Valuation Assessors, acquire equipment, and complete the special legal preparations that would endow the work and its results with statutory authority. On 21 February 1927, towards the visit to Palestine of Shuckburgh of the Colonial Office Middle East Department, the decisive meeting with Plumer took place in which were

crystallised and summarised the final steps for the implementation of the land settlement reform in the rural sector.

When the reform system was nearing completion, the pressures on Dowson were lessened and between February and April 1927 he found time to go to Transjordan for three weeks and to advise the Chief British Representative, Colonel C.H.F.Cox, on a land settlement, triangulation survey, and topographic and cadastral mapping. Cox, who was subordinate to Plumer, the High Commissioner of Palestine and Transjordan, was at the time engaged in setting up an independent surveying capability in his territory. Dowson and Sheppard helped him find a suitable director and recommended A.P.Mitchell, who at that time had resigned from the Egyptian Survey Department (and was later to become the last Director of the Survey of Palestine). Nevertheless, Dowson saw no point in setting up an independent Survey Department in Transjordan, a ‘small replica’ of the Survey of Palestine.¹³⁰ Incidentally, Cox thought of funding the Transjordan survey framework from the proceeds, amounting to P£12,965, from the sale of 6,000 dunams of state domain land in Transjordan to Ruthenberg’s Palestine Electric Corporation.¹³¹

In the spring of 1927 the extensive preparations were completed, and the Government of Palestine submitted its proposed reform legislation. On 29 June the draft Ordinance to Provide for Settlement of Title and Registration of Land was sent to London and was received approvingly—almost as self-evident—for it was formulated according to Dowson’s concept and in several of its paragraphs was based on the law passed in Sudan two years previously.¹³² On the next day, 30 June, a draft Urban Property Tax Ordinance was despatched to London, which was intended to replace the *werko* and *mussaqaqafat* taxes on buildings and urban land.¹³³ This ordinance too was based on Dowson’s proposals and on a working programme he had prepared in March 1927 for the four largest towns: Jerusalem, Jaffa, Tel Aviv, and Haifa.¹³⁴ Dowson subsequently (in 1938) confirmed that the Settlement of Title and Registration Ordinance was adapted to the conditions in Palestine and its needs, in the light of the experience gathered in Egypt and in the Swiss cantons, and after studying the land laws in Punjab, Sudan, Malaya, and Switzerland.¹³⁵

With the conclusion of the legal preparations of the Urban Property Tax Ordinance, Dowson considered his task fulfilled and returned to England in July 1927. In Palestine the government moved along in the spirit of the reform. In December 1927 the Commutation of the Tithe Ordinance was passed—an important link in the reform, which aimed at transmuting the Ottoman land property taxes to a more equitable tax.¹³⁶ In January 1928 Ley submitted the proposal of the Survey Department for the new survey and land settlement procedures.¹³⁷ The Weights and Measures Ordinance was passed on 15 February.¹³⁸ And in April 1928 Dowson added an important layer to the system he had fathered by publishing an article in which he summarised his views on the change in taxation of urban property.¹³⁹

The draft Land Settlement Ordinance was published on 26 January 1928 and was greeted, as expected, with criticism, protests, and support. In February and March 1928 the legal authorities reacted to the proposed law. The High Court judges, the Attorney-General, the Land Court, the Higher Muslim Council, and Arab lawyers tried to delay, change, and correct various provisions. A senior British judge, O.C.K.Corie, related particularly to the great importance of mapping for the success of the cadastral reform and wished to amend certain paragraphs so as to emphasise its essential nature.¹⁴⁰

In the meantime, on 7 November 1927, Albert Abramson had been appointed Commissioner of Lands after having gone to Switzerland with Dowson for a short study trip in preparation for heading the reform.¹⁴¹ In order to avoid any misapprehensions concerning Dowson's departure, the Government of Palestine reconfirmed the authority of the commissioner over the Land and Survey Departments in an announcement published on 30 May 1928, the day the Land Settlement Ordinance was signed and on the eve of its publication in the *Official Gazette*.¹⁴²

The long-awaited reform was launched in the spring of 1928, after the budget had been approved. On 1 June 1928 the Land Settlement Ordinance was published in the *Official Gazette*, and at the end of July it was followed by the Urban Property Tax Ordinance. When these laws were enacted, the draft of a new Survey Ordinance that was to be part of the reform objectives was submitted to the Colonial Office in London.¹⁴³ Ley appended to the proposed ordinance explanatory remarks on the history of the survey regulations in Palestine and on the improvements in the new law over its predecessors, mainly the Cadastral Survey Ordinance 1920. But Amery, the Colonial Secretary, had several reservations that could not be passed over. He requested that the new ordinance encompass all the survey topics, the surveyors, the permits, and fees; he also recollected that in 1921 Churchill had distributed a compendium of colonial laws dealing with surveys that were to have served as models for Palestine. Amery



Figure 5.4 Moving a surveyors' camp, 1931 (source: J.Loxton, Taunton, UK).

demanding that reference be made to the Nigerian survey laws and that the Palestine law proposal be rewritten accordingly.¹⁴⁴ The Survey Ordinance 1929 was passed in May, and in the following year was amended in the Survey Ordinance, Surveyors Regulations 1930, particularly in relation to the registration requirements. From the time that the Land Settlement Ordinance was passed in 1928 the Survey Department launched into

comprehensive mapping activity for the fiscal survey. When this was completed in 1934, the government published the Rural Property Tax Ordinance, which rounded out the series of basic laws of the cadastral reform.

The Land Settlement Ordinance 1928

The Land Settlement Ordinance 1928¹⁴⁵ laid down the procedures of settlement and registration of the property rights.¹⁴⁶ In the section on definitions, ‘block’ designates a subdivision of village land containing one or more parcels and constituting a unit of survey and registration. ‘Parcel’ is defined as a continuous land unit in a block belonging to one person or a group of persons. The definition of ‘land’ includes any rights arising out of land, buildings, and objects connected permanently to the land, and every undivided part and any interest in land that requires or is capable of registration under the ordinance. The term ‘village’ includes rural lands or tribal lands, or lands abutting on a municipal area, and all the land within a settlement region defined as such by proclamation (paragraph 2).

Paragraph 3 of the ordinance stated that the High Commissioner would publish in the *Official Gazette* the Settlement Order in the area intended for settlement. The Settlement Officer was to see to it that the announcement of the survey be made known to the villagers, together with the arrangements and the registration of rights that were to be implemented, thirty days before beginning to set up the demarcation markers of the parcels (paragraph 5). The Settlement Officer was given judicial powers to hear and decide claims in every case of dispute regarding ownership or tenure rights to the land (paragraph 10), and to this end he was also empowered to use the authority vested in the District Commissioners according to the Cadastral Survey Ordinance 1920, or every Ordinance replacing it (paragraph 12). Whoever claimed rights to the land had to appear before the Settlement Officer and submit his claim (paragraph 16) and to indicate or demarcate the land or the limits of the parcel claimed (paragraph 20). The Settlement Officer was empowered to draw up a list of the claims for each block of land—the Schedule of Claims (paragraph 21)—and during the marking of boundaries could determine new limits if the original line wound between separate parcels. He could carry out exchanges of parcels of equal value, and create rights of passage through land bordering on the public domain (paragraph 22). The Settlement Officer was to investigate and settle the rights of the government to land (paragraphs 19 and 28). He was to bring questions before the Land Court and the Muslim religious courts (paragraph 29). After investigation of the rights, he was to subdivide the block into parcels or registry units and to draw up a Schedule of Rights to be transmitted to the Registrar of the title books, together with a signed sketch map (croquis) of the parcels included in the schedule (paragraph 30).

Paragraph 35 states that a new register was to be opened for each village, and despite any pending appeals the land registered according to the conditions set down in paragraph 30. The form of the new Land Registry books was fixed in published regulations that were based on the system of registration proposed by Torrens in Australia. The Land Registry books and the maps were to be preserved with the Directors of the Survey and Land Departments, so that the courts could request the original books,

the documents, or the maps and the survey plans, or their exact copies (paragraphs 45 and 46 [c]). If after registering the settlement a discrepancy was discovered between the boundaries or the areas of the parcels in the field and the markings in the survey map, or between the newly measured area and the area in the Land Registry record, and the area calculated on the survey map, the latter would be the determining document. Neither the survey map nor the registry book was to be corrected except by court order (paragraph 61, 2(b)). This established the superiority of the survey map to preclude the need for the Settlement Officer to order a correction that might injure the rights of the parties. According to paragraph 69, this order also applied to the settlement of the government lands in the Jordan Valley (Ghor—Mudawara), and especially to the Wadi Fari'a lands, which had not yet been settled at the time.

The Torrens system of land registry, the legal status of the map, and the Land Settlement Ordinance

The cadastral reform under the provisions of the Land Settlement Ordinance 1928 was based on the cadastral method devised by Robert Richard Torrens in 1857 in Australia. From the beginning, the cadastre experts had advised the Government of Palestine to adopt the Torrens system, for the decision to fundamentally change the Ottoman land registry had prepared the ground for a new recording system. But in 1921, in the absence of adequate knowledge and preparation, the attempt was made to register land by means of a method that was later referred to as the 'old' British registry system. This was a kind of Torrens system, with at least part of three fundamentals of the system. The first basic measure was the registration of every transaction on a separate page, instead of continuous, unsorted entries in the Land Registry books. The second was the registry of rights to land that could be traced without great difficulties. And the third—in order to prevent the corruption that was rampant in the Ottoman system of registry—was to charge the government with the legal investigation of property rights and the preparation of documents by the Land Registry Department instead of by the lawyers of the parties.¹⁴⁷ Thus, when in 1923 Dowson recommended implementing the reform in the cadastre by the Torrens system, there were grounds for agreement and understanding with him.

The Torrens system is of considerable importance to the history of surveying in Palestine because it was predicated on the survey of lands and the appending of a map as a formal document to the Land Registry books. Two conditions were necessary for a proper land settlement: the first, preliminary condition was that the survey be based on a national control net that would determine the exact site of parcels of land; the second condition was that the investigation of rights be conducted on-site, in the field.¹⁴⁸

The cadastral system according to Torrens served multiple purposes, and was designed to give a true picture of the legal rights to landed property and answer the needs of the tax assessment of real estate.¹⁴⁹ Because of its flexibility, the method had been adopted in the Australian countryside and elsewhere at the turn of the century.¹⁵⁰ The European version tended to follow the Napoleonic cadastre, which was fiscal, and laid the foundations for modern property taxation on the basis of ownership of the land, the degree of fertility, and the estimate of income to be derived from it. In Palestine the adoption of the multi-purpose—legal and fiscal Egyptian version had been recommended, as it also had been for

Transjordan, Iraq, and other countries.¹⁵¹ By 1917, when Palestine set out on the road of reform in the Land Registry books, the Torrens system had been adopted in its entirety, in part, or in combination with existing methods in thirty-one legislatures connected with the British Empire, in sixteen states of the United States, and in several European countries.¹⁵²

Robert Richard Torrens was a public figure of Irish extraction who in his youth worked for four years as a customs clerk in London. In 1840 he emigrated to Adelaide in Australia, where he was appointed Collector of Customs with a seat in the Legislative Council, and in 1852 became Treasurer and the first Registrar-General. In 1857 he became a member of the first Ministry under the new self-governing Constitution of South Australia. Torrens submitted a private bill in June 1857 for a Real Property Act, the main gist of which was the transfer of ownership ('conveyance') by registry and certificate instead of deeds, as was the generally accepted practice at the time. His bill was written into law on 2 July 1858, and was well received in the Australian states and New Zealand as an effective means for settling land matters in a populated country.¹⁵³

The main objective of the Torrens system was to simplify the registration of land rights and to ensure the rights of the property owners. The problems derived mostly from transfers of ownership of real property, which could not be moved like objects, and so only the right to it was transferable. Generally, three systems of recording real estate rights may be taken as representing three periods in the history of land registration:¹⁵⁴

- 1 *Private conveyancing*. The rights in real property are transferred by private agreement between the seller and the buyer by means of a deed of sale. The agreement is drawn up and certified by a notary, it is not publicised, and it is not registered in a central record. This system does not guarantee the quality of the transferred rights.
- 2 *Registration of deeds*. The rights in real estate are transferred by means of a deed of sale from the seller to the buyer, and the transfer is entered in a central official record. The registration follows the sequence of the transactions and the name of the owners, and thus it is difficult afterwards to locate the details of the registration in order to check the correctness of the details. Registry by this means only serves as apparent proof of the rights specified in it and gives no indication of the quality of these rights.
- 3 *Registration of title*. Instead of drawing up a deed of sale, the rights to precisely defined units of land are entered in the land registry book kept by the registrar of lands after thorough investigation and check of the rights in this land. The investigation is conducted by the State. This is the system that was first proposed by Torrens in South Australia.

The system of private transfer of real property has been virtually abandoned since the Torrens reform pointed up its basic deficiency in the registration of deeds. By this method the name of the owner of the land and the details of the transaction were entered in the land registry books, but no official investigation was conducted as to the validity of past deals in the same area, and the buyer had no guarantee for the rights he or she acquired from the seller. This system meant that the interested party had to uncover whether the owner of the land, who may have changed from time to time, had any rights of ownership to the parcel. He or she had to uncover whether it was in the owner's effective possession, whether it had been transferred to someone else without the transfer being recorded, or whether it carried commitments and mortgages, so that there was no

significance to the fact that it happened to be registered in the name of the person who wished to sell it.

As opposed to this, in the system of registering rights the identity of the owner was of no importance. The parcel was registered in the land registry book by serial number, and the registration concerned only that particular parcel. In this way, the property rights were acquired in relation to a defined, immutable unit of land in perpetuity. The registration of rights in this way reflected the existing ownership situation as investigated by the State, in such a way that, with very rare exceptions, the buyer of rights could be absolutely certain of his or her property.¹⁵⁵

At the beginning of the twentieth century a British lawyer, C.Fortescue-Brickdale, set out six prerequisites for a perfect conveyancing system: security; simplicity; accuracy; cheapness; expedition; and suitability to local circumstances. All these were the mainstays of the Torrens system, which simplified and speeded up the process of transfer of ownership while securing the rights of tenure and making public all the information in the land registry books.¹⁵⁶ When Torrens presented his method to the Legislative Assembly of South Australia, he declared that it was his intention not to heal the ills of the then existing law by amending it, but to abolish it altogether.¹⁵⁷ According to him, the law was fundamentally wrong because it forced the buyer to trace at his or her initiative and expense the past rights of former owners of the property. Against the background of the situation in Australia, where people acquired property rights without the complicated ways of retrospective examinations being clear to them, and since even the registration of such transactions did not ensure their rights in the property, Torrens proposed the reform in the system of registry. Every transfer of ownership would, so to speak, revert to the State (the Crown); the State would investigate and check anew the rights in the property in every single transfer, and then the Registrar would enter the rights in the land registry book (*tabu*, in Palestine) and would issue a document attesting the rights (*kushan*). According to this ‘quasi-feudal’ system, there would be no indication of absolute ownership of the land, but only tenure granted by the State, and only the act of registration gave effect to the transfer of ownership.¹⁵⁸

As a former customs official, Torrens had originally conceived the idea of adapting to land a system of registering rights in ships. The system had been in existence for hundreds of years in the Hanseatic League, and its principle was that transfer of ownership of a vessel was not allowed without the previous rights of ownership being investigated, according to data recorded in a central list.¹⁵⁹ This system fitted Torrens’s purpose, because the transfer of ownership of a vessel became effective only with its registration; and the ship, like a parcel of land, was an independent and clearly defined unit. The key to the system was the organisation of the framework for registering land according to unchanging units, independent and clearly defined by subdivision into parcels. These parcels of land were the basis for keeping land registry books in a central recording system, instead of the registration being conducted on a basis that was subject to change, such as deeds of sale or persons.

But, unlike a ship, the parcel of land was permanently fixed and could not be lost or destroyed—hence the legal concept of ‘immovable real estate’ that applied exclusively to land. These characteristics endowed real estate with the prospect that the documents relating to it could be exact and certain, and would cover more information than documents pertaining to any other type of property. Moreover, the parcel of land could be

identified by a specific number. It could be defined unequivocally within an administrative division of the area of the country, and could be located without the slightest element of doubt by a court of justice. However much it was subdivided, the sum total of the changes could never amount to more or less than the measured area of the parcel; and all these characteristics were permanent for all time.¹⁶⁰

The Torrens system thus entailed the creation of a book for the entry of rights in landed property, administered by the State and arranged according to identifying numbers of measured and permanent parcels of land. This book contained (a) the original title deed (*kushan*), a copy of which was remitted to the owner of the property, each such document being registered on a separate page in the book; and (b) statutory instruments (documents) that were an inseparable part of the land registry book and were given effect when entered in the book.

According to Torrens, the rights in land and interest in real estate thus depended on registration and not on documents. On the page of rights in the land registry book all the details relevant to the parcel were written down, such as rights of use, warning remarks, obligations, mortgages and liens, transactions and transfers; the statutory documents were attached to the page, for they were essential to it. The statutory instruments were those documents whose form had been determined in law or that were officially allowed for general use, or that the registrar of land agreed to accept in lieu of those determined by law.¹⁶¹

Some authorities have enumerated ten provisions that characterised the Torrens law's most essentially, among them the provision for attaching an official map as a statutory instrument that would be at the disposal of the owner of the property within the land registry book.¹⁶² In order for the map to be recognised as a legal document, it had to be measured and drawn up by a licensed surveyor, approved by the Survey Department, and deposited with the Registrar of Lands. The *kushan* must have in its margin a table showing the dimensions of the specific area, or refer to the map showing these dimensions.¹⁶³ The Registrar was entitled to request anyone wishing to carry out a land settlement or a land transaction to attach to his or her request a map certified by a licensed surveyor. In this way, preference was given to new survey data over formerly entered dimensions derived from old, hastily conducted administrative surveys, which previous experience in Australia had often shown to be inaccurate.¹⁶⁴ Dowson and Sheppard once remarked that mapping in itself was not the most important goal of the cadastral survey, and that the cadastral survey was not exclusively concerned with preparing maps. But all were agreed that it was impossible to forgo the use of maps for the division of lands, and it was unimaginable not to make use of this important and convenient instrument in meeting the needs of the cadastral survey. Thus, even if it were possible to prepare full documentation for registering the land without maps, the completeness of the documentation and its reliability would always remain in doubt; and no matter how incidental to the cadastral idea, there was no alternative to mapping.¹⁶⁵

The Torrens system of registration was thus instituted in Palestine at Dowson's behest, but the system was alert to the fine points and to the adaptation of the method to local conditions. In the course of time it became clear that the practice in the field did not always conform to the formula.¹⁶⁶ The law and its practical application in Palestine deviated in several areas from the mandatory procedures because of the special needs and

realities of the country, and for this reason proposals were mooted periodically for modifying the law and improving it.

What was necessary was not to look for a new system in Palestine and to re-examine the programme from the beginning, but to assimilate the preparations and experience of other countries—even in the spirit of the Ottoman Land Code, which had not yet passed into oblivion. It was of course necessary to convince those concerned that this was the preferred way, and that is what Dowson did from 1923 to 1928. Since the governors of colonies were empowered to administer the territories as felt best, no conflict arose between what was acceptable in Britain and what was decided for the colony. Thus, the Torrens system, which has not been instituted in Britain to this day, was found good and appropriate for Palestine in the 1920s.

Summary

In the years 1920–1927 the survey and land settlement frameworks in Palestine took their first, hesitant steps. This period was replete with trials and with much groping for the appropriate legal, technical, and cartographic means. The administrative tools that were created at the beginning of the period of civilian government were a tangible expression of the new government's serious desire to advance the implementation of the cadastral survey. But the lack of understanding and the inadequate professional and legal knowledge led to an unwieldy system and deficient implementation of what was to be the recipe for a modern real estate economy. From 1923, when Dowson for the first time accepted Samuel and Clayton's invitation and came to advise the Government of Palestine, five years passed until the reform was instituted. But ten years had gone by from the time the OETA authorities had decided to commence a process intended to base the land policy in Palestine on a modern legal foundation, as demanded by the Zionist leadership.

The enactment of the recommendations for reform in land settlement in 1926 was the important turning point in the land system in Palestine from the time it began to be addressed; it was a shift from research and criticism to practical action. It launched a period of four or five years of intensive legislation in property taxation, land settlement, and surveying procedures. All this bore the stamp of Ernest Dowson, who over a period of ten years was intimately involved in everything that was done in Palestine in these matters.

Dowson frequently returned in his prolific writings to his involvement in Palestine and emphasised the opportunities that had been missed by not beginning with energetic land reform on the first day of British rule of the country. From 1919 the British had struggled with a problem the solution of which was ready at hand in neighbouring Egypt; they did not have the wisdom to make use of it until ten valuable years of work had been lost.

After finishing his work in Palestine in 1930, Dowson returned to his home in Kent, and at Plumer's request summarised in writing the achievements of the cadastral reform.¹⁶⁷ Dowson entitled the reasons that forced the authorities to institute the reform 'principal evils'. There was in this summary nothing dealing with surveys, for these were not under scrutiny—even though over the years everyone concerned expected the cadastre to come about almost of itself through the surveys and the mapping. In his

remarks on the chapter on land in the report of the Royal Commission of 1938, Dowson repeated and summarised the failure in dealing with the question of land in an historical perspective. He thought that three main errors had been committed in Palestine. First, the Government of Palestine had refused to learn from the British experience in solving similar problems in Egypt, India, and Sudan. Second, the government should have immediately revised the Ottoman Land Code and not made the revision dependent upon the completion of the surveys. Third, the failure was organisational, for the relevant departments—Land Registry and Surveys—behaved as competing, conflicting bodies.

In the Colonial Office Dowson was recognised as the outstanding expert on land matters in Palestine, and so he was asked in 1938 to analyse the conclusions of the Royal Commission on Palestine (Peel Commission) as stated in the ninth chapter of its report in 1937.¹⁶⁸ Dowson discussed the obstacles detected by the commission in the administration of lands in Palestine and expanded the scope, as was his wont, with lengthy, detailed explanations and historical perspectives that shed light on everything that had occurred in Palestine from the time of the nineteenth-century Ottoman Land Code.¹⁶⁹

Dowson and Sheppard: postscript

Sir Ernest Dowson continued to work with great dynamism, and he was frequently consulted in the following years. Before leaving Palestine he contributed his experience to the establishing of a Survey Department in Transjordan.¹⁷⁰ Immediately thereafter, in 1929–1930, he conducted a similar investigation—which for some reason was never implemented—in Iraq.¹⁷¹ With the resignation of Sheppard from his work in Egypt, he and Dowson were invited by the Colonial Office to advise in the Crown Colonies. In 1934 they were asked to undertake a similar investigation in Zanzibar and Uganda. According to their proposals, for the first time in the British Empire all the cadastral maps in Zanzibar were prepared from aerial photographic mosaics.¹⁷²

Their professional counselling raised the question as to what extent it was possible to implement the methods of registration and settling the rights of landed property in every country and society according to the same criteria and by the same methods without regard to local differences in traditions, religion, land ownership, law, and regime. These questions challenged Dowson and Sheppard to put forward a plan for gathering all the possible information on the practices and the human experience in land administration on a world scale. Their proposal, which was based on their experience in Egypt and Palestine, was raised at the Conference of Empire Survey Officers in 1931 and was warmly received. The two collected and gathered thousands of documents throughout the world and exhibited their collection in the Science Museum in South Kensington, London. In 1934 they reported that of eighty-three active cadastral systems in the world, they had gathered cartographic documentation on forty-two of them, thirty-five in matters of land legislation and twenty-two systems of documents and forms. Palestine was one of the countries whose documents were fully represented in the collection.¹⁷³

The Colonial Land Tenure Advisory Panel¹⁷⁴ asked Dowson and Sheppard in 1946 to prepare a memorandum on the system of land registry for adoption in the colonies, on the strength of the experience gained throughout the world.¹⁷⁵ The memorandum was

prepared in two parts in 1947–1948, and together with additional publications later became the standard book on land registration that the two published in 1952 (with an important revision in 1956).¹⁷⁶ In this comparative study were examined the different systems and the ways of applying them in various countries of the world. Palestine, the cradle of Dowson's expertise, was mentioned only marginally in the work. Moreover, Dowson and Sheppard devoted a great part of their lives to land reform in countries where Ottoman land laws were in force, and it is surprising that this judicial system was neglected in their research and did not receive the analysis it deserved.

Dowson and Sheppard's project was much praised, but this rich collection was doomed to oblivion; no one wanted it. At the request of the Colonial Secretary, the Royal Geographical Society allocated them a special room for their work during the first years, and at the Conference of Empire Survey Officers in 1935 the collection received royal patronage and was moved to the London divisional office of the Ordnance Survey.¹⁷⁷ After the Second World War the Colonial Office again took it over.¹⁷⁸ Shortly before Dowson's death in 1950 the collection was transferred to the Royal Institute of Chartered Surveyors, and when Sheppard died in 1964 there was no one to continue caring for it, let alone developing it. The collection was required at Cambridge by a team engaged on a research study of the Department of Land Economy. In time, the various elements of the collection have been incorporated into the Directorate of Overseas Surveys at Tolworth, the Public Record Office as OD6/863, and the Ordnance Survey Book Library and the OS International Library. I examined the sad remains of this collection in 1983 in a mouldy basement in the Land Economics building at Cambridge University. From the little material on Palestine that has survived, I found that Dowson and Sheppard maintained some contact with Palestine, and once in a while additional material published by the Survey Department was sent to them.¹⁷⁹

6

The cadastral maps

Fiscal and registration plans

The reform in the systems of collecting property taxes and registration of land rights was based on the division of lands into permanent units within the administrative boundaries of the settlements. Therefore, the organisation for this work entailed the creation of fiscal blocks for tax valuation, and cadastral blocks for registration.

As has been mentioned, in 1925 Dowson had proposed to conduct the fiscal survey before the cadastral survey, because it was quicker and not complicated legally, as was the survey for registering land ownership.¹ The purpose of the fiscal survey was the assessment of property tax in the two separate realms of urban and rural real estate. Accordingly, the survey work entailed mapping in urban and rural areas, and its legal foundation derived from the special legislation enacted for each, which came into effect at different times. The urban survey, which preceded the rural one, began in 1927 and was backed within the year by the Urban Property Tax Ordinance, while the Rural Property Tax Ordinance was enacted only after the completion of the rural survey in 1935. The implementation of these two surveys and the application of the Property Tax ordinances were essentially dependent on the work of the Survey Department. Compared with the fiscal surveys, the cadastral survey and mapping were far more complex and lengthy. Five days after the draft Land Settlement Ordinance was published in Palestine on 26 January 1928,² Ley submitted his draft proposal 'General Survey with Land Settlement Procedures'.³ He advocated dividing the work into topocadastral and cadastral stages. The former was to prepare the topographic maps for the cadastral survey and land settlement, while the cadastral stage entailed the making, marking, measuring, mapping and revision of maps in consultation with the villagers and the Land Settlement Officers in the course of the settlement. These two phases comprised the following sub-phases:

A. Topocadastré:

- a 1:10,000—topocadastré;
- b 1:2,500—surveying areas of dense detail around villages;
- c 1:625—surveying in the built-up area of the village.

B. Cadastre:

- a preliminary to the settlement;
- b settlement.

Thus, the topocadastral stage entailed three sub-stages of surveying to different scales in the field. The plan stipulated that comprehensive, rapid mapping would commence on a scale of 1:10,000 in order to prepare the basis for planning the work. Afterwards a party

of surveyors would be sent to survey the surroundings of the village and of its built-up area. The 1:10,000 topocadastral maps had to be reduced to 1:20,000, and the plan for division of blocks demarcated on them, so that they would serve as key maps. This cartographic work was to be done in the office, and therefore was not part of the field survey.

Two sub-stages were planned for the cadastral stage: a preparatory one in which the survey parties were to go out to the field with the villagers with reference to the maps prepared in the topocadastral survey; claims and reservations would be heard and settled, and the markers moved, altered, and improved—to the satisfaction of all concerned. In the second sub-stage the work would be conducted according to the procedure laid down in the Land Settlement Ordinance. The settlement arrived at in the previous sub-stage would be concluded, the division into blocks of open country belonging to the village added on a scale of 1:2,500, and the preparation of the maps completed for their final publication together with the Schedule of Rights.

In the wake of this proposal, discussions were held during the following months regarding details of the survey, the demarcation of boundaries, and the numbering of the blocks. About a month after the publication of the Land Settlement Ordinance, on 10 July 1928, the representatives of the Survey and Land Settlement Departments convened in the camp of Settlement Crew no. 3 in Rehovoth in order to work out their position on points that had not yet been firmly decided and address details from which lessons could be learned. At the meeting it was decided that the registration block would be marked in the field at the time of the settlement rather than at the topocadastral stage; and that the registration blocks would overlap the fiscal blocks or would be fractions of them, unless there was an extraordinary reason for marking them otherwise. The decision to overlap the blocks proved to be highly effective in expediting the work.⁴

In July and August 1928 the Survey Department published technical instructions for conducting the surveys at the land settlement stage, and instructions for surveys in *mafruz* and *musha'* lands. In this way the technical frameworks for guiding the work of the surveying parties in the field gradually evolved.⁵ One of the important conclusions was arrived at in April 1931, when Ley decided to forgo mapping of the built-up village



Figure 6.1 Haifa, urban survey, 1927
(source: John H.Mankin photo
collection in the Palestine Exploration
Fund archives, London).

areas, in a departure from the original programme. He found that the usefulness of this complicated and painstakingly slow mapping work did not justify its cost.⁶

Town maps for real estate valuation

In 1927 the Survey Department was requested to map the towns and large settlements of Palestine for fiscal purposes, and to complete the work within a short time. The proposal for fiscal surveys in the towns was prepared by Dowson and sent to London on 30 June 1927.⁷ The change in the taxation system was prepared in accordance with an ordinance that became effective in 1928 and was amended later, in 1929 and 1932.⁸ The intention was to fix the tax rates on buildings and plots, and to this end it was necessary to gather a corpus of data based on location and identification of properties. Although the Survey Department mapped many large and small settlements throughout the country over the years, and added and revised maps for purposes of planning, rehabilitation, administration, and assessment of property values, it had no connection with the general cadastral survey since the urban areas were not included in the framework of the national land settlement. Now, with the change in the urban property tax laws, and in the expectation that in time the urban fiscal survey would be integrated in the national land settlement, the department was offered the opportunity to fix many additional triangulation points on tall buildings, to conduct internal town surveys, and to prepare the infrastructure for urban land settlement.⁹



Figure 6.2 Safad, 1929, scale 1:1,250 (reduction). Sheet 195–260 2.c of the Safad series is an example of the fiscal mapping of Palestine towns for assessment under the Urban Property Tax Ordinance 1927; the survey was conducted in 1929, the map was published in 1930 and updated in 1940 and 1944 (source: ML).

The Survey Department’s directors regarded the urban survey as a special, concentrated and difficult project, and in their annual reports dealt with it separately from the other survey projects carried out in 1927–1932.¹⁰

For the survey for the assessment of urban property taxes, the department had to map twenty towns and urban settlements in four years, usually to scales of 1:2,500 and 1:1,250. The department kept to this programme, its output being as follows:

1927–Hadera, Tulkarm, Herzliya, and revision of the 1:2,000 Jerusalem map;

1928–Haifa, Gaza, Beisan, Ramle;

1929–Nablus, Tiberias, Acre, Nazareth, Lydda;

1930–Safad, Jenin, Bethlehem, Beit Jalla, Beersheba, Ramalla, Jericho, Hebron.

Presumably, other towns and large settlements were not included in this list because up-to-date maps had been prepared for them earlier (Jerusalem, Jaffa, Tel Aviv), or because the surveys could be postponed for several years. The annual reports of the Survey Department after 1930 indicated that altogether forty towns and urban settlements were included in the mapping and the regular updating of the maps, according to the Urban Property Tax Ordinances of 1928–1935.

The work was conducted as follows: a special Assessment Commission earmarked the fiscal blocks, usually by city blocks; every such fiscal block was surveyed and mapped by the surveyors, and numbered and valued for tax purposes. The maps were edited, printed, and distributed by the Survey Department, and were issued in a series of sheets together with a clear and detailed key to the urban area maps.

In July 1939 a proposal was tested for adapting the urban fiscal blocks



Figure 6.3 Tiberias survey party, 17 February 1929 (source: J.H.Mankin photo collection in Palestine Exploration Fund archives, London).

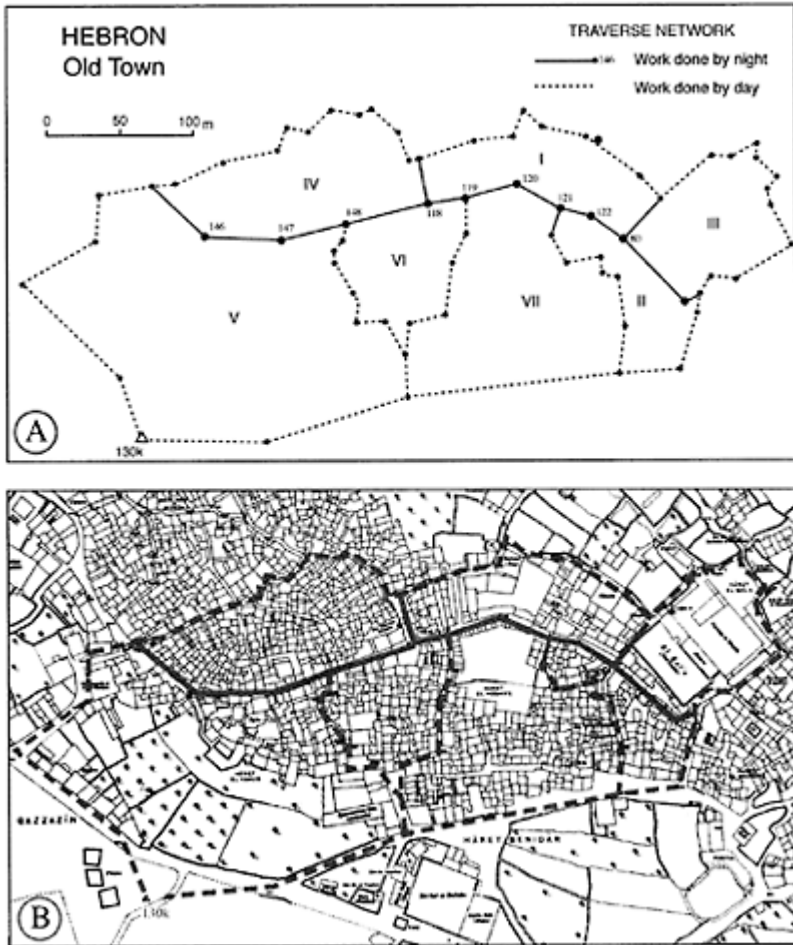


Figure 6.4 Hebron: survey of the Old City to a scale of 1:2,500, 1930 (reduction). A. points surveyed during the day and at night in preparation for mapping the town; B. surveying route on background of the city map (source: Map A, Mankin, ‘Not in the Book’, p. 252).

as registration blocks,¹¹ but only towards the end of the Mandate were urban properties about to be included in the land registry, in the same way as the settlement of property rights in the rural sector had been organised by means of the rural fiscal block structure.¹²

The urban survey and mapping work was very difficult for the surveyors, the draughtsmen, and the Survey Inspectors. It diverted most of their energies from surveys in open country to the smallest intricacies of alleys and mazes in some of the 'most ancient cities of the world', and they often had to draw on their sense of improvisation and inventiveness-not normally acceptable in the precision-conscious atmosphere of survey work.¹³ These towns could not be mapped by observing them from above, because the roofs of the houses hid the original narrow passageways; the Old City of Nablus and several blocks in Lower Haifa were deemed 'unsurveyable', and therefore only skeleton plans were drawn up for them.¹⁴ One of the fascinating urban survey stories was published in the memoirs of the British surveyor J.H.Mankin on his work in Hebron. There, the surveyors were unable to conduct their observations in the heart of the bustling town among multitudes of people, pack animals, and merchandise that blocked the narrow passages. They therefore chose to work at night until dawn, by torchlight and, fearing for their lives, under the protection of the local authorities, the police, and the District Officer.¹⁵ The two maps of Hebron depicted in Figure 6.4 show the part of the town where the survey was conducted. The lower map shows the hump-shaped town centre, and on it the survey lines that were measured during the day and at night. In the upper map these measuring lines are represented against the background of the division of the town into valuation blocks.



Figure 6.5 Hebron survey party, 1930
(source: J.H.Mankin photo collection
in Palestine Exploration Fund archives,
London).

The topocadastral map

The basic, preparatory survey upon which the cadastral division of the lands was built was conducted on a scale of 1:10,000.¹⁶ This was a key map for three applications: topographic, cadastral, and rural-fiscal; topographic—on smaller scales; cadastral—to larger scales; and rural—to the original scale of 1:10,000. (The considerations behind the decisions regarding choice of scale of the Survey Department were discussed at length in Chapter 4.)

The topocadastral map presented a combination of landscape features and the topography essential for orientation within the skeleton lines of the block boundaries for valuation and registration. The identifiable details of the landscape were required to make planning easier at the time of the surveying and demarcation of boundaries in unfenced areas, and where the limits of ownership were not marked. In the topocadastral map the built-up areas were indicated, as were the village boundaries, roads, the limits of cultivated plots, watercourses and drainage lines, plantations, and of course also all the triangulation and control points. In order to carry out the topocadastral survey an especially close net of about 3,000 special topocadastral triangulation points was measured, mainly in the mountainous regions.

The 1:10,000 topocadastral maps were reduced to a series of topocadastral maps on a scale of 1:20,000, so that through them a more compact picture of the area could be represented. The first, provisional series of 1:20,000-scale maps was to serve for planning the division of the area into fiscal blocks for valuation assessment. As the work of the Survey Department progressed, these maps became the first topographic series for Palestine.

The third cartographic application, which was founded on the topocadastral 1:10,000-scale field mapping, was the village maps. This was a series of fiscal maps, derived at the same scale from the field sheets, according to the administrative units of the villages in Palestine.

The work on the basic topocadastral mapping lasted from 1928 to November 1933. In 1928 and 1929 the surveyors completed the renewed mapping to a scale of 1:10,000 of the area that had been surveyed and mapped since 1923 to a scale of 1:2,500. At the same time, other parties worked elsewhere, such as in the coastal plain, the inner valleys, the region of the Qishon River (on a topocadastral scale of 1:2,500), and at the fringes of the mountainous regions. In 1928 the training of surveyors for measuring topographic heights was begun so that contour lines could also be added to the maps. Though the work continued throughout 1929, the output slowed down for several reasons. First, in May the staff of surveyors was reduced from ten to seven in order to bolster the land settlement parties. Second, the surveyors of the topocadastral were required to check the declarations of the villagers regarding the economic value of their parcels. Third, Walter Moffatt, one of the most senior surveyors, was transferred in April to the Transjordan Survey Department. Finally, in the autumn disturbances took place in Palestine that limited the surveyors' freedom of safe movement.

In 1930 the staff was brought up to its former strength, with three parties working in the Acre region and the northern coast, in the Valley of Jezreel, Mount Carmel. In that

year, special mapping in the region of Battir and Bir Zeit near Jerusalem was conducted as a test for land assessment. The area in which the topocadastral mapping had been completed amounted to 5,522,000 dunams—42 per cent of the entire area destined for land settlement. In 1931 the surveyors worked in the Jenin Sub-District, Nazareth, Tiberias, Ramle, and in the Huleh Valley. In 1932 the mapping of the mountains of Upper Galilee and the Sea of Galilee was completed; and in 1933, when the topocadastral project was finished, the surveyors worked in Samaria, Judaea, and the Jordan Valley. In the Bethlehem and Hebron Sub-Districts the area was surveyed to the limit of the inhabited, cultivated lands. In that year an area of about 4 million dunams was surveyed, so that altogether over 13 million dunams had been covered since 1928 in a topocadastral campaign that was the foundation for the planning of the net of formal blocks of the lands of Palestine.¹⁷

The village maps for assessing landed property

The fiscal and cadastral reforms were based on the division of the area into land units. Since village areas were too large for convenient treatment, it was necessary to split them up into manageable fixed blocks of land. There were, however, certain differences between the blocks intended for tax valuation and those for registry. The fiscal blocks could be extensive so long as they were of fairly equal value for tax purposes; the registration blocks, on the other hand, had to be of a standard size more suitable for registry of property rights. If there was no clear, visible boundary between the holdings, the division of lands into blocks was a complicated, involved procedure. Without clear delimitations, there was no basis for dividing the land into blocks and demarcating these, particularly for lands that were held temporarily and worked by periodic allocations, since the way they were allocated changed from time to time. In order to prepare the work programme, the planners had to take into consideration the typical territorial deployment of the Palestinian village, for the village was an accepted administrative unit that had to be preserved.

In the village there was clear differentiation between the built-up nucleus and the agricultural periphery. Near the immediate block of buildings stretched a dense, narrow belt of fenced gardens and orchards (*hawaqir*). Beyond these extended an irregular belt of lands in various stages of cultivation and development, of which part, or most, had clear limits of ownership and were held by individual persons. From this belt to the end of the village lands were open areas of communally owned land that were cultivated by the leading villagers (*hamulas*), who left their mark on the area. These included holdings that were subdivided, permanent, fenced, and held permanently by individuals—the *mafruz* lands; and holdings that were subject to periodic division among the villagers, and so were held temporarily and were liable to change their form at every new division—the *musha'* lands, which made the survey, mapping, and land settlement work especially difficult.

In the first stage of the division of lands the registration blocks were, as we have seen, based on fiscal criteria. The skeletal structure of the fiscal blocks was delineated at the time of the topocadastral mapping from which were derived the 1:10,000—scale fiscal village maps. The village map included the landscape features that were marked on the

topocadastral maps, and added data on the type of holding, whether individual ownership (*mafruz*) or communal (*musha'*). The fiscal village map was obtained when the area of every village was reproduced separately from the topocadastral field croquis to the original scale. The map was passed on to the Land Commissioner, together with a list of data on the value of the land according to the villagers, by categories of land and the crops that could be grown on it. The Commissioner's land-tax assessors came and checked the situation in the field, supplemented or reassessed units of land, and fixed the structure of the fiscal blocks; that is, blocks of equivalent economic value in the area of the village. The block boundaries were measured and delimited, and after they had been entered on the map, the overall areas and the cultivable parts were computed. In this way was created another large series of maps, known as 'village maps', or the series of village maps for fiscal assessment to a scale of 1:10,000.

The system of mapping in the field to a scale of 1:10,000 replaced the old system by which the maps were surveyed in the field directly to a large scale of 1:2,500 that was needed for assessment or registration. Mapping in the field to such a large scale had slowed the work and upset all the schedules for the completion of the cadastral survey within a foreseeable period. The replacement of the system brought immediate results: by November 1934 the Survey Department had completed the mapping of all the area (13,555,667 dunams) included in the rural property tax project—in effect, all of Palestine north of Beersheba; and the Government of Palestine had prepared the ground for collecting property tax in a systematic way according to clear, legally defined criteria.

When the foundation work for the mapping was completed, the government published, in December 1934, its draft Rural Property Tax Ordinance, which was gazetted on 1 April 1935.¹⁸ The ordinance determined the system of work by law: field surveys, preparation of croquis, valuation of the lands and their division into fiscal blocks, calculation of the areas, and preparation of a schedule of land categories lands by block and agricultural crops. In the appendix to the ordinance was a list of sixteen categories by which lands could be classified for property tax purposes, and the amounts of tax per dunam in each category. These tax rates were indicated in the body of the map.

The sixteen Sub—Districts of the country covered by the ordinance numbered 963 villages, or 1,211 units (including detached lands that were not contiguous to the mother villages) divided into 9,198 uniform tax blocks. The blocks were numbered in each village by a serial number beginning with 1; they were indicated on the maps in roman numerals; and for every block assessment, registers were opened in English, with Arabic and Hebrew translations. The register and the map together were the basis for the assessment, appeals, and juridical processes.

The village maps project, which was a by-product of the series of topocadastral maps of Palestine, and the series of town maps that were prepared at that same time complemented each other. On the basis of these two series, the series of large-scale block maps for registration purposes, as stipulated in the Land Settlement Ordinance 1928, was constructed in the following cartographic phase.¹⁹

The cadastral map

Along with the mapping for property taxation, the cadastral system was organised for marking, surveying, and mapping of the lands for registration in the Land Registry books. As we have seen, the work for the cadastral survey had in effect begun earlier with the establishment of the national major triangulation net, and with the preparation of the fiscal maps that created the basis for division of the lands and the land settlement. From this stage began a long process in which the map passed repeatedly between the field and the office until the completion of the survey, the inspection, the revisions, and the preparation of the Schedule of Rights.

The cadastral survey aimed at dividing the village lands into blocks and parcels. For registry in the books, a 'plan' was required; the plan was a map that did not represent landscape or topographic details, but only the skeleton of block boundaries, boundaries of parcels, and triangulation points, as required for registry.²⁰ From 1931 the work was organised and formalised; it encompassed all the area of Palestine that was to be subjected to the land settlement—exclusive of the sparsely inhabited desert regions.

The planning of the block grid was done within the municipal and administrative units. Every village in Palestine was divided into blocks of convenient size and shape, generally 600 dunams in area, that could be drawn to a scale of 1:2,500 on a standard field sheet of 70×60 centimetres. The average size of a parcel was around 15 dunams. Every map or plan had to bear at the top the name of the map, the registration block number, the area, and the schedule of areas, in English and at least one of the two

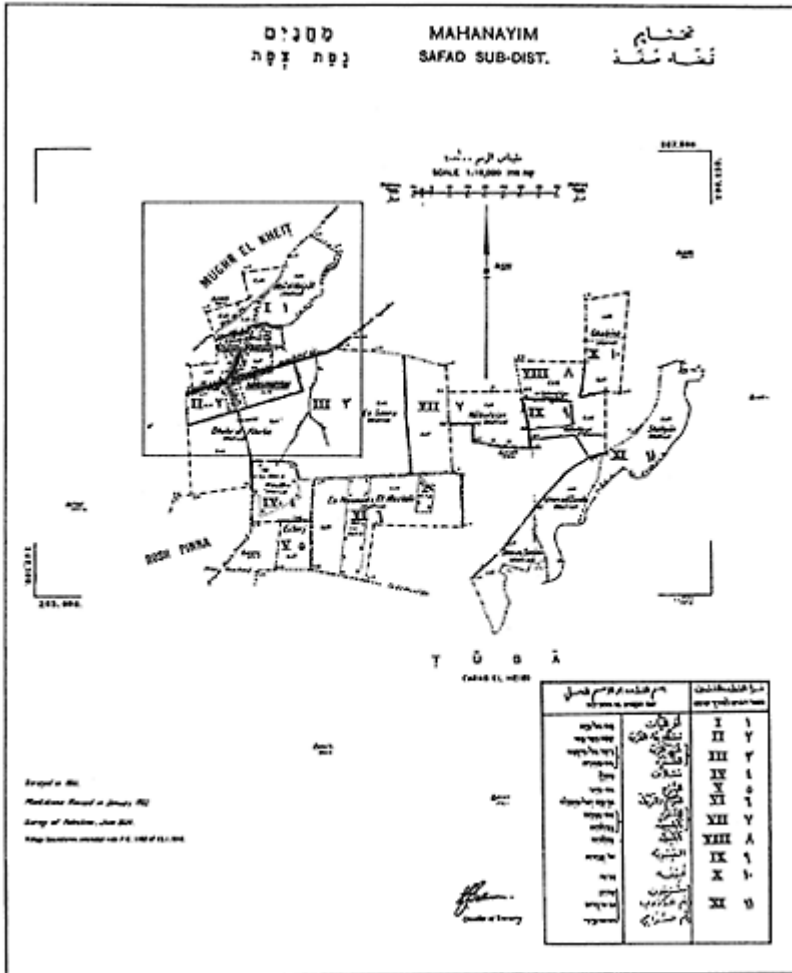


Figure 6.6 Mahanayim: fiscal village map, scale 1:10,000 (reduction), 1932. The fiscal blocks are marked with roman numerals; the land in Blocks I and III are privately owned (*mafruz*), and Block II is the built-up area of the Jewish village of Mahanayim. The cultivated lands in the three blocks are marked 'Cult', and north of the Mahanayim built-up area are entered the economic values of crops for tax

purposes; for example, the full tax (100%) is to be levied if grapevines (V.) or olives (Ol.) are grown in these parcels (source: ML).

other official languages: Hebrew or Arabic. Each map had to show triangulation points and control points that were required for independent, exact mapping within the limits of each block. Every map had to show north and the corners of a grid rectangle for control of sheet distortion. In order to prepare the Schedule of Rights, a special name-list of private Arab and Jewish names was issued to help their correct rendering on the maps in English and Arabic and in English and Hebrew.²¹ The scales of the registration plans were multiples of 1:10,000, depending on the character of the area and the density of details—1:2,500, 1:1,250, 1:625—within the standard draughting sheet.

On the basis of the conclusions drawn earlier from the survey of fiscal blocks, it was decided to change the system of block numbering, which had caused technical and administrative difficulties. The fiscal blocks, which were originally numbered in every village consecutively from 1, made it necessary to identify the block by the name of the village and its number. But this method turned out to be misleading, since in Palestine there were several villages of the same name, and consequently some block maps were entitled with names of entirely different villages having the same name and block numbers. In the fiscal survey the problem had been partially solved by adding the name of the Sub—District to the top of the sheet, next to the name of the village. Another difficulty arose when it became necessary to change the boundaries of the village and transfer one or more blocks to the limits of a neighbouring village, which confused the block numbering system. Therefore a single list of numbers for all the blocks in the country was adopted. Every sub-district was allocated a group of reserved numbers for the eventuality that village blocks would again be split up in the future, or new blocks added that had not before been included in the settlement, as within the built-up area of the village.²² Internal subdivisions were consecutively numbered within each block, from 1. The number of parcels in a village block was not to exceed 100, although in a built-up urban block the number could be greater. This method of numbering made it possible to locate every parcel in the field and in the map, throughout the country, by block and parcel numbers only. The system by which the land was split into parcels was described in detail in a pamphlet by Ley published by the Survey Department in 1931, and in a paper by Ley read in his absence before the Conference of Empire Survey Officers in that year. The emphasis was of course on the problem of the subdivision of non-divided lands, mainly *musha'* land.²³

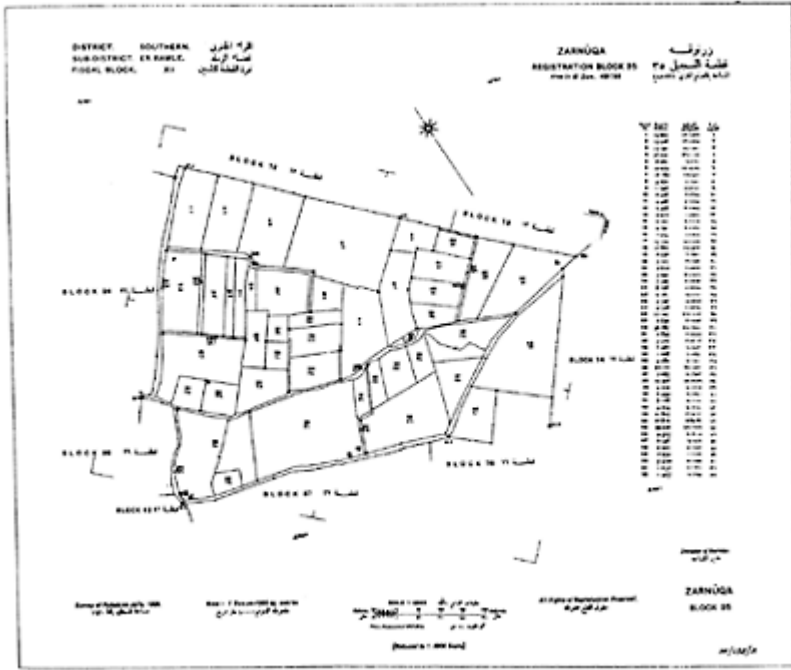


Figure 6.7 Zarnuga: block map to a scale 1:2,500 (reduction), 1929. Fiscal Block No. XII has become Registration Block no. 35 and was divided into fifty-two parcels (source: Ley, *Structure and Procedure*, illustration 1).

The survey and land settlement systems, 1928–1948

A discordant two-pronged effort

The cadastral reform in Palestine coincided with a stormy and difficult period in the relations between the Arab and Jewish populations, as a result of which British policy towards the Zionist idea changed. Lord Plumer, who instilled a sense of quiet and stability in the country, concluded his period in office, and in the autumn of 1928 John Chancellor was appointed High Commissioner. At that time the tension between Jews and Arabs turned into open, violent conflict on religious, demographic, and economic grounds, which set in motion a chain of events: the Western Wall incident in 1928; the bloody disturbances of 1929 and the (Walter) Shaw Commission sent to inquire into the causes in September of that year; the mission of inquiry headed by John Hope-Simpson in May 1930; the White Paper of the Ramsay MacDonald Government in October 1930 that attacked the principles of Zionism and was an outright departure from some of the main Articles of the Mandate; the resignation of Chaim Weizmann from the presidency of the Zionist Executive and from the Jewish Agency, which had been established one year previously with British support; the reversal of MacDonald's policy in a parliamentary message to Weizmann in February 1931; the establishment of a special Government Development Department according to Hope-Simpson's recommendations, headed by Lewis French, in order to advance development programmes mainly in the Arab sector; and the appointment of Sir Arthur Wauchope as the new High Commissioner for Palestine in October 1931.

