

Creating Facts on the Ground: Agriculture in Israel and Palestine (1882-2000)

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1. INTRODUCTION

This paper analyzes the evolution of the agrarian system in Israel/Palestine from before the establishment of the State of Israel to the present. In a setting of conflict over land and water, it presents the historic evolution of the two agricultural systems and their relative (un)sustainability. Because the territory of Palestine is a contested space the conflict over land and water is shown to be one of the main drivers behind land use and labour practices and the development and implementation of agricultural technology in Israel/Palestine. While there is a large body of literature discussing the geopolitics of water in the conflict (Homer-Dixon, 1999; Selby, 2003; Lowi, 1993; Wolf, 1995) and how the conflict over water has had devastating effects on the environment (Lipchin, 2003; Ferragina, 2008), this article focuses on the use of land and water for agricultural purposes in a historical context.

One aspect of agricultural development in Israel is that there exists the imperative for extensification along with intensification, due to security needs. This refers to increasing the area under cultivation and pursuing agriculture in peripheral areas (the desert, the

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north) regardless of the economic cost as a means of claiming, occupying and in the process defending territory under dispute. In Israel, this is called «creating facts on the ground.» Thus, rather than accepting water scarcity as an ecological constraint, Israeli agriculture has turned to technological fixes which permit agricultural activity at any cost. This need to overcome water supply limitations in the face of the «agricultural imperative» has contributed to a range of technological innovations regarding water use –including drip irrigation, the reclamation and reuse of wastewater, cloud seeding and large-scale desalination. This has enabled the country to continue and expand agricultural production despite growing water scarcity.

On the Palestinian side we see how agriculture has responded to politically created water and land scarcity. After the occupation (1967), agriculture in the West Bank is reshaped in large part through Israel's direct and indirect control of labour, land and access to water so as to complement and discourage competition with the Israeli market. The various mechanisms of control exerted can be defined as environmental racism or environmental injustice, the inequitable distribution of environmental burdens and access to environmental goods (Martínez-Alier, 2002), whereby valuable ecological resources are transferred to Israel and environmental bads such as pollution from the settlements are externalized onto the occupied territories (OPT). Agriculture in the West Bank is conditioned through a series of coping strategies as a response to these pressures. This paper demonstrates how competition for resources and dispossession has shaped the landscape and resource use on either side of the green line.

After a brief geographical description of the area under study, the article contains three sections. The first sets out the traditional land use system from Ottoman times and describes the encounter between the fellahin and the colonizing Jewish agriculture during the Mandatory period and onwards. The second focuses on the evolution of the Israeli agricultural system, describing how the process of colonization and security concerns shaped the labour system, land use and ultimately the process of technological innovation in agriculture. The third section describes Palestinian agriculture from 1967 onwards and its adaptation to the politically created scarcity of land and water.

1.1. Geographical Description of the Study Area

Israel is a small country of 22,072 sq. km. In 2008, the population was 7.2 million people, 90 per cent urban and 10 per cent rural, with a density of 315 people per sq. km. The land is divisible into three longitudinal strips running from north to south, comprising a coastal plain, a long inland escarpment and a large desert area in the south. The climate

MAP 1
Israel and the Occupied Territories



Source: Based on UN map, UNISPAL (<http://unispal.un.org/unispal.nsf>).

is semi-arid Mediterranean with average rainfall ranging from up to 700 mm in the (water rich) North to less than 50 mm in the South. In Israel all water resources within the country belong to the state, which runs a highly centralized system of water management and development. Since 1964, the country's freshwater sources have been joined in the National Water Carrier, an integrated grid of pumping stations, reservoirs, canals and pipelines which distributes water throughout the country.

The area of the West Bank (WB) is 5,880 sq. km. In 2008 the population was 2.4 million inhabitants with approximately 45% of the population urban and the rest rural and a density of 255 people per sq. km. The WB is divided into four agro-ecological zones – the Central Highlands, the Semi Coastal Region, the Eastern Slopes and the Jordan Valley, with rainfall ranging between 600 and 200 mm. Annual renewable water sources, mainly groundwater from aquifers shared with Israel, are about 850 MCM in the West Bank.