In the midst of these turbulent events the cadastral project started on its way. Several phases can be distinguished in its progress from then until the end of the Mandate. Internal problems plagued the relations and the extent of cooperation between the departments charged with the implementation of the land settlement. They affected developments in the structure of the system, changes in its personnel, and the improvement and rationalisation of the work. External factors unconnected with the system—the political unrest in the country, the Arab revolt that began in 1936, and the Second World War—influenced the working atmosphere and the output. As a result, three characteristics can be singled out in the survey system in the period following the reform: the impetus of the work entailed a struggle between the professional capabilities of the staff and administrative obstruction; the main partners—the Survey and the Land Settlement Departments—were unable to overcome their mutual antagonism and to cooperate fully; and the Survey Department turned to new cartographic channels.

While the enactment of the reform was being awaited, friction between Land Registration and Surveys, and between private surveyors and the Surveys Directorate, continued. And then, the Land Settlement Officers and the surveyors began to work

together in accordance with the newly introduced procedures.¹ However, with the beginning of the work the differences between the Survey and the Land Settlement Departments came to the fore, expressed in terms of their respective responsibilities and spatial deployment. The survey workers were spread over the whole country and were still occupied with setting up the triangulation network, surveying and topocadastral mapping, fiscal mapping in the towns and the open countryside, and cadastral mapping for the land settlement. As opposed to this, the spatial organisation of the Land Settlement teams was more concentrated, since the declared policy of the cadastral project was for the lands settlement to be implemented initially in the plains of the country. In the first stage of the work, the teams worked throughout three settlement areas in the central parts of the country: in Jaffa, Ramle, and Gaza. Three working parties were detailed to Jaffa and Gaza, and four to the Ramle region.² The cadastral survey was conducted energetically from the beginning, with the surveyors learning from the problems that arose in the course of the work. In May 1929 the Survey Department transferred workers from the triangulation and topocadastral surveys to increase its survey parties from three cadastral parties with ten surveyors to six parties with twenty-five surveyors. The topocadastral surveys were conducted at the time in the Gaza and Tulkarm Sub-Districts and in the Valley of Jezreel in order to set up the net of fiscal blocks according to the new requirements. The survey in the Gaza region was intended in effect to revamp the work that had already been done there since 1923 in an area of 358,190 dunams out of 2 million dunams that had been surveyed in the Southern District. In the spring of 1929 the new method was applied successfully also in the Ghor el-Fari'a, one of the remaining areas of the Ghor-Mudawara lands, and within three months 18,014 dunams in marked blocks was given over to the Beisan Lands Settlement Commission. Also in the coastal region, the surveyors revised the maps of seven Arab villages and seven Jewish *moshavot*, some of which had only been mapped in 1928 by the new method.³ In 1930 the surveyors devoted much time to the survey of *mafruz* and *musha'* village lands, and prepared the preliminary maps and the claims schedule for the lands that had been announced as due for settlement, and for the built-up areas of small villages even though it was not certain that the settlement would also apply to them. In the meantime, the land settlement teams gathered experience and found ways to accelerate the work. In cases where the villagers claimed rights that were not subject to controversy, the parcels were immediately registered in their names without the rights being checked, and the Survey Department was asked to hasten and prepare the final maps sooner than planned.

At the same time, the difficulty of dividing and allocating *musha'* lands had become apparent. Typically, parcels of extensive blocks were divided lengthwise into strips of land less than 10 metres wide and over 500 metres long without access between them.⁴ In other cases it was found that the villagers obstructed the settlement by raising many false claims, including frivolous ones, and the survey parties had to mark these claims, measure, draught and inspect them, only to reject them, and much effort was invested to no purpose in measuring the smallest non-essential details, and in the repeated restoration of boundary markers.⁵ In accordance with the agreed working procedure, the surveyors went into an area declared for settlement several weeks before the Land Settlement Officers. They marked out all the landscape features, including roads and the railway, and permanent and temporary dirt tracks in the villages and between them. But because of the

time that elapsed between the marking and the appearance of the Settlement Officers, the villagers were requested in the meantime to improve existing tracks or to pave new ones under the Village Roads and Works Ordinance 1927. This government Act, positive though it was, sometimes wrought havoc with the infrastructure of the land settlement survey. After a time, the Land Commissioner published an order to regulate the way the work was to be coordinated, so as to prevent mutual hindrance by government bodies, and even ordered the surveyors to indicate the village tracks as they would be in the future, at the time of the actual settlement, if indeed such changes were anticipated.⁶ In its office work too, the Survey Department came up against unexpected difficulties, such as in the Computations Section, which seems to have borne the main brunt of dividing the *musha* lands by graphic means.⁷

These examples illustrate how far the planners of the work were from foreseeing the difficulties, but they also show the ways of coping with the problems—the experience gained, the corrections made, and the conclusions drawn regarding the continuation of the work. One of these was Ley's decision, mentioned earlier, to restrict the cadastral survey to the open agricultural areas and pass over the built-up, clustered areas of the villages.⁸ From the data that he presented at the discussion on 8 April 1931, based on the experience in nine villages, one surveyor could complete the survey of almost 1 dunam in a working day in built-up area at a cost of 1,516 mils, whereas in open agricultural country, in each of the categories of land and according to the calculations he made during four months, an average of 40 dunams could be completed by the same man at a cost of only 1,440 mils. Consequently, the investment in time and money of surveying built-up areas was forty times as great as in agricultural areas. And if the proportion of built-up areas was only 1:150 of the agricultural areas of a village, the survey of the built-up area cost up to 21 per cent of the total expenditure for the land settlement in villages in the flat parts of the country. This proportion could well be higher in the mountainous regions, where there were many villages, and each with a smaller agricultural area than in the plains villages. Also, in the preparation and draughting of the maps in the office, according to the figures for 1930, the built-up areas in the villages took up 21.8 per cent of the draughting time and 13.7 per cent of the time of the Computations Section.

These findings led Ley to calculate the cost of the land settlement survey of the remaining built-up rural area from 1931 to 1942—altogether P£94,087. Considering what the surveyors could expect in mountainous regions, this was a minimal estimate, and probably much too low. The survey in built-up areas was already a heavy burden upon the Survey Department, one without precedent in similar previous land settlement projects, and there was no relation between it and the good that would come of it if it were to remain in the work programme.

As the work progressed, it became increasingly clear to the surveyors and the Settlement Officers that the procedure laid down for the land settlement was in effect an obstacle to improving and moving the work forward. The process was found to be unwieldy, with too many intermediate stages that slowed the pace of work and caused confrontations among the working crews. The synchronous progress of surveyors and Settlement Officers also became disjointed. While the surveyors worked on almost without respite, the Land Settlement Officers were impeded by every marginal and petty claim. And the pace of office work also lagged behind and could not keep up with the work in the field. Mapping and land settlement were uncoordinated. Hundreds of block

plans accumulated in the Survey Department while they awaited the Settlement Officers, who were up to their necks in endless sterile discussions that were never resolved. All that time, transfers of land went on in those areas that had been surveyed but not yet settled, and the maps became obsolete even before they were published. Thus, the gap between the survey and the settlement grew from year to year, along with a feeling of helplessness and frustration among some of the staff, and dampened the readiness of the inhabitants to cooperate in the settlement work.⁹ But one must keep a sense of proportion. The plethora of problems challenged the creative capabilities of the Survey and Land Settlement Directors and led to useful initiatives.

Changes of guard in the first decade

In January 1931 the Colonial Office dispatched a commission to examine the organisational structure of the government system in Palestine. The members of the Commission were S.O'Donnell and H.Brittain of the Exchequer. Towards the arrival of the commission, the directors of the government departments were requested to prepare reports on the structure and functions of their departments.¹⁰ On 24 January, Abramson, the Commissioner of Lands, submitted his report, together with an appendix that dealt with the relations between his office and the Departments of Lands and of Surveys.¹¹ It was a clear and explicit description of the system that was to supervise the implementation of the cadastral reform, and in the light of this document, on 16 January, the O'Donnell Commission investigated the work of the Land Commission itself.¹² After it published its conclusions, Abramson responded, in September 1931, to section 48 in the commission's report, which recommended reducing the staff on completion of the rural fiscal survey, and after the end of the assessment of properties in the urban fiscal survey. The Commissioner was opposed to reducing the staff, but suggested that the proposal be re-examined if the government was determined to amalgamate the Land Department with the Land Commission and to include a Survey Unit, the Registrar of Lands, Land Settlement, Taxation, and general land matters in the unified department, as attributed by Abramson to Plumer in 1927–1928.¹³ It is strange that in the report Abramson had submitted to the commission nine months previously there was no hint of such a need or of any intention of amalgamating the departments.

What caused this turnabout and the change in the Commissioner's approach? The answer is that Ley, whose stubborn persistence had succeeded in maintaining the independence of the Survey Department, left Palestine in August 1931. After eleven years of pioneering work he had to stop because of ill health. This removed the obstacle in Abramson's way. When Ley formally resigned in April 1932, Abramson reminded the Chief Secretary of the Government of Palestine that his appointment as Land Commissioner in 1927 had been intended to remedy the existing split between the bodies that dealt with land matters. He claimed that Plumer, the Chief Secretary, S.Symes, and his predecessor in the Commission, Dowson, had promised him orally that at the first opportunity all these departments would be united under him. Now the opportune time had come, without injuring Major Ley and with no obligation to Robert Crusher, Ley's stand-in, whom he was prepared to appoint head of a technical section for survey matters

in the amalgamated department that was to be set up.¹⁴ Ten years before, Ley had argued for the independence of the department, with the contention that the surveying of a triangulation net was highly professional work that had nothing to do with land matters. Now Abramson used Ley's historic argument by pointing out that the triangulation net was nearly completed, and the Survey Department was involved almost entirely in the cadastre. Hence, there was good reason to improve the coordination between the departments working on the cadastre and to rationalise the work of the staff (as demanded by the O'Donnell Commission) by instituting the administrative changes that had been considered in the past.¹⁵ Behind the return to the subject of the amalgamation of the bodies dealing with land were good reasons for improving and rationalising the system, although it also attests to Abramson regarding the work of the Survey Department through the narrow slot of the cadastre. In this respect it is doubtful that Dowson ever led Abramson to believe that with the completion of the triangulation work the Survey Department should become a cadastral unit subordinate to other departments. Dowson indeed strove for coordination and close cooperation, but had been the chief proponent of an independent Survey Department of broad horizons that would not restrict itself to the cadastral work and would enrich the country with extensive, diversified cartographic output.

In effect, the opposite happened. Instead of the number of departments being reduced, an additional government department was created that also evinced considerable interest in land settlement. This was the Development Department under Lewis French, which purported to soothe the ire of the Palestine Arabs in the wake of the Hope-Simpson Report. French, who had only recently arrived on the scene, closely followed the progress of the cadastral project and took an active part in it—perhaps too much so. He visited the villages with the surveyors and the Land Settlement Officers, and reported in detail on what he saw to the High Commissioner and to London.¹⁶ In his report French related to the land question as though he had authority to intervene in the work of departments that were not subordinate to him. He voiced his views on the question of accelerating the surveys in the villages, the division of *musha*' lands, setting up a Land Administration Agency, and the control over land transfers and the use of water in areas earmarked for development by the government.¹⁷ The new High Commissioner, Arthur Wauchope, did not accommodate Abramson and did not heed French, and in June 1932 he asked London for permission to seek a suitable candidate.¹⁸ This step was supported in London by C. Bottomley, Assistant Under-Secretary at the Colonial Office, who announced that in the large colonies of the Empire the accepted practice was to absolutely separate survey from land matters: 'and that combination, especially under a Commissioner of Lands who is not a surveyor, leads to starvation of all but cadastral work'.¹⁹ The Colonial Secretary, P. Cunliffe-Lister, replied in July to Wauchope that he agreed with his views about not changing the existing situation and confirmed that steps were being taken for finding a replacement for Ley. But, the Secretary added, the candidate would have to know beforehand that should Abramson's proposal be accepted in the future, the Survey Department would cease to exist as an independent body.²⁰

In the absence of further information we may assume that Wauchope did not accede to Abramson's wishes and welcomed the advice and directives from London because he already knew the identity and had heard of the qualifications of the man intended for the

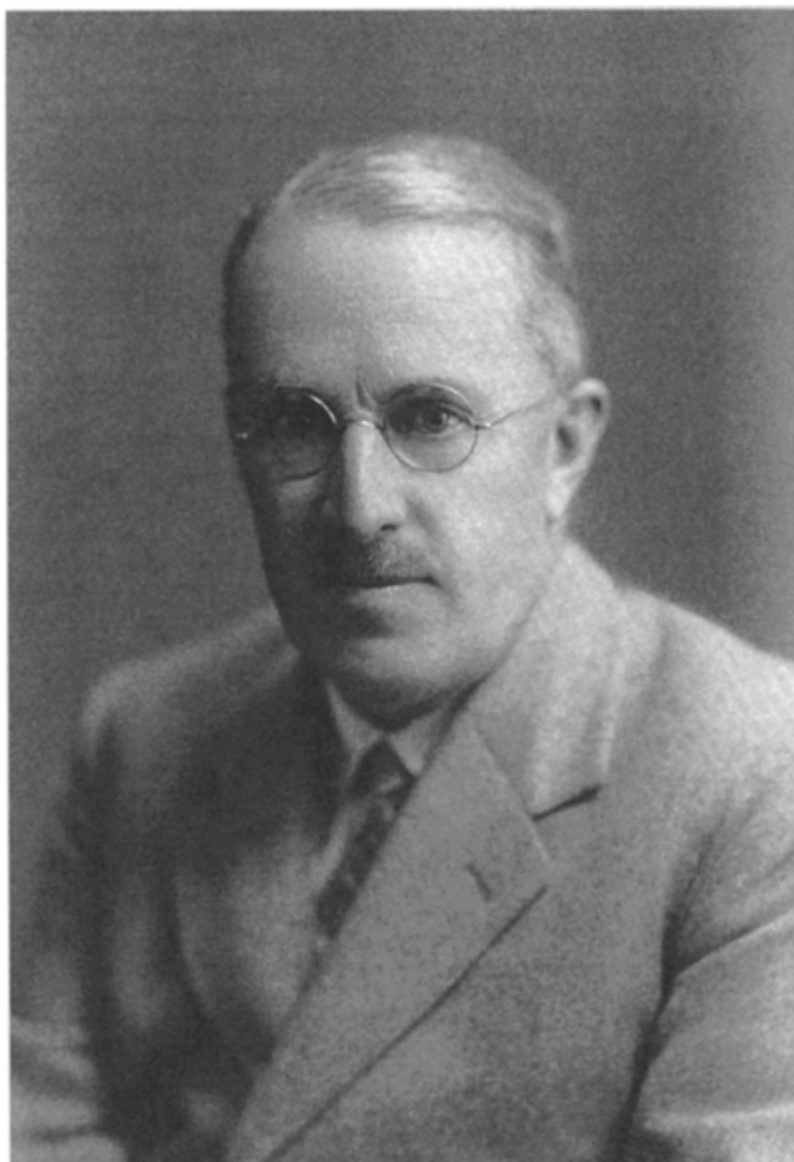


Figure 7.1 Major C.H.Ley, Director of the Survey of Palestine, 1932 (source: SoI photo archives).



Figure 7.2 Frederick J. Salmon, second Director of the Survey of Palestine, 1938 (source: SoI photo archives).

job in Palestine. This was Colonel Frederick John Salmon, head of the Cyprus Survey Department, who at that time was awaiting reassignment. On 21 October 1932 the Colonial Office confirmed the appointment of Salmon as Director of the Palestine Survey

Department. In the same document Salmon was told that in the matter of surveys he was to have full administrative authority, but regarding the cadastral reform he would be subordinate to the Land Commissioner.²¹ The announcement of the appointment was relayed to the Governments of Cyprus and Palestine, and the official appointment was confirmed on 9 November 1932. Salmon assumed his post on 27 March 1933, in the new home of the Survey of Palestine, which had in the meantime moved from Jaffa to Sarona (today in Tel Aviv).²²

Salmon arrived in Palestine after many years of intensive work in the busy Survey Department of Ceylon, and two years of relatively relaxed work with a handful of surveyors in Cyprus. In Palestine Salmon found a bustling organisation of 180 workers, intensely engaged in country-wide survey projects and in the midst of a land reform whose implementation was dependent on surveys and mapping. The advent of Salmon injected new spirit into the system, whose senior directors (Abramson, Ley, Stubbs) and others already showed signs of wear and could no longer come up with new ideas after so many years of common work—perhaps too many years. Salmon was also the harbinger of a new period in the mapping of Palestine and the initiator of a different kind of cartography, of topographic mapping for its own sake, and of thematic mapping. He was a firm believer in topographic mapping and gave it all his energies. Free from Ley's limiting cadastral concept, Salmon immediately grasped the full cartographic possibilities, which had never found expression in this country of varied landscapes and rich historic past, and the object of intense interest throughout the world.

Wauchope well understood what was happening in the cadastral reform. Ley was leaving, and in the Chief Secretariat there was already talk of Abramson's forthcoming resignation. The cadastral work plodded along, and the gamut of difficult problems wore down the senior staff. The coming of Salmon with his wealth of experience—as had Dowson's appearance ten years before—infused new blood into the system and could bring about much-needed change. At Salmon's urging, Wauchope overturned the whole system of considerations and changed his approach to the organisational structure of the cadastral system. Salmon's personality—his professional faculties and his rich surveying experience in land survey, land settlement, and the administration of state domain land—brought Wauchope to consider the amalgamation of the government bodies along lines different from those that had been pursued during past years. At the beginning of 1934 he discovered that in the past there had been no point in uniting all the relevant departments, because the intention had been to place at their head a man who was not expert in surveying. But now, thanks to Salmon, this could be achieved by placing the Director of Surveys himself at the head of the system. And indeed, in the winter of 1934, during the visit of the Colonial Secretary, Cunliffe-Lister, to Cairo, Wauchope discussed this possibility with him. The idea was quite simple: a composite department would be set up under the name Department of Lands and Surveys, and headed by Salmon. The new department would comprise three sections: Surveys, Land Settlement, and Land Registration. The two latter sections were to be headed by Stubbs, the Director of the Lands Department.²³

Among his reasons for amalgamating the departments, Wauchope expressed his hope that by virtue of Salmon's attributes the framework could be simplified and the work made more efficient. He proposed that the new structure take effect on 28 February 1935—the date of Abramson's resignation. By this proposal Wauchope achieved two

things: the departments would finally be amalgamated, and instead of there being three personages ‘with prerogatives’, a new figure from the outside, who owed nothing to the previous directors, would be at its head. In any case, there was a clear advantage in this change, for of Abramson, Ley and Stubbs, only the last would remain in the system; but he was not a candidate to direct it, for he was not a surveyor, and so did not meet Wauchope’s criteria. But Stubbs, although losing his independence as the director of a government department, gained a minor compensation: the appointment as Acting Director in Salmon’s absence, with the official title of Director of Land Registration.²⁴ On 5 June 1934 the reorganisation was confirmed in London,²⁵ but in July Wauchope asked for a change in the name of this function. In order to avoid confusion of the different administrative titles, but in effect to create a hierarchy, he proposed that the head of the new department be titled Commissioner of Land and Surveys, and Stubbs could be Director of Land Registration.²⁶ In this way Salmon would inherit the ‘Commission’ with the departure of Abramson in 1935.

Curbing the impetus of the survey

In the two months before Abramson’s resignation, the Survey Department under Salmon’s direction significantly intensified its output. The department continued its geodetic, topocadastral, cadastral, and urban surveying; it revised the existing block maps, checked and approved plans of private surveyors; and printed and published various types of maps. The outstanding achievement was in the output of the cadastral surveys for registration purposes: 424,600 dunams were surveyed in 1933, and 628,524 dunams in 1934; these were record figures that the department was never to reach again. At the same time, additional projects were launched, such as surveys and studies for the Development Department in the Beisan region, the survey of water sources of Palestine, and the precise levelling. At Salmon’s initiative, new directions were taken in the topographic and thematic cartography fields. The department began to work on a 1:100,000-scale topographic series on the basis of field surveys of 1:50,000. But Salmon’s professional pride was the 1:500,000-scale motor map of Palestine published in two English editions in 1933, with two further editions in 1934, and one Arabic and two Hebrew editions.²⁷ In 1933–1934, 1:750,000-scale maps of Palestine and Transjordan were published, as were a map of the port of Haifa, a 1:250,000-scale communications map of Palestine from data supplied by the Royal Air Force, maps for the annual reports of the Education Department, the Health Department, the Palestine Police, and many varied maps for Transjordan.²⁸

In contrast to the dynamism of the Survey Department, it became clear beyond all doubt in 1934 that land settlement had reached an impasse. The Settlement Officers felt this directly in the field, and the figures for the annual output bear this out quantitatively: if in 1933, 334,139 dunams had been settled, in 1934 only 283,464 dunams were processed—15 per cent less. In 1934 a Land Settlement Officer, Isaac Camp, alerted the Land Commissioner to the situation in the north, pleading for help:

I am overwhelmed with the work of Land Settlement and as the prospects for the future are for even more work, I have considered it advisable to

inform you of the position as it is at present and as it is likely to become in the near future.

After this came a harsh report on the happenings in each sub-district. The most severe situation was in Tulkarm, where there was no limit to the complicated and confused claims that paralysed the work of the settlement teams; and Camp himself, as a Settlement Officer, could no longer issue instructions for intermediate steps that would advance the investigations. In all the regions the men had reached the end of their endurance and goodwill, and the work could not be speeded up.²⁹

On 29 December 1934 Abramson convened a special meeting to discuss the situation.³⁰ Salmon and Crusher for the Department of Surveys, Isaac Camp and Cecil Pusey, the District Settlement Officers, Maurice Bennett,³¹ and Abramson of the commission attended the meeting. Abramson formulated the problem and identified the weak point as the growing gap between the pace of work in the field and that in the office. He did not say that the Settlement Officers could not keep up with the preliminary surveys, but that too many preliminary investigations had been completed in the field without its being possible to bring them to the final stage of registry, since the Survey Department workers did not have time to prepare the required Schedule of Rights. Consequently, the stream of work from the field clogged all the channels of office work, and the people there could not cope with the load and the pace. Therefore, Abramson proposed a temporary slowing of the field surveys and that assistance be directed to the critical stages of the work until the gap between the two would be reduced. He suggested assigning workers from the field to help the overloaded units in the head office, mainly in the final check of the work, and to help the Settlement Officers by allocating additional manpower to settling claims and disputes of smaller value by persuading the claimants to arrive at acceptable agreements.

Abramson's proposal for curbing the work in the field affected mainly the surveyors working in the framework of the land settlement, whose output depended not on the complexities of the settlement and the processing of the data in the office, but on their ability to mark and quickly prepare the preliminary plans. Pusey backed Abramson's analysis with figures: until the end of 1934 the fieldwork for 703 registry blocks had been completed, for which it had not yet been possible to publish the Schedule of Rights. Salmon did not oppose a temporary slowing of the survey work. He even regarded this as a certain advantage that would enable the surveyors to work under less pressure and devote more attention to accuracy; the office sections would be able to close the gaps in dividing the areas, in carrying out the computations, and preparing the final maps; and other men in the Survey Department would be freed for mapping work that had been neglected because of the cadastre.

The discussions resulted in the decision that the work would be completed in those villages where it had already reached the stage of the settlement, but the Survey Department would not begin the survey of lands in additional villages until the progress of the entire land settlement had been reviewed. Five men were allocated to the settling of disputes by 'understanding and good will', and six others were assigned to the office. A work programme for the coming months was drawn up, with the resolve to re-examine the situation after six months. Abramson achieved something unprecedented: in the past, no authoritative figure had ever been able to impose his will on the Survey Department.

But when a surveyor was about to head the entire system, things began to change, for in two months Salmon was to replace Abramson and put a brake on the impetus of the cadastral survey.

On 1 March 1935 Salmon was appointed Commissioner of Lands and Surveys. Abramson was temporarily appointed Rural Property Tax Commissioner until his departure on leave on 1 August and his final resignation on 14 November 1935.³² Immediately on assuming his new post, Salmon informed all government departments that he had two offices, in Jerusalem and Jaffa, and four addresses. Matters relating to the land settlement and urban property tax would be dealt with in Jerusalem; rural property tax matters by Abramson, who sat in Salmon's office in Jerusalem; survey matters in Jaffa; and matters relating to the Land Department at the Land Registry administration in Jerusalem.³³ After a few months Salmon asked Stubbs, the Director of Registry, to locate for him 3–4 dunams for moving the Survey Department to Jerusalem from Sarona.³⁴ The splitting of departments and positions, and the distance from the other government offices, impeded Salmon's ability to carry out his responsibilities; however, the Arab revolt upset these efforts and defeated the intention of moving the offices to Jerusalem.

In 1936 Salmon announced that the new organisational structure of the commission would comprise three departments: the Head Office, Land Registry, and Surveys. The actual changes, compared with the preceding situation, were in the hierarchical relation of the directors, the abolition of the Lands Department, and the transfer of most of its tasks that were not connected with land registration to the Head Office, which had taken over the responsibility for the land policy, land settlement, the administration of state domain land, direct taxation, and land valuation.³⁵ Some of the authority vested in the Head Office in matters of land settlement was diffused and relegated to the teams in the field, so as to enable them to make decisions and to sign uncontested settlement agreements on site. One purpose of the reorganisation was intended, as we have seen, to close the gap between the pace of the surveys and the work of land settlement. But here all the good intention came to nought. In 1935 the goal was more or less attained when the settled areas rose by 5 per cent (298,549 dunams as opposed to 283,464 dunams in 1934) and the pace of the surveys slowed by 43 per cent (360,660 dunams compared with 628,524 dunams in 1934). In 1935 a record 50,873 registries of land transfer were completed. But the trend was reversed with the outbreak of the Arab revolt in April 1936. For fear of injury to the field parties, the land settlement and survey activities were restricted and the Land Registry offices were almost all closed.³⁶ The reduction of fieldwork and the increase in office work did contribute to closing the gaps between them, but it cut short the effort to close the discrepancy between investigation of the claims in the field and the cadastral survey. The result was that in 1936 there was a disparity of 1,100,000 dunams between the two bodies working in the field.

The disturbances of 1936 also contributed a novel facet to the personnel roster of the commission that Salmon proudly presented: the senior officials of the office were made supernumerary policemen, judges, and assistants of various kinds in the District Offices. Thus, Salmon was appointed Special Constable, and his assistant in the Survey, Robert Crusher, was given command of a unit of Special Police in Jaffa.³⁷

Table 7.1 The gap between the cadastral survey work and land settlement, 1927–1936

<i>Year</i>	<i>Surveyed area in dunams</i>	<i>Settled area in dunams</i>
1927–1930	332,600	142,799
1931	149,485	138,387
1932	399,331	167,293
1933	424,600	344,139
1934	628,524	283,464
1935	360,660	298,549
1936	299,920	122,150
Total	2,595,120	1,496,781

Source: From documents prepared by Salmon for the Peel Commission, 28 December 1936: 'Notes on the Progress of Survey and Settlement (G/19/3)' Le Ray Papers, Middle East Centre, St Antony's College, Oxford.

Land settlement in the safety of the Jewish villages, 1936

With the outbreak of the Arab rebellion the land settlement teams moved into the Jewish villages. Thus, one of the side effects that distinguishes the period of the revolt was the advancement of the land settlement in the Jewish colonies, because the work there was safer. In March 1939, towards the end of the disturbances, the Settlement Officer C. Kenyon wrote to Stubbs, who at the time was standing in for Salmon, 'we have either to take up Jewish land or cease work altogether'.³⁸

Salmon's determination to advance the land settlement despite the disturbances revealed similar considerations, some of them circuitous ones. Salmon feared the cessation of survey work by men who were not always well received by the local population.³⁹ For example, when in 1937 three parties of surveyors were transferred from work in the coastal plain to the southern reaches of the Valley of Jezreel, in the vicinity of Jenin, the local villagers openly opposed the intention to settle their lands. They repulsed the parties with the argument that because of their poverty they were not able to provide the iron stakes as required by law for marking their claims. At that time the Jenin region was one of the most virulent centres of the Arab revolt. The villagers refused to cooperate with the authorities for fear of reprisals by armed gangs, and the surveyors were happy to leave this dangerous area. Salmon gave in, and decided to move to a safer place, as long as his men could continue working. He instructed the parties to move north and to begin with the land settlement of nineteen Jewish colonies in the Valley of Jezreel. But in view of the situation, he sought the opinion of the Chief Secretariat in Jerusalem as to whether it was wise at such a time to publicly announce in the *Official Gazette* that a large area under Jewish ownership would be declared for land settlement.⁴⁰ The Chief Secretariat proposed a subterfuge: Salmon would start working in the lands of Yoqne'am and



Figure 7.3 Settlement Officers hearing an appeal by an Arab villager, 1932 (source: Hiram Danin, Jerusalem).

Balfourya, and later would move his parties to two or three Jewish colonies at a time. That is, each time the order would be published for two or three Jewish colonies, at intervals required for the work, instead of one announcement being published to cover all the area to be settled.⁴¹

The effect of the disturbances on the work in the field took various forms. At the beginning of 1938, armed gangs destroyed several surveyors' camps, among them one that was burned down in the lands of the German Templar colony Waldheim on 23 May 1938. More camps were attacked in September; original documents were destroyed, instruments were pillaged, and three workers were killed and five wounded.⁴² The surveyors were forced to abandon the open areas and move into the large cities. Testimony to this situation can be found in a document that was sent on 13 June 1938 from the settlement district of Haifa to Stubbs, the Acting Commissioner for Salmon:⁴³

- 1 Athlit. Mostly Jewish owned. Fairly safe to work in...
- 2 Qisaria. (Caesarea) Many disputes between Government, Arabs, and Jews. Not advisable to attempt work in present circumstances.
- 3 Tantura. In mixed Jewish and Arab ownership. Work in field cannot be done in safety in present circumstances.
- 4 Sarafand. Not safe to attempt work in field. The same fate might befall documents and equipment as that at Kafr Lam.
- 5 Ed-Dumaira. Unsafe. Probably the same dispute as at Qisaria.

6 Ijzim Detached. Ijzim itself is one of the worst places in the country from the point of view of public security. Not advisable to undertake work in the detachment, as the Ijzim people would have to appear.

7 Kfar Brandeis. All in dispute with villagers in Tulkarm SubDistrict. Impossible to undertake work in present circumstances.

8 Ousqus Tab'un. Many disputes between Arabs and Jews. One of the most insecure places in the country.

The disturbances also affected the land settlement in an unexpected way, such as the case of the village that disappeared off the ground. On



Figure 7.4 Jewish constable on guard at the Survey Department in Tel Aviv during the Arab revolt, 1937 (source: J.Loxton, Taunton, UK).

10 May 1940 a surveyor arrived at Bureika, a small village near Zikhron Ya'aqov, and found it destroyed. In the past it had been decided not to conduct the land settlement within the built-up area of the villages in order to accelerate the work and reduce its cost. Now the question was raised whether the destroyed village constituted a built-up area. The Director of Surveys proposed to remove the built-up area of the village from the purview of the survey and to pass it by; but the Director of Land Settlement decided to conduct the settlement there anyhow, for since the British Army destroyed it for security reasons in 1938, the built-up area had become open area suitable for agricultural cultivation.⁴⁴

The Royal Commission report, 1937

Salmon found himself in a difficult position. While he and his devoted men had to contend endlessly with claims and quarrels in the field and the lack of cohesion between the progress of the survey work and the land settlement, he was torn between his aspiration to advance the settlement and the desire to intensify the internal coordination within the system by slowing the pace of the survey work. Within the plethora of such contradictions, when the output of the 'productive' sector in the field was being impeded by the insecure political situation, the Royal Commission came to Palestine in 1937 and breathed down his neck. The commission, under Lord Peel, was appointed on 7 August 1936 to investigate the causes for the outbreak of the Arab rebellion and the way the Articles of the Mandate were being implemented. Between November 1936 and January 1937 the commission studied the situation in the country, and in June 1937 published its recommendation to abolish the Mandate and to divide the country between Arabs and Jews.

Criticism by the commission regarding the land question appeared in chapter IX of the report. The contents drew sharp reactions from Wauchope. A year later, when Dowson was asked for his views, he condensed into five items the main contentions of the Commission:⁴⁵

- 1 Failure to formulate a land code appropriate to the needs of the country and adapted to the economic requirements of both the 'primitive indigenous population and 'progressive immigrants'.⁴⁶
- 2 Slow progress in the conduct of settlement of title...attributed primarily to an unduly meticulous and over-legalistic procedure.... A secondary cause given is the diversion of officers engaged in the work to other duties.⁴⁷
- 3 Defective nature of the record limited to titles to ownership of land to the exclusion of other important interests and incidents of landed tenure...particularly of land values, fiscal obligations, tenancy rights and easement....⁴⁸
- 4 Lack of trustworthy statistical information regarding the land surface of the country.⁴⁹
- 5 Defective conduct of the (new) land register attributed to overcentralization and is imperfectly understood or applied.⁵⁰ '[I]n this matter of land settlement...the Administration...not yet discharged their obligations under the Mandate.'⁵¹

Wauchope responded to the findings of the commission in an angry despatch to London in August 1938, some two months after their publication. He argued that in Palestine

things were done not in a vacuum but on the basis of Dowson's recommendations and the Torrens system of land registration, which had been written into law in 1928.⁵²

The conclusions of the Peel Commission were not accepted without reservations in London. There was agreement with Wauchope's reaction to the irrelevance of some of the findings, such as the ancillary objectives of the survey, the accumulation of data, and the demand for the decentralisation of Land Registry, which showed a lack of understanding of the conditions in the country and the shallowness of the commission's recommendations. The officials of the Colonial Office Middle East Department added marginal comments to the effect that the chapter on land was essentially deficient since the commission had not had enough time to study the subject and to clarify it in Palestine. This chapter was written after the return of the commission to London, and one of its members gained the impression that the significance of land settlement was not properly understood in Palestine, as it was, for example, in India.⁵³ Of all these remarks Wauchope and Salmon tended to take into operative consideration only one: to speed the work of the land settlement teams in the field, and so in 1937 two additional Settlement Officers were appointed and working parties were budgeted for them in 1938.⁵⁴

Economic cadastre and aerial photographs

In this maze of contradictions, in January 1938 Salmon was unexpectedly put upon to publicly defend the cadastral system in the pages of the *Empire Survey Review*. The debate was started by Dr N. Wolff, a Jerusalem hydrologist and geologist who sought to combine advanced technological concepts with a colonial economic philosophy, in this case concerning aerial photography as a means of speeding up the cadastral survey in Palestine.⁵⁵

Probably without being aware of it, Wolff followed in the footsteps of the Royal Commission, which had argued against a narrow legal approach to land settlement in Palestine instead of also addressing economic requirements, as was accepted in India and other colonies.⁵⁶ In a sharp article he wrote for the *Empire Survey Review*, Wolff claimed that besides the fiscal cadastre and the legal real estate cadastre, it was essential to institute an 'economic cadastre' that would supplement the accepted cadastral data with details of the land surveyed. To his mind, the economic cadastre would serve human development in the realm of settlement, transport, land reclamation, town planning, and various technological projects. The common denominator for all three types of cadastre was maps and surveys. In the colonies, as in developed countries, the economic cadastre had to be at the highest order of precision to advance their development. But in the colonies, Wolff wrote, this was not realistic, for the colonial powers could hardly be expected to invest in such an expensive cadastre. The least they should do was to invest in a legal cadastre of property conducted at the highest order of precision. Efficient mapping in the colonies for land settlement was thus conditional upon a different system of implementation that would be economic in all its aspects and would also be suitable for registry of lands. According to Wolff, this system was the photogrammetric method: mapping by means of aerial photographs.

Salmon's ire was aroused, and he went to the trouble of replying to Wolff from the same platform in April 1938, and turned the subject into an internal Palestinian debate.⁵⁷

An aerial survey was not an innovation for Salmon, for, as he explained, he had been the second British officer in history to conduct an aerial survey himself at the outbreak of the First World War, and the first officer whose unit published military maps from aerial photographs in 1915.⁵⁸ Since then, Salmon had not ceased dealing with the subject and had followed its development, particularly after the deliberations of the Imperial Air Survey Committee that was set up to study aerial photographic surveys. As to the subject proper, Salmon was less theoretical and more practical. He opposed the aerial cadastre in Palestine—and in other countries as well—in view of the difficulties and the expense entailed by thousands of marks that were required to identify boundaries of parcels from the air and for the photogrammetric mapping of an area. In Palestine the aerial survey would lose its advantage since a tremendous amount of fieldwork would be required to complete it, entailing much of the surveyors' time being spent in discussions and in resolving conflicts and disputes between the villagers regarding the nature of the boundaries, and not in surveying and mapping.

Wolff and Salmon expanded the debate to many other subjects, and in response to Salmon's reply Wolff again attacked the system and the manner of its implementation.⁵⁹ Wolff believed that land settlement could be speeded up by replacing the system based on fieldwork with work in the office by means of aerial photographs. He was obviously unaware of Newcombe's premature proposal in January 1920 for cadastral mapping between Gaza and Jaffa using aerial photography, and was unaware of the true nature of the crisis affecting the system in 1938, and why it was not possible to hurry the settlement process. Salmon had no choice but to put him in his place. In restrained language, he explained that Wolff had not understood his reply and its intent, since even if aerial photographs held the key to rapid work, at this point no one was interested in rushing the mapping of the country. In Palestine particularly it was preferable to work slowly, for the main problem of the cadastre was not mapping but the painstaking work of the Settlement Officer on the site. Therefore, under the existing conditions there was no point in accelerating the mapping while the land settlement was progressing so slowly. Moreover, rapid changes were occurring in the ownership of the land, there was constant development of agriculture, new settlements were being set up, and a ramified network of roads constructed. Thus, it was better for mapping to be delayed so that it would include the current additions and changes, and in the meantime the land settlement could go on to close the gap between its two main components.⁶⁰

The personnel changes in the second decade

At the time of the debate between Wolff and Salmon, in January to April 1938, Salmon was already in the process of winding up his post; in April he took leave and on 13 July ended his Imperial service. But against the background of the political events at the time, his departure assumed special significance. It was as though a chapter had closed in the history of the land settlement and of the Survey Department, for within two years all the senior staff of the survey system were replaced where possible. We do not have documentary evidence on what happened behind the scenes, but Salmon left without waiting for a replacement, with the feeling that even without the Arab rebellion breaking out in 1936, the amalgamation of the departments would have failed. According to John

Loxton, when Salmon left, Stubbs became Acting Commissioner. Mitchell, who was a Palestine civil servant seconded to Transjordan, was junior to Stubbs and could not be promoted over him. Stubbs could not be retired at that time, and Mitchell would not serve under Stubbs. The problem was solved by abolishing the post of Commissioner and separating the three departments. All this time, Crusher continued as Assistant Director of Surveys until he retired on 1 April 1940, on which day Mitchell took over as Director. Bennett became Director of Land Settlement and Stubbs continued as Director of Land Registration.⁶¹

From his home in Kent, Dowson wrote to the Colonial Office accusing the Acting Director, Stubbs, who was not a professional surveyor, of paralysing the Survey Department.⁶² He singled out Jardine and Mitchell as suitable replacements for Salmon, and finally recommended Mitchell.⁶³ For some reason, during the next two years no one of sufficient stature replaced Salmon. The Assistant Director, Crusher, resigned in 1940 after nineteen years of survey work in the Imperial service. Stubbs was apparently followed in the Survey of Palestine by another temporary replacement. The documentation of that period is signed by a Senior Surveyor, John H. Mankin, as Commissioner of Surveys. But Mankin also left the department—temporarily, on 27 December 1939, to serve in the Second World War in Ireland with the Royal Engineers. The Survey Department in those years lost two other Senior Surveyors: MacArthur-Davis, who was transferred to The Gambia, and H.A.M. Davies, who committed suicide on the way to Jericho.

The turnover in the veteran staff affected the structure of the system. From the time of the establishment of the Survey Department, the Government of Palestine had taken care not to appoint as Director a man who was not himself a surveyor. Thus, because of Stubbs's status, the government was forced to dismantle the commission so that it could appoint a Surveyor-Director at a lower rank to head the department. In January 1940 the termination of the Commission of Lands and Surveys was announced, the former structure was reinstated and the Departments of Registry, Land Settlement, and Surveys regained their independent status. The new-old set-up came into effect on 1 April 1940, when at last a Surveyor-Director was appointed to head the Department: Andrew Park Mitchell.⁶⁴

It may be that there was a connection between the changes in the commission and the political situation in the country, against the demand to speed up the land settlement. In March 1938 a new High Commissioner



Figure 7.5 The senior staff of the Survey Department at a garden party at the District Commissioner's house in celebration of the coronation of King George VI, June 1937: left to right: Deputy Director Robert B. Crusher, John H. Mankin, Hugh G. Le Ray, John Loxton (source: J. Loxton, Taunton, UK).

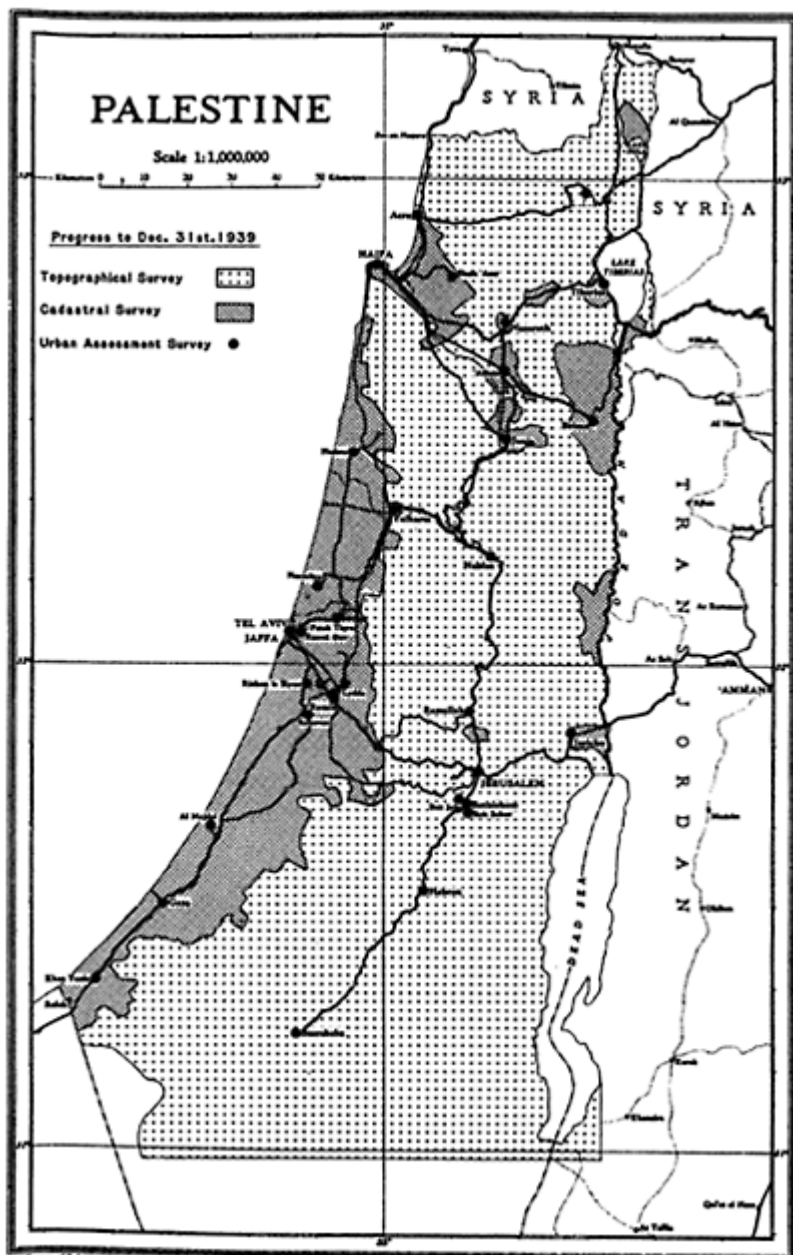


Figure 7.6 Progress of the survey to 31 December 1939 (source: Pal. Govt, *Annual Report of the Director of Surveys*, 1939, maps 1 and 2).

arrived in Palestine, Lord MacMichael, who replaced General Wauchope. The heavy hand in dealing with the Arab revolt was replaced by a different spirit, also reflecting the recommendations of the Woodhead Commission, which laid out lines for partitioning the country and allocating to the Arab population a more generous slice of territory than did the Peel Commission. Then, in 1939, the Palestine White Paper was published in London, and, following it, on 28 February 1940, the Land Transfer Regulations based on the territorial partition plan of the Woodhead Commission, which aimed at limiting the rights of the Jewish population to acquire land in most of Palestine. These measures placated the Arabs and reduced terrorism, and in July 1939 the Survey Department began to return many parties into areas where their safety could be secured, even if under police protection. In one case, however, even the Palestine Police did not save the surveyors when they returned to complete the fifth run of the precise levelling survey of Tiberias-Beisan-'Afula-Nazareth-Tiberias. Despite the police guard, the surveyors had to stop work for fear of their lives.⁶⁵

Changes and impetus in the land settlement, 1940–1947

Mitchell was summoned from the Transjordan Survey Department to direct the mother-department in Palestine in 1940. As his Chief Assistant was appointed Hugh G. Le Ray, who had served in Palestine from 1921 to 1928, and after four years in Iraq returned in 1933. Mitchell and Le Ray directed the department until the end of the Mandate in 1948.

With the arrival of Mitchell, a new era began in the history of surveying in Palestine. The Survey Department was given massive assistance to enable it to increase the workforce and accelerate the surveys for the land settlement. On the outbreak of the Second World War, a foreign factor entered the scene in the form of the military. If in 1933 Salmon laid the foundations for the topographic mapping of Palestine, Mitchell turned the production of topographic maps into a large industry within the framework of the military Survey Directorate Middle East Command.⁶⁶ Nevertheless, the surveys for the land settlement continued to take up the bulk of the department's time—both because of the help Mitchell obtained to this end, and because the war did not affect the normal course of life in Palestine and it was again possible to work throughout the country without interference.

Several factors and landmarks characterised the survey activities from 1940 on.⁶⁷ The attempts and efforts to improve the procedures of the land settlement continued in order to simplify the process. The number of technical staff was increased by 50 per cent in order to speed the settlement and to increase the output and production of maps and their distribution; the status of the workforce was improved by the advancement of workers from the lower ranks as they gained experience. The department was now able to put twenty survey parties in the field, and in order to broaden the



Figure 7.7 School for Arab surveyors at Nazareth, 1945: general view (source: J. Loxton, Taunton, UK).

surveying capabilities in the rural sector a Survey School was opened in Jenin which operated for about one year, from the beginning of 1942 to March 1943.⁶⁸ In December 1944 the Survey School in Nazareth was reopened. Between 1943 and 1946 new methods were tried out in an attempt to develop a suitable system for surveying in the mountainous areas of the country; between December 1942 and September 1945 the work in the Survey Department was declared to constitute military service according to the provisions of the emergency regulations, and the workers were denied the right to resign and to take up other work without special permission.⁶⁹ All this reflects but a small part of the ramified activities of the department relevant to the present study.

In those years, much effort was invested in changing the procedures of the land settlement so as to improve the cooperation between the surveyors and the Settlement Officers. It was difficult to carry out the desired order in which the preliminary reconnaissance of the area, the marking, measurement, noting of claims, and investigating of rights would be combined into one field operation, after which would come the juridical resolution of disputes. Nevertheless, several steps were taken in attempts to limit the series of stages, to combine some of them, or to eliminate any particular one as long as the process would be shortened. Mitchell contributed his experience in Transjordan, and in 1941 succeeded in bringing about a significant change in the procedure for the first time since 1928. He proposed shortening the stages and increasing the coordination between the surveyors and the Settlement Officers by transferring the surveyors to



Figure 7.8 Training at the school for Arab surveyors, Nazareth, 1945
(source: J. Loxton, Taunton, UK).

the Land Settlement Department. The intention was for them to work under one umbrella and to complement and replace one another.

Mitchell's proposal was that in the first stage the marking in the field should be done by a surveyor or a Settlement Officer; thereafter, a croquis would be prepared. Mitchell relinquished the stage of checking the preparation of the preliminary map and had the

marking, the measurement, and the resolution of claims indicated on the actual croquis. After the corrections had been entered, the croquis was transferred to the office for preparation as a final map with the Schedule of Rights. However, this short-cut method failed after a short trial, and Mitchell was quick to admit this before entangling himself further; for no one could be certain that the croquis indeed truly reflected the actual condition in the field, and without a preliminary map there could be no control. Mitchell argued in one of the documents that the failure of his proposal was due to the shortage of British staff to supervise the fieldwork.⁷⁰ But John Loxton, the Chief Inspector of Surveys, explained at the Conference of Empire Survey Officers in 1947 that the survey workers and the Land Settlement Officers were unable to stand in for one another, especially if the Settlement Officer had no experience in surveying, in preparing the croquis as required.⁷¹ As a result, the new arrangements were cancelled and the surveyors were returned to their own department. However, the directors of the system kept on looking for feasible improvements.

In 1943 a different procedure was again tried in which the emphasis was placed on the preliminary map, which had resumed its former place in the cadastral process. In the first stage, it was an unchecked map prepared from a field croquis and according to directives of the Settlement Officer who had reconnoitred the area and prepared a tentative outline for its division. The settlement was carried out on the basis of the preliminary map until the agreement of all concerned was secured. The map was corrected, checked, and approved all in one stage, obviating the old method by which much work was invested in checks and repeated controls as a result of the many changes in the course of the settlement process.⁷² It may be that by this method the work progressed satisfactorily, but a modest addition in the margin of the document suggested otherwise:

Successful settlement, economic survey, future development schemes, etc. depend on skilful preparation of reconnaissance diagram and efficient demarcation. A British officer, in charge of the field operations of settlement and survey, under the supervision of the settlement officer is the only solution in Arab villages.⁷³

In view of the repeated attempts at devising a formula that would speed the land settlement process, it is not surprising that towards the end of the Second World War the idea of amalgamating the departments involved in the implementation of the land settlement was again mooted. The stream of position papers offering proposals for achieving the desired cooperation of the surveyors and the Settlement Officers in the fieldwork never ceased.⁷⁴

One of these initiatives came from Bennett, the Director of the Land Settlement Department, who was on the verge of resigning his post. Bennett was one of the veteran officials who had worked in Palestine since the First World War in the framework of OETA, and from January 1922 had been involved in land affairs in the Department of Lands and in the Land Commission. He had been John Hope-Simpson's secretary from May to August 1930; had headed the project for draining the area of the port of Haifa; and was party to all the deliberations and developments that had occurred in the system dealing with the land policy. Bennett's proposal was formulated in a letter that combined a history of the land regime and a statement of his personal philosophy regarding these

matters,⁷⁵ devoting his energy to rebuilding yet another time a tower of cards that was forever collapsing. Bennett took issue with Dowson, who negated the subordination of Land Registry to the Department of Lands; enumerated the arguments for and against, and returned to the point of origin of the amalgamation of the departments. The main innovation in his proposal was his view that it was also necessary to include the Water Commission in the amalgamated framework.

The letter was addressed to Colonel George Heron, he too being one of the veteran public servants in Palestine, the Director of the Medical Services since 1920, and at the time of his resignation in 1944 serving as Reconstruction Commissioner. His job was apparently to plan the development of the country in the future, when the war had ended. Heron invited the Director of Surveys for a talk, after which Mitchell summarised in writing the evolution of the various directives that had been issued and changed over the years with the intent of speeding up the process of land settlement.⁷⁶ But for some reason Mitchell was again dragged into the matter of amalgamating the departments, and by a convoluted and involved argument supported two amalgamations: of Surveys and Land Settlement, at the level of liaison in the field; and of Land Registry with the Land Settlement Head Office, inclusive of the Water Commission. The discussion was joined also by R.F.Jardine, the Acting Director of the Land Settlement Department,⁷⁷ and the Acting Water Commissioner.⁷⁸ Mitchell returned to the subject again in April 1946,⁷⁹ but none of these discussions could change the structure of the system before the British left Palestine. Until the end of 1947 they continued with their efforts to find a redeeming formula for the land settlement, as though the future was at their disposal with no limits, to the tune of the continuous friction between the field workers of the two camps.⁸⁰

Mitchell set his sights on the ability of the survey system and the land settlement to maintain an annual output of 900,000 settled dunams, and in this way to complete the settlement in the country within ten years. Although he made it conditional on experienced British officials directing the work of the settlement teams, even failing this stipulation he succeeded in mapping 2,039,078 dunams of registration blocks in the period 1940–1946.⁸¹ No other Director of Surveys could marshal a workforce of the size that was at Mitchell's disposal—at one point, 736 workers in the fiscal year 1946–1947,⁸² as against the 78 workers Salmon had had in 1935. Mitchell's men were engaged in all the activities and not only in the cadastre, but most of the system's time was devoted to land settlement—out of all proportion to the actual time allocated to other survey and mapping projects. For example, in 1944 all 115 field surveyors worked on the land settlement in twenty parties, and about 60 per cent of the effective working time of the entire department was devoted to activities connected with land settlement.⁸³

In those years, as a result of population growth, and especially of the war economy, the government's budget was materially increased, with government services and public investments being expanded.⁸⁴ As against a budget of P£68,000 for the Survey Department in 1940–1941, P£258,000 was allocated in 1946–1947.⁸⁵ If 2,900 blocks had been surveyed in Palestine by the end of 1933 and 6,250 by the end of 1939, by the end of 1946 11,000 had been surveyed.⁸⁶ By the time Palestine was to be divided into Jewish and Arab states in 1948, altogether 11,495 blocks in sixteen sub-districts had been divided, made up of 4,797 blocks in the Arab part, 6,534 blocks in the Jewish part and 164 blocks in the projected international enclave around Jerusalem.⁸⁷ Until the end of 1946, out of about 1,000 of the villages in the country the settlement had been concluded

in 473 of them; another 102 villages were in the midst of the process. Most of the remaining 400 villages that had not been settled were in the mountainous Nazareth, Galilee, Samaria, and Jerusalem regions.

The achievements of the cadastral system in Palestine are recorded in several documentary sources. The data are not identical, but not really very disparate. The summaries relate to the extent of the areas in which the land settlement survey was completed, but not yet the final settlement. From the report of the Anglo-American Committee of Inquiry, until the end of 1945 the land settlement had been implemented for 4,808,458 dunams.⁸⁸ The last report of the Survey Department, that for 1940–1946, states that the settlement was completed in 9,190 blocks of 5,140,000 dunams, while in 1,706 blocks only the survey was finished.⁸⁹ If according to the figures of the Survey Department the average block area was 580 dunams, the cadastral survey was completed for 6,320,000 dunams—an area 1,180,000 dunams greater than the area settled.⁹⁰ To add to this confusion of numbers, the enumeration of the areas surveyed in the annual Survey Department reports until the end of 1946 indicates that 5,120,000 dunams was surveyed in the cadastral framework, not counting the surveys in the urban areas.⁹¹

In June 1947 a map summarising the state of the land settlement was published and included in a compendium of maps prepared for the United Nations Special Committee on Palestine (UNSCOP), which was set up on 28 April 1947 and which recommended the partition of the country into two independent states.⁹² On 29 November 1947 the UN Special Assembly confirmed the partition proposal. In the light of the progress of the land settlement it turned out that the overwhelming part of the lands settled in Palestine fell within the area of the Jewish state. The sub-heading of the map carried the following data: 5,240,042 dunams had been settled completely, in 533,880 dunams only the fieldwork and the cadastral survey had been completed, and in 599,550 dunams only the preliminary survey had been done. In all, the work encompassed 6,376,472 dunams. This was the harvest of the cadastral survey and land settlement built on the topocadastral foundations covering more than 13 million dunams.

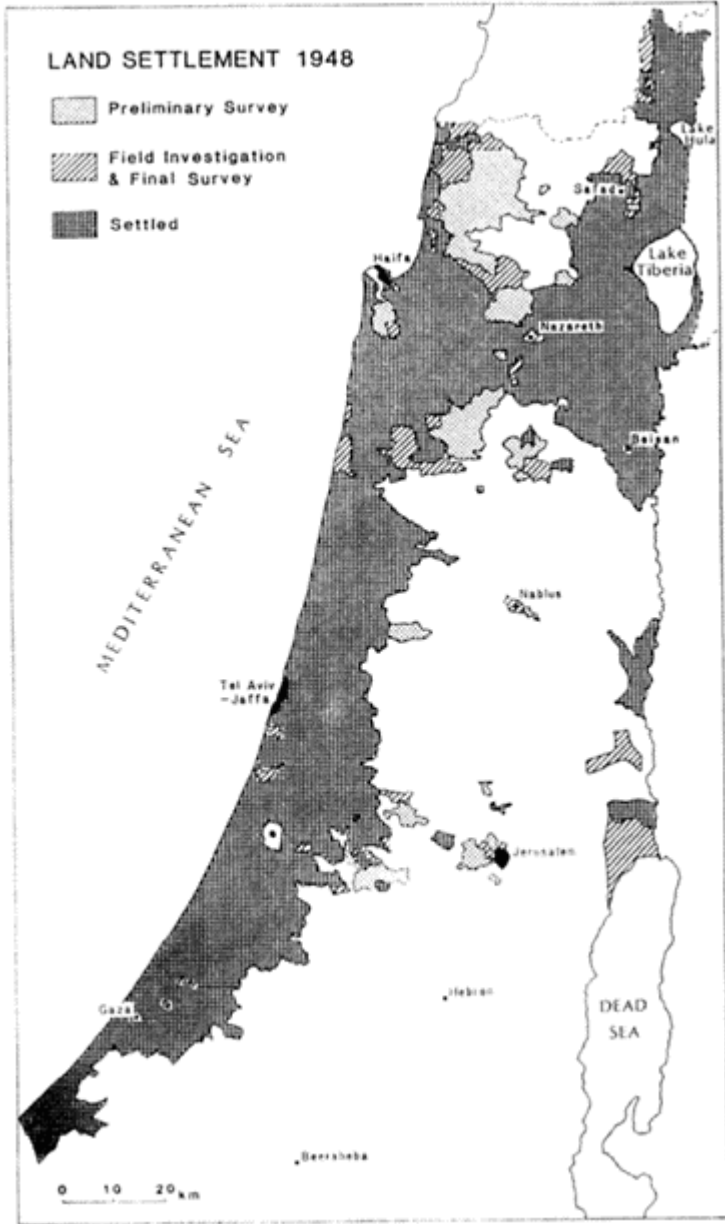
Summary

In the twenty years following enactment of the cadastral reform in 1928, the Survey of Palestine devoted most of its efforts and time to the land settlement. In the years before the reform the department prepared the instruments for working on a large scale and at a high professional level. But the scope of the work, the pace, and the output were dictated by external factors to which the department had to accommodate itself. The main factor here was that the cadastral survey was not limited to one department, but was predicated on the cooperative effort of several bodies, especially of the Survey and the Land Settlement Departments. The coming together of these two bodies in the field and in the office was hardly a paragon of cooperation and coordination: speed of work and output suffered despite the declared aspirations of the departments and the steps they took to improve this relationship. Throughout the entire period, continuous attempts were made by the administrative system to evolve a working relationship in order to reach the common goal of completing the project of registry of land and ensuring the rights to landed property.

In the long period during which the cadastral surveys were being conducted, the survey system never fell into a staid routine. The constant aspiration to speed up the work without affecting its quality, the endless friction between the partners in the cadastral project, and the topographical differences between plain and mountain were only some of the factors that induced creative thinking for perfecting the work and shortening some of the procedures.

Among the outstanding examples of this dynamic and constructive approach was the close laying out of control points by measuring triangulation nets of third and fourth order, which materially facilitated the internal surveys within the blocks. Another example is the replacement of the plane table survey method by chain survey in the preparation of block maps. The chain survey method, which was suitable for surveys in plains with many details, was also improved, and adapted to surveying in the mountainous areas of the country. In addition, trial surveys with other methods and various surveying instruments were conducted to test proposals published in the professional literature.⁹³ Innovations were also instituted in the Computation Section for calculating land areas, so as to deal with the accumulation of material for proposing the division of *musha'* lands, and to compute the areas for the Schedules of Rights.⁹⁴ Another initiative was Ley's decision to skip the built-up areas of villages, in which the cost investment was too great,⁹⁵ and the far-reaching proposal, in 1940, to delete from the survey all details that did not indicate boundaries. In the past, every single detail had been surveyed, even if it neither abutted on nor was itself part of the boundary line of parcels. From 1940 on, houses, wells, electric and telephone lines, milestones, and indications of agricultural land use were omitted from the surveys. These objects were included only if they were of any importance for marking or tracing the boundaries of holdings, and to speed the work, and when there was clearly no chance in the foreseeable future of returning and revising these details in the event of changes or development of the area.⁹⁶ This was a highly significant decision regarding the credibility of the 1:20,000-scale topographic map prepared by the topocadastral and cadastral surveys. As a result, block plans could no longer be considered planimetric maps, since every detail that did not serve to represent the cadastral skeleton was passed over in the survey. In extreme cases this caused dismay to the field parties, who were hard put to locate the pegs among the rocks and the natural vegetation, but did find stone fences which, had they been mapped, would have helped as means of identification in open country.⁹⁷

In the period 1928–1948 the Survey Department was headed by Ley, Salmon, and Mitchell. Although they directed the system consecutively, each of them represented a different historical phase in the survey of Mandate Palestine. Ley reaped the fruits of the meticulous preparation of the framework, and witnessed the entrenchment of the cadastral project during a relatively relaxed period in the early 1930s. Salmon came up against much more difficult conditions when he became Land Commissioner in the days of the Arab revolt, a time of extreme insecurity for the surveying parties in the field. If that were not enough, Salmon, who was a surveyor and cartographer of vision, began his task at a time when the overriding interest of the cadastral system was to brake the impetus of the surveyors and to slow their output, in order to allow the land settlement staffs to catch up, because they could not keep pace with them and were bogged down in unending negotiations with the villagers. Mitchell, compared with his predecessors,



*Figure 7.9 State of the land settlement at the end of the Mandate, 1948 (source: 'Progress of Land Settlement, 1947', in *Maps of Palestine*, prepared*

for the information of the United
Nations Special Committee of Inquiry,
Survey of Palestine, July 1947).

operated under near-ideal conditions. During his tenure, until 1947 the country was quiescent and congenial for survey work, and great resources in manpower and money were allocated to hurry the cadastral survey along. As opposed to the slowed work during Salmon's stint, Mitchell led the surveyors to dynamic activity in the hope of being able to attain the settlement of 900,000 dunams per year, compared with the 200,000–300,000 dunams in Salmon's days. But just when the Survey Department was at the zenith of its impetus, and when it looked as though finally the right formula had been evolved for

raising the output of the cadastral survey, the work was cut off, and the workers saw the fruit of their labours split with the Partition of Palestine.

The Survey Department, which was set up in 1920 to prepare the cadastral survey, by the end of the Mandate had completed the survey and mapping of over 5 million dunams—about 20 per cent of the land area of the country in its Mandate borders—out of 26,300 square kilometres, and about 40 per cent of the area earmarked by the British Mandate government for land settlement from Beersheba to the northern border, for which the topocadastral infrastructure had been prepared. The adherence of the British to the biblical geographic concept 'from Dan to Beersheba' engendered the connection between the cadastral and the topographic maps of Palestine. These two mapping systems covered the same area. Apparently, they did not think it worthwhile to map the Negev south of Beersheba, for it was very sparsely inhabited and was poor in water sources and in cultivable land. The entire programme of the Survey Department's work was from the beginning intended only for the northern part of Palestine.

Part IV

The topographic map

8

The topographic map

A national monument

‘A good topographical survey should be looked upon as a national monument of the first importance’, wrote Colonel Salmon in 1929, in an article he published about four years before his arrival in Palestine.¹ Like Major Ley and Sir Ernest Dowson before him, Salmon too added a special cartographic layer to the history of mapping of Palestine: the topographic map. In the five years of his stint, Salmon succeeded in creating series of new maps—the cornerstone of the topographic mapping produced during both the British Mandate—and afterwards, in Israel.

The ‘good topographic map’ envisaged by Salmon was a cartographic mirror image of the face of the land which represented the relief, the ground cover, and all the details of the landscape in a way that emphasised the special character of the country. The method of presentation, the technical conception, the data, and the level of detail to be aimed at in a topographic map depended on the complexity of the landscape and the scale of the map. When Salmon studied the landscape of Palestine he understood that its typical features were not evenly distributed throughout the country. In contrast with regions of close detail were others that were worthy of mapping but were poor in landscape features. When he arrived in the country in 1933, Salmon believed that the most appropriate scale for topographic maps was 1:50,000, but for practical reasons decided that the topographic map of Palestine would be to a scale of 1:100,000. Salmon tended to disregard the 1:20,000-scale map that was being readied for publication, or thought it irrelevant to topographic mapping. Thus, because of the difference in the cartographic approaches of Salmon and Ley, each of these two cartographic products must be discussed separately. The first of Salmon’s topographic maps—that of Jerusalem—appeared in 1934. It was to be the eighth sheet in the 1:100,000-scale series. It was the first map of the Mandate period that from the outset had been planned, drawn up, and published as a topographic map.

The lack of a topographic map was much felt by the government, the population and the army.² Except for a few sheets of the coastal plain that had been printed by the Survey Department to a scale of 1:20,000, until then there had been no up-to-date topographic map of Palestine since the time of the Palestine Exploration Fund series of over fifty years previously, and the maps of the First World War produced by British and German military surveyors. The first heads of the Survey of Palestine apparently did not properly appreciate the full significance of delaying the production of a topographic map, and devoted all their efforts to cadastral mapping. They expected a cadastral map to provide for the basis of topographic needs, and that a hybrid topocadastral map would benefit both realms.

Salmon arrived in Palestine a few years before retiring from the Colonial Service. His enthusiasm for topographic mapping and his extensive experience in surveying—in military mapping during the First World War and in the Survey Departments of Ceylon and Cyprus—enabled him to give form to the 1:100,000-scale topographic map of Palestine within one year, and to complete the entire series within four years. Circumstances too were on Salmon's side. His maps were produced during the time of the Arab rebellion, when he had to curtail the impetus of cadastral survey work in the field. But this also had a frustrating aspect, for it transmuted his vision into reality in a way other than the one he would have preferred. In time, the impression was created that the topographic map of Palestine was more military than civilian, in contrast with Salmon's conception that if his splendid map could properly reflect the landscape of the country, it would also answer the needs of the army. This cumulative impression derived from three historic factors: Salmon's first series appeared, as we have seen, in the mid-1930s during the Arab rebellion; the new series of sixteen sheets came out during the Second World War in keeping with military requirements; and the Israeli topographic map evolved while the Arab-Jewish war of 1948 was going on. The Survey Department, which during the Arab rebellion realised that it had a product for which there was great demand, especially by the army, was carried along by the topographic production and transferred its cartographic emphasis from cadastral to mainly military topographic mapping. In this way the topographic map of Palestine—the 'national monument'—became a 'military monument'.

The cadastral plan and the topographic map

The standard process of surveying and mapping on a national scale begins with the measurement of triangulation points. Normally, the next step is topographic mapping in order to obtain a comprehensive map of the entire country on a small scale. This did not happen in Palestine. The topographic stage was put off because of the urgency of large-scale fiscal and legal cadastral needs.³ The Palestine Survey Department adopted the prevailing cartographic approach in Egypt: to map the country first to a large scale on the basis of the cadastral survey. Only when it was decided in Egypt to prepare topographic maps of the fertile and cultivated areas were the cadastral master maps combined by means of reduction and photography, or redraughting to small-scale topographic sheets.⁴ This is what the Palestine Survey Department tried to do in its first years when it decided to reduce the 1:2,500-scale plane table maps, join them up, add contour lines, and edit them as 1:20,000-scale topocadastral maps.

The starting point of the survey systems of Egypt and Palestine was thus the cadastral survey, in the course of which topographic landscape details too were surveyed and mapped. These landscape details helped in orientation, enhanced the representation of the ground surface, and, according to one school of thought, were to serve as the corpus of data for the use of land in the development of the country and its economic rehabilitation.⁵ As we have seen, Ley, the first Director of the Survey of Palestine, regarded the small-scale topographic maps only as a side-product of the main cadastral project, whose future in answering general needs was assured.⁶

But realities forced cadastral and topographic mapping to diverge. There were two reasons for this: the way the maps were prepared, and the crystallisation of a thematic approach. The method of preparing the maps entailed the transition from mapping by sheets to mapping cadastral registration blocks that broke up the continuity of topographic maps. The registration block sheet was based on a different premise from the topographic one. The topographic sheet was part of the national grid; the sheet had right angles, disregarded natural landscape boundaries, and cut through them arbitrarily within a rigid frame of coordinates. In contrast, as described in Chapter 5, the cadastral plan was drawn up so as to present in its entirety only the area required for registration of lands, and was not affected by predetermined outlines and the coordinate grid squares, the topographic representation being secondary to the cadastral. The second reason for the divergence of cadastral from topographic mapping was a corollary to the former considerations. More and more, the cadastral map of Palestine came to reflect less of the ground's surface and concentrated on presenting the cadastral and legal data essential for land settlement and registry. It thus became a map restricted to a specific topic. Cadastral maps differ from topographic maps in that the former do not present details unrelated to the indication of block and parcel boundaries. With the increasing pressures on the cadastral system to cut costs and speed up the work, details of the landscape were sacrificed to the direct cadastral needs. At first, built-up areas that impeded rapid surveying were eliminated, and in the end, in the 1940s, every detail except those directly relevant to block and parcel boundaries was left out.

These cartographic restrictions made the cadastral map into a skeletal plan that represented the land divisions, the size of parcels, their form, and their precise location by means of boundary marks and lines that sometimes were not visible on the ground, and were identified by numbers of the parcels and their dimensions. The cadastral map ignored the topography. It aimed at representing as clearly as possible even the most intricate and dense web of parcels, which in the future might be subjected to further subdivision. The difference between topographic and cadastral maps was therefore not in the selective representation of details and the different scale but a thematic, functional differentiation. Their main common basis was the mathematical framework—the coordinates grid and the triangulation points—for which there was no alternative in accurately locating details of the landscape as well as boundaries of land divisions. The secondary joint factor was that, provided the two objectives were not confused, both could be included in one organisational and professional framework.⁷

The functional divergence of the cadastral and the topographic maps in Palestine was also the result of tactical considerations, for there seemed no point in large-scale, detailed topographic mapping if there was no specific planning and engineering need for it. It was enough to conduct countrywide topographic mapping to a medium scale that, in the future, would answer all the demand for comprehensive topographic mapping. The topocadastral map was thus seen to serve both the cadastral and the topographic mapping needs; however, at the same time it sowed the seeds for topographic mapping in its own right.

From topocadastre to topography: the 1:20,000–scale map

The topographic map to a scale of 1:20,000 was a hybrid, and an orphan in terms of its status in the family of the maps produced by the Survey of Palestine. Whoever recommended mapping to this scale in 1928 did not know, or ignored the fact, that it had been abandoned in Britain.⁸ The scale was too large for topographic mapping and too small for the cadastre; from the beginning it was not intended to be topographic, and when it was related to as such, it was displaced by the 1:100,000-scale map. When in 1936 the need arose for a military campaign map to deal with the Arab rebellion, at a scale larger than 1:100,000, the 1:20,000-scale map was reduced to 1:50,000, and again to 1:25,000 during the Second World War. When in 1948 it again became possible to restore it to its original topocadastral status, a scale of 1:10,000 was preferred.

The 1:20,000-scale map was originally conceived as an administrative master map for cadastral land division. The first maps to this scale were obtained by reducing the cadastral 1:2,500 maps to a more convenient scale of 1:20,000. Since the first cadastral maps included topographic details, these derived maps were dubbed 'topocadastral'⁹ (see Figure 4.11, p. 96). From the outset, the intention had been to convert the topocadastral map in the future to a topographic one, when the Survey Department deemed it appropriate and found the budget for completing the contour survey.¹⁰ This approach did not change after the cadastral reform of 1928, when it was decided that the map was to remain a topocadastral master map, but instead of compiling it at as large a scale as the cadastral maps, it would be based on field surveys to a scale of 1:10,000. In the transition year of 1928, the 1:20,000 map was constructed by both methods. Thus, in June the survey of 54,700 dunams was completed in the Wadi Hawarith ('Emeq Hephher) by means of the plane table method to a scale of 1:5,000 and the maps were reduced to 1:20,000 as in the past. At the same time, the first two maps by the new method were completed—of Petah Tiqva and Tel Aviv-Jaffa. The maps showed topographic landscape details, the limits of local jurisdictions, fiscal and village boundaries, and of course the triangulation points, with the addition of their elevation above the mean sea level.¹¹ In 1929 additional maps were completed, and for the first time an attempt was made to give them a topographic character by the addition of contour lines. The finished 1:20,000 maps were mounted on the plane tables in the field, and the contour lines were delineated on them directly as the survey went on. But not all the contour lines were based on this survey work. By the end of 1930 there were already sixteen sheets with contour lines, among them lines that had been copied from the 1:40,000-scale military maps of the First World War by reference to the new triangulation points. Nevertheless, they were considered provisionally as form lines, and not as proper contour lines. On the provisional maps these lines were printed in red, and on the later maps in brown.¹²

In 1929 other uses were also found for these topocadastral maps. Some of them were freely given to government schools for study and teaching, and four maps—one in 1929 and three in 1931—were printed for the soils survey of the Department of Agriculture in six colours, as opposed to the three colours of the regular series.¹³ In May 1931 the government published a gazetteer of place names (*Arabic and Hebrew Proper Names in English Alphabetical Order*) that established the official orthography of the names on the map. In that year fifteen additional maps were completed, and for the first time there was a continuity of topographic mapping between Rafah and Natanya, along the southern and central coastal plain. In 1932 twelve more maps were added, completing the topographical mapping of the Palestine coast to Haifa and Mount Carmel.¹⁴

The second turn in the fortunes of the 1:20,000-scale topocadastral series occurred in 1933 when Salmon took over as Director of the Survey department and changed the direction of the Department's work. In that year only five maps were completed; twenty others were in various stages of production and for none of the maps had contour lines been surveyed. Salmon deflected the initiatives of the Survey Department to the publication of a topographic map of medium scale, and a party of surveyors was despatched to the Jericho plains to practise surveying for a topographic series of 1:100,000 scale. Salmon had only praise for Ley's 1:20,000-scale maps, but was of the opinion that this scale was too large for topographic purposes, as for most other uses, including military applications. In his view, a series at the scale of 1:100,000 represented an economical and rapid cartographic alternative with its fourteen sheets, in a format that would meet most topographic map needs in Palestine.¹⁵ In 1934 the topocadastral mapping on a scale of 1:20,000 continued in the Beersheba Sub-District, but it was the result of direct surveying in the field to this scale instead of to 1:10,000, which was considered too large for the 'empty' expanses of the northern Negev. The Survey Department restricted itself in that year to updating the first maps of Petah Tiqva, Jaffa-Tel Aviv and Rishon le-Zion, which had been published in 1928–1929; and to the production—as a harbinger of the new maps that had not yet been published—of the first topographic sheet of Jerusalem in the 1:100,000 series.¹⁶

Not one 1:20,000-scale map appeared in 1935, and in 1936 only one map, the Ras el-'Ein (Rosh Ha-'Ayin) sheet, was published. The Tel Aviv-Jaffa and the Yibnah sheets were revised according to the cadastral mapping and the survey of the citrus groves south of Tel Aviv. When in the middle of that year the army urgently required topographic maps in the war against the Arab insurgents, it found the 1:20,000-scale map unsuited to its needs; what was wanted was a topographic map for tactical purposes. For lack of a better alternative the Survey Department reduced several 1:20,000-scale maps—of Mount Carmel, Beisan, Gaza and Rafah—to 1:50,000, which was a more effective scale for compact representation and for directing military operations in the field.¹⁷ This lends credence to the assumption that when Ley decided on the production of the 1:20,000-scale series, he gave no consideration whatever to the possibility that it might have to serve as a topographic map. He did not consult the army and disregarded the Imperial experience, and only considered its contribution to the cadastral project.

In 1937 three more 1:20,000-scale maps were revised and only 1,500 copies were printed to meet orders of various customers, but not one new map was completed.¹⁸ When Stubbs took over for a short period after Salmon left, on 21 April 1938, he could not restore the status of the 1:20,000-scale maps after six years of paralysis. Only two sheets in the series were republished—Ramle and Herzliya—which following the land settlement could be revised and overprinted with the names and numbers of registry blocks, with the intention and in the hope that such data would from then on be added to all the maps of that scale. This innovation returned the 1:20,000-scale maps to their topocadastral objective.¹⁹

Further work on the 1:20,000 series was stopped in the coastal plain in 1933. Until 1940, the Survey of Palestine published few revised and updated maps, and many maps in various stages of preparation never saw the light of day. In the meantime the Second World War erupted and, as described in Chapter 9, the Survey Department went over in part to military production. In 1940–1943 the Department was involved in the war effort

by serving the needs of Army Survey Directorate Middle East. This was the third, positive phase in the history of the 1:20,000–scale map of Palestine.

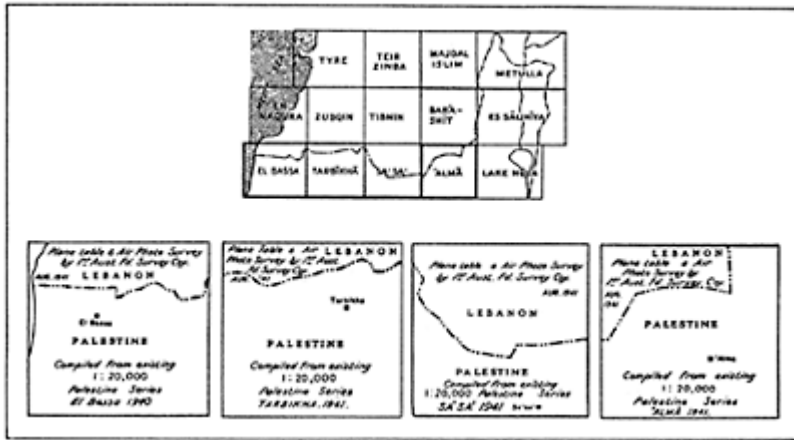


Figure 8.1 Index and reliability diagrams of Lebanon maps that form part of the Palestine 1:20,000 series (source: Gavish, ‘2/1 Australian Field Survey Company’, figure 9).

At the beginning of 1940 the military Survey Directorate Middle East Command conducted a preliminary check of the cartographic inventory in the region, and studied the possibilities of integrating the various national survey departments in the military mapping tasks. The 1:20,000–scale map of Palestine was not accepted as a topographic map, but thanks to the fieldwork that had been conducted in Palestine to a 1:10,000 scale, there was no difficulty in preparing 1:25,000–scale maps.²⁰ Another document explained that to use 1:20,000–scale maps ‘might cause some dislocation of training’, since the army’s instruments and coordinates gauges were graduated for 1:25,000 scale.²¹ Although the army was unhappy with the 1:20,000–scale maps, the Survey of Palestine was requested to extend this scale towards Lebanon, Syria, and Transjordan in order to obtain continuity with the territory across the borders. The British Army in Palestine needed large-scale campaign maps for the north of the country, where it confronted Vichy French forces. The military objective was to produce 1:25,000–scale maps the moment these were needed, and the fastest way to do this was by rapidly completing the 1:20,000–scale maps and reducing them photographically to 1:25,000.²² Since the British Army also needed 1:50,000–scale maps, which were considered tactical maps, the 1:20,000–scale maps were to serve that purpose too. The army therefore encouraged the production of 1:20,000–scale maps as alternatives to the campaign and tactical maps and as the basis for possible conversion to other scales. The military cartographic approach in effect returned to the solution of the time of the Arab rebellion. Thus, in the four years until the end of the war,

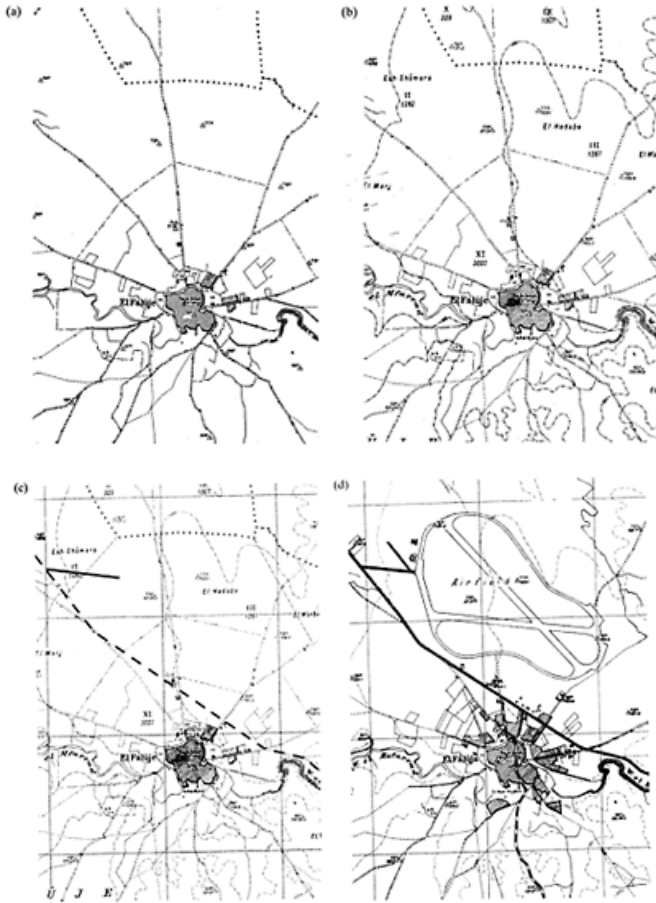


Figure 8.2 (a) El Faluje, scale 1:20,000 (no date) (reduction). First version: the map was printed without sheet numbers or coordinates, with no legend, scale, or date; on the map are marked village land boundaries, limits of fiscal blocks, triangulation points, and very few identifying landmarks.

(b) El Faluje, 1:20,000 scale, 1931, topocadastral (provisional), Sheet 11–12 (reduction). The map is printed in three colours; to the map of the earlier version were added contour lines at 10-

metre vertical intervals, with roman numerals in the fiscal blocks, area sizes in metric dunams, and place names; next to the triangulation points are the spot heights. In the margin is printed a detailed legend of conventional signs; the coordinates of the national grid are not indicated, except for the sheet number attesting to the coordinate rectangle.

(c) El Faluje, 1:20,000 scale, 1943, topocadastré (reduction). The map was revised for the army in 1943 with the military coordinates grid superimposed; the road system is updated.

(d) El Faluje, 1:20,000 scale, 1946, topographic (reduction), The military version converted the topocadastral map to a topographic one. The 1931 map was updated in August 1946 by the 512 (Army) Field Survey Company, RE, revised and corrected by the Survey of Israel, and printed by the IDF Mapping and Photographic Service in July 1948. In the topographic version the sub-heading 'Topocadastré' was eliminated and all data relating to that subject was deleted: to the legend were added topographic details for representing the ground cover; the main roads were updated and coloured red, and classified information on a British military airfield was indicated (source: ML).

eighty-one sheets were completed to a scale of 1:20,000; in 1946 another seventeen sheets were completed, and in 1947, ten sheets; thirteen sheets remained in various stages of completion at the end of the Mandate. The army even converted the values of coordinates of the triangulation points from the Cassini to the Transverse Mercator projection and published these in lists according to the 1:20,000 (1:25,000 military series) sheets—altogether for 165 sheets.²³

The military version of the 1:20,000-scale maps transformed the series from topocadastral to topographic maps. The Palestine grid was superimposed on the maps to become the military grid, and all topocadastral data were eliminated; the title ‘Topocadastré’ was erased, as were the boundaries of blocks and parcels, municipal and administrative boundaries, and to the legend of the map were added details to describe the ground cover, and the representations of roads and tracks were updated. What Salmon did not do to the topocadastral map was done to it by the military, although from an entirely different motivation. The army required a military topographic map, even on the basis of the 1:20,000-scale topographic map, while Salmon aspired to a national topographic map by disregarding this scale. Thus, although this scale was so unusual and not generally accepted, the 1:20,000-scale map of Palestine came to serve many purposes by virtue of the cartographic treatment it was given by the turn of events.

Salmon’s topographic map of the desert and the sown

The topographic map envisaged and created by Salmon was a plastic expression of his cartographic philosophy. His approach was imaginative and founded on fully thought-out principles, which assigned to cartography a combination of functionalism and educational and aesthetic values to make the map into a ‘national monument’. In the latter part of the nineteenth century the surveyors of the Palestine Exploration Fund chose to reflect in their topographic map the remains of the culture and past of the country. Salmon preferred his modern map to represent the most prominent geographic characteristic of Palestine—‘to distinguish the desert from the sown’.²⁴

Salmon was an enthusiastic cartographer. He collected maps of the whole world, and there was not one from which he did not draw conclusions and learn. The collection of maps, cut-out titles, legends and specimens of representations of relief was preserved, and in his will was bequeathed to the Royal Geographical Society in London.²⁵ Salmon delineated his topographic platform in an article published in 1929 in Ceylon, in which he adduced examples of maps from Britain, India, Canada, Japan, France, Germany, Belgium, Switzerland, Italy, Egypt, Cyprus, Australia, and Ceylon.²⁶

In one of the first notes to his article, Salmon pointed out the critical weaknesses of the cartography of Palestine to illustrate the situation in countries like it, where the importance of topographic maps was underrated, especially in new countries in which much effort had to be invested in land settlement at the expense of topographic mapping. Even if engineering projects could be carried out on the basis of local survey maps, it was impossible, he claimed, for this to be done without a full and comprehensive topographic map that offered a common basis for physical, administrative, and military planning. To the same extent, Salmon emphasised the human aspect of carto-topography. No matter how accurate the map, Salmon wrote, people would never trust it if it were not pleasant

and attractive to the eye, for it was impossible not to be affected by its external appearance. Moreover, there was nothing like a topographic map for the surveyor to identify himself with the area and to express his personality in the cartographic space at his disposal on the map. Unlike other branches of the profession, topographic surveying was fascinating and enthralling, for the draughting was done in the field, and much of the mapping work left room for individual expression of the surveyor and was far from mechanical routine.

According to Salmon, the more the topographic map was vital to the development and the military objectives of the country, the more it offered scope for creativity and for giving form to the least of details. Small-scale or larger-scale maps were normally by-products of the topographic map, and therefore did not offer the same advantages to the surveyor-cartographer. In countries where the process was reversed, and the topographic map was drawn up from larger-scale surveys, the topographic map lacked the surveyor's freedom of expression. Until the invention of the plane table, most of the fieldwork had been done by means of sketches and tedious observations. But with the introduction of the plane table method a new dimension of accuracy entered surveying work, on the basis of the preparation of a net of triangulation and control points and surveying on geometric principles. The accuracy of surveying depended on the number of measured points in the field and on the talent of the surveyor in filling in the details of the landscape between the reference points. In both the planimetric and the altimetric measurements there was room for representing the features of an area to the best of the skilled artist-craftsman's ability. It was within his power to leave out or include details in difficult and broken country and to emphasise rolling or flat landscape variations, perhaps with some exaggeration, so long as the map clearly conveyed a sense of the topography. For this reason it was rare to come upon a military topographer with an eye for country—a sensitive draughtsman capable of precise and delicate rendering, responsive to landscape features, enthusiastic about his work, and, of course, with adequate practical experience. Salmon admitted the difficulty in finding such a person. As he put it, 'Such men do not grow on every bush and so really first-class topographical maps are not found everywhere in the world.'²⁷

Salmon did not preach unflinching precision that was sometimes undone by the size of the conventional signs. He also appreciated the cartographic rivalry of the camera, the phototheodolite, stereographic instruments, and obviously also aerial photography, which, he believed, had not yet (in 1929) been recognised as a cartographic breakthrough. All these could replace the plane table where access was limited. But how could there be a comparison between these technical means and an inspired draughtsman and the man who reproduced the delicate outlines of the map and its artistic printing? And what about the choice of symbols, lettering, and scripts, renderings of the relief, the photography of the plates, and the printing colours? All these called for talents and capabilities that could not be learned from textbooks, for there was nothing like experience to master the quality of paper, the efficient size of the map, the way it was folded and bound.

Salmon did not restrict himself to theorising and voicing his aspirations. He was a man of action. His demands and attention stood the tests; he did not yield or leave out anything. In Palestine he took the surveyors out for specialist training in topographic surveying: in country poor in triangulation points he saw to the completion and fleshing out of the net. For mapping the broken badlands of the Judaeian Desert and the Dead Sea region he ordered aerial photographs, and completed the mapping by stereoscopic

interpretation and interpolation plotting. He delved into the printing ink industry to find inks suitable for the climatic conditions of Palestine. He considered various systems of folding the maps to mitigate rapid wear, and designed some of the covers himself. In all he created, Salmon left both his personal imprint and his signature.



Figure 8.3 ‘Central Judaea’, scale 1:50,000, 1937 (reduction) (source: ML).

The 1:50,000-scale topographic map Central Judaea

Salmon stated his conviction on several occasions that the most suitable scale for the topographic mapping of Palestine was 1:50,000.²⁸ This scale was appropriate for the depiction of the many details of the country in certain of its regions. But Salmon admitted

that along with the fertile areas crammed with details, the country also had regions with very sparse features, for which there was no justification to invest very much in surveying and mapping them. In order to cover the populated and fertile parts of the country, for which fourteen sheets of 1:100,000 scale had been projected, fifty-six 1:50,000-scale maps were required, and for this there was no budget and insufficient manpower. Salmon therefore feared that if the Survey Department were to start work on such a large series of maps, it would be many years before the country had a topographic series. For this reason he determined that at least the field surveys for the topographic map would be to a scale of 1:50,000, even if the finished product were on a different scale.

In 1934–1935 the topographic surveyors began work for the 1:100,000 series on a 1:50,000 scale in the surroundings of Hebron and Bethlehem. In 1936 Salmon had an opportunity for the first time to publish several maps on a scale of 1:50,000 in a provisional edition for the army to meet its desperate need for large-scale tactical topographic maps. Other 1:50,000-scale maps were produced for the regions of Zikhron Ya'aqov, Beisan, Gaza, and Rafah. The maps were prepared in a hurry by reducing sheets of 1:20,000, but these were immediately withdrawn from use when the 1:100,000-scale maps were completed.²⁹

Although under these circumstances Salmon published the 1:100,000-scale series of topographic maps, and perhaps because of them, he wished to epitomise his ideas on the 1:50,000-scale map that he thought right for Palestine, and decided to produce one such map as an example. On the basis of the field survey for the map of Jerusalem and the surrounding region to a scale of 1:100,000, he prepared in 1936 one representative sheet to a scale of 1:50,000, which he published in 1937 under the title 'Central Judaea'.³⁰

The Central Judaea map appeared in six colours, with a rectangular coordinate grid of 10×10 kilometres. The conventional signs were simple and concise: linear symbols indicated the categories of roads, cliffs, and the hydrography. Dotted symbols marked ancient sites, ruins, bridges, mosques and churches, quarries, caves, springs, water cisterns and wells. There were area symbols for cultivated vegetation: orchards, olive plantations, vineyards and groves. Topographic heights were marked in three ways: spot heights, contour lines at vertical intervals of 25 metres, and elevation tints on a light brown scale in three grades: up to 600 metres, 600–800 metres, and 800 metres and higher. A buff-hued background tint covered most of the mountainous part of the sheet and effectively conveyed to the beholder a good and aesthetically pleasing sense of the topographic relief. This hue was produced by a special formula chosen by Salmon for the background of all the topographic maps of Palestine. Salmon indeed achieved his aim, for the value of the Central Judaea map should not necessarily be judged by the information it conveyed or by the usual cartographic criteria. The map was not a cartographic product but a 'creation', a kind of declaration of aims that an enthusiastic Director of Surveys wanted to hand down to his successors. It was an expression of a cartographic vision that was never really implemented, and a cartographic conception imbued with the landscape and human culture of Palestine.

This model 1:50,000-scale map was published on the formal grounds that it was intended to serve the needs of the region, but the timing of its appearance happened to be of considerable military importance. In the technical report—which was not for publication—sent every year to the Colonial Office in England, the Directorate of the

Survey Department stated that this map was printed in 1937, at the behest of the army, in 5,500 copies. Presumably it served the security forces in the days of the Arab rebellion in the Jerusalem hills region. (In that year, as has been mentioned, all the 1:20,000 maps were printed in only 1,500 copies.)³¹ In 1938 the Central Judaea map was reprinted in 1,015 copies, and 648 more in 1939. The army also showed interest in this map during the Second World War. In November 1939 and April 1944 the motorable roads within the limits of the map were updated, and in 1945 another revision was published. But in this last edition there was a noticeable change: the layer tints were eliminated and only the tint at the highest elevations of over 900 metres remained.³² The last to use the Central Judaea map for military purposes were the scouts of the Hagana in their reconnaissance and topographic training exercises, before the establishment of the State of Israel.

The idea of the 1:50,000-scale topographic map was again brought up for discussion during the Second World War, when the Survey Directorate Middle East Command took stock of the cartographic inventory in Palestine and the neighbouring countries. The British aspired to produce in Palestine maps to this scale for tactical uses since they matched the 1:50,000 series of Transjordan and the French series in Syria.³³ The advisers to the military estimated that it would be possible to produce such maps in Palestine without difficulty, on the basis of field surveys that had been carried out for the 1:100,000-scale topographic maps, and for which the field surveys were also to a scale of 1:50,000. But in the end the British made do with the 1:100,000-scale maps, and did not invest in developing the new series in Palestine.

The 1:100,000-scale topographic map

The first topographic map of Palestine to a scale of 1:100,000 was the one drawn up by Jacotin for Napoleon Bonaparte's army in 1799. The British returned to this scale about 130 years later after they already had topographic maps of different scales: the one of the Palestine Exploration Fund to a scale of 1:63,360 and the maps of the First World War to a scale of 1:40,000. The first to moot the production of a modern topographic 1:100,000 map during the Mandate had been F.S.Richards, the Director of the Egyptian Survey Department's Computations Section, in 1925, when he checked the mathematical basis of the triangulation measurements in



Figure 8.4 'Safad': Sheet 2 from the first 1:100,000 series edition, 1935 (reduction); note the 'Finger of Galilee' (source: ML).

Palestine. At the time, Richards proposed that the master map for the topographic field survey be on a scale of 1:50,000, to be reduced to 1:100,000 for communications purposes. Ley was the second to hint at such a topographic series in 1927, but without assigning to it any functional significance.³⁴

The first practical step was taken at the end of 1933. A topocadastral party of six surveyors working in the vicinity of Jericho was detailed to practise rapid topographic surveying methods, measuring contour lines and updating details. At that stage there were already plans for compiling the maps of the new 1:100,000-scale series in fourteen sheets, and the Jerusalem sheet, the eighth in the series, was already in the process of preparation.³⁵ The preparation of the 1:100,000-scale map was found to be quicker and cheaper compared with the investment required for the 1:20,000 series, and indeed it was decided not to complete the latter in the more sparsely inhabited parts of the country, for which the 1:100,000 scale was considered adequate. The measurements relied on the triangulation nets, and in regions where the points were less close, additional points were measured. In this way triangulation points on a third-order net were measured in the Judaeen Desert and west of the Dead Sea, in the Bethlehem and Hebron Sub-Districts, and for the Jerusalem and Hebron sheets. In part of this region over an area of 256 square kilometres a full survey to a scale of 1:50,000 was carried out, with contour lines at vertical intervals of 25 metres. In other areas the planimetry was obtained after reducing the 1:10,000 fiscal maps, or with the help of aerial photographs. The altimetry—the measurement of topographic heights—was obtained from field surveys or by copying contour lines measured for the 1:20,000 series, and even form lines measured for the First World War maps.

When in 1936 the army required topographic maps, the Royal Air Force also offered to help with the topographic mapping of the badlands west of the Dead Sea by means of aerial photography. This was done after two surveyors had worked for six weeks to mark the area with control points and conduct barometric elevation surveys.³⁶ With the intensification of the Arab rebellion the 1:100,000-scale series, which had only just been published, was suddenly fully vindicated and was much in demand. In 1936, 16,300 maps were printed as part of a large order of 23,000 1:100,000 maps for the Army; and thousands more were commissioned but could not be produced fast enough.³⁷ Under the great pressure of work, the department was forced to postpone the completion of the fourteen sheets in the series, and the printing of the three southernmost sheets was put off until 1937. This delay led to even greater time lags, and only in October 1937 was a party of four surveyors sent out under the young surveyor John Loxton, who had come to Palestine a short time before,³⁸ in order to do the surveys for Sheets 12, 13 and 14. The survey work was finished in April 1938. In 1937 the stereoscopic plotting of the Judaeen Desert was completed with the aid of aerial photographs, and this brought to a conclusion eleven sheets that were later referred to as ‘first’ or ‘old’ series of the topographic map.

In March 1937, going over the surveys of the Negev conducted by Colonel Newcombe in the south of Palestine in 1913–1914, and trying to tie these into the new national net, was neither planned nor possible. But a surveying party under Loxton was sent to map the Wadi Arabah road and ascertain that it kept to the Palestine side of the border with Transjordan. Additionally, the surveyors were to fix the link road from Aqaba to Egypt. The party went out in two cars for a 600-kilometres trip from Beersheba to Aqaba by way of Kurnub and the Arabah Valley. The surveyors tended to regard this assignment as an

adventure trip to an unknown country. They themselves considered the revision of data along their route and the astronomical measurements and observations not as a great cartographic achievement, but as a survey trip that broke their routine and took them far afield to the Taba shore.³⁹

In 1938 the Survey Department changed the format of the 1:100,000-scale map, and the three southern sheets of the first series were published in accordance with the format of the second, 'new' series.⁴⁰ In that year the Survey of Palestine adapted the series of topographic maps for an unexpected purpose, but one that underlined the need for a compact map: at the request of the Woodhead Commission, which recommended the division of the country between Jews and Arabs, all the Arab village boundaries were represented on the 1:100,000-scale map by overprinting.⁴¹

From the beginning of the Second World War in September 1939 until the end of that year, tens of thousands of 1:100,000-scale topographic maps were printed in Palestine, and the military authorities manifested a growing involvement in their preparation. The army hinted at its desire to revise all the maps, and especially to include the roads and tracks that had been opened and built during the Arab rebellion. In August 1939 Loxton went out to survey all the roads of the country and to grade them.⁴² He surveyed 4,400 kilometres of roads and tracks, of which 2,100 kilometres were covered in military all-terrain vehicles over dirt tracks in the mountain regions, and the others in private cars with military escort where necessary. On 3 September 1939, following the German invasion of Poland, Britain declared war on Germany. In Cairo, as a result of Colonel (later Major-General) R.L.Brown's reconnaissance, a special military mapping command was set up—the Survey Directorate Middle East Command—and in March 1940 its staff visited the Survey Department in Tel Aviv to prepare its integration into military tasks. The updating of roads and revision of all eleven sheets of the topographic map was apparently the first assignment carried out with the help of Royal Engineers draughtsmen seconded for this purpose to the Survey of Palestine. On this occasion some other details that had changed in the landscape were updated, but in effect only one subject was fully revised: the Jewish settlements that had been established since the first series had appeared.



Figure 8.5 Survey expedition on the scarp of the Judaean Desert in the framework of the 1:100,000 topographic survey, 1937 (source: J.Loxton, Taunton, UK).

After the war broke out, the involvement of the army in the production process of the topographic map of Palestine intensified. This found expression in the change of layout, giving the maps a military topographic character, and in their more frequent revision and updating. As a result of this involvement there occurred a turnabout in the objectives of the topographic map, from civilian to military ones; from an administrative and educational instrument, to a means of control and command of military movement in the area. It was at this point that Britain endowed the population of Palestine with the topographic map of primarily military implications and significance. At that time the settled Jewish population, or *yishuv*, was in the midst of its struggle for the establishment of the Jews' own state. Everyone who took part in it, or wore uniform in the Second World War, was entirely taken with the military conception of the topographic map—which was to be inherited by Israel.

9

The 1:100,000 topographic map

Layout, structure, sources

Layouts of the 1:100,000 topographic maps

The planned layout, 1933

The original layout of the topographic map of Palestine was devised in 1933,¹ dividing the First Series into fourteen sheets that covered the country north of latitude 31°. The sheets were planned along regular transverse strips, except for the Jerusalem and Jaffa sheets, which deviated from this standard. These two maps were larger than the others: each encompassed an area of 50×45 kilometres as opposed to the 45×45 kilometres of the other sheets. In this layout, the 'Finger of Galilee' (Huleh Salient) was cut off north of Lake Huleh and included as an inset at the upper right-hand corner on the Safad sheet. The sheets overlapped by 5 kilometres with their contiguous western and southern neighbours. On the west the overlap was planned according to the coastline: except for the Rafah sheet, the southwestern corner of each of the western sheets was planned so as to fall on or near the coastline in order to avoid wasting map space on the Mediterranean. The Jaffa and Jerusalem maps overlapped even more with the adjacent sheets.

The first series, 1933–1938

The layout of the first series was similar in almost every respect to the planned layout, but with small variations in the Safad map and in the three southern sheets. The Safad sheet was changed from square to rectangular so as to include the 'Finger of Galilee' as part of the map, and the southern sheets were enlarged to 50×50 kilometres. As has been mentioned, the first sheet—the Jerusalem map, number 8 in the series—appeared in 1934. In 1938, before the series was completed and after eleven of the fourteen sheets had appeared, the layout of the series was changed and the series was published in a different format.² The series in the original format was published in editions of three and seven colours, and the printing continued until the end of 1942. The coordinates were marked in 10×10-kilometre grid squares, but at the request of the army during the Second World War, a topographic grid of coordinates under the title 'Palestine Transverse Mercator Military Grid' was overprinted on this map.

The new series, 1938–1942

In 1938 a change in the format of the map was announced.³ All the sheets, except for Haifa and Safad, were to be of 50×50 kilometres, so that each 1:100,000-scale sheet

would cover twenty-five sheets of the 1:20,000-scale map. In this series there was less overlap between sheets, except for the two northern sheets and the coastal sheets along the Mediterranean. This new topographic 1:100,000-scale format for Palestine reduced the number of sheets from fourteen to twelve.

The new layout was intended to be more convenient, but was not implemented. In 1938 the three southern sheets—Rafah, Beersheba, and Ras ez-Zuweira—were published. The sheets covered 50×50 kilometres, according to the new layout. The maps extended south of 31° N and were based on a narrow strip of 5–10 kilometres of Newcombe's 1914 1:125,000-scale map of southern Palestine ('The Negeb—or Desert south of Beersheba'). In the new layout these sheets were given numbers 10, 11, and 12 respectively, with a clear indication that the new numbering was that of the New Series. But the Survey Department was not able to keep to this programme, did not change the layout, and continued to produce the eleven sheets of the New Series that in any case were included originally in the First Series. Thus, indirectly, the entire series that had been planned in fourteen sheets was completed. But a peculiar situation arose in which the numeration of the southern sheets became confused. According to the original layout, the Hebron map was number 10 and Bethlehem number 11; now, Rafah also became number 10, and Beersheba number 11, so that two different pairs of maps had the same sheet numbers. What resulted was a combined Old-New Series, and it was referred to as such in the annual reports of the Survey Department in 1938–1939.

The series of sixteen sheets, 1942

In 1942, to meet military demands, the Survey Department converted the production of the 1:100,000-scale topographic map to a sixteen-sheet format.⁴ The army stipulated that none of the sheets should be larger than what could be printed on the mobile press of the military mapping unit. Accordingly, all the overlap between maps—which in any case was not to the army's liking—was eliminated, and the number of sheets had to be increased from fourteen to sixteen. The army had other requests too that did not fall in with the format of the topographic map of Palestine, such as the need for a topographic map of the south of the country. In the latter case, cartographic alternatives were found for areas in the western and eastern Negev by means of the Egyptian 1:100,000-scale maps of Sinai in the west, and the south Levant maps for the eastern parts of Palestine. For the central part of the Negev, for an area of 2,000 square kilometres, the British Army had recourse to Newcombe's old 1:125,000-scale map of preFirst World War vintage. Ultimately, the sheets of this series were issued in several dimensions: Sheets 2 to 10 each encompassed 40×40 kilometres; the southern sheets, Sheets 11 to 16, 50×50 kilometres; and Sheet 1, Metulla, was 55×42.5 kilometres. The size of the northern sheet points to the possibility that the army wanted one map for the entire border region between Palestine and the Lebanon, north of the international boundary, that would continue the topographic grid of Palestine into Lebanon to the Metulla—Tyre line, and would show the junction of the Palestine and the Levant grids.

An interesting version of the three northern maps—Metulla, Haifa, and Safad—appeared in 1948 in the United States at the initiative of the cartographer Zalman Lif. The three sheets were joined together, printed on a plastic material, and were published as a moulded map by an American company in Philadelphia.⁵ Another, unique three-

dimensional version of the entire series of topographic maps was prepared in Lif s photogrammetric institute by cutting out the maps along their contour lines and gluing these in place consecutively on a base-board, one over the other. This fullsize moulded map of the entire series is today displayed in the Hebrew University Department of Geography in Jerusalem.