2. PALESTINE UNDER THE OTTOMANS AND THE BRITISH

2.1. Tenure System and Agricultural Practices in Ottoman Palestine (1800-1914)

The system of traditional land tenure in pre-capitalist Ottoman Palestine is referred to as Masha'a or Musha'a, and it involves communal land tenure characterized by a periodic redistribution of agricultural plots among the cultivators of the extended family group or clan, called a Hamula (Atran, 1986: 271). Three forms of land holding prevailed in the Masha'a system – Mulq, Miri and Waqf. Miri, the predominant system, was organized so that land was redistributed every few years through a lottery system to maintain levels of equality between members of the hamula. Each family cultivated and reaped the produce of their own land, and had use and hereditary rights to the land. Land outside the village for grazing and collecting firewood was held in common by all members of the clan. Mulk holdings resembled a feudal system, whereby the Sultan granted rights to the land to notables in return for civil or military services with production based on sharecropping. Waqf land was a similar system to Mulk, except the land was owned by the religious authorities. A villager could have his miri plot and work as a sharecropper on someone else's land.

Whether the Masha'a system encouraged responsible stewardship over the land is a matter of debate. The Musha land system was a relic of tribal organization and shared grazing rights over a common territory. The system was therefore an impediment to alienation of land to strangers outside the community and fostered village economic and social cooperation (Stein, 1984). Yet both the imperial and the colonial forces viewed Masha'a as

a barrier to agricultural progress. Baer's comments are typical, «Under the Musha'a system there is no incentive to invest in land, which in any case passes sooner or later into the hands of others. The aim of the landholder under such conditions is to exploit the land to its utmost» (quoted in Atran, 1986: 274). Or Stein:

The most harmful aspect of the Musha'a land system was its process of periodic redistribution. Most fellaheen lacked interest in improving their temporarily held land when the fruits of improvement would be taken from them...manuring, weeding, terracing, or crop alternation was rarely employed, and the already nutrient deficient soil was further depleted... Musha'a' shares that evolved through inheritance forced a fixed amount of land to be divided among a geometrically increasing number of heirs... (Musha'a;) was described by every major authority on land in Palestine as the most debilitating factor affecting the (fellaah's) economic betterment (Stein, 1984: 14).

2.2. Fellaah Cultivation Methods and Crops (1840-1914)

At the end of Ottoman rule, 75% of land was devoted to growing grains. A two-field system was common, with wheat and barley grown as winter crops on one half while the other half had a summer dew crop of sesame and Indian millet. The following season, the second half had the winter crop with the first half left fallow (Atran, 1986: 277). Other crops grown included dura, beans, fenugreek, and chickpeas, along with olives, grapes, cotton and oranges. Fallowing was widely used, allowing grazing cattle to feed on the fallow lands. The extensive system was not geared towards profit making but subsistence. The Ottoman government tried to outlaw fallowing by repossessing untilled land, but was largely unsuccessful (Atran, 1986: 278). Terracing was practiced in the hills with olive trees grown everywhere used as a source of oil and soap. By 1910 citrus groves covered 3,000 hectares. Vegetables were grown where irrigation was possible. The fellaah used homemade implements –a light nail plow, a sickle, a threshing board and two sieves, tools which had changed little from biblical times. The advantages of the primitive plow were that it required little draught power and the fields could be worked soon after rain when it would be too heavy for animal power and heavy tools (Casto, 1937).

Beginning with the 1858 Land Code, the Ottoman government, in an attempt to extract more taxes from the Fellaheen, tried to institute policies to transform land ownership. The goal was effectively to undermine «the system of collective holding and to institute an individual land-holding system» (Atran, 1986: 274). The code stipulated that a village could not communally own land and that titles should be given to each individual.

Moreover, non-cultivated (*Musha'a*) land could not be the property of the fellah and would belong to the state. The 1876 Land Law decreed that *Mulk* land held by notables who were not providing services to the Sultan would be seized and could be sold to Europeans. One of the most notable purchasers was Baron Rothschild, who spent an estimated 10 million pounds sterling on land purchases, the construction of settlements, the establishment of plantations and manufacturing plants producing silk, glass, wine and water. He guaranteed the Jewish settlers who came to work on these plantations a minimum income (Aharoni, 1991: 57). At the same time the World Zionist Organization (WZO) was founded in 1897 and created the *Keren Kayemet* fund (JNF) for land purchases two years later. With their help, Jewish-owned land increased from 25, 000 dunums in 1882 to 1.6 million dunums by 1941¹.