Table 9.1 Series of the 1:100,000-scale topographic map: sheet names and numbers

<i>Sheet no.</i>	<i>First series 1934–1938</i>	<i>New series 1938–1942</i>	<i>16-sheet series 1942</i>
1	Haifa (1935)	Haifa	Metulla
2	Safad (1935)	Safad	Haifa
3	Zikhron (1938)	Zikhron	Safad
4	Beisan (1937)	Beisan	Zikhron
5	Tulkarm (1937)	Jaffa-Tel Aviv	Nazareth
6	Nablus (1936)	Nablus	Jaffa-Tel Aviv
7	Jaffa-Tel Aviv (1935)	Gaza	Nablus
8	Jerusalem (1934)	Hebron	Yibna
9	Gaza (1936)	Jerusalem	Ramle
10	Hebron (1936)	Rafah (1938)	Jerusalem
11	Bethlehem (1937)	Beersheba (1938)	Gaza
12		Zuweira (1938)	Hebron
13			Dead Sea
14			Rafah
15			Beersheba
16			Jebel Usdum

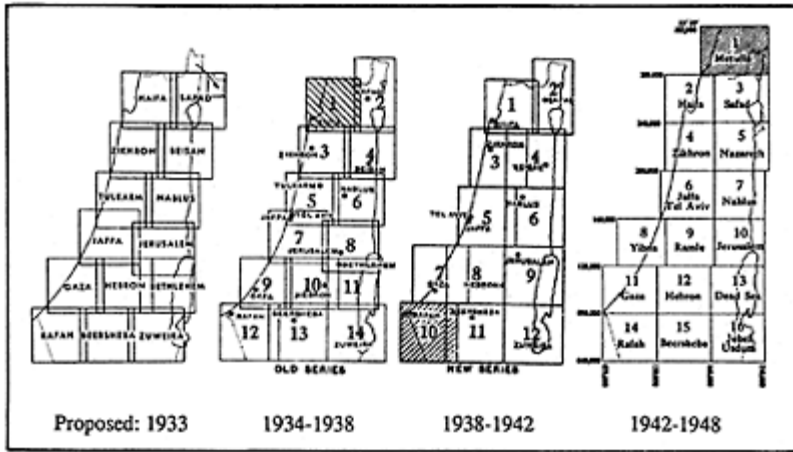


Figure 9.1 Sheet index to the 1:100,000 series of topographic maps, 1933–1948 (source: SoI, Tel Aviv).

The sources of the topographic map and its description

Versions of the First Series

The 1:100,000-scale maps of the First Series appeared in four versions: provisional, full, grey, and military.⁶ The provisional maps were the ones published under the pressure of events at the request of the army during the Arab rebellion, before they could be thoroughly prepared for printing. The ‘full’ map was so called because it appeared in all its splendour, in seven colours. The grey edition had only three pale hues. The contour lines on this map were printed in red, the hydrography in blue, and the planimetric layout in grey. The grey edition of the 1:100,000-scale series was intended for secondary uses, as base maps for archaeological, geological, agricultural, hydrological, and other purposes.⁷

The last, military-style version was published in the first years of the Second World War in three or six to seven colours. This was the map with the topographic coordinates net (the military grid) overprinted in blue under the heading ‘Gridded with Palestine Transverse Mercator Military Grid’ (see Figure 9.2). To the map was added a linear scale in yards and miles, for the convenience of the British soldiers, and instructions for the method of indicating coordinates.

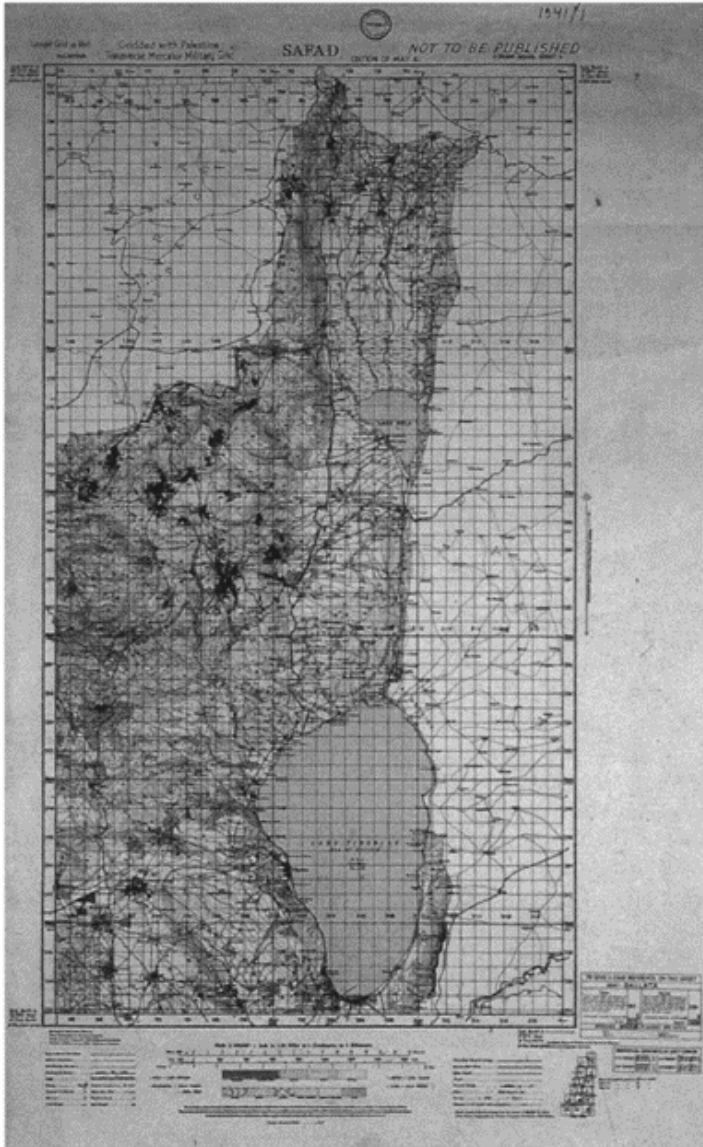


Figure 9.2 ‘Safad’: Sheet 2 from the first 1:100,000 series edition, military version with Transverse Mercator Military Grid, May 1941 (reduction); note the ‘Finger of Galilee’ (source: ML).

The conventional signs and the legend on the maps of the First Series

The choice of standard conventional signs for the topographic map of Palestine derived from identification of the typical elements in the country's landscapes, and reflected Salmon's earlier experience in Ceylon, and especially in Cyprus, whose Mediterranean landscape was similar to that of Palestine. Salmon wrote of his search for suitable conventional signs in an article he published in 1937.⁸ He utterly rejected any regular, standard, internationally accepted system, and took pains to prove, on the basis of his experience in Palestine, that every country had its own individual character deserving of distinctive cartographic expression. It was the job of the carto-topographer to identify and interpret this landscape character and to find the most appropriate cartographic combination of colour, form, and texture, and devise symbols to satisfy a variety of users without sacrificing the clarity and quality of his map.⁹ Salmon adduced the example of Ceylon, where the cartographers responded to the wishes of plantation owners and in many maps distinguished between the various landscape features with layers of colour to indicate tea, rubber, and coconut plantations, and where the topographic map reflected the agricultural nature of the terrain. In Cyprus the topographic maps were made mainly for the use of tourists, and so were published in the form of visitor's maps. In Palestine Salmon aspired to producing a topographic map in its own right, with no legend.

The considerations that guided Salmon in his choice of conventional signs particular to Palestine were the identification of typical landscape characteristics, good orientation attributes, and lucid representation of ground cover. Salmon was endowed with great gifts of observation and perception. A few months in the country sufficed for him to ascertain the leading topographic characteristics. Looking at his maps, one marvels at the profound differences from the topographical maps of our own day, not to mention the military topographic maps of the Second World War. Salmon's maps are suffused with a yellow-pinkish, buff hue evocative of the brown of the earth in all those parts of the country that were not desert, and of the brilliance of the sunlight. In this way, without subheadings or other qualifying statements Salmon chose to represent the main motif of his geographic conception of Palestine: the contrast between the desert and the sown.¹⁰

The assortment of conventional signs instituted by Salmon included linear symbols for administrative boundaries, different categories of roads and tracks, railways, cliffs, and the hydrography of stream beds; dotted and iconographic symbols marked important items in the landscape; and different area coloration represented ground cover. Use was made of various styles of lettering and scripts. Triangulation and spot heights were indicated, and contour lines were shown in red. To all these was added a gamut of colours. Salmon personally chose all the seven colours for his topographic map of Palestine.¹¹ In a subsequent article published in 1938, Salmon admitted that the categorisation of roadways was represented intentionally in an ambiguous manner since the condition of roads in Palestine was subject to rapid change and development, and he wanted to avoid too rapid an obsolescence of the maps.¹²

The dot symbols indicated villages, mosques and churches, police stations, sheikhs' tombs, bridges, ruins, caves, water cisterns, and wells and springs. Salmon stressed that the landscapes of Palestine were covered not only with existing settlements, but also with a wealth of visible ruins and ancient historical sites: Canaanite fortifications, Arab and Crusader towns, Arab villages, Turkish forts and khans. These were not the concern

solely of archaeologists, geographers, and historians, but were of such universal interest that under no circumstances could they be omitted from these maps.¹³ Salmon sought out among the landscape features elements typical of Palestine—in keeping with his outlook regarding the specificity of every country's landscape deriving from its culture, climatic conditions, and topography. Such, for example, were the large crucifixes at roadsides in France, shelters (*ambalam*) along roads in Ceylon, lime kilns in Cyprus. In Palestine he found caves and extensive ruins. These elements had cultural significance, but also a daily, practical one, for they could serve as hiding places for lawless elements. Salmon fixed upon a tiny semicircle to mark caves, and a circle of black points for ruins and ruined sites similar to that used by Kitchener and Conder in the PEF maps. The difficulty in Palestine was that in many regions there were so many such sites and ancient remains that it became impossible to enter their names in a 1:100,000-scale map. In the Hebron region, Salmon calculated, there was room only for ten place names per square inch, and even for this he had to make many cartographic experiments, including the selection of typefaces and letter sizes.

The area and physiographical symbols are the most characteristic of Salmon's work. He determined upon eleven conventional symbols, incorporated decorative motifs, patterns and colours, and allocated colours to fruit trees, gardens, olives, grapevines, citrus groves, forests and brush, shrubbery, swamps, rocky areas, cultivation and pasture, and sands. Most of these symbols appeared even in the first maps he published, but afterwards some changes were introduced, probably as a result of criticism and re-evaluations. In Sheets 1 and 2 only ten conventional signs appear, in other maps eleven; and in the sheets of the New Series that were published by Stubbs after Salmon's retirement in 1938, only six of these symbols remained. In the first model-sheet—the Jerusalem map—Salmon had included separate symbols to represent rocky and broken ground, but there was no symbol for the swamplands of the country, perhaps because there were none in the Jerusalem region. In the second sheet—Jaffa—Tel Aviv—he did include the symbol for swamps but took out the markings for crops and pasture that he had used in the desert borderlands. In the following sheets he dropped the differentiations of stony topography and used only 'rocky ground'. In 1938 Stubbs discontinued the symbols for all fruit plantations; perhaps he believed that these were not relevant to the three southern sheets of the Negev.

It is not clear whether Salmon was requested to justify the plethora of conventional signs, but from his reactions it seems that he was fully prepared to involve others in his uncertainties. He argued that in the open country of Palestine it was important to facilitate orientation. An orchard, a clump of olive trees, gardens, or vineyards, were identifiable elements of the ground cover, of great use for orientation in the field, and if the cartographer were successful in representing them on his map without affecting its clarity, then 'why not?'.¹⁴ In Britain the situation was different, for on maps of larger scale, of one inch to the mile, or 1:63,360, there appeared very many details that could help orientation even without reference to the forms of cultivation.

Salmon emphasised the necessity of indicating mountainous rocky areas typical of the landscapes of Palestine, as they were in Cyprus and Lebanon. The rock outcrops were indicated in the maps of Palestine with small and large dots of purple colour. But this particular symbol was also criticised, especially when the coloration became exaggerated or distorted in printing. For this reason it was decided to enable users who were not

interested in such details to acquire maps lacking this conventional device. This deletion was painful to Salmon, for he believed that no one with an interest in the area could ignore its physical nature. The agricultural officer, the road engineer, the hiker, the pilot, and the soldier had to know that the rocky ground was not fit for cultivation except in patches, that it was difficult to negotiate, dangerous for emergency landings, and impossible for any kind of wheeled transport. Salmon indeed saw in his mind's eye the map as a tool for terrain evaluation. Whether or not the army appreciated this, at the time of the Arab rebellion army units did not benefit from it.

The choice of colours for the representation of the ground cover also entailed much searching. Salmon chose seven colours: black, brown-red, blue, red (for contour lines), green, purple, and a buff hue for background, all of which would tie the conventional signs together into an impressive presentation.¹⁵ Selecting these colours entailed many trial printings. In July 1933, a few months after his arrival in Palestine, Salmon wrote to A.R.Hinks, the Secretary of the Royal Geographical Society:

I am busy on mapping and am experimenting with my printing staff in the hope of being able to produce my own layered maps. I have no camera but am enlisting the services of a well-equipped Jewish photographer who has all the necessary apparatus but lacks experience in map work.¹⁶

In November 1933 Salmon asked Hinks for information on lithographic printing inks. At that time Salmon tried to print the grey version of the 1:100,000-scale map, entitled 'Administration', for it was intended for overprinting of data of the government departments on the neutral grey background. All attempts to dilute the black inks to make them look grey and prevent their fading with time came to nought. He therefore tried to obtain a colour according to a special sample that he described in detail. In fear that the secret of the product be kept from him, he asked for Hinks's help, on the assumption that the Royal Geographical Society would not be refused this information.¹⁷

Salmon's choice of colours and their number, and the many symbols on the map, did not please many people. In defending his approach he explained the choice of green to emphasise the common crops of the country, but admitted that even if the colour did not improve the appearance of the map and lessened its clarity, it helped users understand the terrain and the country's agricultural character, and facilitated orientation. For those who did not like his green and his purple-brown, Salmon went one step further and decided to publish a special edition in three pale hues—the grey version of the topographic map. On the unobtrusive background of the grey map it was possible to present specific subjects as needed, and indeed the map was produced initially for the results of the new archaeological survey that was to be conducted by the Palestine Exploration Fund and the British School of Archaeology in Jerusalem.¹⁸

Another of Salmon's colours that aroused controversy was the buff ground hue that he chose to knit together all the other colours as an aesthetic whole, and to differentiate between the desert and the cultivated land. It seems that this raised the question of how to portray land suitable for cultivation, and barren or uncultivable land, and the wilderness, which Salmon left white. The limit of cultivable lands in their different grades of fertility was determined by the latest revision of the fiscal survey in 1934. Areas cultivated over more than 10 per cent of their area, and areas that could provide natural pasture, were

indicated by earth colour and were labelled ‘crops & pasture’. In order not to emphasise them in particular, Salmon dropped the decorative motif adapted to the legend and was satisfied with the buff background colour, which was fairly close to the white of the wilderness. Bare ground, or land sparsely cultivated, was indicated by an even paler hue to differentiate it from the wilderness, but was not indicated in the legend of conventional signs. In accommodating his critics who complained of the over-detailing and the multitude of symbols, Salmon hoped that the beholder of the map would understand the meaning of the coloration variation, even without the explanatory legend.¹⁹

Salmon’s rich and colourful legend and conventional signs were in marked contrast to the practical and utilitarian military conception during the Second World War. As long as the army used the stock of maps of the First Series, until it was discontinued in 1942, the Survey Directorate had to improvise editions within the limitations of the military and the civilian printing facilities. Hence, the maps were issued in many different versions—with all the symbols and legends and all their colours, with part of the symbols and fewer colours, as well as in a plain version without any of the coloured additions in which the army printed the maps from the basic plates in black and blue, and with only the conventional sign for dunes. When the Military Series in sixteen sheets was published, there was far less use of colours and symbols than on Salmon’s rich map.

The planimetric and altimetric sources

The credibility of a map depends on its sources. The available information on the sources for the topographic map of Palestine derives from the annual reports of the Survey Department, from a document authored by Salmon in January 1935, and from the reliability diagrams and the indication of the sources printed on the edges of the maps, beginning with the three southern sheets mapped in 1938.

In his ‘Notes on the New Topographical Map of Palestine 1:100,000’, Salmon claimed that the accuracy of the map was greater than that of any other Palestine map, excepting the 1:20,000 and larger-scale maps, because most of the data were copied from the originals that had been reduced from the 1:10,000-scale topocadastral surveys. The contour lines at vertical intervals of 25 metres were copied from every source that was found suitable, mainly military maps; most were surveyed by means of plane table and clinometer, some of them in difficult and hostile territory from aerial photographs. In this document Salmon did not specify which inferior maps of Palestine remained in use, and which of the military maps served as sources for the contour lines. Since in all his articles and lectures he always claimed that in Palestine there had been no topographic map since that of the Palestine Exploration Fund and the First World War maps, he apparently meant these, and consequently the comparison with their dubious level of accuracy was not particularly flattering to the modern topographic map.

The sources described in the reports of the Survey Department have been discussed earlier, and there remains only the important information in the brief indications printed at the edges of the sheets. These gave the last sources available to the Survey Department at the time of mapping, and not primary sources. On the maps of the First Series published by Salmon in 1934–1938 the sources were not indicated at all. Reliability diagrams appeared for the first time on the three southern sheets published in 1938, and

later, in 1942, also on the Military Series of sixteen sheets. Until the publication of the sixteen-sheet series many maps were corrected and revised, and so it is not possible to glean the primary sources from them, but only the very latest sources at the disposal of those who produced these series—mainly surveys and revisions by military surveying parties during the Second World War. On some of the maps no sources were indicated for reasons that are unclear: on the Zikhron Ya'akov (4) and Jaffa—Tel Aviv (6) sheets no planimetric sources are given, and on the Nablus (7) and Yibna (8) sheets there are no altimetric sources. What these four maps have in common, from the information in their margins, is that all are based on surveys conducted in 1924–1934 to a large scale—most probably the topocadastral surveys.

Planimetric sources

The key to the sources derived from the data on the maps is presented on pp. 236–237. The following main details may be learned from them:

- 1 The earliest source is Newcombe's Geographical Section, General Staff (GSGS) map of 1914.
- 2 The northern border region was mapped specially for the British invasion of Syria in 1941.
- 3 In the central parts of Palestine, wide use was made of the 1:10,000- and 1:20,000-scale topocadastral maps, which were revised during the war, and of their reductions to a scale of 1:25,000.
- 4 Use was made also of 1:4,000-scale cadastral maps (the Ghor-Mudawara Agreement maps of 1924, in Sheet 5) and cadastral maps of 1:2,500 and 1:5,000 scales (in Sheet 8).
- 5 Field surveys to a scale of 1:50,000, the basis for the 1:100,000-scale map were used only marginally.
- 6 The British Army made use of aerial photographs for mapping and intensive revision, mainly in Transjordan. In Palestine the Judaeian Desert region was mapped by means of aerial photographs in 1935–1937.
- 7 Most of the primary sources were left out when the maps were revised.

The elimination of the primary sources had far-reaching significance. For example, a person looking at a map published in 1988 that was based on the 1948 revised map could not know that the latter was ultimately derived from maps of the First World War.

Altimetric sources

- 1 The earliest source for the contour lines is the form lines in Newcombe's map of 1914 of southern Palestine ('Negeb').
- 2 Until the end of the Mandate, and also for many years in the State of Israel, contour lines were copied from the British campaign maps of the First World War to a scale of 1:40,000.

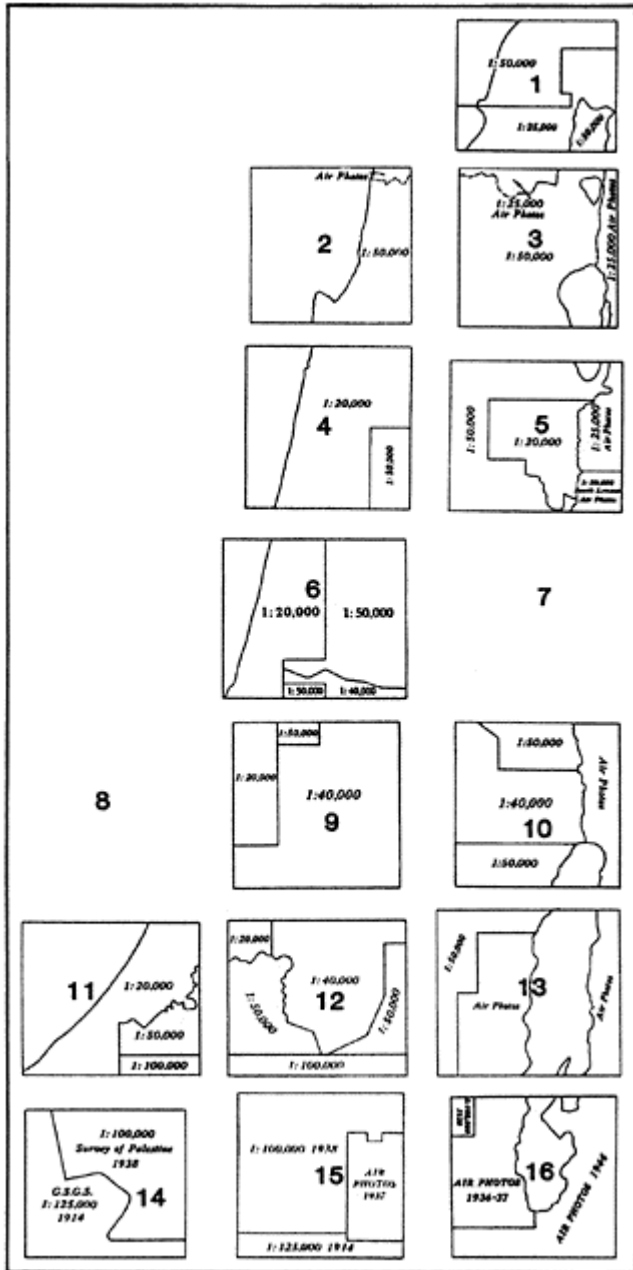


Figure 9.3 Planimetric reliability sources of the 1:100,000-scale map (source: SoI).

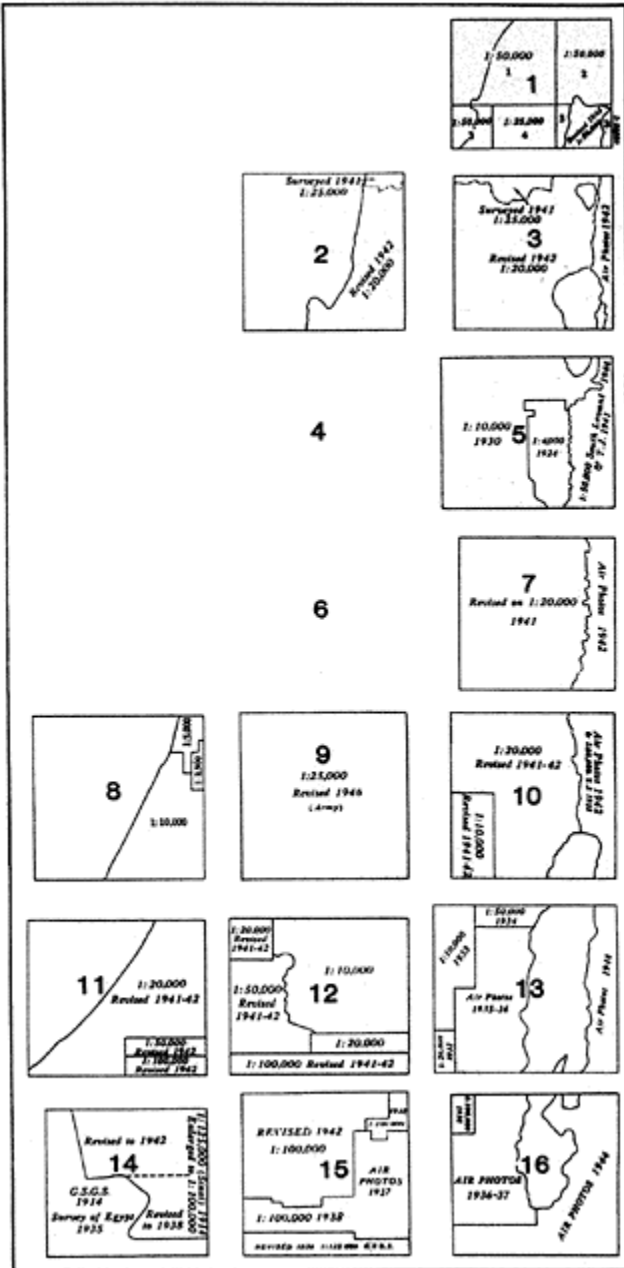


Figure 9.4 Contour reliability (altimetric) sources of the 1:100,000-scale map (source: SoI).

- 3 For the central parts of the country, contour lines were drawn from the topocadastral survey to a scale of 1:10,000 and the 1:20,000-scale topocadastral maps.
- 4 For the north of the country, contour lines measured in field surveys to a scale of 1:50,000 were drawn for the 1:100,000-scale series, and in the south of the country the contour lines were surveyed in 1938 in the course of the field mapping to a scale of 1:100,000.
- 5 West of the Dead Sea, altimetry was plotted by the photogrammetric method from aerial photographs taken in 1937, and east of the Dead Sea the survey was derived from aerial photographs taken during the Second World War.

The system of overlap between maps

Salmon took pride in his idea of overlapping maps. In the article he wrote in Ceylon he argued that there was much to be said for the overlap system so that the beholder would find his way at the edges of the map.²⁰ As was mentioned on p. 225, in Palestine he planned the format of the topographic sheets so that there would be an overlap of 5 kilometres at the western and southern edges. Salmon saw this as a decided advantage that created a convenient continuity from map to map without having to glue them together in order to look at the country beyond the limit of the sheet.²¹ When the change in the format of the series was planned in 1938, the overlap at the southern edges was eliminated, except for the overlap that remained between the Haifa and Safad sheets and the Zikhron Ya‘aqov and Beisan sheets. The overlap at the edges remained and was even extended along the slant of the coastline where it was touched by the southwestern corners of the sheets.²² The most pronounced change in overlap was in the Jerusalem and Jaffa—Tel Aviv sheets, which had been produced in a version of the previous format for greater overlap on all their edges.

The military Survey Directorate did not accept the overlap system. In 1940, when the cartographic inventory in the region was checked, the armed forces had to address the matter of the overlap lest it cause confusion in the Army’s field units.²³ In a special appendix to the report of 25 October 1940²⁴ it was said that, at first sight, the overlap looked attractive and useful—until its military drawbacks became manifest. What was useful to a civilian could be a source of danger, misunderstanding, and waste of resources in a military framework. The system had to duplicate work for the sake of the overlapping areas, it entailed double preparation for printing the same areas, extra paper had to be allocated, and only rarely did the overlapping areas appear in identical form on the two adjacent maps—because of the different times of their revision and the different editions of the maps. Thus an essential feature could be revised on one map, deleted from its overlapping neighbour, or not yet revised on the latter. In such a

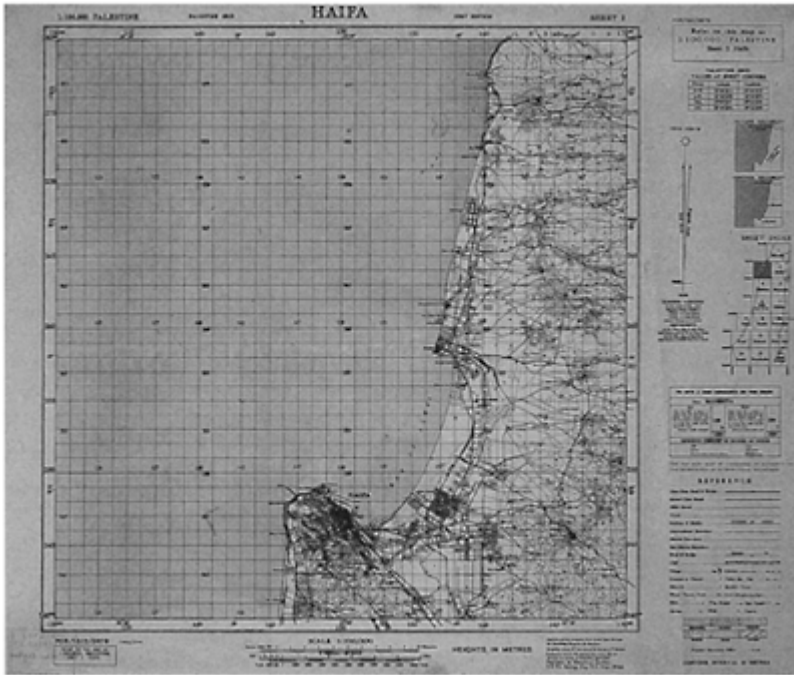


Figure 9.5 ‘Haifa’: Sheet 2, 1:100,000, 1942 (reduction). Example of maps in the last Mandatory topographical series of sixteen sheets, published in November 1942: the last revision and updating was made in March 1946, after the Second World War; note that the coordinates grid is again named ‘Palestine Grid’ (source: SoI).

case it was conceivable that a command could be given on the basis of one map and executed from the neighbouring map—with dire results. Such confusion did indeed occur in France when a new series of 1:50,000-scale maps was prepared and there was no possibility of revising the maps simultaneously. Here was the difference between theory and practice, and between the idea and actual experience gained at much toil and at a later time. The Survey Department had no choice but to take seriously the requests of the army, and a new format in sixteen sheets was planned for the 1:100,000-scale topographic maps.

Multi-language maps: English—Hebrew and English—Arabic

One of Salmon's guiding motifs was the national significance of the topographic map. Salmon, of course, meant the graphic presentation of the landscape, and did not conceive of the possibility that the map could have another, linguistic symbolism without which the population would not identify with the map. According to the British approach in their colonies, the language of the map was English, the language of the ruling power. The cadastral maps, as will be recalled, came out in three languages in pairs: Arabic—English and Hebrew—English according to the population that had recourse to these maps. The motor map too was issued in three languages; but not so the topographic map. The engineer Hillel Birger, who was known as the father of topographic education in the Jewish *yishuv* in Palestine, proposed to Salmon in October 1937 to publish the topographic map in the three official languages: English, Hebrew, and Arabic. In that year Birger proposed topographic training to the Hagana underground organisation units, and the language of the map was adduced as an obstacle to its use. Salmon's reply was quick:

It would, of course, increase the value of our maps very considerably if editions could be prepared in the three official languages and there is no doubt the Jewish community, who devote much time to the study and exploration of the country, would derive great benefit from Hebrew editions. It has been, however, sufficiently difficult with the staff and funds at the disposal of the Department to deal adequately with the cartography of Palestine in one language only. The maps have so far been mostly used for Government Departments, while over 30,000 copies were issued to the Troops, but your suggestion for issuing a key in Hebrew is one which might extend the usefulness of our maps very considerably.²⁵

Salmon had in mind the motor map in three languages, which sold mostly in its English version, less well in Hebrew, and hardly at all in Arabic. Finally he concluded that the Arabic and Hebrew maps could serve for the motor route map, as also the 1:100,000 and 1:20,000-scale maps, and he promised to consider their production. In his Survey Department report for 1938 Salmon stated that the list of conventional signs in Hebrew for the 1:100,000-scale maps would appear shortly, as indeed happened.²⁶

Salmon mentioned incidentally the list of conventional signs in Hebrew that would also serve the 1:20,000-scale map. For some reason he did not refer to the special version of this series that was issued in a bilingual Hebrew—English edition and was printed by the Survey Department. From 1932 the Palestine Development Company published the topocadastral maps in a reduced version of 1:40,000 scale.²⁷ Yehoshua Hankin and Zalman Lif, who were among the chief Jewish experts on land matters of the *yishuv* institutions, prepared these maps. In addition to the topocadastral mapping copied from the sources of the Survey Department, and with its permission, the lands owned by Jews were marked on the map according to their division among the Jewish National Fund, the Palestine Colonisation Association, the Palestine Development Company (*Hakhsharat*

Hayishuv) and privately owned lands. But the most characteristic bilingual topocadastral edition was issued many years later, in 1947, to the original scale of 1:20,000. In these maps all the registry blocks with their parcels were reduced and printed very clearly. In this series the lands were also marked according to ownership, whether by the Jewish National Fund or privately, and according to internal categorisation by *musha'*, *mafruz*, or lands held as concessions.²⁸ Although these maps were not produced out of nationalist motives but in order to plan national Jewish land policy, something of this nationalist fervour did attach to the Hebrew version prepared before the establishment of Israel.

Military mapping and the topographic maps of the Second World War

Topographic and military campaign maps are virtually the same thing. In both surveying and military literature it is generally accepted that the range of scales of topographic maps for military applications varies from 1:10,000 to 1:250,000. In army parlance this range is divided into three groups by scales: small-scale strategic maps; medium-scale tactical maps; and large-scale battle maps. The close conceptual connection between the military and the topographic maps attests also a technological affinity, namely that topographic maps are created according to military specifications. But in the case of Mandate Palestine the historic development of the topographic map was different. The army received a supposedly finished product that had been prepared by the Survey Department for other purposes; nevertheless, the military had sufficient scope to speed up the work, to make special production demands, to introduce important changes, and especially to step up the pace of the revision of details to reflect rapid developments in the landscape. In the Second World War the British Army found in Palestine a cartographic production system, a diversified stock of maps, and a superior professional staff that was ready to meet the demands of military production.

The Survey Directorate was set up in February 1940 in the General Headquarters Middle East Forces of the British Army in Cairo. It was headed by Colonel R.L.I. Brown, who came to Cairo with a small staff from the emergency reserve of the Survey Command of the army. Immediately after him, in March, two professional units arrived in the region: the 512 (Army) Field Survey Company Royal Engineers (which was to invest great cartographic effort in Palestine), and the 2 Field Survey Depot Royal Engineers.²⁹ Within a short time came additional survey units, and with the growth in operational activity, changes were instituted in the structure and the hierarchy of the commands. In Palestine a local command was established, with one commanding officer and two clerks. The commanding officer was Major E.W. Nesham in the position of



Figure 9.6 Australian 2/1 Field Survey Company at work at the time of the British invasion of Syria in 1941 (source: Australian War Memorial, 22643, Canberra).

DAD [Deputy Assistant Director] Survey.³⁰ The small team and temporary reinforcements they were given directed the cartographic preparation in Palestine and Transjordan for the invasion of Syria and Lebanon in 1941. The task was apparently beyond their capabilities, and in September 1941 their status was changed as part of an extensive reorganisation of British deployment: the Western Desert Force became the Eighth Army, and in the Palestine Sector the Ninth Army was formed. The Survey Directorate of the forces in Palestine and Transjordan was moved to the Ninth Army, under Colonel A.Prain as DD [Deputy Director] Survey.³¹

Immediately after its establishment in February 1940, the Survey Directorate Middle East Command conducted the first inventories of the cartographic stock and began planning the integration of the civilian Survey Department into military mapping tasks. The inventories encompassed the entire theatre of operations: the Balkans, Turkey, Iraq, Syria, Palestine, Egypt, Aden, Italian Africa, Kenya, and North Africa.³² In March 1940 the Survey Directorate visited the Palestine Survey Department, which had enlisted in the war effort and placed at the disposal of the army its stock of maps of military value, as well as the means of production for cartographic work.

The visit revealed the capabilities of the department and assessed the value of its maps, and a comprehensive and fully considered evaluation was set out in a ‘most secret’

document of 25 October 1940.³³ The objective of this document was the preparation of a paper on the surveying and mapping requirements for operations to be carried out in Palestine, or from Palestine and Transjordan. The investigation was conducted on the estimation that military operations against Syria would not begin before March 1941. The war zone was defined as the Northern Defensive Position of the Defence Line in northern Palestine and Transjordan, with the possibility of advance into Syria or retreat through Palestine. The subjects to be ascertained were the availability of strategic, tactical, and operational battle maps; triangulation grids, coordinate grids, and sheet indexes of the maps; and possibilities of producing new maps as required.

Specifically, the army needed 1:250,000-scale maps of Palestine, Transjordan, and the lava plateaux of the Hauran and southwest Syria for strategic applications; 1:50,000-scale tactical maps of the Northern Defence Line and its approaches, and of certain other areas; and detailed 1:25,000-scale operational maps.³⁴ The answer to these requirements in Palestine was a 1:250,000-scale strategic map, with revised coordinate grid and updated roads; the 1:100,000-scale topographic series with a revised grid and fully updated details filled the place of the tactical map; and, for operational uses, the 1:20,000 series, with the reservations as to the inconvenience of this scale.

The decision was to use all the existing cartographic raw material of 1:10,000-scale for reduction to 1:20,000, and to add a coordinate grid to all the maps. This would start from the north of the country and move south to the Haifa—Beisan line. The Survey Department was asked to try to convert the contour lines on the 1:50,000 scale (which had been prepared for the 1:100,000-scale series) so as to adapt them to the 1:20,000-scale series and in this way to economise on surveying anew in the field. The programme stipulated that when the Survey Directorate was allocated the necessary means, the 1:20,000-scale series would be reduced to 1:25,000 scale. It was also decided that GHQ would draw up a plan for aerial photography of the area for which operational maps were needed and for which there was no suitable existing cartographic material.

Two of the military requests require elaboration. One, regarding the operational 1:25,000-scale battle maps, has already been explained by the fact that the army's instruments were graduated to this scale. The second had to do with the coordinate grid. The army used the geodetic Transverse Mercator projection grid, commonly referred to as 'military grid'. This projection, known otherwise as Gauss-conformal,³⁵ had been considered in the past for Palestine, but, as mentioned earlier, the Cassini—Soldner projection had been adopted instead.³⁶ The Cassini projection is not conformal and did not suit military applications. The difference between

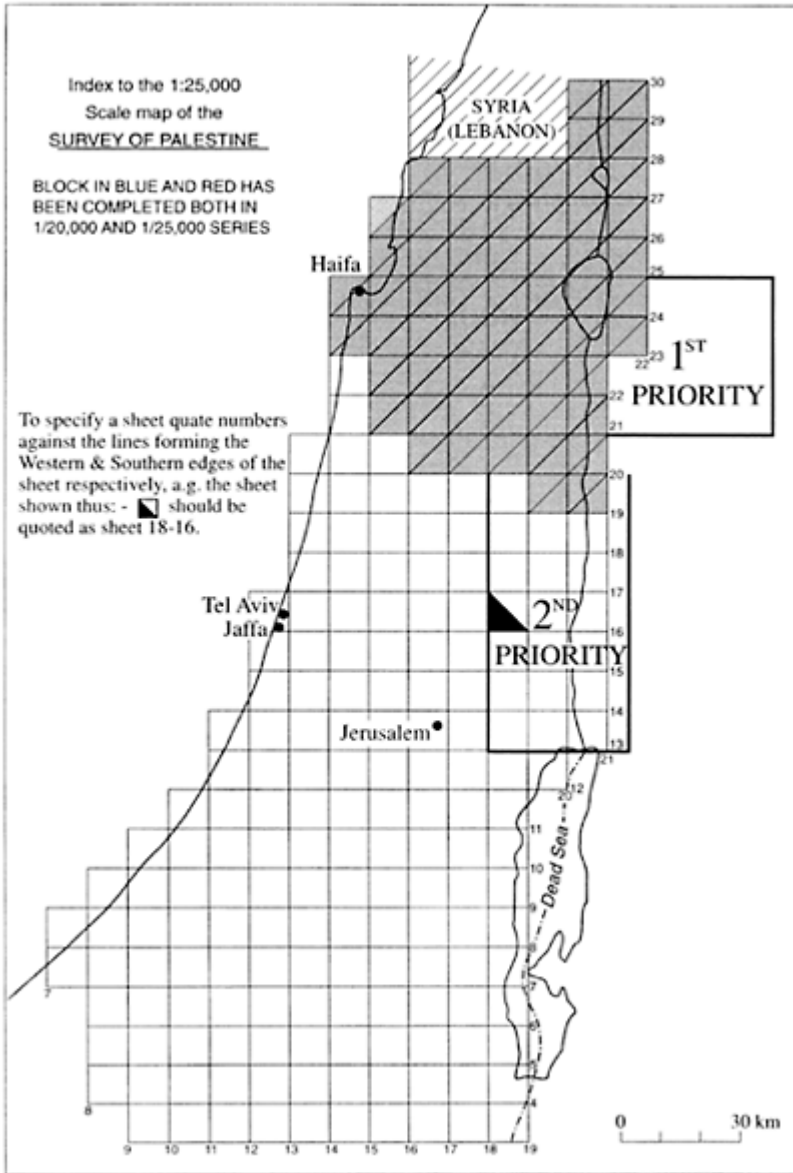


Figure 9.7 Priorities of mapping the Palestine 1:20,000 and 1:25,000 series in 1941 (source: Monthly Report, August 1941, Survey Directorate HQ ME, CRME/9688/CV, Ministry of Defence, London).

these two projections in a country as narrow as Palestine was not significant; it was noticeable only along the ordinates (the longitudinal axes of the coordinates system), and increased proportionally to the square of the distance from the central meridian of the country—the Jerusalem meridian. If the difference between the projections along it was zero, then in the Jordan Valley there was only a minuscule difference of 10 centimetres on the ground. At the westernmost part of the country, at a distance of 80 kilometres from the Jerusalem meridian, the whole difference came to 3 metres.³⁷ These were totally negligible values that did not affect the accuracy of mapping, were not noticeable on maps of smaller scale than 1:50,000, and were not very important even on maps of larger scale. But these differences were of significance in the directing of artillery fire.

In January 1941 calculations were undertaken in the Survey Department regarding the conversion of coordinates values from Cassini to Transverse Mercator for the triangulation points in Palestine. With the completion of the conversion, lists of coordinates were published in trig lists arranged according to the sheet numbers of the 1:20,000-scale maps,

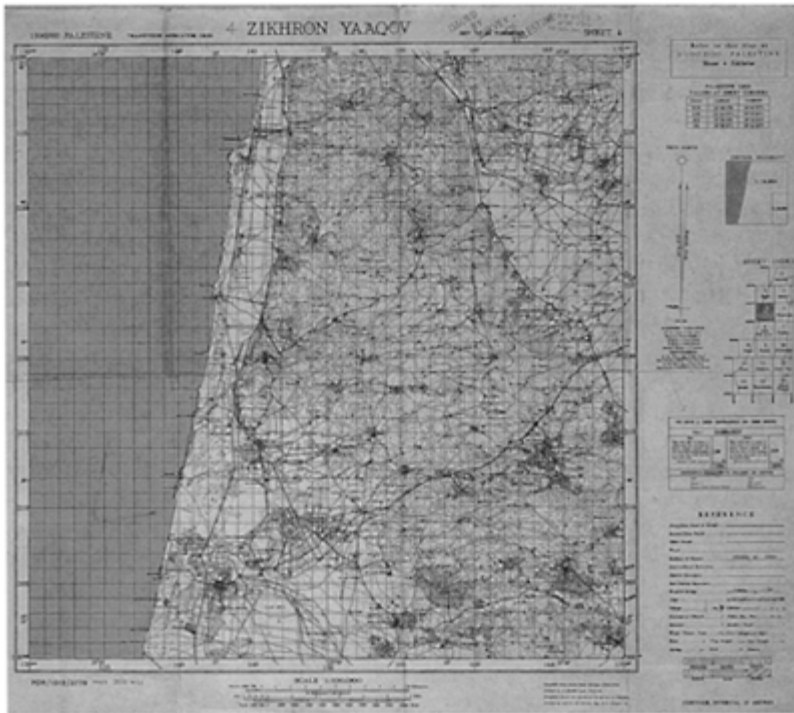


Figure 9.8 ‘Zikhron Ya‘aqov’: Sheet 4, 1:100,000 (reduction): the military version designated ‘Transverse Mercator Grid’ (source: ML).

or on 1:25,000-scale military versions.³⁸ But the army, which converted the coordinates, did not convert the map grid, for the tiny difference between the two projections saved them the trouble of redrawing the grid. For efficiency's sake the army simply overprinted the maps with the national grid, mainly in blue, and sometimes in black under the title Transverse Mercator Grid, or Palestine Military Grid. And so, by changes of colour, a new-old grid was added to the maps of Palestine, and from that time two grids were indicated on the maps of the country: the Palestine Grid in black, and the Palestine Military Grid usually in blue (some maps of Palestine also had the Red Grid of the Levant or of Egyptian Sinai). This peculiar but practical step was explained by the intention to avoid confusion and errors by soldiers, who would have to work with tables and maps that were not constructed along the same mathematical bases. For this reason the name of the grid was changed without changing the grid itself, avoiding contradictions between the tables and the maps that were distributed for use without reservations.

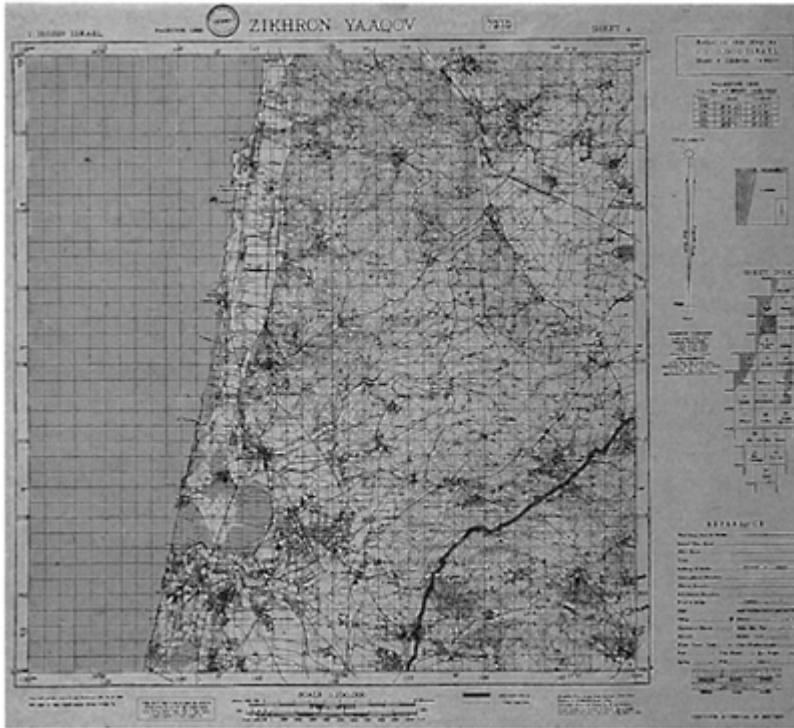


Figure 9.9 'Zikhron Ya'aqov': Sheet 4, 1:100,000 (reduction): the regular version designated 'Palestine Grid' (source: ML).

One of the most important side products of the military mapping was the *Gazetteer of Place Names*, which was prepared to accompany the 1:100,000-scale maps of Palestine and the 1:250,000-scale map of Transjordan. The gazetteer was an index of all the places indicated on the map. The military gazetteer, which appeared in Cairo in 1945, superseded the first one, prepared by R.F.Jardine of the Lands Department and B.A. MacArthur-Davis of the Palestine Surveys, which was published in 1940.³⁹ It included an alphabetical glossary of terms and abbreviations, the number of the map in which the name appeared, the grid references, and a description of the place. To the name of the settlement or village was added information on its type, area, the sub-district, and the number of inhabitants and their religion(s). The 1945 gazetteer was prepared by a special unit of the Survey Directorate in Jerusalem under Professor David Amiran, charged with compiling gazetteers for many other districts and countries. The new gazetteer for Palestine included names from the south Levant maps that complemented the maps of Palestine east of the Jordan and the Dead Sea, and names from the southern sheet of Palestine to a scale of 1:250,000.⁴⁰ The military gazetteer was reissued by the Survey Department in 1948.⁴¹

The military mapping of Palestine during the Second World War became the model for the topographic map inherited by Israel from the British. The civilian topographic map was replaced by the military one, which was indifferent to the 'desert and the sown', less elaborate, and more matter-of-fact; it presented less of the ground cover and had fewer colours and symbols. All the maps were gridded with the Military Grid, were revised frequently with no concessions to civilian convenience such as overlap between neighbouring sheets, had special formats for folding, and were without the picturesque covers.

To take one typical example—in the categorisation of roads on the topographic maps—the full impact of the differences between the civilian and the military approaches becomes evident. As we have seen, Salmon intentionally blurred the differentiation in his representation of roads since the determinations were liable to become obsolete fairly quickly as new roads were built. The army acted in exactly the opposite way when Loxton was sent out to update all the roads of the country and classify them precisely as to passability by military vehicles. In contrast to Salmon's civilian outlook, the army saw to it that every change in the landscape of the country was immediately reflected in the maps; hence, many revisions were published throughout the war years.

The State of Israel inherited the British military topographic maps and printing plates in 1948. Since Israel was then in the midst of the war with the Arab countries, the conception connecting the military and the topographic map tended to become entrenched. Only in recent years has the Survey of Israel freed itself of this approach, with the military map—in particular the UTM series—now being separated from the civilian topographic map, which has been given a touring aspect with emphasis on recreation and educational factors, and the military coordinate grid repressed as much as possible.

The Survey Department and the partition of Palestine, 1948

The survey of Palestine came to a halt at the end of 1947. Efforts were made in the Survey Department to continue working in the field, at the office, at the draughting tables, and at the printing presses. In that year the number of plans checked by the District Surveyors increased by 50 per cent compared with 1946, but these were rearguard actions as the British planned their departure from Palestine. In February 1947 the British officials sent their families home; those going to work did so under armed escort. Between 2 and 17 March martial law was proclaimed in the Jewish parts of the country; government activities were cancelled, and the Survey Department was completely cut off from the field parties and the district offices. Mitchell, the Director of Surveys, found himself in the position of adviser on survey matters to the military commander of the Tel Aviv region and was much valued for his professional contribution. From February until November 1947 the Survey of Palestine's head office in Tel Aviv was guarded by an army unit housed in the department. The building was attacked in March, and one of its men was killed.⁴² The Palestine partition resolution was passed by the UN Security Council on 29 November 1947, and that very moment all contacts between the Jewish and the Arab areas ceased. The Arab workers could no longer come to the head office, located as it was in the Jewish city.

The British withdrawal from Palestine commenced at the beginning of December 1947. On 4 December the directorate of the Land Settlement Department alerted its Field and District Officers regarding the disposal of all documentation dealing with land settlement in the future Arab state, the Jewish state, the international zone of Jerusalem, and to settlements whose fate had not yet been determined by the exact demarcation line of the Partition.⁴³ That month the military Survey Directorate and the civilian Survey Department began to prepare their exit from the country. Perhaps it was symbolic that towards the New Year of 1948, thirty years after the end of military mapping of the First World War and the dawn of civilian mapping, as the preparations for departure of the British were in full swing, Andrew Park Mitchell was presented with the CMG by the High Commissioner.⁴⁴

Mitchell, who apparently was not issued clear instructions on the future of the Survey Department, decided to act on his own. He did not restrict himself to dividing the map store between Jews and Arabs, but resolved on establishing a branch—in effect, a survey department—for the coming Arab state. The official reason for this was the desire to continue employing the Arab staff of the Survey Department who were no longer able to come to the head office in Jewish Tel Aviv.⁴⁵ On 18 January 1948 Mitchell moved the Arab workers and their families to Ramle and put Loxton in charge.⁴⁶ The army placed at his disposal buildings and stores in the RAF camp at Ramle together with lorries to transport the documents, maps, equipment, the printing shop, and part of the office from Tel Aviv. Transport was provided by the army because Jewish drivers could not enter Ramle and Arab drivers were afraid to go to Tel Aviv.⁴⁷

From then until the end of the Mandate, some of the Jewish workers were given a new 'job' in the department, that of dividing the documents and maps according to the Partition plan. They were detailed to separate the maps—but after working hours were

busy undoing the Partition plan. From the testimony of one of them, the Partition line sometimes cut through registry blocks, and he had to decide to which of the two states the maps would go. With the open support of one of the senior British officials, he left the map in the 'Jewish pile'.⁴⁸ The Jewish workers found ways to remain in the department after hours, and, following instructions from the Hagana, messed up the arrangements, and transferred maps, field books, and lists of coordinates to the pile that was to remain in Tel Aviv, or copied documents they feared would be shipped to Britain.⁴⁹ From all the available evidence, this Jewish underground activity was not unknown to the British, who could not, or perhaps did not want to, prevent it. The only thing Mitchell did was to speed up the transfer of sorted material to Ramle. But the Hagana also managed to capture some of the British lorries on the way and to hide the loads in the cellar of one of the buildings in Saron.⁵⁰ The separation of material could not, of course, affect the partition of the country, but only leave it for Israel with all the other documentation dealing with lands. The maps of Arab villages had obvious military value in the coming open war between Arabs and Jews after the departure of the British.

The first task of the British and Arab survey workers in Ramle was to check the material transferred to them. This is attested by the files entitled 'Missing Documents', 'Stolen Documents', 'List of Documents of the Arab State Transferred to Ramle'. Among the files there were lists of blocks missing in the Arab and the international parts; field books that been transferred to Ramle by mistake that belonged to the Jewish part, and field books of the Arab part that did not reach Ramle; city maps that disappeared (Jaffa and Tiberias to a scale of 1:1,250); a list of stolen registry blocks in the Jerusalem region—'Ein Karim, Lifta, Deir Yasin, Beit Safafa, Qaluniya, and Motsa; the list of maps of contour lines that disappeared; and others.⁵¹ Presumably, much of the material moved to Ramle was eventually returned to Tel Aviv—certainly not all of it, because after the RAF base in Ramle had been vacated, the guard was relaxed and groups of Arabs invaded it and pillaged and burned equipment and documents that were in effect destined for the Arab State.

Mitchell and Le Ray joined the department in Ramle on 28 February and did not return to the head office in Tel Aviv. Mitchell bid farewell to the department in Ramle on 25 March 1948 and left the country in April.⁵² Le Ray, who had begun his work in Palestine in the Survey in 1921, left after him, on 8 April. Loxton took pride in being the last of the British survey workers to leave Palestine. He left from Lydda on 23 April 1948 on a plane that also carried the British airport staff. In the short interval until the proclamation of the State of Israel on 15 May 1948, the Jewish workers of the Survey Department organised themselves under the direction of Boris Goussinsky, the senior Jewish employee, while awaiting instructions from the newly formed Government of Israel.

Along with the division of the material, the British also dealt with personnel matters to ensure the future and pension rights of the staff. In April 1948, about a month before the British departure, Mitchell and Loxton conducted a personal check of all the Jewish employees of the department (the Arabs were no longer in Tel Aviv) to clarify which of them intended to continue working and which refused to work under the new authority. The list of workers who signed for continued employment, 118 names (later two more names were added—those of the cleaning ladies), was transmitted to the United Nations representation in Jerusalem.⁵³

In order to complete the withdrawal in time and in orderly fashion, the British established two branches for dealing with personnel: one in Cyprus and one in the Colonial Office in London. In Cyprus an Accounts Clearance unit was set up, to which all the personal files of the non-British Government employees were transferred, and in London a special group was formed to deal with the residual staff of British Government employees, some of whom had already taken up positions in other colonies.⁵⁴

The British left the Survey Department without taking with them the archives of documents and maps of the department; nor did they take the Land Registry books and the land settlement documentation, but microfilmed them for back-up. These back-up photographs were subsequently returned to the Government of Israel.⁵⁵ Among the list of secret documents that were brought to Britain or were destroyed by the Chief Secretariat of the Palestine Government there was no mention of any Survey Department documents.⁵⁶

The imprint of Salmon

The topographic chapter in the mapping of Palestine during the British Mandate began out of cadastral motivation with the 1:20,000-scale series and ended with the 1:100,000-scale military series. The prominent change in the cartographic conception must be entirely credited to the Director of the Survey Department, Colonel F.J.Salmon, who arrived in Palestine in 1933. In March 1941, twenty years after the establishment of the British Mandate, the new Director of the Survey Department, Andrew Park Mitchell, spoke on Radio Jerusalem:

[I]n 1938, Palestine had a series of first-class topographical maps covering the country from the northern frontier to a line as far south as Beersheba. These maps are printed in eight colours and, with the symbols representing the various features, give a bird's-eye view of whole landscape. This is the type of map which should be your companion.... These topographical [1:100,000] maps have served as a base on which many problems, affecting both the Government and the people, have been studied.... They hold their own with the modern maps of other national map-making Departments and we are proud of them.⁵⁷

The topographic map inherited by the State of Israel from the British was Salmon's creation—not so much because he initiated it and made it a reality, but mainly because it reflected his professional philosophy and its complete identification with the natural and human landscape of the country. Ley was a surveyor of strong geodetic background, whereas Salmon was a professional with an original, imaginative cartographic conception. During his stint in Palestine, Salmon took upon himself many responsibilities and challenges, far beyond those of his predecessor. In September 1935 he wrote to Ernest Dowson:

Time does not hang on my hands these days as I have surveys, settlement, registration, state domains and both the rural and urban property tax to

deal with. However things are going not too badly and life would be rather dull if we had no problems to solve.⁵⁸

With all of this, Salmon pushed for the development of a 1:100,000-scale topographic series. He directed the precise levelling in Palestine for the water sources survey, and had in reserve plans for an administrative map to the scale of 1:250,000, a map of Roman Palestine drawn up from data provided by the Antiquities Department, and a new 1:2,500-scale map of Jerusalem's Old City.

Salmon did not hide his pride in his cartographic creations. In his writings and lectures he used the first person singular in describing the stages of planning, the considerations governing his decisions, the implementation, and the drawing of conclusions. The concrete expression—perhaps somewhat strange and presumptuous—of his attitude is to be found in the margins of his maps and in the margins of the covers of the maps, in the form of his name—an artist claiming credit for his creation. In this he undoubtedly took inspiration from the attractive touring map covers designed and drawn by Ellis Martin and others for the Ordnance Survey.⁵⁹ Salmon also printed his name on the maps he published in Cyprus.

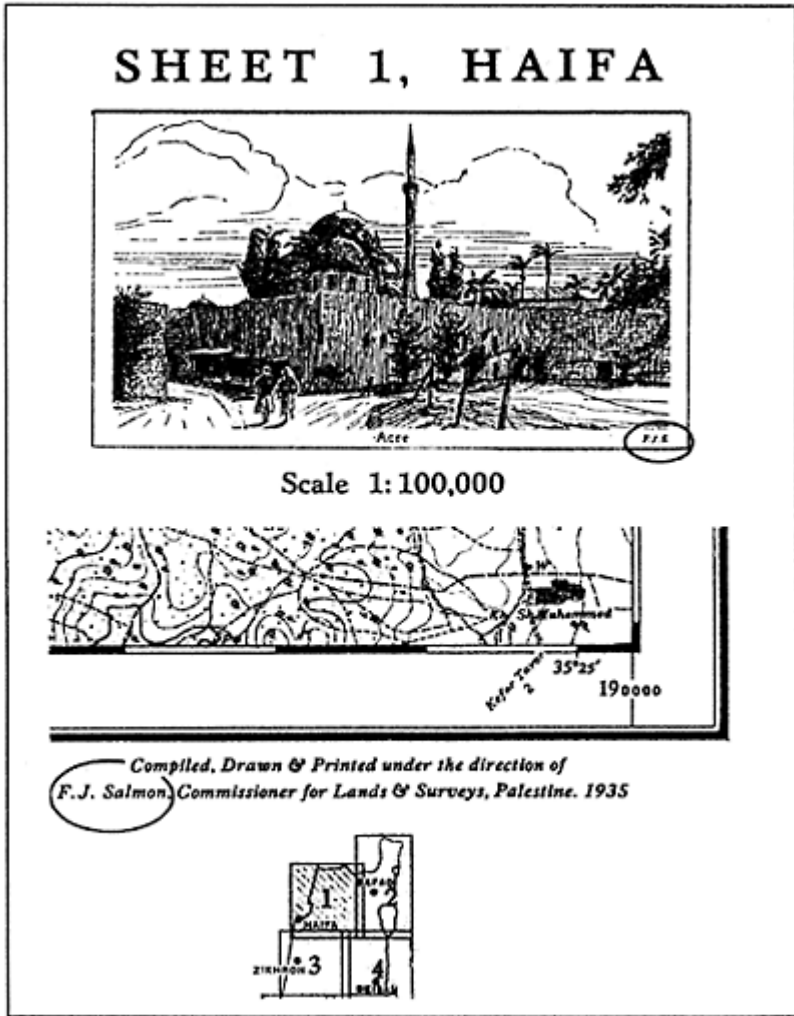


Figure 9.10 Salmon's name and initials indicated in maps made under his directorate: top—on binding cover; bottom—in margin of topographic map (source: ML).

His short-term heir in Palestine, Stubbs, tried to imitate him and put his name in place of Salmon's in the margins of the three southern sheets to 1:100,000 that appeared in 1938. He even erased Salmon's name from the covers of the maps. But with the arrival of Mitchell this practice was stopped and in the sixteen-sheet series it no longer appears.

The topographic series appeared at an opportune time with the outbreak of the Arab rebellion in 1936. In a lecture Salmon delivered in 1938 before the Royal Central Asian Society in London he said regarding this matter:

[I]t was by the greatest luck that I had completed the sheets in the area where most of the troops were;—Tulkarm, Nablus and Jenin—which is the worst country for bandits and raiders. So that as soon as the two Divisions came to Palestine I was able to issue them sheets, and in 1936 my printing staff, with only one machine, working often day and night, produced 30,000 copies for the troops and police.⁶⁰

In 1936 Salmon received a letter of thanks from Lieutenant General J.G.Dill, the commander of the British forces in Palestine and Transjordan, for the war effort of the Survey Department's staffs: 'I know how readily you have co-operated with my Survey Officer in meeting our urgent demands for special editions of maps and plans, and with your valuable advice; and I appreciate it very much.'⁶¹ Salmon replied to the general with a touch of humour:

Unfortunately the trouble started before I had been long enough in Palestine to get very far with my mapping programme, though it is fortunate that you did not come a year ago as I should then have been able to give you very little.'⁶²

And Salmon continued:

By next Spring I shall have 1/100,000 sheets of all excepting the Beersheba Sub-District finished and I shall keep a fair stock in reserve. Our maps, of course, have to be designed for a variety of users and so they are not ideal for the Army, but being on the reserve of the survey Branch of the Corps, I do try to keep Military requirements in view.'⁶³

Aftermath

The Survey of Israel took over the property of the Mandate Survey Department. In the first years of the State the topographic map was printed from the printing plates of the original map, in English. Gradually the department began to update and revise the old maps and to add details overprinted in Hebrew, and after several years went over to a full Hebrew printing. The printing plates of the topographic maps of Palestine passed through many hands. At the time of the Second World War, units of the Royal Engineers took part in the revision, the printing, and distribution of the maps, and the plates found their way to London and Cairo; and after the State of Israel was established they still served military needs.

However, in Palestine too the British topographic maps were put to special use.⁶⁴ When the activities of the Jewish underground organisations against the British forces in the country intensified, and preparations were increasingly made for the inevitable open

conflict with the Arab population, topographic maps were required for training the underground units. Most of the maps were obtained by raids on the map stores of the British Army, although some were purchased legally. But the Technical Department of the Hagana launched into its own initiative, and in 1944–1946 decided to draw up Hebrew topographic maps by copying the British maps. The Hagana's cartographer was Gershon Plotkin, some

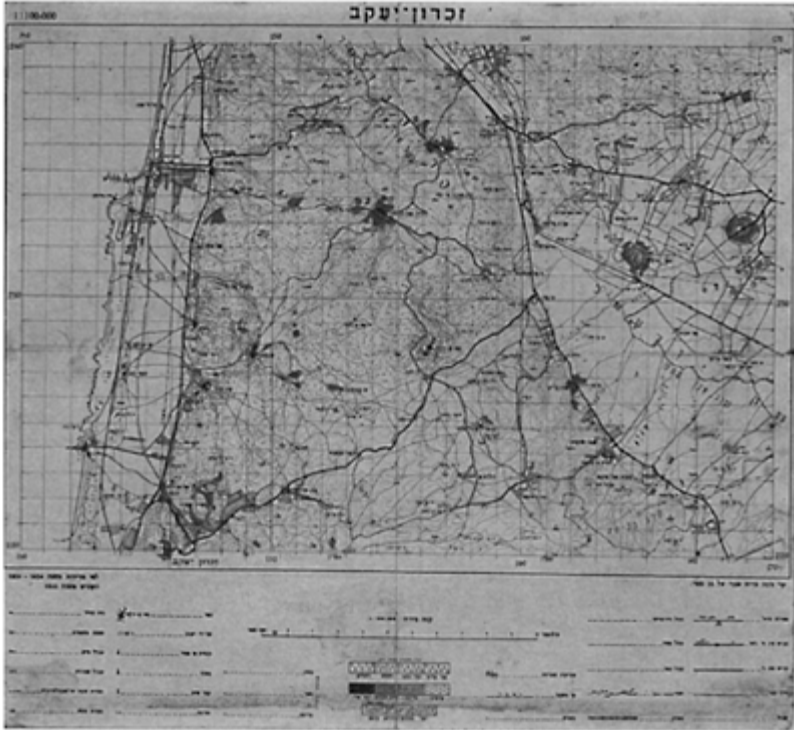


Figure 9.11 'Zikhron Ya'aqov': Sheet 4, topographic map in Hebrew, 1:100,000: the map was drawn up by the Hagana in 1945. The small format of the sheet was dictated by the size of the printing press. The coordinates grid was added in pencil to the printed map (source: M.Netzer, Holon).

years before he became a director and actor with the Cameri Theatre in Israel. Apparently, seven sheets of 1:25,000-scale Hebrew maps were published, and another sheet of 1:100,000-scale of the Zikhron Ya'aqov map.

The maps were prepared for a platoon commanders' course of the Hagana at Juara near Kibbutz 'Ein Hashofet. Only a few sheets of this map have survived (mostly in private hands) since in the wake of 'Black Saturday' (29 June 1946), when mass arrests of Jewish leaders were made by the British forces, the Hagana destroyed many of its archives for fear of discovery. Nevertheless, the documentation taken by the British included some of these maps. According to Zalman Lif, who at that time worked in the Survey Department at the printing of the topocadastral maps for the Jewish National Fund, Mitchell asked him with a wink, 'Why did the Hagana have to make its own maps?'⁶⁵

Part V
The map of Mandate
Palestine

10

The map of Palestine and the Imperial cartographic system

The history of the connection of Palestine with the British Imperial survey system can be divided into two periods: the pre-Mandate period and the time of the British Mandate. In the first period the people of Palestine hardly had any interest in the mapping of their country, and British surveyors worked there for scholarly as well as for political and Imperial strategic ends. The second period commenced with the British as conquerors and continued as trustees with a mandate for the administration of Palestine. At that time Palestine was in urgent need of mapping, and the Mandate government was hard put to meet the demand. The Royal Engineers, the Admiralty, the Ordnance Survey, the GSGS, the military field survey units, and the Palestine Survey Department—each in turn was involved in the modern mapping of the country, and throughout more than a century, from 1841 to 1948, created a rich and varied cartographic continuity. The country's cartographic attraction to the British has raised the question whether their motivation was colonialist or had the best interest of Palestine at heart.¹

The pre-Mandate period began in the first half of the nineteenth century. In 1841 surveyors of the Royal Engineers landed in Palestine and under the command of Lieutenant Symonds surveyed the country and drew up a map. Some twenty years later, in 1864–1865, Captain Charles Wilson mapped Jerusalem for the British Ordnance Survey. In 1871 the Royal Engineers Lieutenants C.R. Conder and H.H. Kitchener with their parties of sapper surveyors conducted the detailed surveys for the Great Map of Western Palestine of the Palestine Exploration Fund. And along with the surveyors on land, the British Admiralty mapped the Red Sea coasts, continued under Mansell along the Mediterranean in 1862, and later returned many times to survey the continental shelf of Palestine. Colonel Newcombe and his Royal Engineers survey parties in 1913–1914 mapped north Sinai and southern Palestine. The military mapping of the First World War closed the first cartographic period. Much of this cartographic activity was done on the initiative of British military intelligence, associated with the initials GSGS (Geographical Section, General Staff).²

In the second cartographic period, under the Mandate, from the end of 1920 to 1948, intensive survey and mapping activity was carried out in the country by the Survey Department of the Government of Palestine—the Survey of Palestine. The department was directed and controlled by a British staff trained by the Royal Engineers, the British Ordnance Survey, and universities in England—men who had gathered much experience in mapping projects throughout the Empire on behalf of all the colonial bodies. The colonial background of the surveyors was highly useful and beneficial, and their surveying methods and administration were the result of practical professional

considerations. Perhaps, had it not been for the pressing land question, they would not have undertaken such a rapid mapping of Palestine.

When the British conquered Palestine in the First World War they did not come to an unknown land, but to a region that they themselves had mapped a quarter of a century previously. During the war they again surveyed and mapped most of the country, and just at the end of the war, when they controlled the country, they stopped the military mapping before it was completed. When the British signed agreements for demarcating the borders of Palestine, the surveyors went out into the field with maps of the preceding century, and put their signatures to these even before the Survey Department launched into the modern mapping of the country. Thus, the borders of Palestine were determined without any connection to the mapping done under the Mandate.

The British institutions for surveying in the colonies did not intervene in the mapping conducted under the Mandate, and the survey system in Palestine maintained its professional independence, as in Ceylon, India, Egypt, and Sudan. The Colonial Survey Committee, which had been set up in 1905, directed most of its energies and attentions to the African colonies. When the Survey of Palestine was established in 1920, the committee was occupied with organising a survey capability in Nigeria following discussions that started in 1914, and showed no interest in the objectives of the Survey of Palestine.

After that, there was only marginal concern with surveying in Palestine. In December 1926, in a memorandum to the Colonial Office on vacant surveying positions in the colonies, Palestine and Cyprus were mentioned at the end of a group of Mediterranean colonies; that is, there was a group of Mediterranean colonies, and also Cyprus and Palestine.³ In the second part of this document appeared a table of senior positions to be filled, the salaries, and service conditions of survey departments whose rosters had been approved. Cyprus was included, but not Palestine, which was relegated to a special notice stating separate conditions of employment for surveyors there: salaries, travel expenses, vacations, pension rights, and a remark to the effect that bachelors would be preferred. This notice began with the words, 'In Palestine there is a small department for surveys', to avoid any misconception as to the Imperial proportions.

All the intensive work of the Survey Department, the deep involvement of Ernest Dowson, and the cadastral reform were discussed at the Middle East Department of the Colonial Office and not in the Colonial Survey Committee; and so it was in the following years too. Only in 1929 was an Imperial project involving Palestine and Transjordan brought up at the committee. This was the experimental aerial survey for determining the route of the Haifa—Damascus railway, which was presented as a model for mapping from aerial photographs. The trial project was planned by a parallel committee for aerial surveys in the Ministries of War and Air, and was to be carried out in October 1930.⁴

Among the important things reported to the Colonial Survey Committee was the reconnaissance conducted by Colonel Winterbotham, the Chief of the GSGS, in the survey departments of the colonies in 1929, a trip that had been encouraged in the first Conference of Empire Survey Officers in 1928.⁵ The tour was indeed important and provided an opportunity for gathering information on what was happening in the realm of surveys in different territories. From a private letter, we know, for example, how much Salmon expected from Winterbotham's visit to Ceylon a short time before he was to take over the directorship of the small survey department of Cyprus. Winterbotham did travel

to Ceylon and on the way stopped in Cyprus, but did not set foot in the 'very important' Survey Department of Palestine. Winterbotham's tour took place a short time before his retirement from the army and his appointment in 1930 as the Director-General of the British Ordnance Survey. Perhaps in his new position he could also devote some attention to minor matters, for in a professional publication of the Ordnance Survey in 1933, on the geodetic surveys in the British Isles and the Crown Colonies, a relevant report on the surveys in Palestine was included.⁶

The name of Palestine was indirectly brought up at the Colonial Survey Committee in 1934, when it discussed a memorandum by Dowson and Sheppard regarding their collection of cadastral documents. The memorandum emphasised that the value of the collection derived from their previous experience in Egypt and Palestine.⁷

On the eve of the Second World War, the Colonial Survey Committee, which was by then called the Colonial Survey and Geophysical Committee, discussed the amalgamation of survey departments in the colonies.⁸ Possibly following these discussions, a report on the Survey of Palestine in 1938 mentioned that the Colonial Office set up a Colonial Survey Service on 1 January 1938, which widely advertised the list of senior positions offered by the Commission of Lands and Surveys of Palestine.⁹

In 1941 the Colonial Office began to outline plans for the post-war period. The programme for surveying in the colonies was presented to the Colonial Research Committee in April 1944,¹⁰ which recommended the establishment of a central institute for geodetic and topographic surveys in the colonies; Palestine was for the first time included in a defined colonial framework. Item 22 of the programme proposed that the central office be headed by a Director-General with an Assistant Director-General. Under them were to serve three Directors to head the Survey Departments in West Africa, East Africa, and the Far East respectively. All the remainder, such as the West Indies, the Mediterranean, and odd colonies would be under the Assistant Director-General. The plan was sent to Palestine on 19 September 1944, and in item 5 of the accompanying letter attention was drawn to item 22, already mentioned, to the effect that the Assistant Director-General would be responsible for the surveys in Palestine.¹¹ This was the first time that a proposal was advanced to remove certain prerogatives from the Directorate of the Survey of Palestine to the charge of a non-resident Director who would move about among the colonies. Mitchell, who at that time headed the Survey of Palestine, welcomed the plan, even though it would in effect impair his authority—perhaps because he only related to the financial aspects of the proposal. He even expressed his hope that the reorganisation would enable him to complete the mapping of the urban settlements and the topographic mapping of all of Palestine, and that he would have the help of the Royal Air Force (RAF) to advance the plan of the Government of Palestine for the Arab Village Development Scheme by mapping with aerial photography.¹² Item 27 of the programme assured the colonies that there would be no interference in their affairs since all the funding would come from HM Government. In February 1945 the High Commissioner, Lord Gort, conveyed his agreement to the programme to the Colonial Secretary.¹³

The programme left the cadastral survey in the hands of the local survey departments, but assumed responsibility for the topographic mapping, particularly aerial mapping. At that time a similar initiative was mooted in the War and Air Ministries for photographing extensive areas for mapping, so long as the skies and the borders were open to the RAF. The plan was to set up a framework for using the RAF photographic units that had been

trained during the war.¹⁴ The advantages of such a store of information from aerial photographs require no elaboration. One of the fruits of this programme in Palestine was the series of aerial photographs of the country, known as the ‘PS’ series—PS being the identifying code for these photo sorties—which for the first time covered the entire area of Palestine by aerial photography.

The agreement of Gort to the integration of Palestine in the colonial mapping programme won the warm support of Brigadier M. Hotine, who was to head it. Hotine, who at the time was the Director of Military Survey, War Office, visited Palestine at the beginning of 1945, about a month before the High Commissioner gave his approval, and apparently ‘assisted’ Lord Gort in making up his mind.¹⁵ Hotine was placed at the head of the central institution for mapping in the colonies when it was established, in March 1946. However, this institution had no connection with the work of the Palestine Survey Department in the short time that remained to the Mandate government. Nevertheless, on 4 May 1946 the Government of Palestine received a circular from London informing it that the RAF would carry out the photographic mission according to the programme of the Colonial Survey Organisation.

When the first annual report of this body was received in Palestine at the end of September 1947, it turned out that Palestine was outside the area of its concerns, and Hotine’s deputy, Lieutenant Colonel G.J. Humphries, did not assume the functions of supreme head of the Palestine Survey Department and had no status whatsoever in the country.¹⁶

The British Mandate map of Palestine

As in other colonies and mandates, the Palestine Survey Department remained independent in the British Imperial mapping programme. For those who would regard the map of the country as part of a system that transcends its borders, it was such only in the narrow sense that the entire survey system was conducted by a foreign element: the British. Therefore, despite the strategic status of Palestine, the impact and importance of the cartography under the Mandate were negligible in the web of considerations governing British mapping throughout the Empire. But notwithstanding its small importance, the survey system in Palestine benefited from the best the Empire had to offer. Most of the senior personnel went to Palestine with a wealth of experience, mature professional concepts, and high standards of work quality that they had gained from surveying tasks in other colonies.

The surveys and mapping of Palestine were thus determined by the independent considerations of the Government of Palestine, for specifically local objectives, on the basis of imported knowledge and experience. John Loxton, who served as the last Chief Inspector of Surveys in Palestine for a brief period, asserted that ‘We did what we had to do’. Others stated that no surveyor could hide behind the claim that his work had been dictated by an umbrella policy from London. The surveyors in Palestine were free from interference in their professional decisions, but conceivably they identified with what they perceived to be the British interest in the country.

Under the Articles of the Mandate, Britain had a threefold commitment in Palestine: to ensure the establishment of a Jewish national home; to safeguard the rights of all the

inhabitants; and to develop the country and prepare it for self-government when the time came. From a cartographic point of view, and even more so from a national one, the common denominator for all this was land. The way chosen by the Mandate government to implement its commitments was the early organisation of the land system on a legal foundation for land ownership. Such a land settlement was impossible to achieve without surveying and mapping. The Zionist Organisation expected by this means to identify state domain and uncultivated lands for the establishment of the national home promised in the Balfour Declaration. The British hoped to tighten their hold on landed property, for the improvement and modernisation of the real estate market; and incidentally, to create a manipulatory instrument for political control over land matters—the most sensitive national issue confronting the two main population elements in Palestine: the Jews and the Arabs.

The connection between the map and land was thus at the root of the existence, and the rationale for the establishment, of the Survey Department by the government of Mandate Palestine. The map of Palestine purported to meet the commitments assumed by Great Britain under the League of Nations Mandate. And if from strategic aspects the Empire profited from the cartography of Palestine during a hundred years of British mapping, from an historical and geographical vantage point Palestine/Israel benefited manifold from the cartographic legacy of the British when they left Palestine in 1948.

Appendix A

Survey ordinances of Palestine

U

nder orderly government, survey work must be officially sanctioned. In this way a standard system of surveying within an agreed cartographic framework obligates anyone engaged in surveying—governmental and private—to be licensed for this purpose by the authority of the State.¹

When the British military administration decided to preserve the Ottoman laws in force in Palestine on the outbreak of the First World War, it did not inherit survey legislation, for such laws did not exist. Thus, the entire field of surveying and mapping remained unregulated and anarchic until the spring of 1920. The survey laws were a British innovation in the administration of Palestine. This new legislation was designed not primarily to create a legal basis for all surveying in the country, but to provide an obligatory professional framework only for land surveying.

From the first Survey Ordinance until the end of the Mandate, the government enacted legislation regulating surveying, surveyors, and survey fees and amended, updated, and changed laws and ordinances designed to maintain the authority of the surveys and the professional status of the surveyors. The survey legislation derived from the government's decisions to solve the land registration problem: land settlement based on survey and mapping. This connection was expressed in legislation intended to give legal sanction to every detail of the survey and mapping process. The following ordinances represent the main survey legislation of the British Mandate over Palestine; the list does not, however, include all the various amendments enacted from time to time.

The Cadastral Survey Ordinance 1920

The first legislation affecting surveying was promulgated at the end of the military administration in response to allegations voiced in the country and abroad that it did nothing to solve the land problem. The Cadastral Survey Ordinance 1920² was signed by the head of OETA, Major-General Bols, in May 1920 in Jerusalem, and was published in the *Official Gazette* in July by the new civilian government of Palestine. The cadastral survey began in the Gaza and Beersheba regions under this ordinance.

The ordinance empowered surveyors to enter the private domain where necessary for carrying out survey measurements and marking of land as part of the cadastral survey. Immediately after its proclamation came a public announcement regarding the survey fees imposed on the owner of the property surveyed, payment of which entitled him 'to a certified true copy of the original plan of his land and to a land certificate (Kushan) when the title has been determined'.³

In February 1921 the ordinance was amended to extend the cadastral survey to the entire country, rather than being limited only to the Gaza and Beersheba Districts.⁴ This

survey ordinance was replaced in 1929 in order to institutionalise the legal connection between surveys and land settlement, according to the reform in the cadastral system. It had become necessary to extend its purview to villages and towns, and to fully legalise the prerogative of surveyors to enter courtyards and roofs of buildings so as to fix survey points in built-up areas too. Moreover, surveyors had to be given certain authority that in 1920 had for some reason been vested in the District Governors, who did not actually deal with land settlement.⁵

Wood and Forests Ordinance 1920

The Wood and Forests Ordinance 1920⁶ did not deal with surveys, but exemplifies the provision requiring those wishing to conduct surveying to comply with the Cadastral Survey Ordinance 1920.⁷ In this case the law stipulated that in order to determine the boundaries of state forests and forest reserves, the Department of Agriculture would appoint committees empowered to identify and delimit state domain lands. Among other things, the committees were authorised to conduct surveys as needed; and the law further stated that the marking of boundaries had to conform with the survey regulations of the Cadastral Survey Ordinance. In November 1921 High Commissioner Herbert Samuel signed a public notice announcing the establishment of committees for demarcating state land of the *mewat*, *mahlul*, and other categories according to the Wood and Forests Ordinance. He attached to these bodies a representative of the Land Department, but not of the Survey Department.⁸ However, it soon became clear that in several places the demarcation of boundaries had proved inaccurate because the committees employed surveyors whose measurements did not correspond to the official figures of the Survey Department.⁹ One of the most important and positive examples of the application of this regulation was the case of the committee set up for demarcating the lands of the Ghor-Mudawara Agreement in 1921. The Survey Department was requested to join in this large land settlement project so that the surveys there could be effectively integrated in the national cadastral project.

Surveyors Ordinance 1921

The Surveyors Ordinance 1921¹⁰ regulated the surveying profession, assured the legal status of surveyors, and prohibited unqualified persons from conducting surveys. The ordinance was annulled in 1925, when it was replaced with a more detailed one.

Survey Fees Ordinance 1922

The Survey Fees Ordinance 1922¹¹ replaced the Public Notice of July 1920. It imposed a fee of 3.5 Egyptian girsh on owners whose land had been surveyed in the cadastral project for every Turkish dunam that was not in a built-up area. In return, the landowner could request a plan of the land after the settlement was completed.¹²

Land Surveyors Ordinance 1925

The Land Surveyors Ordinance 1925¹³ replaced the earlier one of 1921, and was the first to require registration of landed property to be based on an approved plan. The ordinance related exclusively to land surveyors and defined 'surveyor' and 'survey' as concepts applying only to land surveying. This ordinance was more detailed, and forcibly reiterated the stipulation that no person might engage in the surveying profession unless licensed to do so. It stated that no survey or plan was acceptable for land registry unless prepared and signed by a surveyor holding a Palestine government licence.¹⁴ The ordinance was published on 1 May 1925, and at the end of that month was followed by regulations based on section 7 of the ordinance. Chapter 'plans' enumerated directives for the licensing of surveyors, for surveying methods, for means of indicating boundaries with permanent markers, and for the preparation of plans:¹⁵

- 16 The following particulars shall be shown as headings on every Survey plan:
 Name of District, Name of Town or Village, Name of Quarter, Locality or Block (if any), Name or Names of person or persons for whom the plan is prepared.
- 17 The scale of a Survey Plan shall be metric, and an even multiple of 1/10,000. It shall be indicated by a representative fraction and drawn clear of detail on the plan.
 The direction of the true or magnetic north must also be drawn clear of detail on the plan.
- 18 All the detail surveyed shall be clearly and neatly drawn in black on the plan.
 Government survey marks shall be shown in red ink on the plan by a fine dot surrounded by a small triangle and shall be given numbers obtained from the Survey Department.
 All other fixed points shall be marked by fine dots surrounded by small circles and numbered in blue ink.
 In Municipal areas dimensions of frontages of properties abutting on public roads shall be shown on the plan.
 Junctions with the boundary under survey of boundaries between adjoining properties shall be shown on the plan.
- 19 In the survey of a block comprising several distinct properties, the boundaries between these shall be shown on the plan, and each property shall be clearly numbered on the plan.
 Where a property comprises several lots the boundaries of which have been surveyed, these boundaries shall be connected together on the plan by the conventional signs prescribed by the Survey Department.
 If the lots represent different classes or categories of land they shall receive sub-numbers or letters, to be inscribed on the plan.
- 20 Schedules shall be inscribed on or attached to every Survey plan showing:
- a On a form prescribed by Survey Department the bearings and distances of all lines of traverse, the closing errors of poly gons, and the final co-ordinates of fixed points;

In this form the fixed points shall be numbered to correspond with the plan, and their calculated co-ordinates shall conform with those of the Government marks;

- b A list of properties or lots surveyed, numbered or lettered to correspond with the plan, showing the categories and classes of land, the adjusted areas in square metres of the several properties or lots, the names of claimants or reputed owners, and the numbers and dates of any kushans or Land Registry records held by these persons.

Land Settlement Ordinance 1928

The Land Settlement Ordinance 1928¹⁶ set down the procedure of investigating ownership rights in land and their registration according to the cadastral reform adopted in 1928. The main objective of the ordinance was to establish the order of keeping the land registry books on the basis of precise measurements.¹⁷ The method was based on the Torrens system of registry adopted in 1857 in Australia. According to the system, a unit of land, rather than its owner, is registered in the books as an independent entity, after its boundaries and surface area have been determined by means of surveys conducted by the authorities.¹⁸ This was the statutory foundation for establishing the relationship between land settlement, the cadastral survey, and mapping in Palestine. According to this ordinance, the survey part began with a notice of the impending survey published by the Settlement Officer. It was followed by settlement and registry of rights in a given village, and processes for appeal and correction of errors, and ended with taxation and penalties for tampering with temporary survey marks and permanent boundary markers.¹⁹

Survey Ordinance 1929

The new Survey Ordinance 1929²⁰ complemented the cadastral reform enacted with the promulgation of the Land Settlement Ordinance 1928 by regulating the survey of lands and licensing of surveyors. It particularly emphasised its connection with the cadastral survey. It defined 'surveyor' as a 'Government surveyor or a licensed surveyor, and 'cadastral survey' as 'public survey', which is defined as any survey directed by the High Commissioner.²¹ This section was amended in 1946 so as to include also topographic surveys and urban surveys connected with land settlement. This ordinance replaced the Survey Ordinance 1920, the Survey Fees Ordinance 1922, and the Land Surveyors Ordinance 1925. At the directive of the Colonial Secretary, some of the other important sections of this law were modelled on the relevant Nigerian law.²²

Survey Ordinance, Surveyors Regulations 1930

The Surveyors Regulations were amended after the Land Settlement Ordinance 1928 and the Survey Ordinance 1929, and section 7 of the 1929 Ordinance. The chapters of the Regulations are as follows: Permits, Execution of Surveys, Permanent Marks, Croquis and Documents.²³

These regulations related only to surveys for registry purposes. Each chapter laid down detailed instructions on the method of work, so that in the final stage of registry according to the Land Settlement Ordinance the croquis required for the registration would be properly prepared. In paragraph 25 of chapter D (Croquis and Documents) were set down the details that had to be entered at the heading of every sketch. Paragraph 26 states that the plan was to be of a suitable metric scale of an even multiple of 1:10,000, would be indicated in a representative fraction, and would be drawn on the sheet outside the details of the plan. The sketches of the property with changes of the final settlement were to be drawn to a scale of 1:2,500, 1:625, or larger. Subsequent paragraphs laid down the details, the lists, and the sketches that had to be included in the map or appended to it—among them the signature of the government surveyor.

Survey Ordinance, Surveyors Regulations 1938

On 29 July 1938 the regulations regarding licensing of surveyors were amended and updated, and published anew as the Survey Ordinance, Surveyors Regulations 1938.²⁴ This ordinance remained in effect until it was annulled by the State of Israel and replaced by the Surveyors Regulations 1965, enacted on 5 August 1965.²⁵ In the years between the promulgation of the ordinance in 1938 and the Israeli regulations of 1965, the Mandatory Ordinance was amended in June 1953 by cancelling the reservations ‘for the purpose of registry’, as stated in the 1930 regulations.²⁶ The amendment now made possible the issuing of orders for all purposes entailing surveys, and a year later regulations were passed dealing specifically with topographic surveys.²⁷

Survey Ordinance (Amendment) 1946

The Survey Ordinance (Amendment) 1946²⁸ amended sections of the 1929 ordinance. The most important alteration dealt with the term ‘public survey’, defined as ‘government surveys’, which now became any public survey; that is, any topographic or urban survey carried out by the Survey Department in connection with the settlement of landed property rights in accordance with the Land Settlement Ordinance 1928. A supplement to the ordinance, a new regulation of 29 January 1946, dealt with the survey fees.

Appendix B

High Commissioners for Palestine

Herbert Samuel	1920–1925
Herbert Plumer	1926–1928
John Chancellor	1928–1931
Arthur Wauchope	1931–1938
Harold MacMichael	1938–1944
John Gort	1944–1945
Alan Cunningham	1945–1948

Appendix C

Biographical summaries

By Stephen Bank

Albert Abramson, CBE, 1876–1944

Born in Palestine of Romanian parents; converted to Christianity. Spoke fluent Arabic. Educated privately; worked for Cooke's travel agency. During the First World War served in the British Army with the rank of major; intelligence officer in Egypt and Palestine.

- 1918 Military Governor, Hebron, OETA
- 1920 Director, Land Department, and Chairman, Land Commission
- 1921 British Representative, Transjordan at Amman
- 1922 Governor, Southern District, at Gaza
- 1925 Commissioner, Northern District, at Haifa. A senior member of the administration
- 1927 Commissioner of Land Settlement, and on Advisory Council. Later also Rural Property Tax Commissioner
- 1935 Retired, moved to England. Was on friendly terms with Amir Abdullah

Maurice Christmas Beimet, FSI (now FRICS), 1887–1957

During the First World War was Captain, Reserve of Officers; mentioned in despatches

- 1918 Joined OETA, Palestine, November
- 1920 Assistant Director, Department of Commerce and Industry, July
- 1922 Transfer to Department of Lands and Surveys as Land Officer
- 1928 Seconded to Office of Commissioner of Lands
- 1930 Secretary to Sir John Hope Simpson, for his report
- 1934 Agent, Haifa Harbour (reclaimed area) Estate
- 1935 Assistant Director, Office of the Commissioner for Lands and Surveys
- 1940 Director, Land Settlement, and Agent, Haifa Harbour Estate
- 1948 Retired?

Sir John Robert Chancellor, KCMG 1913, etc., 1870–1952

Old Scottish gentry whose family estate dated back eight centuries. Blair Lodge School; Royal Military Academy, Woolwich.

1890 2nd Lieutenant, Royal Engineers. Served in India, decorated for bravery

1904 Assistant Secretary (military), Committee of Imperial Defence

1906 Secretary, Colonial Defence Committee. Gained experience in higher strategy and planning

1910 Major in army

1911 Governor of Mauritius

1916 Governor of Trinidad and Tobago

1918 Lieutenant-Colonel

1921 Principal Assistant Secretary, CID

1923 First Governor of Southern Rhodesia

1928 High Commissioner for Palestine and Transjordan. An efficient, experienced colonial administrator, but his attitudes did not help him understand the problems of the Holy Land, or sympathise with Zionist aims. Was away on leave when the riots broke out in August 1929; he angrily condemned them and rushed back. By the end of his three-year term he was a disappointed and dispirited man. However, he remained active as head or committee member of many colonial societies, institutes, and commercial groups

Robert Barker Crusher, MBE 1927, OBE 1937. 1877–1962

1895 Joined the Ordnance Survey of Great Britain

1901 South Africa survey

1904 Anglo-Portuguese Boundary Commission along the Zambesi river

1906 To Canada Survey

1909 To Ceylon

First World War Served as military surveyor

1919 Ordnance Survey, York region

1921 To Palestine as Chief Draughtsman, Lands and Surveys Department

1922 Promoted sub-inspector

1924 Assistant Inspector

1927 Inspector; served as Acting Director of Surveys for short periods of most years, and for nineteen months between Ley and Salmon

- 1932 (until 1940) Assistant Director. During
1936 disturbances was in command of
special constables in Jaffa
1940 Retired

Moses Doukhan, OBE 1926, 1884–1958

Born in Russia; became barrister in St Petersburg.

- 1915– Served in Russian Army
1916
1921 Assistant Director, Lands, Palestine.
Entered Palestine bar to qualify as a
lawyer
1923 Title changed to Land Officer
1927 Senior Land Officer
1929 Assistant Director, Lands. Served as
Acting Director
1928, Lecturer at the Government Law
1931, School, Jerusalem. Wrote *Land Laws of*
1934 *Palestine* and *Collection of the Laws of*
Pales-tine
1936 Left government service (succeeded by
Jardine)

Sir Ernest MacLeod Dowson, CBE, KBE 1924, MICE, 1876–1950

Born in India; father worked for Imperial Telegraphs. Educated at Isle of Wight College and Central Technical College of London.

- 1898 To Egypt, assistant engineer, Delta
Light Railways
1900 Transferred to Survey Department
1909 Director-General, Survey of Egypt

1916– Mentioned in despatches three times
1917
1919 Under-Secretary of State for Finance,
Egypt
1920 Financial Adviser to the Government
of Egypt
1923 To the Government of Palestine and
Transjordan, as adviser on settlement
and registration of rights to land and
other land questions—five years

1919– Adviser to the Governments of Iraq,
1930 and Zanzibar, and Kenya on land
1935– questions. Was awarded many
1940 decorations and medals

John S.S.P.Vereker, Viscount Gort, VC, 1886–1946

Old Anglo-Irish nobility; born and died in London. Succeeded father as 6th Viscount at the age of 14. Educated at Harrow and the Royal Military Academy, Sandhurst.

1905 Second-Lieutenant, Grenadier Guards. Held staff posts during the First World War

1917 Battalion commander in his Guards regiment. An outstanding leader, wounded several times, won all medals for bravery, and eight mentions in despatches. Then was instructor in army training colleges, served India, was chosen above senior generals to be a fresh, young, energetic Chief of Imperial General Staff at the age of 51. He was skipped a rank to be promoted to full general; his position was unusual, somewhat controversial, as the army prepared for the Second World War

1939 Commander-in-Chief of the British Expeditionary Force in France. When the Germans attacked and broke through the French lines he had to retreat to Dunkirk and evacuate the army. Then relegated to Inspector-General of Home Forces to prepare for the expected invasion

1941 Governor and Commander-in-Chief, Gibraltar, then promoted to the same position in Malta

1942 The island was under heavy siege by the Germans, and the situation was critical. His defence and social welfare tasks proved successful

and he became very popular with the population; was promoted field-marshal

1944 Appointed High Commissioner and Commander-in-Chief for Palestine and Transjordan, at a very tense, uncertain time. The victory in the war, the new Labour Government in Britain, and his own character made him popular and began to gain confidence of both Arabs and Jews, and a new outbreak of violence was avoided. Tragically, he now developed liver cancer and had to leave for hospital in England in November 1945, to widespread sorrow. He died soon after

Robert Frier Jardine, CMG 1928, OBE 1926, 1894–1982

Educated at Downing College, Cambridge.

- 1914 Army, Second-Lieutenant, Gallipoli, Egypt, Mesopotamia
- 1917 Political Officer in northern Iraq; dealt with the Assyrians and Kurds for five years
- 1924 On the British delegation on frontier questions to the League of Nations, and at Constantinople
- 1925 Assessor, Turco-Iraq Frontier Commission
- 1926 At Ankara for tripartite treaty negotiations; advisor to British Ambassador
- 1925 Administrative Inspector at Mosul, Iraq
- 1928 At Basra
- 1933 President, Land Settlement Commission, Iraq
- 1936 To Palestine; Chief Inspector, Land Registration; on various commissions
- 1940 Assistant Director, Land Settlement, then, from 1942, Water Commissioner. During the Second World War adviser on the General Staff at Jerusalem, as Lieutenant-Colonel
- 1945 Director, Land Settlement, also Commissioner for Compensation for Rebellion and War Damages
- 1948 Retired. Spoke Arabic and Kurdish

Sir Walter Roper Lawrence, KCIE 1903, GCIE and created Baronet 1906, GCVO 1918, 1857–1940

The epitome of the Imperial civil servant, eminent in all his various careers. Educated at Cheltenham and at Balliol College, Oxford, but did not graduate; instead, passed first in exams into the Indian Civil Service.

- 1877 Held many posts; considered brilliant and had a high-flyer career
- 1889 Commissioner, Kashmir, for settlement of land and revenues for six years. In 1895 wrote a book about this which became the standard work
- 1896 Left the Indian Civil Service to be chief agent (business) for the Duke of Bedford, whom he knew from Balliol
- 1898 Lord Curzon recalled him to India as his private secretary, to help carry out reforms, for five years
- 1903 Back to the Duke of Bedford's service
- 1905 Chief of staff to Prince of Wales on tour of

India

- 1907 Member of the Council of India
- 1909 Returned to private affairs. During the First World War was a temporary colonel on various missions for Kitchener
- 1917 Mission to the United States
- 1918 On the staff of the Indian Air Force. Major-general
- 1919 Mission to Palestine and Syria. Urged to write his memoirs; instead, wrote *The India We Served* in 1928, and many articles for *The Times*, etc.

Hugh Granville Le Ray, 1895–1974

Educated at Dulwich College and Trinity College, Cambridge (MA).

- 1915 Army, Second-Lieutenant, Worcestershire Regiment and Field Artillery
- 1917 Lieutenant
- 1918 German prisoner of war
- 1919 Returned to finish at Cambridge
- 1921 To Palestine; chief computer, Surveys
- 1927 Inspector
- 1928 To Iraq; Survey Officer
- 1933 Returned to Palestine
- 1934 Superintendent of Surveys
- 1936 During the disturbances was temporary magistrate
- 1940 Assistant Director

Cuthbert Hillyar Ley, RE, OBE, FRMetSoc, 1872–1948

Plagued by ill-health, which constantly interrupted his career.

- 1892 Commissioned into Royal Engineers
- 1896 Served in Jamaica and South Africa, then had to go to England owing to illness
- 1899 Served in the Boer War, at the relief of Ladysmith
- 1900 Aide-de-camp to the Inspector-General of Fortifications and Engineers
- 1903 Geodetic Survey of South Africa
- 1906 To the General Staff, Topographical Section
- 1907 Retired from the army, having reached the rank of major
- 1908 Survey of Fiji, but had to return to England owing to bad health
- 1912 Joined the Ordinance Survey of Great Britain; stayed for eight years. During the

First World War, at Southampton in the
Department of Fortifications, the Ministry
of Munitions, and the Directorate of
Artillery

1920 To Palestine, Director of Surveys

1931 Ill-health forced return to England

1932 Final retirement

John W.Loxton, b. 1913

Educated at Taunton School and St Catherine's College, Cambridge (MA). Postgraduate research scholar at the Royal Institute of Chartered Surveyors.

1937 To Palestine; Assistant Superintendent,
Survey Department

1940 To Transjordan

1941 Palestine; Superintendent

1948 To Kenya; Staff Surveyor

1950 Assistant Director, Surveys

Andrew Park Mitchell, CMG 1948, 1894–1975

Educated at St Paul's School, London, and the University of London.

1914 First World War in India, Egypt and France.
Pilot in the Royal Flying Corps

1919 Joined Survey of Egypt

1927 To Transjordan; Director of Lands and
Surveys

1940 To Palestine, as Director of Surveys

1945 Member of the Committee of Inquiry into
Land Transfer Regulations

1948 To Nigeria; Director of Surveys

1951 Inspector-General of Surveys

1954 Uganda; Director of Surveys; Land Officer,
Commissioner of Mines

1957 Malaya; member of the Land
Administration Commission

1958 Cyprus; member of the Survey Enquiry

1959 Seychelles; member of the Land
Registration and Survey Enquiry

Frederick Oliver Jones Ongley, 1863–1937

There is a remote possibility he was related to the family of Baron Ongley; the title died out in 1877.

1875 Cadet, Royal Navy

1879 Clerk, Cyprus high court

1884 In Chief Secretary's office and Receiver-
General's office

1889 Turkish translator to High Commissioner,
Cyprus

- 1890 To Imperial Bank of Persia, Accounts Department, and Chief Clerk, Customs Department
- 1892 Assistant to Director of Surveys, Cyprus; translated Ottoman Land Code
- 1897 Assistant to Commandant, Nicosia
- 1899 Acting Registrar-General of Land, Cyprus
- 1910 Registrar-General
- 1921 To Palestine; Controller/Director of Land Registries
- 1922 Judge, Land Settlement Court, Jaffa. Knew Turkish
- 1924 Retired?

Herbert, Lord Plumer, created Baron 1919, Viscount 1929, 1857–1932

From a Yorkshire family of gentry. After Eton, commissioned directly into his county regiment, the 65th Foot, in India.

- 1884 Sudan
- 1896 Natal campaigns. A successful field commander in the Boer War
- 1902 Promoted major-general, advanced to high positions in army
- 1915 Commander of the Second Army in France; held Ypres; at the battles of Messines and Passchendale
- 1917 Commander of British and French troops in Italy after the defeat of Caporetto. Returned to the Second Army in Flanders, advanced
- 1918 and occupied the Rhineland. One of few commanders to emerge from the war with greater respect and reputation. Showered with honours, and promoted field marshal in 1919
- 1919 Governor of Malta, then in great turmoil and crisis. He was strong, fair and firm in dealing with all the economic and political problems
- 1925 High Commissioner for Palestine and Transjordan. Brought all these qualities to the Mandate and was supportive of the *yishuv*. He reduced the garrison to its lowest ever, but his personal presence was said to be worth at least a thousand soldiers, and there was tranquillity during his three years in office
- 1928 Retired, full of honours, respect and much regretted by many

Frederick John Salmon, CMG 1937, MC, ACGI, FRGS, 1882–1964

Educated at University College School, London, and Central Technical College, South Kensington, London.

- 1904 Transvaal Mines, South Africa. Associate, Institute of Mining
- 1908 To Ceylon; Assistant Superintendent of Surveys
- 1914 Superintendent
- 1915 Army service in France; field survey units. Promoted Lieutenant-Colonel, Royal Engineers. Reserve of Officers. After war returned to Ceylon
- 1930 To Cyprus; Director, Land Registration and Surveys Department
- 1933 To Palestine; Director of Surveys
- 1934 Acting Commissioner for Lands (succeeding Abramson), November
- 1935 Head of new combined departments, and member of Advisory Council
- 1938 Retired but remained active in local social services, e.g. Honorary Director, Citizens' Advice Bureau, Bath
- Second World War Divisional Petroleum Officer, and Regional Fire Prevention Officer for Bristol

Sir Herbert Louis Samuel, created viscount 1937, 1870–1963

From a Liverpool banking family; uncle was created Baron Swaythling, cousin was Edwin Montagu, also Liberal MP and colleague in the Cabinet. Educated at University College School, London, and Balliol College, Oxford.

- 1902 Liberal MP (until 1918). Held various offices, 1909. The first practising Jew in the cabinet.
- 1916 Home Secretary. Supported Zionist plans from 1914; involved in Balfour Declaration. Resigned with Asquith, December 1916
- 1919 Special Commissioner to Belgium
- 1920 First High Commissioner for Palestine under League of Nations Mandate. Tried hard to be even-handed with both sides; many conciliatory acts towards Arabs, although a sincere Zionist. Advocated a federated Middle East state, with Jewish and Christian (Lebanon) autonomy but full economic integration
- 1925 Wanted to settle in Palestine after leaving office, but government opposition drew him back to British politics as Chairman of the Royal Commission on the Coal

Industry, then helped end the General Strike in 1926

- 1929– Liberal MP and a leader of the main group
- 1935 as the party was divided
- 1931 Home Secretary in coalition National Government (until 1932)
- 1937 Liberal leader in House of Lords; spoke on many topics, including Zionism. Now a senior statesman, philosopher, Jewish leader. President of learned societies; wrote books on philosophy, memoirs

Vivian Lee Osborne Sheppard, CBE 1927, FSI, FRGS, FRICS, 1877–1963

Educated privately.

- 1896 Articled to Dowlais Works, Nettlefolds (for six years)
- 1903 Worked on Portland Breakwater
- 1904 To Gold Coast
- 1906 Entered Egyptian Civil Service
- 1917 Director, Cadastral Survey
- 1924 Surveyor General of Egypt
- 1931 Joint Curator, Cadastral Survey and Land Records Office

- 1932– Advised the Government of Sarawak
- 1933 on land registration and settlement questions
- 1937– Advised the Government of Uganda
- 1938 on same questions
- From British Representative and joint
- 1934 rapporteur, Permanent Cadastral Committee of International Federation of Surveyors

- 1940 Retired
- (approx.)

Sir John Farley Spry, knighted 1975, 1910–1999

Educated at Perse School and Peterhouse College, Cambridge (MA in History).

- 1935 Solicitor
- 1936 Uganda; Assistant Registrar of Titles and Conveyancer
- 1944 To Palestine as Chief Inspector, Land Registration
- 1945 Assistant Director, Land Registration
- 1948 To Tanganyika; Registrar-General
- 1950 To Kenya; same position

- 1952 Return to Tanganyika to same position
- 1956 Became Legal Draughtsman
- 1960 Principal Secretary, Public Service Commission, then Puisne Judge, all in Tanganyika
- 1964 Justice on Court of Appeal for Eastern Africa
- 1970 Vice-President of same
- 1975 Chairman, Pensions Appeal Tribunal
- 1976 To Gibraltar; Chief Justice
- 1980 Justice of Appeal; same
- 1981 Also to British Indian Ocean Territories as Chief Justice (six years). Also from 1983, President, Court of Appeal, Gibraltar (eight years)
- 1983 Also Chief Justice, St Helena and Dependencies
- 1992 Retired

Published books about sea shells, and civil law

James Nelson Stubbs, MC, 1889–1972

Born at Waerengaokuri, Gisborne, New Zealand. Educated at Napen High School and Auckland University. Was a farmer, of Dunedoo, New South Wales.

First World War Served with Australian Light Horse Division in EEF. Captain

- 1920 Joined the Occupied Enemy Territory Administration as Assistant Controller of Land Registries
- 1921 Appointed to Haycraft Commission of Inquiry into Jaffa riots
- 1922 Director of Lands
- 1925 Also Controller of Mines (for four years)
- 1935 Director of Land Registration under Salmon. Became one of the longest-serving senior officials in Palestine, yet seems to have been quite modest
- 1948 Retired

Sir Arthur Wauchope, KCB 1935, 1874–1947

Old Scottish gentry and military family. Educated at Repton School.