Throughout these changes, the situation of the peasantry grew progressively worse as the tax burden increased. Often the fellah was forced to borrow money to make ends meet and many ended up selling the titles to their land, which they continued to work on, but with reduced benefits. By the turn of the century, six families in Palestine (the *effendi*) owned 23% per cent of all cultivated land, while 16, 910 families owned only 6% (Awartani, 1993).

2.3. The British Mandate (1914-1948)

Following the First World War, Palestine was designated as a mandated territory to Britain to rule the country until it become ready for independence. Along with this was the provision, first enshrined in the Balfour Declaration of 1917², to secure a national home for the Jewish people in Palestine. When the British received the Mandate for Palestine, the land issue was highly contentious. This is because the Mandate included the incompatible goals of «encouraging close settlement by Jews on the land» while at the same time «ensuring that the rights and position of other sections of the population are not prejudiced».

1. Originally a dunum was the amount of land one man could till in one day. It was not precisely defined and varied considerably from place to place. It is still used, in various standardized versions, in many countries formerly part of the Ottoman Empire. In Palestine it is 1,000 m² or 0.1 hectares.

2. On November 2, 1917, Arthur Balfour, the foreign secretary in Lloyd George's cabinet, addressed a letter to Lord Rothschild. The letter, which read as follows, became known as the Balfour declaration: «I have much pleasure in conveying to you, on behalf of His Majesty's Government, the following declaration of sympathy with Jewish Zionist aspirations which has been submitted to, and approved by, the Cabinet. 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 British put into place policies that permitted the transfer of the land to the European settlers. The first being the transfer law of 1921, which granted individual holders the right to become the private owners of their land. Another law, the rural property tax, stipulated that land not cultivated for three years could be seized by the state and «be made use of in a more efficient way» (Zu'bi, 1981: 99). In August 1929, riots broke out between Muslims and Jews when a conflict over access to the Western Wall in Jerusalem escalated. During the week of riots, at least 116 Arabs and 102 Jews were killed and 339 wounded. One result of the riots was the establishment of the Hope Simpson Royal Commission, charged with looking into the causes of the conflict. The commission's report, headed by Sir John Hope Simpson, and dated October 1, 1930, recommended limiting Jewish immigration due to the lack of agricultural land to support it. Yet despite new policies which tightened laws regarding Jewish land acquisition after 1929, the period of the mandatory government saw widespread expansion of Jewish agricultural settlements in Palestine (Table 1). For example, from 1900 to 1927, the area owned by the Jewish sector expanded from 42,060 to 90,300 ha: an average increase of under 2,000 ha a year. While from 1932 to 1941, after the riots, the area expanded from 105,850 ha to 160,480 ha—an average annual increase of 6,000 ha.

TABLE 1
Expansion of Cultivated Land Owned by the European (Jewish) Sector
in Palestine (1882-1941)

Year	Area Owned by the Jewish Sector (Hectares)	% of cultivated land
1882	250	
1900	22,070	3.4
1914	42,060	6.4
1922	59,400	9.1
1927	90,300	13.8
1932	105,850	16.0
1936	139,260	21.0
1941	160,480	24.5

Source: *Survey of Palestine* (1945). Reprinted in Zu'bi (1981: 98).

The quality of the soils of the land purchased is debated among scholars. According to Alon Tal, an Israeli environmental historian: «Though the real estate that Arab landlords were willing to sell was largely malaria infested swamps and wastelands, new agricultural settlements soon began to dot the map of Palestine» (Tal, 2006: 4). On the other hand, «The main areas appropriated by European investors were those concentrated in the maritime plain, the most fertile area in Palestine, specializing in citrus production» (Atran, 1989: 739).

Zu'bi (1981: 99) also writes, «Under British Colonization, the land appropriated by European (Jewish) settlers was the most densely populated areas. In 1921, the transfer of 240,000 dunums in the Beisan (Galilee) area to the European sector resulted in the dispossession of 8,730 families living from this land. By 1929 it was reported, 29.4% of peasant families' land was expropriated as a result of the Zionist settlement».