- 1893 Commissioned into Scots militia
- 1896 Transferred as Second-Lieutenant into the Black Watch, the family infantry regiment. Saw much combat in the Boer War, India, France and Mesopotamia, badly wounded

several times. Wavell became a lifelong friend

- 1915 Commanded his battalion. They went to Upper Silesia; served during the plebiscite and uprising
- 1923 Major-General
- 1924 Chief of British section, Inter-Allied Commission of Control in Berlin, to inspect German disarmament (for three years)
- 1929 Commander, Northern Ireland, thus well prepared and experienced for the problems of the mandate in Palestine
- 1931 Lieutenant-General, High Commissioner for Palestine and Transjordan. Optimistic, energetic, enthusiastic, supportive of all groups, he constantly travelled, talking to all levels and peoples, seeing things for himself. A wealthy bachelor who spent much of his own fortune on many cultural and educational projects of both Jews and Arabs. Tried to be conciliatory, as Jewish immigration reached its peaks
- 1936 His term of office was extended for another five years; promoted full general. But then the Arab revolt began and his tasks became impossible and he began to lose heart
- 1938 Had to retire, worn out and ill. He had tried to help all groups, but was most popular with the *Yishuv*.

Glossary

Note: Turkish, Arabic, Hebrew, French derivations are indicated by (T), (A), (H), and (F), respectively.

Daftar khani (T) Administration of land registry in the Ottoman Empire.

Dunam (T, A) Land area measure fixed under the Mandate at 1,000 square metres or about a quarter of an acre.

Feddān (A) Egyptian unit of land area measure, a little over 0.4 hectares.

Fellah (pl. **Fellahin**) (A) Peasant.

Hagana ('Defence' in Hebrew) The Jewish self-defence forces in pre-Israel Palestine.

Hamula (A) Extended family; clan.

Hawaqir (A) Land planted to vegetables and other green crops.

IDF Israel Defence Forces.

Jiftlik (T) Tract of land cultivated and harvested annually. This term was applied also to land formerly owned personally by the Sultan.

Kushan (T) Title deed.

Mafruz (A) Land held permanently by individuals.

Mahlul (A) Uncultivated *miri* land.

Mewat (A) 'Dead' or undeveloped land.

Miri (A) Lands in which the owner held the usufruct, but not title; state or feudal land.

Moshav (pl. **Moshavim**) (H) Private or cooperative Jewish smallholder settlement.

Moshava (pl. **Moshavot**) (H) Jewish village or small rural town.

Mulk (A) Land in full private possession.

Musha' (A) Form of land tenure by which a group of persons, usually a village, held parcels that were reallocated among them periodically.

Mussaqa (pl. **Mussaqa**) (A) Income-producing buildings or real estate.

Pic, Pik (F) Unit of length varying from about 45 to 75 centimetres.

Sanjaq (T) Administrative district of the Ottoman Empire.

Tapu (T), **Tabu** (A) Title to land.

Waqf (A) Inalienable land of religious endowments.

Werko (T) Tax on houses and land.

Yishuv (H) The Jewish entity in Palestine before the establishment of the State of Israel.

Notes

Abbreviations and full bibliographical details of works cited in these notes are given under the heading 'Sources' (p. 316), except in the case of a few peripheral works that are not repeatedly cited in the notes.

1

The first maps based on original surveys

- 1 Kain and Prince, *The Tithe Surveys of England and Wales*, pp. 1–5.22; Kain and Baigent, *The Cadastral Map in the Service of the State*.
- 2 The Palestine Exploration Fund was founded in London in 1865.
- 3 Ben-Arieh, *Jerusalem in the Nineteenth Century*, pp. 1–2.
- 4 Ben-Arieh, 'The First Survey Maps', p. 65.
- 5 Wilson, *Ordnance Survey of Jerusalem*; Seymour, *History of the Ordnance Survey*, pp. 154–157; PRO OS 1/12/4289; PRO OS 3/6–13, 30–31.
- 6 Roux, 'Golfe de Caiffe'; Frumin, Rubin and Gavish, 'A Russian Naval Officer's Map of Haifa Bay (1772)'.
- 7 Jones, 'British Military Survey', pp. 29–41; Wilson, 'Recent Surveys', pp. 206–240; Schattner, *The Map of Eretz Israel*, p. 164.
- 8 Baedeker, *Palestine and Asia* (Leipzig, 1876 and 1912).
- 9 Gavish and Biger, 'Innovative Cartography', pp. 38–44; Royal Engineers, *History of the Corps*, p. 259; Thomas, 'Geographical Reconnaissance', pp. 349–376; *Military Handbook on Palestine* (Cairo, 1917).
- 10 Pleschtschejew, *Tagebuch einer Reise*.
- 11 Wilson, *Recent Surveys*, p. 216; Schattner, *Map of Eretz Israel*, pp. 171–173.
- 12 Map of Egypt 1:250,000, July 1915 (GSGS 2321).
- 13 British Admiralty charts 1585, 1591, 2634; Mediterranean Pilot, V, 1930–1931; the hydrographic survey party of the Palestine coast had recourse to the triangulation net measurements of the British Mandate period. The observations showed a deviation in the geographical longitude and latitude of the country; see Ordnance Survey, *Further Notes*, p. 20, para. 8; Pal. Govt, *Annual Report—Surveys, 1930, 1932*; for collected surveys data, see Almagor and Hall, 'Morphology of the Mediterranean', pp. 1–31.
- 14 Map of the Red Sea from Jedda to Suez from the surveys of the Danish explorer Carsten Niebuhr in 1762–1763, in *The Complete East India Pilot I* (1800); the maps of James Bruce (1770), of Captain Robinson (1777), and L.S. de la Rochette (1785), the 1:1,800,000-scale maps of the Red Sea and the Gulf of Suez by the French admiral Rosili (1798); and the British Admiralty chart no. 14 of *Surveys of the Chief Ports and Anchorages in the Red Sea* (1843)—all these at the NMM. On the mapping of the Red Sea and the Gulf of Aqaba, see Godlewska, 'The Napoleonic Survey of Egypt', pp. 38–39, 90–104; Shadur, 'Staking Out the Sea Lanes to Elat'.
- 15 Hull, *Mount Seir*, pp. 193–222 and diagram of triangulation system facing p. 199; Magnus, *Kitchener*, pp. 58–62.
- 16 Wade, *A Report on the Delimitation of the Turco-Egyptian Boundary (1906)*, p.58.

- 17 'Akaba', 1:7,500, GSGS 4017; PRO AIR 1/2284/209/15/8.
- 18 Map GSGS 4023, November 1917; Survey of India. *The War Record 1914–1920: Records of the Survey of India XX*, p. 102; Royal Engineers, *History of the Corps*, p. 259.
- 19 Robinson, *Biblical Researches*, I, p. 507; Schattner, *The Map of Eretz Israel*, pp. 162–164.
- 20 Lynch, *Narrative of the United States' Expedition to the River Jordan and the Dead Sea*; Schattner, *The Map of Eretz Israel*, pp. 165–166.
- 21 F.de Saulcy, *Narrative of a Journey round the Dead Sea and in the Bible Lands in 1850–1851* (London, 1854); Schattner, *The Map of Eretz Israel*, pp. 166–167.
- 22 J.MacGregor, *The Rob Roy on the Jordan* (London, 1904), pp. 189, 195, 274, 338.
- 23 On Napoleon Bonaparte's map, see Elster, *The Jacotin Map*; Ben-Arieh, *Rediscovery*, pp. 21–26; Hopkiris, 'Nineteenth-Century Maps'; Kallner (Amiran), 'Jacotin's Map'; Karmon, 'An Analysis of Jacotin's Map'.
- 24 Hart, 'The Survey of Palestine', p. 218; Hopkins, 'Nineteenth-Century Maps of Palestine', p. 32.
- 25 Jones, 'British Military Survey', pp. 29–41; Wilson, 'Recent Surveys', pp. 206–240; Schattner, *The Map of Eretz Israel*, p. 164.
- 26 Van de Velde, *Map of the Holy Land constructed...from his own surveys in 1851, 1852 and 1862; from those made in 1841 by Majors Robe and Rochefort Scott, Lieut. Symonds R.E. from the triangulation made in 1840 and 1862 under the direction of Comm. A.L.Mansell R.N.and from the Researches of Robinson, Wetzstein and other travellers* (Gotha, 1862).
- 27 Wilson, 'Recent Surveys', p. 217; Palestine Exploration Fund, *Twenty-One Years' Work in the Holy Land*, pp. 73–75; Gavish, *French Cartography*'.
- 28 On the PEF maps, see Conder and Kitchener, *The Survey of Western Palestine*; Elath, 'Conder'; Elster, 'Map of the Palestine Exploration Fund'; Amiran (Kallner), 'Topographical Mapping'; Schattner, *The Map of Eretz Israel*, pp. 182–193; Ben-Arieh, *Rediscovery*, pp. 209–218; Ben-Arieh, *The Geographical Exploration*'; pp. 89–90; Arden-Close, 'Claude Regnier Conder'; Hart, 'Survey of Palestine'; Hopkins, 'Nineteenth-Century Maps'.
- 29 Wilson, 'Recent Surveys', pp. 218–229; Schattner, *The Map of Eretz Israel*, pp. 180–183.
- 30 Wilson, 'Recent Surveys', p. 224.
- 31 *Ibid.*, p.229.
- 32 Cassar, *Kitchener, Architect of Victory*, pp. 23–30.
- 33 Schattner, *The Map of Eretz Israel*, pp. 192–193.
- 34 Request from War Office, 17 September 1921, M.I. 4b/64 (ASIA).
- 35 Özkale and Şenler, *Haritaci Mehmet Şevki Paşa*, pp. 66–71.
- 36 Ben-Shemesh, *The Land Laws*, p. 274; Doukhan, *Land Laws in Israel*, pp. 366–367; Compendium of Turkish Statutes 'New Dastour', vol. 5, no. 61, p. 79 (1913). English translation of the Provisional Law of Survey and Registration of Immovable Property of 5 February 1913, in ISA RG 22 M/3326/16 (LD 34/16).
- 37 Kark and Gerber, 'Land Registry Maps'; Turkish Maps and Documents, Map List A—C, February 1922, in ISA RG 22 M/3542/13 (G 41/1).
- 38 The Chief Engineer for Palestine, G.Franghia, prepared a map in French and a plan for water supply from the Arrub springs to Jerusalem in 1889, CZA A112/11.
- 39 Wade, *Report*, p. 4.
- 40 Gavish, *Hadera, Hundred Years*, pp. 23–42; Treidel, 'Kartenkunde'; Gavish and Kark, 'The Cadastral Mapping', p. 76.
- 41 Özkale and Şenler, *Haritaci Mehmet Şevki Paşa*; United States of America, War Office, *Foreign Maps*.
- 42 Close, 'A Fifty—Years Retrospect', pp. 133–134; Newcombe, 'The Survey of Sinai and South Palestine'; Newcombe, T.E.Lawrence, *Personal Reminiscences*'; Amiran, 'Topographical Mapping', p. 34; Elster, 'British Maps'; PRO WO 303/133.
- 43 F.F.Kress von Kressenstein, *Mit den Türken zum Suezkanal* (Berlin, 1938), p. 44; Shadur, *Travels and Explorations*, pp. 27–28.

- 44 In 1909 the German cartographer H. Fischer drew up a map, *Das Syrisch-Ägyptische Grenzgebiet*, not based on proper field surveys. It was published to a scale of 1:1,400,000 in *ZDPV* 23 (1910).
- 45 The Czech physician and orientalist A. Musil explored and travelled widely through the desert regions in 1895–1902. See Fischer, ‘Begleitworte’, p. 200; Shadur, *Travels and Explorations*, pp. 17–21.
- 46 Alt, ‘Aus der Kriegsarbeit’, p. 99.
- 47 Vermessungs-Abteilung 27 commanded by Dr Heinrichs.
- 48 On the Prussian *Vermessungs-Abteilung 27* (Survey Company), see Alt, ‘Kriegsarbeit’; Holzhausen, ‘Tätigkeit’; Amiran, ‘Maps of Palestine’, pp. 34–35; Gavish, ‘World War I Battle Maps’.
- 49 A marginal annotation on each map reads, ‘Hergestellt nach der “Palestine Exploration Fund” Karte, ergänzt nach Luftbildern der Feldflieger-Abteilungen und nach eigenen Messungen. Vermessungs-Abt. 27’.
- 50 Monthly Photographic Report, October 1918, 8 November 1918 (D 12917), PRO AIR 2/98.
- 51 Thomas, ‘Geographical Reconnaissance’, p. 351.
- 52 Directorate Military Survey, ‘Report on the Work of the Seventh Field Survey Company’, and see PRO WO 95/4409; WO 95/4459; Government Press and Survey of Egypt, *A Brief Record*, pp. 88–89; Survey of India, *War Record*, pp. 99–104; Royal Engineers, *History of the Corps*, pp. 283–284, 306, 376–377, 412–413; Gavish, ‘World War I Battle Maps’; Collier, ‘An Early Attempt’.
- 53 Hart, ‘The Survey of Palestine’, p. 218; Hopkins, ‘Nineteenth-Century Maps’, p. 32.
- 54 PRO WO 303.
- 55 Salmon, ‘The Land of Palestine’, p. 548.

2

The transitional period: from the land problem under the military administration to the survey system of the Government of Palestine

- 1 *A Brief Record*, Plate 55.
- 2 Falls and Becke, *Military Operations, Egypt and Palestine II*, p. 607.
- 3 Report of Lawrence to Allenby, 13 May 1919, PRO FO 371/4143/104119, p. 2.
- 4 Instruction for the Administration of Occupied Enemy Territory by Major-General Bols, 27 January 1919, IOR MSS F 143/121.
- 5 The main port of the island of Lemnos in the northern Aegean.
- 6 Allenby to War Office, PRO FO 371/3348/358.
- 7 Instruction for the Administration of Occupied Enemy Territory by Major-General Bols, 27 January 1919, IOR MSS F 143/121.
- 8 Telegram 2557 from the Army HQ at Cairo to the Intelligence HQ in London, 26 June 1919, PRO WO 95/4373.
- 9 Agriculture and Colonization Department, Jaffa. ‘Maps Lent to Authorities, March-April 1919’, CZA L4/3N.
- 10 Head of OETA to ‘Maps’, GHQ 1st Echelon, 28 March 1919, ISA RG 2, CS/220, no. 2/43, Jerusalem Defense Scheme file.
- 11 E.P. Brooker (War Office) to H.W. Young (Colonial Office), 14 May 1920: ‘Co-ordination of Civil and Military Engineering’, PRO FO 371/5139/4805.
- 12 The Irishman L.B. Weldon was the Director of the Topographic Surveys of Egypt from 1909 to 1912. During the War he was Map Officer at GHQ and served as liaison officer with the Jewish ‘Nili’ spy group against the Turks.

- 13 Director of the Land Registry Department to the Public Works Department, 28 September 1920, and to the Surveys Department at Giza on 5 October 1920 and 20 January 1921, ISA RG 22, M/3542/12, File Maps: (G.44) 1920–1927.
- 14 Weldon to Ongley, 31 January 1921, *ibid.*
- 15 Request of maps for the Land Commission, 7 April 1921, *ibid.*
- 16 Survey Department to Bennett, 29 January 1923, *ibid.*
- 17 Intelligence HQ to OETA-Palestine, 28 March 1920, PRO WO 95/4375.
- 18 Request from War Office, 17 September 1921, M.I. 4b/64 (ASIA), *ibid.*
- 19 Samuel to Churchill (Colonial Office), 30 October 1921, PRO CO 733/7/56655. At the time, Newcombe was planning the tie-up of the Hejaz Railway to Baghdad.
- 20 Mankin, 'Middle East Frontiers Triangulation', pp. 30–31. Letter from Mankin to Ley, 24 October 1924 (T/M/55), Mankin file, p. 14, Sol/C.
- 21 ISA RG 22, M/3600 (G.71/8) file 'Beisan Aerodrome' (1922–1926).
- 22 This refers to Map GSGS 3740, 1:250,000, which was used for a long time for various purposes, such as for the Hope-Simpson Report of May 1930 regarding the land question, immigration, and the economic development of the country.
- 23 The command of the Lydda district of OETA-Jerusalem, 20 August 1919; security plan of 22 September 1919, CZA L4/3N.
- 24 American Colony Stores, *A Guide-Book to Jerusalem and Environs* (Jerusalem, 1920).
- 25 Report on Jaffa disturbances of 16 August 1921, PRO CO 733/5/43345.
- 26 PRO CO 733/9/38770 (21 August 1921).
- 27 Samuel to Colonial Office, 13 December 1923, PRO CO 733/28/63771.
- 28 Weizmann to Shuckburgh, 9 January 1930, 'Land for Jewish Settlement', PRO CO 733/170/2/67207.
- 29 On the development of land documentation in the ancient world, see Dowson and Sheppard, *Land Registration*.
- 30 Polak, *History of Agrarian Relations*, Baer, *Introduction to the History of Agrarian Relations*, pp. 22, 28–29, 35–36; Government of Egypt, *Almanac for the Year 1917*, p. 45; Lyons, *The Cadastral Survey of Egypt 1892–1907*.
- 31 Tute, *Ottoman Land Laws*; Ben-Shemesh, *The Land Laws*, pp. 174–175; Doukhan, *Land Laws in Palestine*, p. 7; Hilleli, 'The Rights in Land', pp. 575–610.
- 32 Natham altabu, 8 Jamaad Thani 1275.
- 33 Doukhan-Landau, *The Zionist Companies*, p. 14; Shilony, *Ideology*, pp. 66–71.
- 34 Provisional Law of Survey and Registration of Immovable Property of 5 February 1913, ISA RG 22, M/3326/16 (LD34/16); Ben-Shemesh, *The Land Laws*, pp. 187, 274; Doukhan, *Land Laws in Israel*, p. 366; Tute, *Ottoman Land Laws*, p. 161; Dowson, 'Settlement and Registration of Title Land and Associated Fiscal Reforms in Palestine', p. 3, PRO CO 733/361/75072/38.
- 35 Doukhan, *Land Laws in Palestine*, p. 6; Granott, 'Outline of the Land Regime'; Goadby and Doukhan, *The Land Law of Palestine*, p. 1.
- 36 Ben-Shemesh, *The Land Laws*, p. 245; Pal. Govt, *An Interim Report on the Civil Administration of Palestine during the Period 1st July 1920–30th June 1921*, p. 40; Bentwich, *England in Palestine*, p. 274.
- 37 Goadby and Doukhan, *The Land Law of Palestine*, p. 269.
- 38 Ruppin, *My Life II*, p. 121; Doukhan-Landau, *The Zionist Companies*, p. 15.
- 39 Tolokowsky, *Zionist Political Diary*, p. 210; Weizmann to Brandeis, 12 November 1917, Weizmann, *Letters VIII*, pp. 4–5.
- 40 Tolokowsky, *Zionist Political Diary*, p. 236–238; telegram of Foreign Office to Clayton, 11 December 1917, PRO FO 371/3054/235200 (F84173) 1176.
- 41 Weizmann, *Letters VIII*, introduction, p. xix.
- 42 The first discussion of the Zionist Commission en route to Palestine, Rome, 11 March 1918, CZA L4/293; Weizmann, *Letters VIII*: to De Haas, 12 December 1917, pp. 20–21; to

- R. Graham, 17 December 1917, pp. 28–29; to Brandeis, 14 January 1918, pp. 45–46; to Balfour, 30 May 1918, pp. 197–198.
- 43 Rubinstein, *At the Height of Expectations*, p. 28.
- 44 Rubinstein, 'Land Survey', pp. 119–127; PRO FO 371/3348/358.
- 45 Rubinstein, *At the Height of Expectations*, pp. 17–19.
- 46 Bentwich, *England in Palestine*, p. 24; Dowson, 'Settlement and Registration', C, p. 4, para. 3.
- 47 Rubinstein, 'Aaronsohn's Proposal', p. 80; Tolkowsky, *Zionist Political Diary*, 26–28 February 1918, pp. 282–284.
- 48 In Rubinstein, 'Aaronsohn's Proposal', p. 79; Tolkowsky, *Zionist Political Diary*, 2 March 1918, p. 285.
- 49 Report no. 5 of Ormsby-Gore to Zionist Commission, PRO FO 371/3395/99964. On p. 6 the Jewish speculators are dubbed 'Jewish Effendis'.
- 50 Weizmann, *Letters VIII*, to Graham and Sykes, 16 January 1918, pp. 61–63; PRO FO 371/3394/11053/11053.
- 51 Rubinstein, *At the Height of Expectations*, pp. 53–60.
- 52 Minutes of session of Zionist Commission, 23 April 1918, CZA ZA/483; Tolkowsky, *Zionist Political Diary*, 10 January 1918, p. 251, note 1.
- 53 Doukhan, *Land Laws in Palestine*, pp. 168–169; Ben-Shemesh, *The Land Laws*, p. 321.
- 54 Bentwich, *Legislation of Palestine 1918–1925*, 'Proclamation: Establishment of the Courts', 24 June 1918, pp. 605–609.
- 55 Proclamation no. 75 Prohibiting Land Transactions in the Sanjak of Jerusalem, 1 November 1918, and Proclamation no. 76 of 18 November 1918 Prohibiting Land Transactions in the Sanjaks of Acre and Nablus; Doukhan, *Laws of Palestine 1918–1925*, pp. 294–296.
- 56 Wavell, *The Palestine Campaigns*, pp. 179–183.
- 57 Bein, *History of the Jewish Settlement*, p. 152.
- 58 Rubinstein, *At the Height of Expectations*, pp. 29–31; Weizmann, *Letters VIII*, to Sokolow, 18 April 1918, p. 141; Tolkowsky, *Zionist Political Diary*, 14 May 1918, p. 311, note 3.
- 59 Rubinstein, 'Aaronsohn's Proposal'; Weizmann, *Letters VIII*, to Ormsby-Gore, 21 April 1918, p. 150; to Balfour, 30 May 1918, pp. 197–206.
- 60 Rubinstein, *At the Height of Expectations*, pp. 136–137.
- 61 'Provisional Executive Committee for General Zionist Affairs: Engineering Unit for Palestine', Report of 7 March 1918, CZA L4/634/199.
- 62 Weizmann, *Letters VIII*, to De Haas, 26 April 1918, pp. 168–169 (in reply to letter from De Haas of 22 March 1918, CZA L4/634/199).
- 63 Weizmann, *Letters VIII*, to Ormsby-Gore, 30 April 1918, p. 170.
- 64 Weizmann, *Letters VIII*, to De Haas, 23 May 1918, p. 194; to Brandeis, 12 July 1918, p. 225. In May 1919 surveying instruments arrived in Palestine for the engineer Sorsky for planning the drainage and sewage system for Jerusalem, in File 160: 'Zionist Commission, Technical Department, Surveying Instruments 1919', CZA L4/563. On 11 July 1919 General Money requested the Royal Air Force to photograph Jerusalem from the air for the urban survey, PRO WO 95/4375.
- 65CZA, L4/176, L4/422, L4/967, Z4/367/A.
- 66 Letter of Clayton to Ormsby-Gore, 29 June 1918, Despatch I 10685/B/46, 'Extracts from Appendix 105 of the Minutes of the 17th Meeting of the Zionist Commission, which were Deleted from the Text as Containing Information Undesirable for Communication', p. 3, para. 8, PRO FO 371/3395/137853.
- 67 Weizmann, *Letters VIII*, to Ormsby-Gore, no. 222, p. 221.
- 68 Note 66, above, p. 2, para. 5 in the despatch, and p. 2, para. 5 in the deleted passages.
- 69 Weizmann, *Letters IX*, to Aaronsohn, 23 October 1918, p. 1.
- 70 Weizmann, *Letters IX*, to Cecil, 1 November 1918, appendix I, pp. 389–390; Proposals Submitted to the Foreign Secretary by the Zionist Organisation 'Regarding Matters

- Affecting the Jewish Population of Palestine during the Military Occupation', cypher despatch no. 250 (N) of 9 November 1918 from Foreign Office to Clayton, PRO FO 371/3395/182887.
- 71 Hilleli, 'The Rights in Land', pp. 579, 583.
- 72 Clayton to Foreign Office, 19 November 1918, para. 5, PRO FO 371/3395/191998, no. 197.
- 73 Weizmann, *Letters IX*, appendix II 'Land Commission', p. 399; Tolkowsky, *Zionist Political Diary*, 20 January 1919, p. 406, note 2.
- 74 Lyons, *Cadastral Survey*; Pal. Govt, *A Survey of Palestine, Prepared in December 1945, and January 1946 for the Information of the Anglo-American Committee of Inquiry*, pp. 238–239, paras 40 and 41; Dowson, 'Report on the Land System in Palestine', B, pp. 7–8, 16, December 1925; Dowson, 'Settlement and Registration', C, p. 8.
- 75 T.W.Brown, 'Report on Forestry and Horticulture in Palestine', 12 January 1919, pp. 16–17, in Sawyer, *A Review of the Agricultural Situation in Palestine II*, pp. 16–17.
- 76 Report by W.Lawrence to Allenby, 13 May 1919, PRO FO 371/4143/104019.
- 77 *Ibid.*, p. 7, para. 10. About six months later, Weizmann attacked the approach represented by Lawrence: according to him, the British, 'lacking imagination and vision, considered a state of misery, squalor and desolation' as permanent, not permitting absorption of new population (Weizmann, *Letters IX*, to Zionist Office, London, 7 November 1919, p. 239).
- 78 Weizmann, *Trial and Error*, pp. 294–295; Clayton letter, note 66, above, p. 7.
- 79 Weizmann, *Letters IX*, to Eyre-Crowe, 16 December 1918, p. 71, para. 3.
- 80 Survey of India, *The War Record*, p. 19.
- 81 T.E.Lawrence to W.Lawrence, 14 March 1919, IOR, MSS EurF143/118.
- 82 IOR, MSS EurF143/110; F143/121.
- 83 *Ibid.*; see also note 76, above.
- 84 Allenby's remarks to W.Lawrence's report, 16 June 1919, PRO WO 93/4373.
- 85 The Advisory Committee on the Economic Development of Palestine, Third Session, 16 April 1919, p. 13, CZA Z4/16034.
- 86 Bentwich, *England in Palestine*, p. 266; Pal. Govt, *Report on Palestine Administration, July 1920–December 1921*, p. 110.
- 87 Doukhan, *Land Laws in Palestine*, pp. 179–182; Gt Britain, Peel Commission Report, p. 168.
- 88 Biger, *Crown Colony*, p. 136; Bentwich, *England in Palestine*, pp. 152–153; Pal. Govt, *Interim Report 1920–1921*, pp. 10–11.
- 89 Money to OETA, 9 May 1919, PRO FO 371/4226/127920; EEF, OETA, South, 'Estimates of Receipts and Expenditure for the Year 1919–1920', Cairo (October 1919). Agricultural Loans, pp. 4–5, para. 8, PRO FO 371/4143/138121; Pal. Govt, *Interim Report 1920–1921*, p. 16; Gt Britain, Peel Commission Report, pp. 154–157; Biger, *Crown Colony*, pp. 135–136.
- 90 Foreign Office to Clayton, 7 June 1917, no. 188, PRO FO 371/4171/86622; Clayton to Foreign Office, 19 June 1917, no. 348, PRO FO 371/4171/94476; Weizmann, *Letters IX*, to Vansittart, 13 June 1919, p. 154; Pal. Govt, *Report of the High Commissioner on the Administration of Palestine 1920–1925*, p. 16.
- 91 French to Foreign Secretary, 25 July 1919, CPO.35/19, PRO FO 371/4226/113300; Meinertzhagen to Foreign Secretary, 12 August 1919, PRO FO 371/4226/116996; announcement of British HQ Cairo to French Attaché, Cairo, 12 August 1919, PRO WO 95/4373.
- 92 Weizmann, *Letters IX*, to Spicer, 6 September 1919, pp. 210–211; telegram from London to Cairo HQ, 24 August 1919, PRO WO 95/4373.
- 93 Weizmann, *Letters IX*, to Graham, 13 July 1919, pp. 177–181.
- 94 Weizmann, *Letters IX*, to Spicer (Foreign Office), 6 September 1919, pp. 210–212 (also in PRO FO 371/4226/127352; PRO FO 371/5138/E1368).
- 95 See marginal remarks by Scott of the Foreign Office, PRO FO 371/4226/171814.
- 96 Meinertzhagen, *Middle East Diary 1917–1956*, 26 September 1919, p. 50; Weizmann, *Letters IX*, introduction, pp. xxxi–xxxii.

- 97 Meinertzhagen, *Middle East Diary*, 2 June 1920, p. 84.
- 98 Weizmann, *Letters IX*, to Young, 2 July 1920, pp. 384–386; Meinertzhagen, *Middle East Diary*, 11 September 1919, p. 47; 4 November 1919, p. 57.
- 99 Scott's marginal comment, note 95, above.
- 100 See note 94, above; letter from Zionist Organisation, London, to Scott, 14 January 1920, PRO FO 141/686/8752.
- 101 Meinertzhagen, *Middle East Diary*, pp. 59–60; Scott's marginal comment, note 95, above.
- 102 Meinertzhagen, *Middle East Diary*, 13 January 1920, p. 70.
- 103 Telegram, 10 February 1920, PRO FO 371/5138/E131.
- 104 Weizmann, *Letters IX*, to Curzon, 2 February 1920, p. 301.
- 105 E.Krause's 'Program for Surveyors' Course', 15 January 1920, CZA Technical Department of Zionist Commission L3/602. The course was held in Jerusalem from March to July 1920 under E.Krause. About thirty students participated.
- 106 Weizmann, *Letters IX*, appendix II, p. 399.
- 107 The Advisory Committee on the Economic Development of Palestine, Third Session, 16 April 1919, p. 13, CZA Z4/16034.
- 108 Weizmann, *Letters IX*, to Curzon, 2 February 1920, p. 301.
- 109 Meinertzhagen, *Middle East Diary*, 2 December 1919, p. 65.
- 110 Samuel to Allenby, 31 March 1920, PRO FO 371/5139/E3594/131/44.
- 111 'Preliminary Note on Capital Expenditure', in Samuel to Berstow, 3 June 1920, PRO T 161/138/11982.
- 112 Dowson to Samuel, 3 April 1920, PRO FO 371/5139/E3680 (also found in PRO OS 1/11/48898).
- 113 Weizmann, *Letters IX*, to Curzon, 2 February 1920, p. 301.
- 114 Order of Wavell to RAF Commander, 26 February 1920, PRO WO 95/4375 (G.S.1659/1); Newcombe to Close, 20 August 1920, PRO OS1/11/2; Gavish, 'An Account of an Unrealized Aerial Cadastral Survey', note 13.
- 115 Weizmann, *Letters IX*, to Curzon, 2 February 1920, p. 301.
- 116 Meinertzhagen to British Resident, Cairo, 9 April 1920 (CPO 276/1) and copy to Foreign Secretary, 10 April 1920 (FO 45), PRO FO 371/5139/E3647/131/44; and Meinertzhagen, *Middle East Diary*, April 1920, pp. 72–79.
- 117 Newman to British Resident, Cairo, 17 April 1920 (Observations on Dr Weizmann's Report), para. 2, PRO WO 95/4375 (G.S./1897).
- 118 *Haaretz* newspaper interview with Bols, 20 February 1920, p. 3 (translated from the Arabic newspaper *Mar'at esh-Sharq*).
- 119 Sawyer, *Agricultural Situation*, p. 1.
- 120 Survey Department: 'The Chief Administrator instructs that the Department of Surveys will be transferred from the legal branch to the Finance Department to take effect as from the date of this notification' (Ref. 11313/F), 19 May 1920. *Official Gazette OETA* (South) 22, 1 June 1920, p. 7.
- 121 'Cadastral Survey Ordinance', May 1920 (25 July 1920), An Ordinance to Facilitate the Demarcation of Boundaries and the Making of Surveys with a View to a Cadastral Survey, *OG*, 24; Bentwich, *Legislation of Palestine*, pp. 58–60; and see Appendix A.
- 122 28 June 1920, CZA L3/615. Coulthard-Clark, *Australia's Military MapMakers*, pp. 16–27, 205.
- 123 Samuel to Churchill, 1 September 1922, tables 1, 2, PRO CO 733/25/45281.
- 124 Meinertzhagen to British Resident, Cairo, 9 April 1920 (CPO 276/1) and copy to Foreign Secretary, 10 April 1920 (FO 45), PRO FO 371/5139/E3647/131/44; and Meinertzhagen, *Middle East Diary*, April 1920, pp. 72–79.
- 125 Chief Political Officer to Foreign Secretary, 19 June 1920, Cadastral Survey of Palestine file, PRO FO 371/5139/E7728 (no. FO 70, CPO 276/1).

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Organising the system

- 1 Bentwich to Chief Secretary, 31 October 1920 (LS 612), ISA RG 2, ADM/117 Pt/II.
- 2 Churchill to Samuel, 13 July 1922, Despatch 748, ISA RG 2, ADM/117, Pt/III.
- 3 The date for commencing work (June) cannot be correct since the document is dated 19 June and refers to future action. The intention apparently was to begin in the first week of July, when the administration of the country was to be changed.
- 4 Judge G.W. Williamson, 'Note on Land Law in the Ottoman Empire, 1919', MEC, Spry Papers I, HD 1265; *Palestine Administration 1920–1921*, p. 110; Dowson, *Report on the Land System B*, pp. 7–8, 16.
- 5 Dowson, *Report on the Land System B*, p. 16; 'Bols despatch': Chief Political Officer to Foreign Secretary, 19 June 1920, Cadastral Survey of Palestine file, PRO FO 371/5139/E7728 (no. FO 70, CPO 276/1), para. 2; Quinlan to Technical Department, Zionist Commission, Jerusalem, 'Position in Survey Department, Gaza', 28 July 1920, CZA L3/615.
- 6 Documents in files PRO FO 371/5267/E8833, 24 July 1920; PRO FO 371/5268/E11312/8343/44, 14 and 20 September 1920.
- 7 Samuel to Curzon, 'Senior Service Officials, Posts Actually Created and Filled', 15 October 1920, Despatch 96, PRO FO 371/6370/E13509/1136/44.
- 8 Letter of Clayton to Ormsby-Gore, 29 June 1918, Dispatch I 10685/B/46, 'Extracts from Appendix 105 of the Minutes of the 17th Meeting of the Zionist Commission, which were Deleted from the Text as Containing Information Undesirable for Communication', p. 3, para. 5, PRO FO 371/3395/137853.
- 9 'Explanatory Note on the Land Settlement Ordinance', 29 June 1927. PRO CO 733/142/44605/27; Goadby and Doukhan, *Land Law of Palestine*, p. 271; Doukhan, *Land Laws in Israel*, p. 390.
- 10 Bell (Legal Adviser, Sudan) to Legal Adviser, Jerusalem, 11 April 1927 (LD/34), ISA RG 22, M/3326/1.
- 11 'Bols despatch': Chief Political Officer to Foreign Secretary, 19 June 1920, Cadastral Survey of Palestine file, PRO FO 371/5139/E7728 (no. FO 70, CPO 276/1), paras 2, 4.
- 12 Zionist Commission, Technical Department, Study Courses, CZA L3/601–602; and see E. Krause's 'Program for Surveyors' Course', 15 January 1920, CZA Technical Department of Zionist Commission L3/602.
- 13 See, for example, documents in files PRO FO 371/5268–69; and FO 371/6370/E2312 and E2569.
- 14 Foreign Office to Boyce, 18 October 1920, PRO FO 371/5268/E12697/8343/44.
- 15 Note 7, above, list 2.
- 16 Telegram 214 from Foreign Office to Samuel, 26 October 1920; to Boyce, 27 October 1920, PRO FO 371/5269/E12968/9343/44; PRO WO 106/202/E14123/8343/44.
- 17 Ley to Foreign Office, 12 November 1920; Foreign Office to Samuel, 15 November 1920, Telegram 244, PRO FO 371/5269/E14123/8343/44 (same document in PRO WO 106/202).
- 18 Pal. Govt, *Report of High Commissioner, 1925*, p. 23.
- 19 List of senior British officials in Palestine, 27 August 1921, PRO CO 733/5/44554.
- 20 Budget estimates of 16 February 1921, Despatch 85, pp. 12–13, vote viii, PRO CO 733/1/10319.
- 21 See note 2, above.
- 22 Captain C.D. Day, J.C.E. Clarke, W.S.S. Moffatt; Keith-Roach to Curzon, 24 December 1920, Despatch 220: 'Statement Giving Proportion of British Officials', PRO FO 371/6370/E442/29/88; and see note 7, above.
- 23 Deedes to Curzon, 18 February 1921, Despatch 87, PRO CO 733/1/10321; and 22 February 1921, Despatch 94, PRO CO 733/1/15325.

- 24 In marginal remark of PRO CO 733/1/10321; Churchill to Samuel, 28 April 1921 (draft), PRO CO 733/1/15325.
- 25 Samuel to Foreign Office, 28 March 1921, Telegram 49, PRO CO 733/1/15325, Churchill to Samuel, 28 April 1921, PRO CO 733/1/10321; Samuel to Colonial Office, 13 May 1921, Telegram 154, PRO CO 733/3/23915.
- 26 Samuel to Churchill, 1 March 1921, Administrative Report for February, Despatch 105, p. 8, PRO CO 733/1/13440.
- 27 Minutes of eighth meeting of 3 May 1921, PRO CO 733/3/24594.
- 28 Letter from Hecker, Head of Technical Department of Zionist Commission, to S.Joffe, 22 August 1920 (no. 1390), CZA L3/601.
- 29 Storrs, *Orientalism*, p. 375; and see Kisch, *Palestine Diary*, 20 February 1924, pp. 103–104.
- 30 ‘Colonial Survey Appointments, Miscellaneous’, no. 225, Colonial Office, December 1926, p. 2, PRO WO 181/143.
- 31 Estimate of January 1923, PRO CO 733/93/27246.
- 32 For correspondence on subject, see PRO CO 733/140/7/44434.
- 33 Coulthard-Clark, *Australia’s Military Map-Makers*, pp. 16–27, 205; Quinlan, ‘*Australian map maker*’, pp. 268; Major Quinlan returned temporarily to the country on 1 December 1933 to head the survey of the water resources of Palestine. This survey was conducted by the Survey Department in coordination with the PWD for the Department of Development. See Pal. Govt, *Annual Report—Surveys, 1933*; Pal. Govt, *Technical Reports 1934*, para. 14.
- 34 Personalia: Major C.H.Ley, O.B.E. (ret’d.), *ESR* 2 (Jan. 1933): 63; *PCSL*; Bentwich, *England in Palestine*, p. 266.
- 35 Ley, ‘An Outline of Cadastral Structure in Palestine’, pp. 181–192.
- 36 On Crusher’s advancement, see PRO CO 733/73/45205; PRO CO 733/92/13816; *PCSL*.
- 37 Herbert, ‘The Salmon Collection’, pp. 2–5.
- 38 Winterbotham, ‘British Survey on the Western Front’, pp. 273–274; Salmon, ‘With the Field Survey Units in France’, pp. 268–278.
- 39 *PCSL*. One of his exploits, in the conquest of Majdal on the shore of the Sea of Galilee, is described in the official history of the Australians in the First World War: H.S.Gullett, *The Australian Imperial Force in Sinai and Palestine 1914–1918* (Sydney, 1944), pp. 735–737 (*The Official History of Australia in the War of 1914–1918* VII).
- 40 Dowson to Martin, 16 August 1938, para. 4, PRO CO 733/361/75072.
- 41 For his biography and appointment in Transjordan, see PRO CO 733/140/7/44434; *PCSL*.
- 42 ‘Cadastral Survey Ordinance, May 1920’ and tender for survey workers (Notice) of 20 July 1920, published in *OG* 24 (25 July 1920); and see CZA L3/601.
- 43 Dowson, *Settlement and Registration C*, pp. 5–7, paras 5 and 6. According to Baer, *Introduction to the History of Agrarian Relations*, pp. 35, 53–58, all the agricultural land in the Fertile Crescent (except Lebanon), including Syria and Palestine, was *miri*.
- 44 Jardine to Chief Secretary, 31 August 1945, para. 5; ISA, RG 22, M/3566/21 (LS/29).
- 45 Salmon, ‘Some Experiments with Zeiss-Bosshardt Direct-Reading Tacheometer’, p. 213.
- 46 Luke and Keith-Roach, *The Handbook of Palestine and Trans-Jordan*, p. 210.
- 47 PWD Memorandum, 18 June 1928, ‘New Survey Department HQ Jaffa’; ISA, RG 12, M/4122 (698 I).
- 48 Mitchell, ‘Survey of Palestine: The First Twenty Years’, p. 389.
- 49 Dowson, ‘Notes on Land Tax, Cadastral Survey and Land Settlement in Palestine’, pp. 27–28, para. d; report from Dowson to Clayton, 7 February 1923, PRO CO 733/60/59971; MEC. HJ.2999P.3.
- 50 Dowson repeated this view in 1938.
- 51 Dowson, ‘Survey and Land Settlement Estimates 1925–1926’ (A-E), PRO CO 733/92/23816.
- 52 *Ibid.*, A, paras 8 and 9, pp. 16–17 and ‘Note I: Capital Expenditure’.
- 53 *Ibid.*, marginal remark, 16 August 1925.

- 54 Ley to Central Housing Commission, 8 May 1928, SUR/A/5/1, ISA RG 12, M/4122 (698 I).
 55 Ibid., letter of PWD, 7 July 1928.
 56 'Headquarters Office: Accommodation', Pal. Govt, *Annual Report—Surveys, 1928*, p. 4.
 57 Ley to PWD Administration, 28 September 1928, ISA, RG 12, M/4122 (698 I).
 58 Luke to Amery, 12 October 1928, Despatch 1017, no. 15850/28, *ibid.*
 59 Mitchell, 'Survey of Palestine', p. 390.
 60 Salmon to Registrar of Lands, 31 October 1935, no. A/54; ISA RG 22, M/3333/32 (LD/25/15).
 61 'Government Property', Survey Plan TP 2266, 8 February 1929, File 30033, Department of Town Planning, Jerusalem City Engineer.
 62 The details were gleaned from documents in ISA, RG 12, M/4122 (698 II).
 63 Pal. Govt, *Annual Report—Surveys 1940–1946*, para. 4.

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Geodetic and cartographic considerations

- 1 Richards, 'Report to Dowson' (1925); Elster, 'Geodesy. Key Maps'; Pal. Govt, *Annual Report—Surveys, 1931*, p. 4.
 2 Pal. Govt, *Annual Report—Surveys, 1921*, para. 1.
 3 Diary of report of W. Moffatt to Director of Surveys, 18 March–12 July 1921, SoI/C; Pal. Govt, *Annual Report—Surveys, 1921*, para. 2; Ordnance Survey, 'Further Notes', p. 19.
 4 The plan was reconstructed in Pal. Govt, 'Annual Report of the Director of Surveys' for 1921, para. 2. *Annual Report of the Director of Surveys, 1920–1927* (one report covering this period) was apparently typed in 1927 and not printed. The reports have been located in typescript in two libraries: in the Survey of Israel (SoI) in Tel Aviv and at the Middle East Centre (MEC) in Oxford.
 5 From a discussion on the amalgamation of the Departments of Agriculture, Land Registration, Lands, Surveys and Land Settlement on 17 October 1921. See Ley to Civilian Secretary, 26 October 1921, p. 3, para. 3, ISA, RG 2, ADM 117, Pt. II.
 6 Pal. Govt, *Annual Report—Surveys, 1921*, para. 1.
 7 Pal. Govt, *Annual Report—Surveys, 1929*, p. 2; Pal. Govt, *Annual Report—Surveys, 1933*, p. 2, para. 4.
 8 Le Ray, 'The Triangulation of Palestine', pp. 287–294.
 9 Pal. Govt, *Annual Report—Surveys, 1921*, para. 3.
 10 On the method of closing nets and its application in Palestine, see Ley, *Note on the Technical System*, pp. 2, 4–6, paras. 6, 10–14; Adler, 'Control Densification'.
 11 October Monthly Report, 11 November 1921, PRO CO 733/7/57950; Ley to Moffatt, 28 March 1921, in file Bases (Reconnaissance and Selection of) B/3/R, SoI/C/14; Ley to Civilian Secretary, 2 October 1921, Quarterly Report, September 1921 (SUR/R/2/1).
 12 Pal. Govt, *Annual Report—Surveys, 1921*, p. 1.
 13 Pal. Govt, *Annual Report—Surveys, 1924*, p. 3; Pal. Govt, *Annual Report—Surveys, 1925*, p. 2; 'Palestine Boundaries—July 1922' (G/46), ISA, RG 22, M/3519/18; Biger, *Crown Colony*, pp. 35–36; Brawer, *Israel's Boundaries*, pp. 103–123.
 14 Filling in Gaps, Major Triangulation (SUR/C/T/4), correspondence and sketches by Ley, Le Ray, and Mankin, 5 March–19 May 1925, SoI/C/14.
 15 Pal. Govt, *Annual Report—Surveys, 1924*, p. 1.
 16 According to the British triangulation maps and *Atlas of Israel* (1970), Sheet I/7, Point 58 was also fixed outside the country's border, when in effect it is on Tel 'Artal at Kefar Ruppin.

- 17 Mankin, *Middle East Frontiers*, pp. 30–31; Mankin to Ley, 8 January 1925 (T/4/204), Mankin file, SoI/C/14.
- 18 Pal. Govt, Annual Report—Surveys, 1923, para. 2; Pal. Govt, Annual Report—Surveys, 1924, p. 1; Acre Base file (Technical) (SUR/B.3.1), August 1922, SoI/C/14.
- 19 Le Ray to Mankin, 8 December 1924 (SUR/T/4/A), SoI/C/14.
- 20 Mankin to Ley, 22 December 1924 (T/4/184), Mankin file; ‘Semakh Base’ file (C/L/3), levelling survey and topographic section of Line 101M-102, 26–27 February 1925, SoI/C/14.
- 21 Pal. Govt, Annual Report—Surveys, 1925, p. 1; Dowson to Under-Secretary for Colonies, 10 August 1924, p. 3, PRO CO 733/85/38440; ‘Major Triangulation Base Measurement (Imara and Samakh) by Survey of Egypt’, SoI/C/13.
- 22 F.S.Richards served in Palestine during the First World War in the 7th Field Surveys Company. In 1920–1927 he directed the Survey of Egypt’s computations section, and in 1927–1938 was the Assistant Director of Surveys.
- 23 Richards, ‘Report to Dowson’, pp. 1–15.
- 24 On Moffatt, see Gavish, *Cadastral and Topographical Mapping*, p. 76. J.H. Mankin served in Palestine during the First World War and continued in the Survey of Palestine from August 1921 to December 1939. He published articles of reminiscences of his work in the country and on the Syria—Transjordan boundary demarcation in 1932.
- 25 Richards, ‘Report to Dowson’, pp. 7–8.
- 26 ‘Reports on Adjustment of Major Triangulation May 1926–April 1927’, SoI/C/12.
- 27 Salmon ‘The Department of Land and Surveys’, 4 December 1936, pp. 1–2, ‘Memorandum Submitted by Government in Respect of Land Question’, Le Ray Papers, 19/(3)/8, MEC.
- 28 Gt Brit., Hope-Simpson Report.
- 29 Survey of Egypt, *Report on the Work of the Survey Department of Egypt 1932–1933*, pp. 30, 42–44.
- 30 French, *First Report on Agricultural Development* (Jerusalem, 23 December 1931); PRO CO 733/214/5/97049.
- 31 From the day Salmon took over as Director of Surveys, on 27 March 1933, he made it a practice to publish a Technical Report on 31 March of each year. This document was not an official annual report appearing regularly in January following the preceding year, but a summary that was apparently intended to be sent to England, the data and dimensions being given in acres and square miles.
- 32 Triangulation of Palestine (1st List): Trig. List No. 150, Primary Triangulation of Palestine, GHQ, ME Survey Directorate’, SoI/L.
- 33 M=Major Trig.; in the documentation this also appears as Primary Trig. and/or Principal Trig.
- 34 Samuel to the Duke of Devonshire, 17 August 1923, Ley’s remark to para. 9 of the Northern Boundary Agreement, p. 2, PRO CO 733/48/42895.
- 35 Dowson to Under-Secretary for Colonies, 10 August 1924, p. 3, PRO CO 733/85/38440; Colonial Office to Foreign Office, 23 September 1924, Despatch 44463/24, para. 36, PRO CO 141/686/8752.
- 36 Pal. Govt, Annual Report—Surveys, 1924, pp. 1–3.
- 37 Pal. Govt, *Report on Palestine Administration*, pp. 50–51; Ley, *Technical System*, p. 7, para. 17; ‘Anglo-French Boundary Commission’, Directorate of Military Survey, MCE(RE), Cn 301 E(2).
- 38 Pal. Govt, Annual Report—Surveys, 1928, appendix (May 1929), pp. 6–7.
- 39 Elster, ‘Geodesy. Key Maps’; Pal. Govt, *Report to the Council of the League of Nations* (1928), p. 78.
- 40 Report of Chief of Survey Directorate in Palestine to Middle East Survey Directorate, CR/PAL/24092/SVY, 6 February–6 March 1941, para. 4, PRO WO 169/1046.
- 41 Pal. Govt, Annual Report—Surveys, 1936, para. 85; Pal. Govt, Annual Report—Surveys, 1937, para. 126; Pal. Govt, Annual Report—Surveys, 1938, para. 115; Pal. Govt, *Report to*

- League of Nations, 1936*, p. 86, para. 48; Pal. Govt, Annual Report—Surveys, 1937, p. 77, para. 54; Le Ray, 'Triangulation of Palestine', p. 287.
- 42 Director of Surveys, GHQ, ME, 'Palestine Report', 8 July 1940, p. 2, PRO WO 169/39, appendix 3; 'Surveys and Maps, Palestine, Transjordan and Syria' (CRME/891/CV), 25 October 1940, p. 3.
- 43 Pal. Govt, Annual Report—Surveys, 1940–1946, para. 38; Survey Directorate, Palestine, Trans-Jordan and Syria War Diary (September 1941), appendix Q, para. d(1), PRO WO 169/1046. The extension of the Egyptian triangulation net towards Palestine was completed in March 1945, according to Murray, *The Survey of Egypt 1898–1948*, p. 53; or in December 1945, according to the Survey Directorate War Diary: PRO WO 169/19609, appendix J13 (9688/SY), 14 January 1946, 'Short Report for December 1945', p. 6, para. 8; PRO OD 6/423.
- 44 Dowson to Shuckburgh, 4 August 1927, para. 3, PRO CO 733/140/7/44434.
- 45 Survey Directorate War Diary (10 May 1941–9 June 1941), appendix G, para. 3, PRO WO 169/1046; 'Major Triang. Northern Block, Solution of Triangles', computation sheets of the extension of the net to Transjordan, July 1941, Sol/C/12; Gavish, '2/1 Australian Field Survey Company'.
- 46 Pal. Govt, Annual Report—Surveys, 1927, pp. 2–3; Pal. Govt, *Report to League of Nations, 1928*, p. 79.
- 47 Pal. Govt, *Technical Reports*, 31 March 1934, para. 8.
- 48 Gt Brit., Hope-Simpson Report, 'Hydrographic Survey, p. 147'; French's proposal, 16 November 1931, PRO CO 733/213/6/97032; French, *First Report*, pp. 20–23, paras 77–89.
- 49 Pal. Govt, *Report to League of Nations 1933*, p. 53, para. 27. The base points were marked F (fundamental) and points incised on culverts were marked C (culvert).
- 50 On the history of determining the level of the Dead Sea, see Salmon and McCaw, 'The Level and Cartography of the Dead Sea', pp. 103–111.
- 51 Pal. Govt, Annual Report—Surveys, 1936, paras 88–90, diagram 3; Pal. Govt, *Technical Reports*, 31 March 1936, para. 5.
- 52 Pal. Govt, Annual Report—Surveys, 1936, para. 100; Pal. Govt, Annual Report—Surveys, 1935, paras 120–199, diagram 3.
- 53 Pal. Govt, Annual Report—Surveys, 1937, paras 128–129; Pal. Govt, *Technical Reports*, 3 March 1938, para. 3; Pal. Govt, Annual Report—Surveys, 1938, para. 117.
- 54 Pal. Govt, Annual Report—Surveys, 1939, paras 20 and 21; Pal. Govt, Annual Report—Surveys, 1940–1946, para. 41; 'Precise Levelling Grid'.
- 55 'Grid and Projection Problems', 3–6 April 1940, appendix 2, PRO WO 169/39.
- 56 Salmon, 'Topographical Maps', p. 2.
- 57 Salmon, 'The Land of Palestine', p. 542.
- 58 Le Ray, 'Triangulation', pp. 287–294, especially p. 292.
- 59 Richards, 'Report to Dowson' p. 3.
- 60 Dowson, 'Survey and Land Settlement Estimates', C, p. 4, note II.
- 61 Personal communication from Dr Liebrecht, 9 June 1980.
- 62 Adler and Chamielnik, 'Introduction and Background', pp. 1–2.
- 63 Jacques Cassini de Thury (1677–1756) was one of a French family of astronomers and cartographers who through several generations directed the observatory of the French Academy of Sciences in Paris. Cassini conducted the first triangulation survey for the mapping of all of France, which was completed by his grandson in 1793.
- 64 Soldner was a Bavarian geodesist who in 1809 applied the spherical system of coordinates to plane surfaces in the mapping of Bavaria.
- 65 Pal. Govt, Annual Report—Surveys, 1922: 'Report on Cadastral Survey 1922–1923'.
- 66 Close and Winterbotham, *Topographical and Geographical Surveying*, pp. 91–93.
- 67 In 1744 Jacques Cassini de Thury began the first topographic mapping of France with this projection, and a year later it was also adopted by the British in the mapping of Ireland,

- England, and Wales. The projection was applied thirty-nine more times in various regions of Britain, and was also adopted in Belgium and Austria. But sixty-four years later, in 1808, the French replaced it with another projection more suitable for a broad country such as France, whereas Britain retained the Cassini projection for another two hundred years. When the Survey of Palestine began to work according to the Cassini projection it was already clear to the British that it would be replaced at home. The decision to replace it was taken only in 1938 and was effected after the Second World War. During the war, the British Directorate of Military Survey temporarily introduced the Gauss-Conformal projection to Palestine since it was more suited to artillery needs. J.B.Hurley, *Ordnance Survey Maps: A Descriptive Manual* (Southampton, 1975), pp. 17–18; D.H.Maling, *A Coordinate System and Map Projection* (London, 1973), pp. 208, 216–217; Andrews, *A Paper Landscape*, p. 76; Report of Davidson Commission on Surveys in England, pp. 38–39, PRO OS1/121.
- 68 On the Cassini—Soldner projection, see in detail note 130, above; Maling, *A Coordinate System* (see note 67), pp. 206–217; Adler, ‘Geodetic Projection’, pp. 7–9; Adler and Chamielnik, ‘Introduction and Background’, pp. 20–26.
- 69 The Cassini projection looks like a cylindrical transverse projection. Thus, it is tangential to the meridian and not to the equator, as is normally the case. The longitudinal geographic coordinates of the Jerusalem meridian are 30°12'43".49 East.
- 70 The number of the triangulation point at the Ali el-Muntar hill is 5'dM. There was also a point on Ali el-Muntar in the First World War, and its number in the military triangulation net was M22 (M=Military).
- 71 Richards, ‘Report to Dowson’, p. 36.
- 72 Report of Lawrence to Allenby, 13 May 1919, p. 5, para. 7, PRO FO 371/4143/104019.
- 73 Avitsur, *Daily Life*, pp. 78–80.
- 74 The *pic* is usually a linear unit of land measurement, although in some places it also served for area measures—in Syria, Egypt, and Sudan.
- 75 Goadby and Doukhan, *Land Law of Palestine*, p. 295 (note). The metric system was adopted in France in 1799 and written into law in 1840. The system became legally valid in the United States in 1866, and thirty years later it was adopted in the Ottoman Empire.
- 76 According to Ben-Shemesh, *The Land Laws*, pp. 172–173. No confirmation for this was found. The area of a Turkish dunam is usually given as 918.7–919.3 square metres.
- 77 Avitsur, *Daily Life*, pp. 78–79.
- 78 Ben-Shemesh, *The Land Laws*, pp. 172–173; Ottoman Land Code, para. 131; ‘Land Registration, 1st Draft’, Spry Papers/1, MEC.
- 79 In the croquis and maps of the early years of the Mandate, the areas of land parcels were indicated in dunams and ells, as in Ottoman times. In these cases the dunams were not metric but of square ells, or in *pic* units.
- 80 Samuel to Curzon, 8 November 1920, Despatch 119, PRO FO 371/5292/E14805/44.
- 81 J.B.Barron was the Director of the Customs and Revenue Department and the Chief Assistant Financial Secretary of the Government of Palestine.
- 82 E.R.Sawer was Director of the Agriculture and Fisheries Department.
- 83 V.A.Van Vriesland was a member of the Zionist Commission in the period 1923–1927. From 1919 to 1929 he served as Treasurer of the Zionist Executive.
- 84 PRO CO 733/1/14139.
- 85 Polak, *History of Agrarian Relations*, pp. 9–10. For example, in Hadera, according to a local administrator, an agricultural dunam was 900 square metres, and a building plot dunam 800 square metres.
- 86 Plumer to Amery, 21 September 1925, Despatch 1128 (ADM 2/13), PRO CO 733/97/44810.
- 87 Dowson to Chief Secretary, 20 November 1924 (LS/27), *ibid.*
- 88 Dowson, ‘Report on the Land System’, B, appendix 1, p. 27.
- 89 Dowson, ‘Settlement and Registration’, C, p. 12.
- 90 Bentwich, *Legislation of Palestine B*, p. 281.

- 91 M.Hotine, 'A Grid System for Ordnance Survey Maps', *REJ* (1936): 603.
- 92 Dowson, 'Notes on Land Tax', p. 31, para. G.17.
- 93 Jugum—Roman land area measuring unit varying according to the fertility of the soil and its sustenance factor.
- 94 Dowson and Sheppard, *Land Registration*, pp. 2–3.
- 95 See note 87, above.
- 96 PRO CO 814/21.
- 97 See note 86, above.
- 98 PRO CO 733/97/44810.
- 99 Meeting of 23 December 1926, PRO CO 814/22.
- 100 'Weights and Measures Ordinance No. 2, 1928', *OG* 202 (1 January 1928): 2–6; *OG* 205 (16 February 1928): 92.
- 101 See, for example, Report of 10 January 1928, 'Soil Reconnaissance of Palestine', p. 135, PRO CO 733/156/4.
- 102 See, for example, W.K.Wilton, 'Units of Length and Their Relations to Areas in Cadastral Surveys', *ESR* 3 (July 1935): 165–169.
- 103 S.K.S.Mudaliar, 'Impact of Switch-Over to Metric System on Surveying and Mapping in India', *CSO*, pp. 46–62.
- 104 G.McGrath, 'From Hills to Hotine', *CJ* 13 (1976): 14.
- 105 This cartographic point of departure resembles the original French topographic mapping, which was based on reductions of the cadastral plans, connecting one sheet with the other, updating, and adding contour lines to make them topographical. Similarly, after 1852 the mapping of England on a scale of one inch to the mile (1:63,360) was reduced from the basic maps of six inches to the mile, or approximately 1:10,000. See Close and Winterbotham, *Topographical and Geographical Surveying*, p. 137; Salmon, 'Topographical Maps', p. 2.
- 106 Salmon, 'Topographical Maps', p. 7.
- 107 Richards, 'Report to Dowson', p. 21.
- 108 Dowson, 'Notes on Land Tax', p. 26.
- 109 Richards, 'Report to Dowson', p. 3, Dowson's letter of appointment of 2 February 1925, para. 10.
- 110 *Ibid.*, pp. 31–35, 47–50.
- 111 Ley, *Technical System*, p. 2, para. 4, and p. 4, para. 9.
- 112 Dowson, 'Settlement and Registration', B, chapter I, p. 1, para. 1, and chapter III, p. 12, para. 16.
- 113 Pal. Govt, Annual Report—Surveys, 1928, pp. 2–3.
- 114 Ley, *Structure and Procedure*, pp. 3–4, para. 8.
- 115 Close and Winterbotham, *Topographical and Geographical Surveying*, p. 137.
- 116 Ley, *Technical System*, p. 4, para. 9.
- 117 Ley, *Structure and Procedure*, p. 6, para. 14; Ley to Commissioner of Lands, 31 January 1928 (SUR/L/2/1), ISA, RG 22, M/3862/16.
- 118 Ley, *Structure and Procedure*, p. 7, paras 14–16.
- 119 Salmon to Birger, 27 October 1937 (M/106) YBZA 8/2/2/1; Salmon, 'The Modern Geography of Palestine', pp. 39–40.
- 120 Salmon, 'The Land of Palestine', p. 549.
- 121 'Palestine Report', Director of Surveys, GHQ, ME, 8 July 1940; 'Survey & Maps, Palestine etc.' (CRME/891/CV), 25 October 1940, PRO WO 169/39; War Diary, January—May 1941, appendix A (CR/PAL/24029/SVY), 6 February 1941, PRO WO 169/1046.
- 122 'City of Jerusalem Town Planning Scheme, 1920–1924', PRO FO 141/432/10946.
- 123 War Diary, 11 July 1919, PRO WO 95/4373. Jerusalem was photographed from the air by the 14th Squadron, which took off from Ramle on 2–3 and 17–18 February 1920. War Diary, The Palestine Group, RAF 1920, PRO AIR 1/1730/204/126/58.

- 124 Weizmann, *Letters*, IX, to Zionist Bureau, London, 7–9 November 1919, p. 247; Ruppin to Palestine Zionist Office, Jaffa, 5 September 1919 (AR/LI); Librarian of Zionist Organisation, London, to Morse (assistant to Geddes), 10 September 1919 (G.16), CZA Z 4/2790; Storrs, *Orientalisms*, p. 323.
- 125 Pal. Govt, Annual Report—Surveys, 1921, p. 4; Pal. Govt, Annual Report—Surveys, 1922, para. 4; Pal. Govt, Annual Report—Surveys, 1925, p. 2; Administration Report for October 1921, p. 10, PRO CO 733/7/57950; Administration Report for Quarter September 1923, appendix A, p. 2, PRO CO 733/50/55845; Gavish, ‘Map of Jerusalem’.
- 126 Personal communications from the brothers Yehoshua and Shmuel Prushansky and Abraham Wilensky, graduates of the Surveyors’ School, and documents of November 1921 in their possession.
- 127 Storrs, *Orientalisms*, p. 326.
- 128 The city was photographed on 16 April 1925; PRO AIR 5/1245.
- 129 Ley to Chief Secretary, 3 September 1925 (SUR/J/2/3); Davies (Treasury) to Chief Secretary, 29 September 1925 (105/7860), PRO CO 733/98/47015; Pal. Govt, Annual Report—Surveys, 1937, p. 79, para. 143.
- 130 Pal. Govt, Annual Report—Surveys, 1927, p. 4.
- 131 Exchange of correspondence between District Commissioner and Jerusalem City Engineer, 26 March–10 May 1940, file C.E. 3/810/201, ‘Abu Tor Quarter’, Town Planning Programme 18, Town Planning File 806, Town Planning Department Archive, Jerusalem City Engineer.
- 132 E.W.G.Masterman, ‘The Ophel Hills’, *PEFQS* 55 (1923): 37–45. The British Ordnance Survey printed a map in 1925 for the summing up of the Ophel excavations of 1896–1925. One of the sources for this was the Survey of Palestine 1:1,000-scale map of 1922. See map in R.H.S. Macalister and J.G.Duncan, ‘Excavation on the Hill of Ophel, Jerusalem 1923–1925’, *PEFA* IV (1923–1925).
- 133 C.Close, ‘The New Map of Jerusalem’, *PEFQS* 57 (1925): 217–219.

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The survey and land settlement systems, 1920–1927

- 1 Dowson, ‘Survey and Land Settlement Estimates 1925–26’, A, p. 2, and Ley’s ‘Observations on Sir E.Dowson’s Covering Memorandum Note (A)’, *ibid.*, p. 1.
- 2 ‘Occupied Enemy Territory Administration is Now the Government of Palestine’, *OG* 24 (25 July 1920).
- 3 ‘Cadastral Survey Ordinance, May 1920’, *ibid.*
- 4 See Chapter 2; Samuel to Foreign Office, 21 July 1920, Telegram 139, PRO FO 371/5139/E8686.
- 5 PRO FO 371/5267/E8833.
- 6 *OG* 26 (1 September 1920), pp. 2–3; ‘Land Commission’, PRO CO 733/18/9614.
- 7 PRO FO 371/5140/E12710; E13511; E14341.
- 8 ‘The Transfer of Land Ordinance 1920–1921’, *OG* 28 (1 October 1920); *OG* 41 (15 April 1921); *OG* 57 Amendments (15 December 1921).
- 9 Public Notice no. 176: ‘The Land Registries will be opened in all Districts of Palestine for transactions on October 1st. All dispositions of immovable property must be made through the Registry in accordance with the Ordinance which will be issued immediately.’ PRO FO 371/5140/E16210; *OG* 28 (1 October 1920), p. 4.
- 10 Public Notice no. 164: ‘Palestine Land Registries Schedule of Fees’, July 1920; Goadby and Doukhan, *Land Law of Palestine*, pp. 300–301; PRO FO 371/5140/E16210.
- 11 Weldon to Dowson, 3 February 1921 and accompanying letter to High Commissioner in Egypt, 6 February 1921, PRO FO 141/686/8752/31.

- 12 'Mahlul Land Ordinance 1920', *OG* 36 (1 February 1921): 10.
- 13 'Mewat Land Ordinance, 16.2.1921', *OG* 38 (1 March 1921): 6.
- 14 Pal. Govt, *Report on Palestine Administration, July 1920–December 1921*, p. 113.
- 15 'Land Courts Ordinance 1921', *OG* 42 (1 May 1921): 1–3.
- 16 Doukhan, *Land Laws in Palestine*, p. 172.
- 17 Budget estimates for 1921–1922, Despatch 85, 16 February 1921, PRO CO 733/1/10319.
- 18 PRO CO 733/1/10321; 13440; 15325; CO 733/2/17961; 21697; CO 733/3/23915; 24594.
- 19 Samuel to Churchill, 19 April 1921, Despatch 59 (ADM 901), Draft Land Surveyors' Ordinance 1921, PRO CO 733/2/21445; Discussion on 'Surveyors' Ordinance', at eighth meeting of the Advisory Council, 3 May 1921, PRO CO 733/3/24594 and also PRO CO 733/4/34936; *OG* 44 (1 June 1921): 4, and see appendix A.
- 20 Samuel to Colonial Office, 24 June 1921, Despatch 235, PRO CO 733/4/36135; 'June Monthly Administration Report, 4 July 1921', p. 9, PRO CO 733/4/34950.
- 21 Samuel to Churchill, 24 November 1921, Despatch 472, PRO CO 733/7/61433.
- 22 Pal. Govt, *Administration Report 1920–1921*, p. 111.
- 23 Samuel to Churchill, 14 May 1921, Despatch 104, PRO CO 733/3/26588.
- 24 Keith-Roach, Chief Secretariat, 17 October 1921, 'Administration Amalgamation', ISA, RG 2, ADM 117, pt III.
- 25 Ley to Chief Secretary, 26 October 1921 (L/8/GEN), *ibid.*
- 26 Memorandum of Legal Secretariat, 31 October 1921 (L.S. 612), *ibid.*; Memorandum of Treasury Secretariat, 31 October 1921 (F 337/21), *ibid.*
- 27 Samuel to Churchill, 31 March 1922, Despatch 198, 'Report of the Tithes Commission, 27 February 1922', PRO CO 733/20/17045.
- 28 Samuel to Churchill, 24 May 1922, Despatch 378, 'Draft Land Valuers Ordinance', PRO CO 733/22/27123.
- 29 Churchill to Samuel, 22 August 1922, PRO CO 733/20/17045; Pal. Govt, *Report on Palestine Administration 1922*, pp. 46–47.
- 30 'Organization of Land Regime', 3 March 1945, ISA, RG 22, M/3566/21.
- 31 'Agreement between the Government of Palestine and the Cultivators of the Ghor Lands', *OG* 59 (15 January 1922): 10–22; *OG* 219 (16 September 1928): 567; *PG* 388 (14 September 1933): 1311–1314; Bentwich, *Legislation of Palestine II*, pp. 500–505; Doukhan, *Laws of Palestine*, pp. 60–64; French, *First Report*, appendix III-B, pp. 40–43 and appendix III-C, pp. 44–45.
- 32 Dowson, 'Report on the Land System', B, pp. 22–23.
- 33 Gt Britain, Hope-Simpson Report, pp. 18, 83–85; French, *First Report*, pp. 26–28, paras 99–107 and appendix IV-A, pp. 46–47.
- 34 On the *jiftlik* lands in 1913, see Wolfson to Jacobson, 17 July 1913. CZA W143 II; 'Beisan Land Agreement (1920–1922)' file, ISA, RG 22, M/3599/6 (G41/1); Weizmann, *Letters IX*: to Zionist Commission, 13 January 1920, p. 273; to Ussishkin, 30 January 1920, pp. 287–288; to Meinertzhagen, 31 January 1920, pp. 289–290.
- 35 Samuel to Foreign Office, 13 October 1920, Telegram 308(R)—Samuel's proposal for leasing state lands, PRO FO 371/5140/E12710.
- 36 PRO CO 733/3/31805. The Civil Secretary distributed Samuel's speech in Arabic and English among the Arabs of Beisan. ISA RG 22, M/3599/6, 20 May 1921 (G41/1).
- 37 'Demarcation of Government Lands, 10 November 1921', Regulation under Wood and Forests Ordinance 1920, in Bentwich, *Legislation of Palestine II*, pp. 397–398, 500–505.
- 38 On the background, the Government of Palestine's land policy, and its political implications, see Doukhan, *Land Laws in Palestine*, pp. 143–147; Gt Britain, Hope-Simpson Report, pp. 84–85; French, *First Report*, appendix IIIA, pp. 36–39; Goadby and Doukhan, *Land Law of Palestine*, pp. 62–64; Gt Britain, Peel Commission Report, pp. 259–262; Granowsky, *The Land Episode*, pp. 17–30; Avneri, 'The Struggle', pp. 111–113; Avneri, *The Jewish Land*

- Settlement*, pp. 136–143; Spry, ‘Memorandum, October 1948’, PRO CO 733/494/3 (76452/1A/48), p. 12; Stein, *The Land Question in Palestine*, pp. 59–64.
- 39 Pal. Govt, Annual Report—Surveys, 1922, para. 3; Director of Lands to Governor of Galilee District, 13 January 1922 (M/GAL/4/227), ISA, RG 22, M/3599/6 (G44/1).
- 40 On the Turkish map episode, see Chapter 1; Director of Lands (note 39, above), para. 18; ‘Turkish Maps and Documents’ file, correspondence, and List of Maps A-C, February 1922, ISA, RG 22, M/3542/13 (G44/1); Kark and Gerber, ‘Land Registry Maps’, pp. 30–32.
- 41 Stubbs to Chief Secretary, 7 October 1923 (DLR/500/23), PRO CO 733/50/51406.
- 42 ‘Observers’ Reports—Technical’ (SUR/R/8/0); Ley to Moffatt, 3 and 9 January 1922, SoI/C/14.
- 43 Richards, ‘Report to Dowson’, chapter 14, pp. 41–44.
- 44 Maurice C. Bennett served in Palestine during the First World War and later in the OETA HQ. With the establishment of the civilian government in July 1920, he was appointed Assistant Director of the Commerce and Industry Department. On 1 January 1922 Bennett was transferred to the Department of Lands, where he served in senior positions, among these as secretary to John Hope-Simpson in 1930.
- 45 On surveying the Beisan lands, see Ley to Bennett, 15 February 1922 (J/GAL/4/227); Bennett to Legal Adviser, 14 December 1922; Summary at end of one year of the Agreement and additional correspondence in Personnel-Beisan’ file (G.41/9), ISA, RG 22, M/3542/3; Administrative Report for quarter of 30 September 1923, PRO CO 733/50/44845, appendix A, p. 1, 3(C); ‘Reports on Cadastral Survey 1922–23’, in Pal. Govt, Annual Report Surveys, 1922; Pal. Govt, Annual Report—Surveys, 1922–1926, Pal. Govt, Annual Report—Surveys, 1931–1933; Pal. Govt, *Technical Reports*, 31 March 1934, para. 10; Pal. Govt, *Report to League of Nations*, 1925, p. 45; Pal. Govt, *Report to League of Nations*, 1926, pp. 51–53.
- 46 Dowson, ‘Survey and Land Settlement Estimates 1925–26’, D, p. 3.
- 47 Stubbs to Camp (Land Registry, Gaza), 4 August 1922 (M/GAL/4/227), ISA RG 22, M/3542/3 (G.41/9).
- 48 Dowson, ‘Survey and Land Settlement Estimates 1925–26’, D, p. 9. Camp was appointed Land Settlement Officer for the Huleh lands on 22 July 1923.
- 49 The figures for the area settled in the framework of the Ghor-Mudawara Agreement differ in different sources. These discrepancies are due to the land being scattered over four districts, and to confusing the entire surveyed area with the settled land area actually given over to Arabs. According to Doukhan, *Land Laws in Palestine*, p. 147, note 2, the entire area encompassed 450,000 dunams, of which 350,000 dunams was to be transferred to the ownership of the villagers; 370,000 dunams according to the memorandum of the Jewish Agency to Gt Britain, Hope-Simpson Report, p. 156, appendix 1; 388,517 dunams from the Survey Department data in the above memorandum to Hope-Simpson; 381,771 dunams according to French, *First Report*, p. 38; 235,054 dunams according to Granowsky, *The Land Episode*, pp. 19–20, and Hyamson, *Palestine under the Mandate, 1920–1948*, p. 82; 242,000 dunams according to Dowson, ‘Settlement and Registration’, C, p. 29, para. 32; 232,499 dunams in Pal. Govt, *Report to League of Nations*, 1937, p. 65.
- 50 Richards, ‘Report to Dowson’, chapter 14, pp. 41–44.
- 51 Appendix A—Surveys Report August 1920–1923, in Administration Report for quarter September 1923, PRO CO 733/50/55845.
- 52 PRO CO 733/50/52404; 733/52/62363; 733/60/55965.
- 53 Surveys Report, note 51 above, p. 4, para. 4.
- 54 Pal. Govt, Annual Report—Surveys, 1923, p. 2.
- 55 Weizmann, *Letters XI*, to Kisch, 7 February 1923, p. 244.
- 56 Dowson, ‘Settlement and Registration’, C, p. 11, para. 10; Pal. Govt, *A Survey of Palestine, 1946*, pp. 238–240.
- 57 Dowson, ‘Notes on Land Tax’, p. 7, para. 6; p. 10, para. 8.
- 58 According to the maps of the annual Survey Department reports.

- 59 Dowson, 'Report on the Land System', B, p. 16.
- 60 Treasury memorandum for amended budget estimates, Samuel to the Duke of Devonshire, 24 July 1923, Despatch 759, PRO CO 733/47/39355.
- 61 Dowson recorded his involvement in the cadastral reform in Palestine in his unpublished writings of 1930 and 1938.
- 62 Lyons, *Cadastral Survey of Egypt*.
- 63 'Mapping from Aerial Photographs in Gallipoli Peninsula, 1915', PRO, AIR 1/2284/209/75/10; E. Dowson, Further Notes on Aeroplane Photography in the Near East', G/1921.
- 64 Dowson, 'Notes on Land Tax'.
- 65 Dowson, 'Settlement and Registration', C, pp. 10–11, paras 9–10; Dowson, 'Report on the Land System', B, p. 8, para. 10.
- 66 Dowson to Young, 22 August 1924, PRO CO 733/85/40464.
- 67 Dowson, 'Settlement and Registration', C, p. 11, para. 10.
- 68 Dowson, 'Notes on Land Tax', pp. 10–12, para. 8.
- 69 Dowson, 'Settlement and Registration', C, p. 27, para. 28.
- 70 Dowson, 'Notes on Land Tax', pp. 35–39, paras 18–20.
- 71 Kisch, *Palestine Diary*, 20 February 1924, p. 104.
- 72 Samuel to Thomas (Colonial Secretary), 23 May 1924, Despatch 711 (ADM 4/901), PRO CO 733/68/26349.
- 73 Marginal comment by Keith-Roach, 17 June 1924, *ibid*.
- 74 Dowson to Assistant Under-Secretary for Colonies in Middle East Department, 5–August 1924, PRO CO 733/85/37358; Thomas to Samuel, 17 July 1924, Telegram 207, PRO CO 733/68/26349; Colonial Office to Foreign Office, 23 September 1924, Despatch 44463/24, PRO FO 141/686/8752.
- 75 Samuel to Thomas, 18 March 1924, Despatch 402 (ADM 6/901), PRO CO 733/66/15404; comments to draft law of 12 January 1925, PRO CO 733/87/1688.
- 76 *Instructions to Registrars*, Land Department, Palestine, 14 November 1924, SoI/L.
- 77 Chief Secretary to Thomas, 11 July 1924, PRO CO 733/71/34792.
- 78 Chief Secretariat to Thomas, 29 August 1924, Despatch 1175 (ADM 4/901); Young to Dowson, 17 September 1924, PRO CO 733/72/42723; Dowson to Under-Secretary for Colonies, 24 August 1924, PRO CO 733/85/40464.
- 79 Samuel to Thomas, 30 September 1924, Despatch 1295, PRO CO 733/73/48156.
- 80 Dowson to Chief Secretary, 20 November 1924 (L.S. 27), PRO CO 733/97/44810; and see Chapter 4.
- 81 Dowson to Under-Secretary for Colonies, 10 August 1924, PRO CO 733/85/38440.
- 82 Young to Dowson, 21 August 1924, *ibid*.
- 83 Dowson to Young, 22 August 1924, PRO CO 733/85/40464.
- 84 Samuel to High Commissioner of Egypt, 10 December 1924, Despatch 232 M.E. (ADM 4/901), PRO FO 141/664/8002/25.
- 85 Dowson to Chief Secretary, 20 January 1925 (L.S./6); Samuel to Amery, 26 January 1925, Despatch 109 (ADM 12/901), PRO CO 733/88/6259.
- 86 Young to Winterbotham, 20 March 1925 and to Crostwaithe, 25 March 1925, PRO CO 733/88/6259/25.
- 87 Dowson to Clayton, 15 March 1925 (L.S./II); Samuel to Amery, 16 March 1925, Despatch 294 (ADM 4/901), PRO CO 733/90/14349.
- 88 Richards, 'Report to Dowson'.
- 89 See Chapter 4.
- 90 Dowson, 'Survey and Land Settlement Estimates 1925–26', A–E.
- 91 Samuel to Amery, 12 May 1925 (19/12695/P), *ibid*.
- 92 See Chapter 3.

- 93 Dowson, 'Survey and Land Settlement Estimates 1925–26', [Ley's] 'Observations on Sir E. Dowson's Covering Memorandum, Note (A)', p. 2.
- 94 *Ibid.*, 'Note (A) to Accompany Observations on Survey Estimates 1925–26, The Permanent Cadre of the Survey Department'.
- 95 Dowson, 'Survey and Land Settlement Estimates, 1925–26', 'Observations on Sir E. Dowson's Covering Memorandum, Note (A)', p. 1; and see Dowson's impassioned response to this matter in the same place: Dowson, 'Survey and Land Settlement Estimates 1925–26', D, p. 2, para. 6. Le Ray remained with the Survey Department until the end of the Mandate, when he was Deputy Director of Surveys.
- 96 Dowson was known for his verbosity. In London there was constant dread of his long reports and the surfeit of paper he produced. A marginal comment of 16 August 1925, in the evaluation file on Dowson's budget estimates, reads, 'I tremble to think how long that report will be, judging from the length of his previous report and of his memorandum on these estimates, which forms the first enclosure.' PRO CO 733/92/23816.
- 97 Dowson, 'Survey and Land Settlement Estimates 1925–26', A, p. 1, para. 2.
- 98 *Ibid.*, pp. 1–2, para. 3.
- 99 *Ibid.*, p. 2, para. 4.
- 100 *Ibid.*, pp. 2–4, paras 5–7.
- 101 *Ibid.*, p. 4, para. 8.
- 102 *Ibid.*, pp. 6–7, paras 14 and 15.
- 103 *Ibid.*, pp. 7–8, paras 18 and 19.
- 104 *Ibid.*, pp. 8–9, para. 20.
- 105 'Preliminary Study of Land Tenure in Palestine, 3.11.1925', PRO CO 733/109/50095/25.
- 106 Dowson, 'Report on the Land System'.
- 107 'Land Surveyors Ordinance, 1925, No. 14', *OG* 138 (1 May 1925); and see appendix A.
- 108 Ley to Chief Secretary, 15 May 1925 (SUR/E/1/7/A); Samuel to Amery, 5 June 1925 (18192/P), PRO CO 733/93/27246.
- 109 Ley to Chief Secretary, 3 September 1925 (SUR/J/2/3); Davies (Treasury) to Chief Secretary, 29 September 1925 (105/7860), PRO CO 733/98/47015; Pal. Govt, *Annual Report-Surveys*, 1937, p. 79, para. 143.
- 110 Dowson, 'Settlement and Registration', C, p. 15, para. 14.
- 111 Marginal comment by Young, 14 October 1925, PRO CO 733/109/46142.
- 112 'Extract of Private Letter from Lord Plumer to Sir J. Shuckburgh', 20 November 1925, PRO CO 733/109/54812.
- 113 Dowson, 'Report on the Land System', A, p. 10.
- 114 *Ibid.*, B.
- 115 *Ibid.*, A, pp. 20–22, para. 14.
- 116 *Ibid.*, A, p. 10.
- 117 *Ibid.*, B, p. 23, para. 16, 'Colony Records'. On the private land registry books, see Doukhan-Landau, *The Zionist Companies*, pp. 24–25; Solel, 'Private Land Registers'.
- 118 'Government of Palestine Ordinance 1926, Correction of Land Registers Ordinance No. 12', 16 February 1926, pp. 75–78. The importance of the ordinance is in its introduction of a regularised method of entries in the registry books, as a step in instituting a new order in the system.
- 119 Spry, 'Memorandum', p. 2, para. 10.
- 120 Dowson, 'Settlement and Registration', C, p. 4, para. 3.
- 121 Plumer to Amery, 22 April 1926, Despatch 447 (5998/26), PRO CO 733/114/C9494.
- 122 *Ibid.*, p. 3, para. 3; Dowson, 'Progress in Land Reforms'; Dowson, 'Settlement and Registration', B, p. 1, para. 1.
- 123 Doukhan, *Land Laws in Palestine*.
- 124 Goadby and Doukhan, *Land Law of Palestine*; on their joint work, see Dowson, 'Settlement and Registration', B, p. 1, para. 1; C, p. 19, para. 18.

- 125 'Immediate Measures in Connection with Survey, Land Registration and Land Settlement in Palestine', June 1926, Jerusalem. Le Ray Papers, MEC. MD 951, p. 3.
- 126 Plumer to Shuckburgh, 25 June 1926, PRO CO 733/125/C14854/26.
- 127 PRO CO 733/125/C17193/26.
- 128 Dowson, 'Land Tenure and Taxation in Palestine', Memorandum on the Appointment of Commissioner of Lands, 11 January 1927; PRO CO 733/136/8/44225.
- 129 Plumer to Amery, 8 April 1927, Despatch 534 (5076/27); Symes to Amery, 14 July 1927, Despatch 1057 (10996/27), PRO CO 733/136/8/44225.
- 130 Dowson to Shuckburgh, 4 August 1927, PRO CO 733/140/7/44434.
- 131 Cox to Chief Secretary, 13 February 1927 (II 90–28); Symes to Shuckburgh, 1 April 1927 (5000/27), PRO CO 733/140/7/44437.
- 132 Symes to Amery, 29 June 1927, Despatch 969 (10213/27), 'An Ordinance to Provide for Settlement of Title and Registration of Land', PRO CO 733/142/11/44605. On the connection with Sudan, see, *ibid.*, Bentwich's comments document; Goadby and Doukhan, *Land Law of Palestine*, p. 271. The Sudanese law is entitled The Settlement of Rights to Land and Registration of Title to Those Rights, Land Settlement and Registration Ordinance 1925'. On the connection with Dowson, see marginal comments by Robinson of the Colonial Office Middle East Department of 29 June 1927: 'I do not think it would be possible to attempt to criticise this draft at any great length as it is the result of Sir E. Dowson's work in Palestine.'
- 133 Symes to Amery, 30 June 1927, Despatch 985 (7263/27), PRO CO 733/142/11/44608.
- 134 Dowson to Chief Secretary, 4 May 1927, *ibid.*
- 135 Dowson, 'Settlement and Registration', C, p. 19, para. 18.
- 136 On 12 June 1926 a commission headed by the Director of the Treasury (W.J. Johnson) proposed intermediate steps to be taken until the abolition of the tithe on the agricultural harvest. The draft proposals of the commission were published in June 1926. The abolition was due to become effective on completion of the fiscal survey planned by Dowson. Symes to Amery, 5 October 1926, 'Land Taxation System', PRO CO 733/117/C19560; 'Land Settlement: Abolition of Tithe', PRO CO 733/135/1/44176.
- 137 Ley to Lands Commissioner and Government Offices, 31 January 1928 (SUR/L/2/1), ISA, RG 22, M/3862/16.
- 138 'Weights and Measures Ordinance, No. 2', *OG* 202 (1 January 1928), pp. 2–6.
- 139 Dowson, 'Notes on the Abolition of the Tithe and Establishment of Land Tax in Palestine', April 1928, PRO CO 733/152/59195.
- 140 'Observations and Criticism on & Amendments to Land Settlement Ordinance 1928', ISA, RG 22, M/3862/39.
- 141 Plumer to Amery, 4 July 1927, Despatch 1057 (10996/27), and exchanges of despatches of 9–17 September 1927, PRO CO 733/136/8/4225.
- 142 Circular no. 122 of Chief Secretary signed by E. Mills, Acting Chief Secretary, 30 May 1928, 'Relations between the Commissioner of Lands and the Departments of Lands and Survey', Appendix to Dowson Memorandum II of 15 August 1938, PRO CO 733/361/75072/38.
- 143 Plumer to Amery, 19 June 1928, Despatch 614 (9970/28), 'Survey Ordinance'; PRO CO 733/158/13/57443.
- 144 *Ibid.*, in marginal note 4, Despatch 195 from Churchill, 8 June 1921 (21445/21).
- 145 *OG* 212, 1 June 1928.
- 146 The paragraphs cited in what follows are from the original ordinance as well as from subsequent amendments; Ben-Shemesh, *The Land Laws*, pp. 274–320.
- 147 Administration Report, 1920–1921, p. 112; Samuel to Churchill, 10 February 1922, Despatch 77, para. 3, PRO CO 733/18/7979.
- 148 Pal. Govt, *A Survey of Palestine, 1946*, p. 241.

- 149 Doukhan, *Land Laws in Palestine*, pp. 163–164; Ben-Shemesh, *The Land Laws*, p. 298; Dale, *Cadastral Surveys*, pp. 1–3.
- 150 Kerr, *Principles of Australian Land Titles*, p. 2, note 4; *The Australian Encyclopaedia* VIII, pp. 523–524.
- 151 Dowson and Sheppard, 'Land Registration, Part 1: Principles and Practice', Colonial Office Land Tenure Advisory Panel 1946, September 1948, pp. 4–10, paras 2–21, PRO CO 993/4.
- 152 Kerr, *Principles of Australian Land Titles*, pp. 1–3.
- 153 *Ibid.*, p. xii; *Encyclopaedia Britannica* XXII (1951), p. 305; Simpson, *Land Law and Registration*, pp. 67–69.
- 154 Dowson and Sheppard, *Land Registration*, p. 71; Simpson, *Land Law and Registration*, pp. 12–23.
- 155 Doukhan, *Land Laws in Palestine*, pp. 164–165; Ben-Shemesh, *The Land Laws*, p. 298.
- 156 Quoted in Kerr, *Principles of Australian Land Titles*, p. 6, para. 5; Dowson and Sheppard, *Land Registration*, p. 71; Simpson, *Land Law and Registration*, pp. 17–18.
- 157 Kerr, *Principles of Australian Land Titles*, pp. 6–9.
- 158 *Ibid.*, p. 26.
- 159 *Ibid.*, pp. 7–8, 25; Hogg, *The Australian Torrens System*, pp. 9–11, 21, 777; Meek, *Land Law and Custom in the Colonies*, pp. 274–275.
- 160 Dowson and Sheppard, *Land Registration*, p. 82.
- 161 Hogg, *The Australian Torrens System*, p. 905; Kerr, *Principles of Australian Land Titles*, p. 9, para. 10.
- 162 Hogg, *The Australian Torrens System*, pp. 29–30, 763.
- 163 Kerr, *Principles of Australian Land Titles*, pp. 33–37, paras 54–61.
- 164 *Ibid.*, p. 102, para. 186.
- 165 Dowson and Sheppard, *Land Registration*, p. 83.
- 166 Spry, 'Memorandum', p. 5, para. 22.
- 167 Dowson, 'Progress in Land Reforms'.
- 168 Dowson to Under-Secretary for the Colonies, 21 June 1938, *ibid.*; and see Chapter 7.
- 169 Dowson, 'Settlement and Registration'.
- 170 Cox to Plumer, 13 February 1927, PRO CO 733/140/744434.
- 171 'Government of el'Iraq: An Inquiry into Land Tenure and Related Questions' (Review), *ESR*, 1 (Oct. 1932), p. 1, para. 61.
- 172 'Cadastral Surveys: Papers by Sir E. Dowson and Mr. Sheppard', PRO CO 852/1364/17/1945.
- 173 'Collection of Cadastral Maps and Land Records at the Royal Geographical Society, Dowson and Sheppard (Feb. 1934)', James to Winterbotham, 9 February 1934 (30776/34), PRO OS 1/61.
- 174 Dowson and Sheppard, 'Land Registration', Part I.
- 175 'A Comparative Analysis of the Salient Feature of Registration of Title to Land under Various Jurisdictions' (1948), PRO CO 993/4, Sept. 1948.
- 176 Dowson and Sheppard, *Land Registration*.
- 177 'Collection and Study of Cadastral Maps and Records', *CSO* (1935), pp. 21–34; PRO OS 1/350.
- 178 Dowson and Sheppard, *Land Registration*, in the introduction to the first edition; E. Dowson and V.L.O. Sheppard, 'Work of the Cadastral Survey and Land Records Office, 1932–1945', *ESR* 8 (April 1945): 42–52; Porter, *The Dowson and Sheppard Collection*.
- 179 Salmon to Dowson, 14 September 1935, Dowson Collection, Department of Land Economics, Cambridge.

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The cadastral maps

- 1 Dowson, 'Report on the Land System', B, pp. 20–22, para. 14.
- 2 Extraordinary issue of the *Official Gazette*, 26 January 1928.
- 3 Ley to Commissioner of Lands and Government Offices, 31 January 1928 (SUR/L/2/1), ISA, RG 22, M/3862/16.
- 4 'Memorandum. Meeting Held at No. 3, Settlement Camp Rehovoth', 10 July 1928, *ibid.*
- 5 Ley to Commissioner of Lands, 30 July and 4 August 1928 (SUR/L/2/7), *ibid.*
- 6 Ley to Commissioner of Lands, 16 April 1931 (SUR/L/2/lh), *ibid.*, M/3548/15.
- 7 Symes to Amery, 30 June 1927, Despatch 985 (7263/2), PRO CO 733/142/11/44608.
- 8 'Urban Property Tax Ordinance, 1927', PRO CO 733/142/44608; Goadby and Doukhan, *Land Law of Palestine*, p. 365; Urban Property Tax Ordinance no. 23, 28 July 1928, *OG* 216 (1 August 1928): 447–454; *OG* 519 (20 June 1935): 518–520.
- 9 Ley, *Structure and Procedure*, p. 9, para. 23.
- 10 Pal. Govt, *Annual Report—Surveys, 1927–1930*.
- 11 Mankin, Survey Commissioner, to Director of Land Registry, 31 July 1939 (U/6–2675), ISA, RG 22, M/3396/11 (LD 28/8).
- 12 Spry, 'Memorandum', p. 7, para. 29.
- 13 Pal. Govt, *Annual Report—Surveys, 1930*, Town Survey, p. 3.
- 14 Pal. Govt, *Annual Report—Surveys, 1928*, p. 3; Pal. Govt, *Annual Report—Surveys, 1931*, p. 9, para. 23.
- 15 Mankin, 'Not in the Book', pp. 251–255.
- 16 See note 4, above.
- 17 Pal. Govt, *Annual Report—Surveys, 1928–1935*.
- 18 'The Rural Property Tax Ordinance, 1934', 8 December 1934, *OG* 480 (13 December 1934): 1215–1236; Pal. Govt, *Annual Report—Surveys, 1935*, pp. 7–9, paras 41–66; Pal. Govt, *Report to the League of Nations, 1934*, p. 35.
- 19 Ley, *Structure and Procedure*, pp. 6–7, paras 15–17.
- 20 *Ibid.*, pp. 3–5, paras 8–11.
- 21 Survey of Palestine, *Arabic and Hebrew Proper Names*.
- 22 Loxton, 'Systematic Surveys', p. 114, paras 6 and 7.
- 23 Ley, *Structure and Procedure*, pp. 12–28, paras 32–58; Ley, 'An Outline of Cadastral Structure in Palestine', pp. 181–192; Elster, *Cadastre and Survey Legislation*, pp. 23–24.

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The survey and land settlement systems, 1928–1948

- 1 See full details in files in ISA, RG 22, M/3527/18–19.
- 2 'Aide-Memoire of Meeting Held at Jaffa on 23 April 1931', ISA, RG 22, M/3549/3.
- 3 Pal. Govt, *Annual Report—Surveys, 1929*, pp. 2–3.
- 4 Pal. Govt, *Annual Report—Surveys, 1930*, p. 3; Granowsky, *Land Regime*, pp. 202–206.
- 5 Loxton, 'Systematic Surveys', p. 115, para. 9.
- 6 Abramson to District Commissioners, 27 May 1931 (LS/4), ISA, RG 22, M/3549/3.
- 7 Loxton, 'Systematic Surveys', p. 115, para. 9.
- 8 Ley to Commissioner of Lands, 16 April 1931 (SUR/L/2/lh), ISA, RG 22, M/3548/15.
- 9 Dowson, 'Settlement and Registration', B, p. 7, para. 9; Loxton, 'Systematic Surveys', p. 115, para. 9.
- 10 Chief Secretary to Heads of Departments, 13 January 1931 (NO. X/6/31), ISA, RG 22, M/3566/23 (LS/29).

- 11 Abramson Memorandum, 24 January 1931, Office of Commissioner of Lands, and appendix A, of E.Mills, 'Relations between the Commissioner of Lands and the Departments of Lands and Survey', ISA, RG 22, M/3566/22 (LS/29).
- 12 Chief Secretary to Commissioner of Lands, 13 February 1931, ISA RG 22, M/3566/23 (LS/29).
- 13 Abramson to Chief Secretary, 29 September 1931 (LS/2/5), 'Memorandum on the Recommendation of the Financial Commission in paragraph 48 of the Report, Middle East No. 43, Confidential', *ibid.*
- 14 Abramson to Chief Secretary, 19 May 1932 (LS/2/5), ISA RG 22, M/3566/22 (LS/29).
- 15 *Ibid.*, para. 6.
- 16 'Director of Development and Land Settlement', *Haaretz* (daily newspaper) 22 October 1931, p. 1 (Hebrew).
- 17 Wauchope to Cunliffe-Lister, 2 January 1932, French 'First Report on Agricultural Development', Jerusalem, 23 December 1931, PRO CO 733/214/5/97049.
- 18 Wauchope to Colonial Office, 18 June 1932, Despatch 618, quoted in Cunliffe-Lister to Wauchope, 11 July 1932, Despatch 638, ISA, RG 22, M/3566/23.
- 19 Document 97281/32, 4 July 1932, quoted in marginal note in file PRO CO 733/262/16/37443.
- 20 Cunliffe-Lister to Wauchope, 11 July 1932, Despatch 638, ISA, RG 22, M/3566/23 (LS/29).
- 21 Darnley to Salmon, 21 October 1932 (97281/32), *ibid.*
- 22 Cunliffe-Lister to Chief Secretariats of Cyprus and Palestine, 24 October 1932, Despatches 427 and 979; Chief Secretariat Jerusalem to Acting Director of Surveys, Commissioner of Lands, and Treasury, 9 January 1932 (L/47/32) *ibid.*; Pal. Govt, *Annual Report—Surveys, 1933*, p. 1.
- 23 Wauchope to Cunliffe-Lister, 5 May 1934 (CF/52/34), PRO CO 733/262/16/37443/34.
- 24 *Ibid.*, paras 6 and 7.
- 25 Exchequer (London) to Colonial Office, 5 June 1934 (E.16791), *ibid.*
- 26 Huthorn-Hull to Williams (Treasury, London), 11 July 1934 (CF/52/34), *ibid.*
- 27 'Notes on the Palestine Motor Map, 1:500,000', Salmon's Box, RGS.
- 28 Pal. Govt, *Annual Report—Surveys, 1933*; Pal. Govt, *Annual Report—Surveys, 1934*.
- 29 Camp to Commissioner of Lands, 26 November 1934, ISA, RG 22, M/3549/2 (LS/7).
- 30 'Aide—Mémoire of Meeting Held at the Office of the Commissioner of Lands on 29th December 1934, 3 January 1935', *ibid.* (LS/6).
- 31 Maurice Bennett was transferred to the Lands Commission in 1928. In 1934 he was appointed Agent of the Haifa Harbour (Reclaimed Area) within his capacity of assistant to Abramson; he was to become Salmon's chief assistant in the Lands and Surveys Commission. See Note 44, above.
- 32 Pal. Govt, *Annual Report—Surveys, 1935*, p. 1, para. 1.
- 33 Salmon to Government Departments, 11 March 1935 (LS/2/5), ISA, RG 22, M/3344/17 (LD 33/5).
- 34 Salmon to Stubbs, 31 October 1935 (A/54), ISA, RG 22, M/3333/32 (LD/25/15).
- 35 Pal. Govt, *Annual Report—Surveys, 1936*, pp. 1,4, para. 39.
- 36 Pal. Govt, *Annual Report—Surveys, 1936*, p. 11, para. 80; Pal. Govt, *Annual Report—Surveys, 1937*, p. 8, para. 60.
- 37 Pal. Govt, *Annual Report—Surveys, 1936*, p. 2, para. 11.
- 38 Kenyon to Stubbs, 11 March 1939, ISA RG 22, M/3549/1.
- 39 For example, the opposition of the Arabs of Masmiya el-Kabireh to the land settlement in view of their intention of selling land to Jews and their fear of the gangs. Camp to Commissioner of Lands and Surveys, 9 August 1938 (63/20), ISA, RG 22, M/3549/1.
- 40 Salmon to Chief Secretariat, 10 July 1937, ISA, RG 22, M/3549/1; Pal. Govt, *Annual Report—Surveys, 1937*, p. 20, para. 150.
- 41 Chief Secretary to Salmon, 26 July 1937 (L/61/36), *ibid.*

- 42 Pal. Govt, *Annual Report—Surveys, 1938*, p. 17, para. 108; Pal. Govt, *Report to the League of Nations, 1938*, p. 83, para. 48; Dowson, ‘Settlement and Registration’, C, p. 20, para. 19; Loxton, ‘The Survey of Palestine 1937–1948: A Personal Memoir’, pp. 14–15.
- 43 Camp to Acting Commissioner of Lands and Surveys, 19 June 1938 (H/12/1), ISA, RG 22, M/3549/1.
- 44 Report of the surveyor, 10 May 1940; letters of 27 May and 10 and 14 June 1940, ISA, RG 22, M/3548/13.
- 45 See Chapter 5; Dowson to Under-Secretary for the Colonies, 21 June 1938, ‘Settlement’, pp. 1–2, para. 2, in Dowson, ‘Settlement and Registration’.
- 46 Gt Britain, Peel Commission Report, chapter 9, paras 27–29.
- 47 *Ibid.*, paras 10, 26, 31, 35, 36, 40.
- 48 *Ibid.*, paras 30, 34, 38.
- 49 *Ibid.*, paras 3, 23.
- 50 *Ibid.*, paras 25, 26, 31, 40.
- 51 *Ibid.*, para. 41.
- 52 Wauchope to Ormsby-Gore, 16 August 1937 (L/118/37).
- 53 Marginal comments in ‘Land Settlement’, PRO CO 733/329/75072/11/37.
- 54 Pal. Govt, *Annual Report—Surveys, 1937*, p. 8, para. 62; Wauchope to Ormsby-Gore, 27 September 1937 (L/118/37) and 26 November 1937 (U/1650/35), PRO CO 733/329/75072/11/37.
- 55 Wolff, ‘Air Survey and Colonial Cadastral Mapping’, *ESR* 4 (January 1938): 281–290; Gavish, ‘An Account of an Unrealized Aerial Cadastral Survey’.
- 56 Gt Britain, Peel Commission Report, chapter 9, paras 34, 38.
- 57 Salmon, ‘Cadastral Air Survey’.
- 58 Salmon, ‘With the Field Survey Units in France’.
- 59 Wolff, ‘Air Survey’.
- 60 Salmon, ‘Cadastral Air Survey’, p. 335, d.
- 61 John Loxton, personal communication, 9 December 1994.
- 62 Dowson to Martin, 16 August 1938, para. 4, PRO CO 733/361/75072.
- 63 Dowson to Downie, 4 October 1938, para. 3, PRO CO 733/361/75072; Mitchell to Heron, 16 April 1945 (SEC/D/1), para. 2, ISA, RG 22, M/3566/21.
- 64 Acting Lands and Surveys Commissioner to Departmental Directors, 31 January 1940 (LS/29), ISA, RG 22, M/3589/6; Chief Secretariat Circular no. 31, 28 March 1940 (L/4/40), ISA, RG 22, M/3334/17 (LD 33/5); Loxton, *Survey of Palestine*, p. 18.
- 65 Pal. Govt, *Annual Report—Surveys, 1939*, paras 12, 20.
- 66 On the status of the Survey of Palestine in the Surveys Directorate GHQ ME, see PRO WO 169/39/App. 2, 7 November 1940; PRO WO 169/1046, appendix I.
- 67 Pal. Govt, *Annual Report—Surveys, 1940–1946*, pp. 3–5.
- 68 Eliyahu Beit–Tzuri, who was later executed for the murder of Lord Moyne in Cairo, studied surveying at the Jenin course in April–June 1942, and after a brief period of practical work returned in 1943 to the school as a Surveyor-Instructor.
- 69 Government of Palestine, ‘Defence (War Service Occupations) Regulations, 1942’, Notification of the Chief Secretary to the Survey Department (SF/210/42), 8 December 1942 (original in Loxton’s possession); Loxton, *Survey of Palestine*, p. 22.
- 70 Mitchell to Heron, 16 April 1945 (SEC/D/1), ‘Settlement—Survey Procedure’, ISA, RG 22, M/3566/21.
- 71 Loxton, ‘Systematic Surveys’, p. 115, para. 10.
- 72 Loxton, *ibid.*, para. 11; Mitchell to Heron, note 70, above, para. 3.
- 73 Mitchell to Heron, note 70, above.
- 74 See, for example, the documents of 28 February 1945, ‘liaison between Survey and Land Settlement Officers’, ISA, RG 22, M/3566/21.
- 75 Bennett to Heron, 3 May 1945 (LS/29), ‘Organization of Land Regime’, *ibid.*

- 76 Mitchell to Heron, note 70, above.
- 77 Jardine to Chief Secretary, 31 August 1945 (LS/29), ISA, RG 22, M/3566/21.
- 78 Acting Water Commissioner to Chief Secretary, 1 December 1945 (LS/29), *ibid.*
- 79 Mitchell to Chief Secretary, 29 April 1946 (CONF/63), *ibid.*
- 80 ISA, RG 22, M/3566/21.
- 81 Pal. Govt, *Annual Report—Surveys, 1940–1946*, chapter F, table 24.
- 82 *Ibid.*, para. 2, table 2; Staff Roster, 12 November 1947, ‘Departmental Establishment, 1947–48’, SoI/A.
- 83 Pal. Govt, *Annual Report—Surveys, 1940–1946*, para. 30, diagram 6.
- 84 Gross, ‘The Economic Policy’.
- 85 Pal. Govt, *Annual Report—Surveys, 1940–1946*, p. 5, para. 19.
- 86 According to the Survey Reports in the years indicated.
- 87 Document in ‘General File’, SoI/A.
- 88 Pal. Govt, *Survey of Palestine, 1946*, p. 237, para. 36.
- 89 Pal. Govt, *Annual Report—Surveys, 1940–1946*, chapter F, table 23.
- 90 *Ibid.*, p. 7, para. 29.
- 91 Gavish, *Cadastral and Topographical Mapping*, p. 313.
- 92 ‘Maps of Palestine, Prepared for the Information of the United Nations Special Committee of Inquiry, July 1947’, UNSCOP, Map no. 7, ‘Progress of Land Settlement’, 30 April 1947.
- 93 ‘Purchase of Equipment for the Department of Survey, 1934–1942’ (L/135/34) ISA, RG 2, M/299; Salmon, ‘Some Experiments’; Loxton, ‘Systematic Surveys’, p. 118, paras 25–28.
- 94 E.Shisha, ‘A Logarithmic Area Computing Scale’, *ESR* 3 (April 1936): 338–339.
- 95 Ley to Lands Commissioner, 16 April 1931 (SUR/L/2/1H), ISA, RG 22, M/3548/15.
- 96 Loxton, ‘Systematic Surveys’, p. 119, para. 33; personal communication from Hiram Danin, 16 November 1983.
- 97 Miller (Land Settlement Officer in Northern District) to Mitchell (Director of Surveys), 2 September 1947 (HM/13/12); Jardine to Mitchell, 29 September 1947 (LS/3/19), ISA, RG 22, M/3548/8.

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The topographic map: a national monument

- 1 Salmon, ‘Topographical Maps’, p. 1.
- 2 Salmon, ‘Notes on the New Topographical Map of Palestine’; ‘The Land of Palestine’, p. 548.
- 3 Salmon, ‘Topographical Maps’, p. 2; Salmon, Memorandum, 4 December 1936, p. 2: The Department of Land and Surveys’, MEC, Le Ray Papers.
- 4 Dowson to Samuel, 3 April 1920, ‘Cooperation of Egypt in Fuller Application of Air Photography to Map Making’, para. 6 in Despatch of Under-Secretary of State (Finances) to Murray, 13 April 1920 (182222P./19), PRO FO 371/5139/3680; also in PRO OS 1/11/4889S.
- 5 Wolff, ‘Air Survey’.
- 6 Ley, ‘Notes on the Technical System’, p. 4, para. 9.
- 7 Dowson and Sheppard, ‘Land Registration, Part 1’, p. 13, para. 32, and p. 15, para. 39; Dowson and Sheppard, *Land Registration*, pp. 83–85; Dale, *Cadastral Surveys*, p. 78.
- 8 The scale of 1:20,000 (three inches to the mile) was designed for the ‘British System of Reference’, indicating the position of a point on large- or medium-scale tactical military maps. The British System was introduced in 1919 and discontinued in 1927, when it was replaced by the Modified British System. See War Office, *Notes on Map Reading*, 7929, 26/G.S. Publications/125, reprinted with amendments in 1939 (London, 1940), pp. 47–48, paras 43 and 44; Close and Winterbotham, *Topographical and Geographical Surveying*, p.

- 137 and plate 16. Topographic maps of 1:20,000 scale were also in use in other European countries. In France such a new series was drawn up before and during the First World War, 1914–1918 (*plans directeurs de guerre*). After the war a new, more reliable series was produced to form the basis for reduction to a 1:50,000 series. A good series of 1:20,000 topographical maps, covering the entire country, was also in use in Belgium. See Clough, *Maps and Survey*, pp. 19–20.
- 9 See Chapter 4.
- 10 Ley, *Notes on the Technical System*, p. 4, para. 9.
- 11 Pal. Govt, *Annual Report—Surveys, 1928*, p. 4.
- 12 Pal. Govt, *Annual Report—Surveys, 1929*, p. 3; Pal. Govt, *Annual Report—Surveys, 1930*, p. 3.
- 13 Pal. Govt, *Annual Report—Surveys, 1929*, p. 3; Pal. Govt, *Annual Report—Surveys, 1937*, p. 3.
- 14 Pal. Govt, *Annual Report—Surveys, 1932*, p. 2; para. 7, and p. 3, para. 10.
- 15 Pal. Govt, *Annual Report—Surveys, 1933*, p. 2, para. 5, and p. 3, para. 12; Salmon, *The Land of Palestine*, p. 548.
- 16 Pal. Govt, *Annual Report—Surveys, 1934*, pp. 2–3.
- 17 Pal. Govt, *Annual Report—Surveys, 1936*, p. 15, paras 110, 115; Pal. Govt, *Technical Reports, 1936*, p. 2, para. 3.
- 18 Pal. Govt, *Annual Report—Surveys, 1937*, p. 19, paras 144, 147.
- 19 Pal. Govt, *Annual Report—Surveys, 1938*, p. 22, paras 140, 153.
- 20 Colonel R.L. Brown, ‘Report on Reconnaissance in Palestine for a Photo-litho Establishment Suitable for the Survey Service’, 25 March 1940, 3 (19), PRO WO 169/39.
- 21 Survey Directorate HQ ME, *Talestine Report*, 8 July 1940, p. 4, PRO WO 169/39.
- 22 ‘Survey Maps, Palestine, Transjordan and Syria. Appreciation by Director of Survey and Maps, Middle East, 25 October 1940’, CRME/891/CV. paras 24–25(d), PRO WO 169/39.
- 23 Pal. Govt, *Annual Report—Surveys, 1940–1946*, p. 9, para. 43, and p. 10, para. 52.
- 24 Salmon, ‘Some Notes on Conventional Signs for Topographical Maps’, pp. 51–52.
- 25 Colonel Salmon’s Collection of Legend Sheets, RGS; Herbert, ‘The Salmon Collection’.
- 26 Salmon, ‘Topographical Maps’, pp. 17–19.
- 27 *Ibid.*, p. 4.
- 28 Salmon, ‘Notes on the New Topographical Map’; Salmon to Birger, 27 October 1937 (M/106), YBZA, File 8/2/2/1; Salmon, ‘The Modern Geography’, p. 40; Salmon, ‘The Land of Palestine’, p. 549.
- 29 Pal. Govt, *Annual Report—Surveys, 1936*, p. 15, para. 110.
- 30 Map no. MAP-J-1–37; Pal. Govt, *Annual Report—Surveys, 1937*, p. 19, para. 142; Pal. Govt, *Technical Reports, 1938*, p. 5, para. 10.
- 31 Pal. Govt, *Technical Reports, 1937*, p. 5, para. 9.
- 32 Map no. 500/12/45.
- 33 See note 22, above.
- 34 Richards, ‘Report to Dowson’, p. 35; Ley, *Notes on the Technical System*, p. 4, para. 9.
- 35 Pal. Govt, *Annual Report—Surveys, 1933*, pp. 3–4, paras 6, 12; Pal. Govt, *Technical Reports, 1934*, p. 10, para. 12.
- 36 Pal. Govt, *Technical Reports, 1934*, p. 5, para. 6; Loxton, *Survey of Palestine*, p. 15.
- 37 Pal. Govt, *Annual Report—Surveys, 1936*, pp. 14–15, paras 105–111, and p. 16, para. 121.
- 38 Loxton, *Survey of Palestine*, pp. 8–13.
- 39 John Loxton, personal communications, 12 May 1983 and 9 December 1994; Loxton, *Survey of Palestine*, pp. 13–14; Pal. Govt, *Technical Report, 1938*, p. 2, para. 5; Pal. Govt, *Annual Report—Surveys, 1938*, pp. 19–20, paras 122, 125.
- 40 Pal. Govt, *Annual Report—Surveys, 1938*, p. 22, para. 141.
- 41 *Ibid.*, p. 23, para. 143.

42 Pal. Govt, *Annual Report—Surveys, 1939*, p. 5, para. 26, and p. 7, para. 38; Loxton, *Survey of Palestine*, pp. 16–17; ‘Army Road Reports, June 1942’, Sol/A.

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The 1:100,000 topographic map: layout, structure, sources

- 1 Pal. Govt, *Annual Report—Surveys, 1933*, map 2; Survey of Palestine, *Maps and Publications* (Jaffa, 1935), p. 26.
- 2 Pal. Govt, *Annual Report—Surveys, 1938*, p. 22, para. 141a.
- 3 *Ibid.*, p. 22, para. 142b.
- 4 Pal. Govt, *Annual Report—Surveys, 1940–1946*, pp. 9–10, para. 44 and map 1; Report of Survey Directorate GHQ ME, 31 August 1942 (CV.PAL. 4/6) MOD, Part 3.
- 5 Lif, ‘Bibliography’.
- 6 Pal. Govt, *Annual Report—Surveys, 1935*, p. 14, para. 125; Pal. Govt, *Annual Report—Surveys, 1936*, pp. 14–15, para. 109.
- 7 Salmon, ‘Notes on the New Topographical Map’.
- 8 Salmon, ‘Notes on Conventional Signs’.
- 9 *Ibid.*, p. 50.
- 10 *Ibid.*, p. 52; Salmon, ‘Notes on the New Topographical Map’.
- 11 In the Survey Department documentation and Salmon’s articles, there is no consistency regarding the number of colours printed on the topographic maps: six, seven, and even eight. Mitchell, ‘Survey of Palestine’, p. 391.
- 12 Salmon, ‘The Modern Geography’, pp. 40–41.
- 13 Salmon, ‘Notes on Conventional Signs’, pp. 52–53; Salmon, ‘The Modern Geography’, pp. 40–41.
- 14 Salmon, ‘Notes on Conventional Signs’; Salmon, ‘The Modern Geography’.
- 15 ‘The Seven Colours of the Palestine 1:100,000’, Salmon’s Collection, RGS: ‘buff overprint to knit the colours together’.
- 16 Salmon to Hinks, 7 July 1933, Salmon File, RGS.
- 17 Salmon to Hinks, 6 November 1933, *ibid.*
- 18 Salmon, ‘The Modern Geography’, pp. 40–42.
- 19 Salmon, ‘Notes on the New Topographical Map’.
- 20 Salmon, ‘Topographical Maps’, p. 15.
- 21 Salmon, ‘The Modern Geography’, p. 42; Salmon, ‘The Land of Palestine’, p. 549.
- 22 Pal. Govt, *Annual Report—Surveys, 1938*, p. 22, para. 141(b).
- 23 PRO WO 169/39, 1 February 1940 and Supplements B and C; Loxton, *Survey of Palestine*, p. 17.
- 24 ‘Survey Maps, Palestine, Transjordan and Syria. Appreciation by Director of Survey and Maps, Middle East, 25 October 1940’, CRME/89/CV. paras 24–25(d), PRO WO 169/39.
- 25 Salmon to Birger, 27 October 1937 (M/106), YBZA, File 8/2/2/1.
- 26 Pal. Govt, *Annual Report—Surveys, 1938*, p. 23, para. 142.
- 27 Pal. Govt, *Annual Report—Surveys, 1932*, p. 3.
- 28 Lif, ‘Bibliography’.
- 29 PRO WO 169/20337; Clough, *Maps and Survey*, pp. 49, 66; EWB *et al.*, ‘Memoir, Major General Llewellyn Brown’. The second-in-command of this unit in 1945 was Lieutenant D.H. Kallner—later Prof. David Amiran, who established the Department of Geography of the Hebrew University at Jerusalem in 1950.
- 30 Robert Crusher resigned his position in the Survey Department on 31 March 1940. He directed the department after Major Ley’s departure and for many years served as Acting Director. After resigning, Crusher asked the High Commissioner to appoint him to a military

- mapping post. The army considered Crusher suitable for the position of Assistant to A.D. Survey on a Corps Survey Directorate coming to Palestine, but the post went to an army officer. PRO WO 169/39, App. 2, 25 March 1940, para. 25.
- 31 War Diary, November 1941, App. B (SVY/13/1), PRO WO 196/175; Clough, *Maps and Survey*, p. 59.
- 32 PRO WO 169/39, 1 February 1940 and Supplements B and C; Loxton, *Survey of Palestine*, p. 17.
- 33 See note 24, above.
- 34 *Ibid.*, paras 23–25 and appendix C.
- 35 *Ibid.*, para. 18.
- 36 See Chapter 4.
- 37 B.G. (Goussinsky?), 'Palestine Geodetic Data (Miscellaneous)', 24 December 1954, SoI/C.
- 38 Appendices to War Diary of the Survey Directorate, 1941. Report of Major Nesham, DAD Surveys, Palestine and Transjordan to Director of Surveys, GHQ ME, 6 February 1941, appendix A (CR/PAL/24029/SVY), para. 4; appendix B, para. 4, PRO WO 169/1406; GHQ, 'Middle East Technical Instruction', no. 16, May 1941 and no. 28, June 1941, SoI/C.
- 39 Jardine and McArthur Davies, *A Gazetteer of Place Names*; Loxton, *Survey of Palestine*, p. 4.
- 40 *Palestine Index Gazetteer*, compiled by Survey Directorate General Headquarters, Middle East, Cairo, 1945, MDR 599/12077. On the Gazetteer Section, see PRO WO 169/15678; PRO WO 169/19609.
- 41 Survey of Palestine, *Palestine Index Gazetteer*.
- 42 Report of Survey Directorate, March 1947 (SY/PAL/9/6), 4 April 1947, para. 1, MOD; Pal. Govt, *Annual Report—Surveys, 1940–1946*, p. 4, para. 8.
- 43 Camp to Land Settlement Districts and Settlement Officers, 4 December 1947 (LS/29(8)C), ISA RG 22, M/3816.
- 44 Survey Directorate, HQ Palestine (SY/PAL/9/6), 2 January 1948, 'Monthly Report, December 1947', 1 (D), MOD.
- 45 Survey Directorate Monthly Report, March 1948, para. 8 (SY/PAL/9/8), MOD.
- 46 Loxton to Mitchell, 2 February 1948 (TR/4), in 'Departmental Establishment' file, SoI; Loxton, *Survey of Palestine*, p. 27.
- 47 Survey Directorate Monthly Report, note 45, above, para. 12.
- 48 Menahem Eini, personal communication, 9 June 1980.
- 49 Barukh Osri, personal communication, 21 September 1981.
- 50 M. Ben-Sira, the Tel Aviv City Engineer from 1929 to 1950, in a lecture on 29 May 1985 at the Conference of Chartered Surveyors in Israel.
- 51 'Departmental Establishment' file and 'General File', SoI/A.
- 52 Survey Directorate Monthly Report, March 1948 (SY/PAL/9/8), MOD; Loxton, *Survey of Palestine*, p. 28. In July 1960 A.P. Mitchell, with his background in Palestine and Transjordan, examined the Dowson and Sheppard collection of cadastral survey and land registration records. Porter, *The Dowson and Sheppard Collection*, p. 3, and DOS file 1000 in PRO OD 6/863.
- 53 This material is documented in 'W/4 Personnel', SoI/A.
- 54 'Establishment of Palestine Government Accounts Clearance Office in Cyprus and a Residual Staff of the Colonial Office, London 9 April 1948, Notice No. 26 (U/2586/47)', W/4 Personnel, SoI/A.
- 55 Spry, 'Memorandum', p. 9, para. 40, appendices 1–3 and marginal notes of 20 November 1948; Hiram Danin, expert on land acquisition and registration, personal communication, 16 November 1983; Gavish, 'British Efforts', pp. 107–120.
- 56 'Palestine Government Records Disposal of Secret Papers, 1948', PRO CO 733/489/1/75872/159/1.
- 57 Mitchell, 'Survey of Palestine', p. 391.

- 58 Salmon to Dowson, 14 September 1935, D.Coll.
 59 Browne, 'Packaged to Appeal to the Traveller', pp. 62–63; Browne, *Map Cover Art*.
 60 Salmon, 'Land of Palestine', p. 549.
 61 Dill to Salmon, 27 November 1936 (CR/PAL/3284/G), MEC Salmon File, DS/107.
 62 In Salmon's reply to Dill there is a double sting: a year before, the maps were not yet ready; and General Dill was himself appointed to the post on 15 September 1936, about two months before writing to Salmon.
 63 Salmon to Dill, 30 November 1936 (F.J.S. 50), MEC, Salmon File.
 64 For the subsequent mutations of the 1:100,000 map, see Gavish, 'Foreign Intelligence Maps'.
 65 Hillel Birger, personal communication, speaking for Zalman Lif, 13 January 1986.

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The map of Palestine and the Imperial cartographic system

- 1 On British colonial cartography and the Imperial survey system, see in detail D. Gavish, *Cadastral and Topographical Mapping*, pp. 412–432.
 2 The GSGS was to provide geographic and topographic information and maps, to map the colonies and future theatres of war, and to provide geographical counselling to the Colonial and Foreign Offices.
 3 'Colonial Survey Appointments, Miscellaneous', no. 225, Colonial Office, December 1926, p. 2, PRO WO 181/143.
 4 'Minutes of Meeting of Colonial Survey Committee, 4 February 1929', para. 6, PRO WO 181/143; Air 8/91; *Report of the Air Survey Committee 2—1935*, The War Office (London, 1936), pp. 137–142.
 5 Winterbotham Report, April 1929–May 1931, Colonial Survey Committee, PRO WO 181/144.
 6 Ordnance Survey, 'Further Notes', pp. 19–20.
 7 Secretary of Committee to Winterbotham, 9 February 1934, PRO OS 1/16 (30776/34).
 8 Colonial Survey and Geophysical Committee, July 1935–1942, PRO WO 181/146.
 9 Pal. Govt, *Annual Report—Surveys, 1938*, p. 17, para. 106, Colonial Survey Service.
 10 Colonial Research Committee, Colonial Survey and Geophysical Committee, CM no. 7, 1944.
 11 Stanley (Colonial Secretary) to Government of Palestine, 19 September 1944, Despatch 444, ISA, RG 2, M/314 (L/42/46).
 12 Heron to Chief Secretary (Z/41/40), H.Kendall (Town Planning Adviser) files in Jerusalem Municipality; Mitchell to Chief Secretary, 23 November 1944 (54/1), ISA, RG 2, M/314 (L/254/46).
 13 Gort to Stanley, 8 February 1945, Despatch SF/180/44, ISA, *ibid*.
 14 'Air Photography and Air Survey Post War Policy, 1945–1949', PRO AIR 20/8064.
 15 War Diary, Ninth Army Field Survey Depot RE 1945, PRO WO 169/20341.
 16 Thomas (Colonial Office) to Colonies, 27 September 1947, Circular 28152/15/17, Directorate of Colonial Surveys, 'Annual Report', 1946–1947, ISA, RG 2, M/314 (L/42/46).

Appendix A:

survey ordinances of Palestine

- 1 On the survey laws of Palestine, see Elster, *Cadastral and Survey Legislation*; Goldstein, *A Surveyor's Companion Book*.
 2 'Cadastral Survey Ordinance, May 1920, No. 161', *OG 24* (25 July 1920): 1–2.

- 3 Public Notice no. 166: Survey Fees, July 1920, PRO FO 371/5140/E16210.
- 4 'Public Notice', *OG* 37 (15 February 1921): 6.
- 5 Doukhan, *Land Laws in Palestine*, p. 169; Chief Secretary to Director of Lands, 27 'March 1928 (4428/28), in the explanations to the draft amendment of the 'Survey Ordinance 1920', ISA, RG 22, M/3386/2 (LD 45/18).
- 6 'Wood and Forests Ordinance, No. 190, 190', *OG* 29 (15 September 1920): 16–23; Sawyer, *Agricultural Situation*, part C, chapters 7–8.
- 7 *Ibid.*, chapter 2, para. 9.
- 8 'Public Notice. Demarcation of Government Lands, 10 November 1921', *OG* 56 (1 December 1921): 10.
- 9 Granowsky, *Land Regime*, p. 110.
- 10 'Surveyors Ordinance, 10 May 1921', *OG* 44 (1 June 1921): 4; *ibid.*, 47 (15 July 1921): 2; Doukhan, *Land Laws in Palestine*, p. 170; Doukhan, *Land Laws in the State of Israel*, p. 369.
- 11 'Survey Fees Ordinance, 1922', *OG* 67 (3 May 1922): 1.
- 12 Bentwich, *Legislation of Palestine I*, pp. 272–273; Doukhan, *Land Laws in Palestine*, p. 169. The ordinance was annulled in 1928, with the publication of the new Survey Ordinance.
- 13 'Land Surveyors Ordinance, 1925, No. 14', *OG* 138 (1 May 1925): 205–206.
- 14 Bentwich, *Legislation of Palestine I*, pp. 514–516; Doukhan, *Land Laws in Palestine*, p. 170; Doukhan, *Land Laws in the State of Israel*, pp. 369–370.
- 15 Regulation under the Surveyors Ordinance 1925 of 28 May 1925, *OG* 140 (1 June 1925): 252–255.
- 16 'Land Settlement Ordinance, 1928, 30 May 1928', *OG* 212 (1 June 1928): 260–275.
- 17 Ben-Shemesh, *Land Laws*, pp. 274–320.
- 18 *Ibid.*, p. 298.
- 19 On the connection between the ordinance and the surveys, see in detail Elster, *Cadastre and Survey Legislation*; Doukhan, *Land Laws in the State of Israel*, pp. 390–393.
- 20 'Survey Ordinance, 1929, No. 48', *OG* 235 (16 May 1929): 520–524; Supp. no. 24, p. 1189.
- 21 Sections 2 and 8 of the Ordinance. See explanations of the Attorney General N. Bentwich of 4 September 1928 (A.G. 296) and comments of the Chief Secretariat of 13 September 1928 (14882/28), ISA, RG 22, M/3386/2 (LD 45/18); Doukhan, *Land Laws in the State of Israel*, pp. 389–390.
- 22 Amery to Chief Secretariat, 22 August 1928, Despatch 693, and Bentwich's explanations (see note 21, above).
- 23 'Survey Ordinance, 1929, Regulations Made under Section 7, 18 January 1930', *OG* 253 (16 February 1930): 91–97.
- 24 *OG* 803, Supplement 2, 4 August 1938; Pal. Govt, *Annual Report—Surveys, 1938*, p. 18, para. 113.
- 25 State of Israel, *Kovetz HaTakanot* (Subsidiary Legislation), no. 1755, 5 August 1965; Goldstein, *A Surveyor's Companion Book*, pp. 98–108.
- 26 State of Israel, 'Amendment of Surveyors' Ordinance', para. 7b, *Reshumot* 125 (Legislation of Israel), 19 June 1953, p. 98; Elster, *Cadastre and Survey Legislation*, p. 48.
- 27 State of Israel, *Kovetz HaTakanot* (Subsidiary Legislation), no. 487, 2 December 1954, pp. 206–210; Goldstein, *A Surveyor's Companion Book*, pp. 83–87.
- 28 'Survey (Amendment) Ordinance, 1946, No. 2', *PG* 1472 (5 February 1946): 128, Supp. 1, pp. 5–8.

Sources and bibliography

Institutions, archives, and libraries

- APL** Aerial Photography Library,
Department of Geography, The
Hebrew University of Jerusalem
- AWM** Australian War Memorial, Canberra
- CZA** Central Zionist Archives, Jerusalem
- D.COLL** Dowson Collection, Department of
Land Economics, Cambridge
- DOS** (Directorate of Overseas Surveys);
now OS International, Ordnance
Survey, Southampton
- GSGS** Geographical Section General Staff
- IOR** India Office Library and Records; now,
British Library, London
- ISA** Israel State Archives, Jerusalem
- MCE,**
RE Mapping and Charting Establishment,
Royal Engineers; now Directorate of
Geographic Information, Tolworth
- MEC** Middle East Centre, St Antony's
College, Oxford
- ML** Map Library, Department of
Geography, The Hebrew University,
Jerusalem
- MOD** Ministry of Defence Map Library
(MCE, RE), Tolworth
- NMM** National Maritime Museum,
Greenwich
- OS** Ordnance Survey, Southampton
- PEF** Palestine Exploration Fund, London
- PRO** Public Record Office, Kew
- RAE** Royal Australian Engineers
- RGS** Royal Geographical Society, London
- SoI** Survey of Israel, Tel Aviv
- TAHA** Tel Aviv Historical Archives
- YBZA** Yad Yitzhak Ben—Zvi Archives,
Jerusalem

Journals and publications

- BJPES** *Bulletin of the Jewish Palestine
Exploration Society*
- CJ** *Cartographic Journal*
- CSO** *Conference of Colonial/Empire/British
Commonwealth/Survey Officers*
- ESR** *Empire Survey Review*
- GJ** *Geographical Journal*
- GR** *Geographical Review*
- IEJ** *Israel Exploration Journal*
- JRCAS** *Journal of the Royal Central Asian
Society*
- JRGS** *Journal of the Royal Geographical
Society*
- OG** *Official Gazette*
- PCSL** *Palestine Civil Service List*
- PEFA** *Palestine Exploration Fund Annual*
- PEFQS** *Palestine Exploration Fund Quarterly
Statement*
- PEQ** *Palestine Exploration Quarterly*
- PG** *Palestine Gazette*
- REJ** *Royal Engineers Journal*
- ZDPV** *Zeitschrift des deutschen Palästina
Vereins*

Codes of archive record groups (RG)

- CZA CENTRAL ZIONIST ARCHIVES,
Jerusalem
- A112 N. Wilbushewitz, Personal Archive
- L3 Zionist Commission, Jerusalem 1918–1921
- L4 Zionist Commission, Jaffa 1918–1921
- Z4 Central Bureau of the Zionist Organisation
and the Jewish Agency, London 1917–
1955

ISA—ISRAEL STATE ARCHIVES, Jerusalem Files of the Mandate Government of Palestine:

- Record Group Chief Secretariat
2
- Record Group Legal Adviser, later Attorney
3 General
- Record Group Public Works Department
12
- Record Group Department of Lands

22
 Record Group Arab Agency
 65

SoI—SURVEY OF ISRAEL, Tel Aviv

A Archives
 C Computations
 L Library

PRO—PUBLIC RECORD OFFICE, Kew, London

AIR—Air Ministry

AIR 1 Air Historical Branch: Series 1, 1914–1918
 AIR 2 Correspondence, 1887–1962
 AIR 5 Air Historical Branch: Series II, 1921–1930
 AIR 8 Chief of the Air Staff, 1916–1945
 AIR Unregistered Papers, 1912–1948
 20

CO—Colonial Office

CO Palestine Original Correspondence, 1945–537 1948, and Supplementary Papers
 CO Palestine Original Correspondence, 1921–733 1945
 CO Palestine Sessional Papers, Administrative 814 Reports
 CO Economic: Original Correspondence, 852 1935–1949
 CO Colonial Land Tenure Advisory Panel 993

FO—Foreign Office

FO 371 Political, General

OS—Ordnance Survey

OS 1 Correspondence and Papers, 1831–1967
 OS 3 Miscellanea 1756–1939

T—Treasury

T 161 Supply Files

WO—War Office

WO 95 War Diaries, 1914–1922
 WO War Diaries, Middle East Forces, WW II 169

WO	Directorate of Military Surveys: Papers,
181	1887–1942
WO	War of 1914–1918 Palestine Campaign
303	Maps

Books, articles, documents

The references to the published material listed below are given in abbreviated form in the notes to the text.

- Abramson, A., 'Office of Commissioner of Lands', Memorandum Describing the Organization and the Duties of the Office of the Commissioner of Lands with an Explanation of the Special Purposes Which the Office has been Created to Fulfil, and Appendix, 24.1.1931, ISA, RG 22, M/3566/22 (LS/29).
- Adler, R., 'Geodetic Projections for Israel', *Geodetic Papers* 4 (Tel Aviv, 1970) (Hebrew).
- , 'Control Densification with Analytical Photogrammetry', *Photogrammetry in Israel 1984*, Photogrammetric Papers 3 (1984), pp.11–21 (Hebrew).
- Adler, R. and Chamielnik, C., 'Introduction and Background to Geodetic and Cartographic Map Projections in Israel', *Geodetic Papers* 6 (Tel Aviv, 1979) (Hebrew).
- Almagor, G. and Hall, J.K., 'Morphology of the Mediterranean Continental Margin of Israel', *Geological Survey of Israel Bulletin* 77 (May 1984): 1–31.
- Alt, A., 'Aus der Kriegsarbeit der deutschen Wissenschaft in Palastina', *ZDPV* 43 (1920): 93–108.
- Amiran, D. (Kallner), 'The Development of the Topographical Mapping of Palestine', *BJPES* 9 (1941): 33–38 (Hebrew).
- , 'Maps of Palestine from World War', *Eretz Israel* 2 (1953), pp. 33–40 (Hebrew).
- Andrews, J.H., *A Paper Landscape: The Ordnance Survey in Nineteenth Century Ireland* (Oxford, 1975).
- Arden-Close, C.F., 'Maps of Palestine', *ESR* 6 (October 1942): 501.
- , 'Claude Regnier Conder (1848–1910) and the Survey of Palestine', *ESR* 7 (April 1944): 234–240.
- Avitsur, S., *Daily Life in Eretz Israel in the XIX Century* (Tel Aviv, 1972) (Hebrew).
- Avneri, A.L., 'The Struggle with the Mandate Authorities over State Lands', *Cathedra* 12 (1979): 110–124 (Hebrew).
- , *The Jewish Land Settlement and the Arab Claim of Dispossession 1878–1948* (Tel Aviv, 1980) (Hebrew).
- Baer, G., *Introduction to the History of Agrarian Relations in the Middle East 1800–1970* (Tel Aviv, 1971) (Hebrew).
- Beech, G., 'Cartography and the State: The British Land Registry Experience', unpublished paper, 14th International Conference on the History of Cartography, 1991, Stockholm.
- Bein, A., *History of the Jewish Settlement in Israel* (Ramat Gan, 1976) (Hebrew).
- Ben-Arieh, Y., 'The Geographical Exploration of the Holy Land', *PEQ* (July-Dec. 1972): 81–92.
- , 'The First Survey Maps of Jerusalem', *Eretz Israel* 11 (1973), pp. 65–74, plate 14 (Hebrew).
- , *The Rediscovery of the Holy Land in the Nineteenth Century* (Jerusalem and Detroit, 1979).
- , *Jerusalem in the 19th Century: The Old City* (Jerusalem, 1984).
- Ben-Shemesh, A., *The Land Laws of the State of Israel* (Tel Aviv, 1953) (Hebrew).
- Bentwich, N., *Legislation of Palestine 1918–1925* (Alexandria, 1926).
- , *England in Palestine* (London, 1932).
- Besant, W. (ed.), *Twenty-One Years' Work in the Holy Land* (London, 1886).
- Biger, G., *Crown Colony or National Homeland?* (Jerusalem, 1983) (Hebrew).
- Brawer, M., *Israel's Boundaries, Past, Present and Future* (Tel Aviv, 1988) (Hebrew).

- Browne, J.P., 'Packaged to Appeal to the Traveller', in Barber, P. and Board, C. (eds), *Tales from the Map Room* (London, 1993).
- , *Map Cover Art*, Ordnance Survey Books (London, n.d.).
- CFC, 'The New Map of Jerusalem', *PEFQS* 57 (1925): 217–219.
- Cassar, G.H., *Kitchener, Architect of Victory* (London, 1977).
- Close, C., 'A Fifty-Years Retrospect', *ESR* 2 (8) (April 1933): 66–73; (July 1933): 130–136.
- Close, C. and Winterbotham, H.St.J.L., *Topographical and Geographical Surveying* (London, 1925).
- Clough, A.B., *Maps and Survey: The Second World War, 1939–1945* (London, 1952).
- Collier, P., 'An Early Attempt at Series Mapping Using Aerial Photography: Sinai and Palestine 1914–19', *Mapping the Nations, Proceedings of the 15th International Cartographic Association Conference, Bournemouth, 1991*, pp. 922–926.
- Conder, C.R., *Tent Work in Palestine* (London, 1878).
- Conder, C.R. and Kitchener, H.H., *The Survey of Western Palestine: Memoirs of the Topography, Orography, Hydrography and Archaeology* (London, 1881–1883).
- Coulthard-Clark, C.D., *Australia's Military Map-Makers: The Royal Australian Survey Corps 1915–1996* (South Melbourne, 2000).
- Dale, P.F., 'Cadastral Surveys: An Analysis of the Efficiency of Certain Types of Cadastral Survey; With Special Reference to Countries of the Commonwealth', PhD dissertation, North-East London Polytechnic (London, 1976).
- Directorate Military Survey, 'Report on the Work of the Seventh Field Survey Company, R.E.: Egypt, Sinai, Palestine & Syria, December 1915 to October 1918', DMS, Feltham, UK.
- Doukhan, M., *Land Laws in Palestine* (Jerusalem, 1925) (Hebrew).
- , *Laws of Palestine 1918–1925* (Tel Aviv, 1933).
- , *Land Laws in the State of Israel* (Jerusalem, 1953) (Hebrew).
- Doukhan-Landau, L., *The Zionist Companies for Land Purchase in Palestine, 1897–1914* (Jerusalem, 1979) (Hebrew).
- Dowson, E., 'Notes on Land Tax, Cadastral Survey and Land Settlement in Palestine', PRO CO 733/60/59971; Report to Clayton, 7 February 1923, ISA RG 65, File 02059 P/359; MEC HJ.2999P.3.
- , 'Survey and Land Settlement Estimates 1925–26', A. Covering Memorandum; B. Note I—Capital Expenditure; C. Note II—Figures Recurrent Expenditure; D. Note III—'Notes on Staff Recurrent Expenditure'; E. Note IV—'Notes on Other Heads of Recurrent Expenditure', PRO CO 733/92/23816.
- , 'Preliminary Study of Land Tenure in Palestine', 3 November 1925, PRO CO 733/109/50095/25.
- , 'Report on the Land System in Palestine', December 1925: A. Covering Memorandum to Report on the Land System in Palestine, 5 December 1925; B. Report on the Land System in Palestine, PRO CO 733/109/54812/25.
- , 'Land Tenure and Taxation in Palestine', Memorandum on the Appointment of Commissioner of Lands, 11 January 1927, PRO CO 733/136/8/44225.
- , 'Memorandum of Proposals for the Assessment of Properties for House and Land Tax (Werko) throughout Prescribed Areas of Jerusalem, Jaffa, Tel-Aviv and Haifa (March 1927)', 4 May 1927, PRO CO 733/142/11/44608.
- , 'Notes on the Abolition of the Tithe and the Establishment of a Land Tax in Palestine', April 1928, PRO CO 733/152/59195.
- , 'Progress in Land Reforms 1923–1930', November 1930, PRO CO 733/221/4/97169.
- , A. 'Settlement and Registration of Title Land and Associated Fiscal Reforms in Palestine'; B. Memorandum I: 'The Remedy of the Principal Defects Diagnosed by the Royal Commission', 21 June 1938; C. Memorandum II: 'The History of Cadastral Survey Settlement of Title and Associated Measures in Palestine between 1913 and 1936', 15 August 1938, PRO CO 733/361/75072/38.

- Dowson, E. and Sheppard, V.L.O., 'The Cadastral Survey of Egypt, 1879–1907', *ESR* 8 (July 1945): 57–82; *ibid.* 8 (October 1945): 122–132; *ibid.* 8 (January 1946): 162–175.
- , 'Land Registration, Part I: Principles and Practice', CO Land Tenure Advisory Panel 1946, September 1948, PRO CO 993/4 (DC 72621/1).
- , *Land Registration*, Colonial Research Publication 13 (London, 1956).
- Egypt, Government of, *Almanac for the Year 1917* (Cairo, 1916).
- , *Report on the Work of the Survey Department of Egypt 1932–33* (Cairo, 1935).
- Elath, E., 'Claude Reignier Conder', *Eretz Israel* 7 (1964), pp. 158–170 (Hebrew).
- Elster, J., 'The Jacotin Map', *Atlas of Israel* (Jerusalem and Amsterdam, 1970), Sheet 1/4.
- , 'Map of the Palestine Exploration Fund', *Atlas of Israel* (Jerusalem and Amsterdam, 1970), Sheet I/5.
- , 'British Maps of the Early Twenties', *Atlas of Israel* (Jerusalem and Amsterdam, 1970), Sheet 1/6.
- , 'Geodesy: Key Maps', *Atlas of Israel* (Jerusalem and Amsterdam, 1970), Sheet I/7.
- , *Cadastre and Survey Legislation* (Tel Aviv, 1971) (Hebrew).
- E.W.B. *et al.*, 'Memoir, Major General Llewellyn Brown', *REJ* 97 (December 1983), pp. 282–284.
- Falls, C. and Becke, A.F., *Military Operations, Egypt and Palestine*, History of the Great War II (London, 1930).
- Fischer, H., 'Begleitworte zur Karte des Syrisch-Ägyptischen Grenzgebiets', *ZDPV* 33 (1910): 188–221.
- , 'Geschichte der Kartographie von Palastina', *ZDPV* 62 (1939): 169–189; *ibid.*, 63 (1940): 1–111.
- French, L., *First Report on Agricultural Development and Land Settlement in Palestine*, 23 December 1931, PRO CO 733/214/5/97049.
- Frumin, M., Rubin, R., and Gavish, D., 'A Russian Naval Officer's Map of Haifa Bay (1772)', *Imago Mundi*, 54, 2002, pp. 125–128.
- Gavish, D., 'The Aerial Cadastral Survey: A Chapter in the History of the Map of the Land of Israel', *Photogrammetry in Israel 1984*, Photogrammetric Papers 3 (Tel Aviv, 1984), pp. 1–10 (Hebrew).
- , 'The 1:2,000-scale Map of Jerusalem, 1920–1922', *Cartography in Israel 1985*, Cartographic Papers 12 (Tel Aviv, 1985), pp. 43–49 (Hebrew).
- , 'The Cadastral and Topographic Mapping of the Mandate Survey Department in Palestine: A Historical-Cartographic Analysis', PhD dissertation, Hebrew University (Jerusalem, 1986) (Hebrew).
- , 'An Account of an Unrealized Aerial Cadastral Survey in Palestine under the British Mandate', *GJ* 153 (March 1987): 93–98.
- , '2/1 Australian Field Survey Company and the Survey of Palestine—1941', unpublished paper, Australian War Memorial MSS 1322 (Jerusalem, 1990).
- , 'World War I Battle Maps, Palestine 1915–1918', in Eliav, M. (ed.), *Siege and in Distress: Eretz Israel during the First World War* (Jerusalem, 1991), pp. 191–211 (Hebrew).
- , *Land and Map: The Survey of Palestine, 1920–1948* (Jerusalem, 1991) (Hebrew).
- , 'First Maps of Hadera, 1891–1894', *Hadera, Hundred Years More* (Jerusalem, 1993), pp. 23–42 (Hebrew).
- , 'French Cartography of the Holy Land in the Nineteenth Century', *PEQ* 126 (1994): 24–31.
- , 'Foreign Intelligence Maps: Offshoots of the 1:100,000 Topographic Map of Israel', *Imago Mundi* 48 (1996): 174–184.
- , 'The British Efforts at Safeguarding the Land Records of Palestine in 1948', *Archives* 95 (October 1996): 107–120.
- Gavish, D. and Biger, G., 'Innovative Cartography in Palestine 1917–1918', *CJ* 22 (June 1985): 38–44.

- Gavish, D. and Kark, R., 'The Cadastral Mapping of Palestine, 1858–1928', *GJ* 159 (March 1993): 70–80.
- Goadby, F.M. and Doukhan, M.J., *The Land Law of Palestine* (Tel Aviv, 1935).
- Godelewska, A., *The Napoleonic Survey of Egypt*, *Cartographica* 25, Monograph 38–39 (Toronto, 1988).
- Goldstein, Y., *A Surveyor's Companion Book: Fifty Years of Land Survey in the Land of Israel, 1921–1971* (Tel Aviv, 1973) (Hebrew).
- Government Press and Survey of Egypt, *A Brief Record of the Advance of the Egyptian Expeditionary Force, under the Command of General Sir Edmund H.H. Allenby, G.C.B., G.C.M.G., July 1917 to October 1918* (Cairo, 1919).
- Granott, A. (Granovsky), 'Outline of the Land Regime in Israel', introduction to Ben-Shemesh, A., *The Land Laws of the State of Israel* (Tel Aviv, 1953), pp. 7–10 (Hebrew).
- Granowsky, A., *The Land Episode in Palestine* (Jerusalem, 1936) (Hebrew).
- , *The Land Regime in Palestine* (Tel Aviv, 1949) (Hebrew).
- Great Britain, Cmd 3686, *Report on Immigration, Land Settlement and Development* [Hope-Simpson Report] (London, 1930).
- , Cmd 5479, *Palestine Royal Commission Report* [Peel Report] (London, 1937).
- Gross, N.T., 'The Economic Policy of the Government of Palestine during the Mandate Period', *Cathedra* 24 (1982):153–180; *ibid.*, 25 (1982): 153–168 (Hebrew).
- Hart, I.D., 'The Survey of Palestine', *REJ* 93 (1965): 214–225.
- Herbert, F., 'The Salmon Collection of Map Samples in the Map Room of the Royal Geographical Society', *Sheetlines* 4 (September 1982): 2–5.
- Hilleli, A., 'The Rights in Land: General Historic Background for the Development of Land Tenure in the Land of Israel', *The Lands of Galilee* vol. 2 (Haifa, 1983), pp. 575–610 (Hebrew).
- Hodson, Y. and Jacobson, D.M., *The Survey of Western Palestine: Introductory Essays* (London, 1999).
- Hogg, J.E., *The Australian Torrens System* (London, 1905).
- Holzhausen, R., 'Die Tötigkeit der Vermessungs Abteilung 27 in Palastina', *Orient-Rundschau* 19 (1937): 52–55.
- Hopkins, I.W.J., 'Nineteenth-Century Maps of Palestine: Dual-Purpose Historical Evidence', *Imago Mundi* 20 (1968): 30–36.
- Hull, E., *Mount Seir, Sinai and Western Palestine, being a Narrative of a Scientific Expedition* (London 1885).
- Hyamson, A.M., *Palestine under the Mandate, 1920–1948* (London, 1950).
- I.S., 'Colonel S.F. Newcombe, D.S.O.', *REJ* (December 1956): 398–400.
- Jardine, R.F. and McArthur Davies, B.A., *A Gazetteer of Place Names Which Appear in the Small-Scale Maps of Palestine and Trans-Jordan* GPP 11095–600 (Jerusalem, 24 August 1940).
- Jones, Y., 'British Military Survey of Palestine and Syria', *CJ* 10 June 1973): 29–41.
- Kain, R.J.P. and Baigent, E., *The Cadastral Map in the Service of the State: A History of Property Mapping* (Chicago, 1992).
- Kain, R.J.P. and Prince, H.C., *The Tithe Surveys of England and Wales* (Cambridge, 1985).
- Kallner, D.H., 'Die Landkarten Palästinas', *Palastina: Zeitschrift für den Aufbau Palästinas* 20 (March 1937): 132–136.
- , 'Jacotin's Map of Palestine, Surveyed during Napoleon's Campaign in 1799', *PEQ* 76 (1944): 157–163.
- Kark, R., 'Land Purchase and Mapping in a Mid-Nineteenth-Century Palestinian Village', *PEQ* 129 (1997): 150–161.
- Kark, R. and Gerber, H., 'Land Registry Maps in Palestine during the Ottoman Period', *CJ* 21 (1984): 30–32.
- Karmon, Y., 'An Analysis of Jacotin's Map of Palestine', *IEJ* 10/3 (1960): 155–173; 10/4 (1960): 244–253.
- Kerr, D., *The Principles of the Australian Land Titles (Torrens) System* (Adelaide, 1927).

- Kisch, F.H., *Palestine Diary* (London, 1938).
- Le Ray, H.G., 'The Triangulation of Palestine', *CSO* (1935), pp. 287–294.
- Ley, C.H., *Note on the Technical System of the Survey of Palestine* (Jaffa, 1927).
- , *The Structure and Procedure of Cadastral Survey in Palestine* (Jerusalem, 1931).
- , 'An Outline of Cadastral Structure in Palestine', *CSO 1931* (London, 1932), pp. 181–192.
- Lif, Z., 'Bibliography of Maps Edited by Zalman Lif', *Eretz Israel* 2 (1953), pp. 23–24 (Hebrew).
- Loxton, J.W., 'Systematic Surveys for Settlement of Title and Registration of Rights to Land in Palestine', *CSO 1947* (London, 1951), pp. 113–120.
- , 'The Survey of Palestine 1937–1948: A Personal Memoir', unpublished paper (Taunton, 1988).
- Luke, H.C. and Keith-Roach, E., *The Handbook of Palestine and Trans-Jordan* (London, 1930).
- Lynch, W.F., *Narrative of the United States' Expedition to the River Jordan and the Dead Sea* (London, 1850).
- Lyons, H.G., *The Cadastral Survey of Egypt 1892–1907* (Cairo, 1908).
- Magnus, P., *Kitchener, Portrait of an Imperialist* (Harmondsworth, UK, 1968).
- Mankin, J.H., 'Not in the Book: Reminiscences of Cadastral Surveying in Palestine 40 Years Ago', *ESR* 19 (April 1968): 251–255.
- , 'Survey of the Old City of Jerusalem 1865 and 1935', *ESR* 19 (Oct. 1968): 338–341; *PEQ* (Jan.–June 1969): 37–39.
- , 'Middle East Frontiers Triangulation. Survey Reminiscences 1922–1932', *ESR* 24 (1977): 28–41.
- Meek, C.K., *Land Law and Custom in the Colonies* (London, 1968).
- Meinertzhagen, R., *Middle East Diary 1917–1956* (London, 1959).
- Military Handbook on Palestine* (Cairo, 1917).
- Mitchell, A.P., 'Survey of Palestine: The First Twenty Years', *ESR* 6 (July 1942): 388–392.
- Murray, G.W., *The Survey of Egypt 1898–1948*, Department of Survey Paper no. 50 (Cairo, 1950).
- Newcombe, S.F., 'The Survey of Sinai and South Palestine, Akaba, 14.2.14', *PEFQS* 46 (1914): 128–133.
- Newcombe, S.F., 'T.E.Lawrence, Personal Reminiscences', *PEFQS* (1935): 110–113.
- Ordnance Survey, 'Further Notes on the Geodesy of the British Isles, Geodetic Surveys of the Crown Colonies', Ordnance Survey Professional Papers New Series, 15 (London, 1933).
- Özkale, E. and Şenler, M.R., *Haritacı Mehmet Şevki Paşa ve Türk Haritcihk Tarihi (1919 yilina kadar)*, II Boliim (an abridgement of 'A Summary of Ten Years of Efforts Regarding Turkish Cartography' by Mehmet Şevki Paşa) (Ankara, 1980), part 2. (Turkish).
- Palestine, Government of, Annual Report of the Director of Surveys, 1920–1927 (unpublished), So/L and Le Ray Papers, MEC.
- , *Annual Report of the Director of Surveys, 1928–1948*. (In 1935–1938, published as the *Report of the Surveys and Lands Department*. During the Second World War years, a combined Report in one volume was published for 1940–1946.)
- , *An Interim Report on the Civil Administration of Palestine during the Period 1st July 1920–30th June 1921* (London, 1921).
- , *Report on Palestine Administration, July 1920–December 1921* (London, 1922).
- , *Report on Palestine Administration* (London, published until 1924).
- , *Report of the High Commissioner on the Administration of Palestine 1920–1925* (London, 1925), COL. 15.
- , *Report to the Council of the League of Nations on the Administration of Palestine and Transjordan* (London, published from 1926).
- , *Technical Reports: 1934, 1936, 1937, 1938*, Survey of Palestine, PRO CO 814/8/7.
- , *A Survey of Palestine, Prepared in December 1945, and January 1946 for the Information of the Anglo-American Committee of Inquiry*. (Palestine, 1946).
- Palestine Exploration Fund, *Twenty-one Years in the Holy Land: A Record and a Summary* (London).

- Pleschtschejew, S.S., *Tagebuch einer Reise des russ. Marine-Lieutnants Sergjei P. von der Insel Paros nach Syrien u. Palastina nebst einer kurzen Geschichte Ali Beys* (Riga and Leipzig, 1874).
- Polak, A.N., 'The History of Cadastral Survey in Palestine and the Neighbouring Countries', *Co-operative Bulletin* 17–18 (1937): 327–329; *ibid.*, 19–20 (1937): 356–358 (Hebrew).
- , *History of Agrarian Relations in Egypt, Syria and Palestine* (Jerusalem, 1940) (Hebrew).
- Porter, R.T., *The Dowson and Sheppard Collection of Cadastral Survey and Land Registration Records: A Note on the Origin, History, and Current Whereabouts of the Collection* (Southampton, Ordnance Survey International 1993).
- 'Precise Levelling Grid', *Atlas of Israel* (Tel Aviv, 1970), Sheets 1/7B.
- Quinlan, C.V., 'Australian map makers', *Australian Surveyor*, 9 (September 1943): 266–269.
- Richards, F.S., 'Report Submitted to Sir Ernest Dowson on "Certain Aspects of the Proposed Land Settlement, Cadastral Surveys and the Introduction of a System of Registration of Title to Land in Palestine"', 1925, DOS no. 14.
- Robinson, E., *Biblical Researches in Palestine and the Adjacent Regions: A Journal of Travels in the Years 1838 and 1852*, 2nd edition, with new maps and plans (London, 1856).
- Roux, J., *Golfe de Caïffe: Recille des Principaux Plans des Ports et Rades de la Mer Méditerranée Extraits, de ma Carte en Douze Feuilles...*, Marseille, 1764, pl. 119.
- Royal Engineers, *History of the Corps of Royal Engineers, VI: Gallipoli, Macedonia, Egypt and Palestine 1914–1918* (Chatham, UK, 1952).
- Rubinstein, S., 'Aaronsohn's Proposal for the Development of Uncultivated Lands between Jaffa and Rafah', *Cathedra* 28 (1983): 77–118 (Hebrew).
- , 'Land Survey and Locating of Land Registry Books', *Kivunim* 36 (1987): 119–178 (Hebrew).
- , *At the Height of Expectations: Land Policy of the Zionist Commission 1918* (Jerusalem, 1992) (Hebrew).
- Ruppin, A., *My Life and Work: Laying Foundations in Palestine 1907–1920 II* (Tel Aviv, 1968) (Hebrew).
- Salmon, F.J., 'Topographical Maps', *Transactions of the Engineering Association of Ceylon* (1929?), pp. 1–19.
- , 'With the Field Survey Units in France', *ESR* 2 (January 1934): 268–278.
- , 'Notes on the New Topographical Map of Palestine 1:100,000 Scale', 11 January 1935, MOD, D26/H1/A2.
- , 'Some Notes on Conventional Signs for Topographical Maps', *GJ* 89 (1937): 50–53.
- , 'The Modern Geography of Palestine', *PEFQS* 69 (1937): 33–42.
- , 'Some Experiments with Zeiss-Bosshardt Direct-Reading Tacheometer', *ESR* 4 (Oct. 1937): 213–216.
- , 'Cadastral Air Survey', *ESR* 4 (April 1938): 334–338.
- , 'The Land of Palestine', *JRCAS* 25 (October 1938): 542–553.
- Salmon, F.J. and McCaw, G.T., 'The Level and Cartography of the Dead Sea', *PEQS* (1936): 103–111.
- Sawer, E.R., *A Review of the Agricultural Situation in Palestine*, Department of Agriculture and Fisheries, Palestine, 1920–1922 (Haifa, 1922).
- Schattner, I., 'The Cartographic Literature (Cartobibliography) of Palestine', *BJPES* X (July–Oct. 1943): 90–97 (Hebrew).
- , *The Map of Eretz Israel and its History* (Jerusalem, 1951) (Hebrew).
- Seymour, W.A. (ed.), *A History of the Ordnance Survey* (Folkestone, UK, 1980).
- Shadur, J., 'Staking Out the Sea Lanes to Eilat', *Israel—Land and Nature* 3 (Fall 1976) 1:26–31.
- , *Travels and Explorations in the Negev Highlands*, 2nd edition (Tel Aviv, 1979) (Hebrew).
- Shilony, Z., *Ideology and Settlement: The Jewish National Fund, 1897–1914* (Jerusalem, 1998).
- Simpson, S.R., *Land Law and Registration* (Cambridge, 1976).

- Solel, A., 'Private Land Registers of the Jewish Colonies at the End of Ottoman Rule', *Cathedra* 58 (1990): 74–83 (Hebrew).
- Spry, J.F., 'Memorandum on the History, Law and Practice of Land Registration in Palestine' (76452/IA/48), PRO CO 733/494/3/75872, and Spry Files 2, MEC, HD.126 5.P3.
- Stein, K.W., *The Land Question in Palestine, 1917–1939* (Chapel Hill, NC, 1984).
- Storrs, R., *Orientalisms* (London, 1937).
- Survey Directorate GHQ ME, *Palestine Index Gazetteer* (Cairo, 1945), MDR 599/12077.
- Survey of Egypt, *Report on the Work of the Survey Department of Egypt 1932–1933* (Cairo, 1935).
- Survey of India, *The War Record 1914–1920*, Records of the Survey of India, XX (Dehra Dun, India, 1925).
- Survey of Palestine, *Arabic and Hebrew Proper Names in English Alphabetical Order* (Tel Aviv, 1931).
- , *Palestine Index Gazetteer* (Tel Aviv, 1948).
- Thomas, H.H., 'Geographical Reconnaissance by Aeroplane Photography, with Special Reference to the Work Done on the Palestine Front', *GJ* 55 (May 1920): 349–376.
- Tidhar, D., *Encyclopedia of Pioneers of the Yishuv and its Upbuilders* (Tel Aviv, 1947–1971) (Hebrew).
- Tolkowsky, S., *Zionist Political Diary 1915–1919* (Jerusalem, 1981) (Hebrew).
- Treidel, J., 'Kartenkunde und Vermessungswesen Palästinas', *Palastina: Organ für die wirtschaftliche und kulturelle Erschließung des Landes* 1/2 (Jan.–Feb. 1907): 8–22; *ibid.*, 5 (May 1907): 117–125.
- Tute, R.C., *The Ottoman Land Laws* (Jerusalem, 1927).
- United States of America, War Office, *Foreign Maps*, Department of the Army Technical Manual TM 5–248 (Washington, DC, 1956), pp. 98–100.
- Wade, E.B.H., *A Report on the Delimitation of the Turco-Egyptian Boundary (1906)*, Survey Department, Egypt, Paper no. 4 (Cairo, 1907).
- Wavell, A., *The Palestine Campaigns* (London, 1928; revised and augmented 1933).
- Weizmann, C., *Trial and Error* (London, 1949).
- , *The Letters and Papers of Chaim Weizmann* Series A, ed. Weisgal, M.W., vols. VIII, Nov. 1917–Oct. 1918; IX, Oct. 1918–July 1920; XI, Jan. 1922–July 1923 (Rutgers, NJ and Jerusalem, 1977).
- Wilson, C.W., *Ordnance Survey of Jerusalem Made in the Years 1864 to 1865* (Southampton, 1866).
- , 'Recent Surveys in Sinai and Palestine', *RGS* 43 (1873): 206–240.
- Winterbotham, H.St.J.L., 'British Survey on the Western Front', *GJ* 53 (April 1919): 253–276.
- Wolff, N., 'Air Survey and Colonial Cadastral Mapping', *ESR* 4 (Jan. 1938): 281–290; 4 (July 1938): 444–448.
- Woolley, C.L. and Lawrence, T.E. *The Wilderness of Zin* (Archaeological Report), PEF Annual (London, 1914–1915).
- Yoeli, P., *Map Projections* (Haifa, 1969) (Hebrew).

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