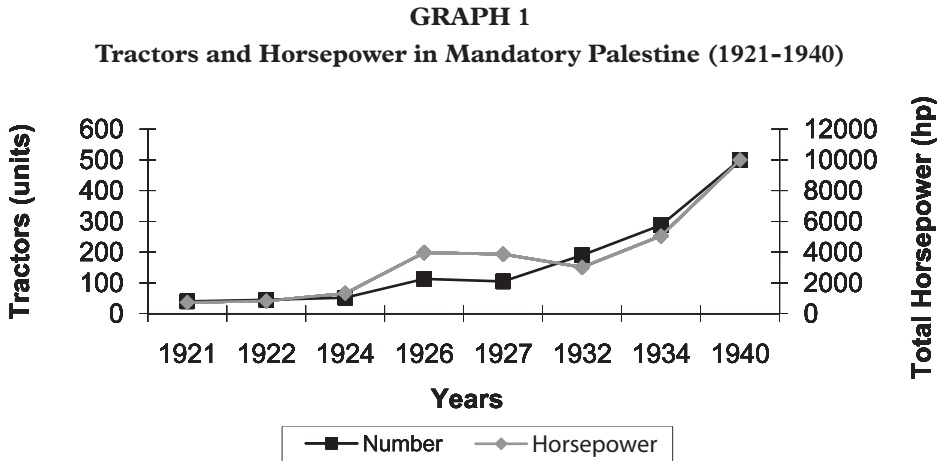
2.4. The Widening Gap: Jewish and Arab Production Methods under the Mandate

While Palestinian farmers maintained their family-oriented, labour-intensive forms of production, Jewish farmers focused on high value crops and livestock oriented towards the market. Jewish farmers owned 49% of all citrus orchards in the country in 1948 (Table 2), when their share of total land area amounted to less than 6% (Awartani, 1993). At the time, citrus exports accounted for 75% of all exports. The differences can be attributed in part to the supportive services available to each group, including credit sources and educational opportunities. The fellah did not adopt the new methods of the Jewish settlers, for example, the more sophisticated thresher (The Jewish Plow) did not replace the single nail plow by the end of the Ottoman period (Tal, 2002: 49). While the use of tractors grew from the 1920s onwards (Graph 1), by 1940, of the 500 tractors in use, only 50 units were owned by Arabs and the rest by Jews (Kamen, 1991).

Due to the technological gap, Jewish yields for crops such as wheat and barley were double those of the Palestinian producers. Fellaheen methods produced extremely low yields, even by the standards of the region. For example, a 1937 study shows that a local Palestinian Arab cow provided 400-800 liters of milk a year, as opposed to a cow from Beirut Lebanon who could generate 2,000-3,000 litres, or from Damascus who could reach 3,500 litres (Tal, 2006). In comparison, in 2003 Israeli cows on kibbutzim were providing an average of 8,529 litres, the highest national rate in the world. The Jews also experimented with new crops such as the grapefruit, which takes less time to come to fruit than oranges, can grow in less fertile soils, and is hardier (Zemach, 1933).

One of the most detailed descriptions of the fellah's farm during this period is captured by Elazari-Volcani (1930). Its most distinguishing features was the farm's complete autarky or self-sufficiency, in other words almost no external inputs entered the agro-ecosystem. Using Volcani's study, Gerald Stanhill conducted an energy balance of the Fellah's farm in 1930 (Stanhill, 1978). During this period, Masha'a still accounted for half of the land under cultivation. Each fellah received a strip of land several metres wide and several hundred meters long. The average size was 9 ha. Animals were used to help with cul-

tivation with an average of three oxen or a horse or a camel, and a few hens; the more wealthy farms had a dairy cow.



Source: Own elaboration with data from Kamen (1991: 210).

Stanhill concludes that the average farm could support eight persons on a «barely adequate» vegetarian diet. Thus the land requirement per person was approximately 1.7 ha. The output-input ratio of the net edible human food energy produced (2.11 GJ per ha per year), to the input of human labour and animal feed (1.31 GJ per ha per year) yielded a ratio of 1.63. «The ratio is considerably below that of most subsistence farming systems and only marginally superior to that of contemporary fossil-fuel powered agro-ecosystems» (Stanhill, 1978). Stanhill attributes this low productivity to the disincentive to manure the soil due to the Masha'a system.

However other authors attribute the lack of fertilization to the unavailability of manure due to the widespread use of animal dung as firewood (Kamen, 1991: 197). The author tends to agree with this explanation, given that if the fellah could increase the yield of his crops in one year, logic dictates that he would do so. Furthermore, the use of terracing attests to improvements undertaken despite Masha'a. Moreover, if fertilization was standard practice in the community, all would benefit despite the periodic redistribution.

2.5. In Defense of the Fellah's Farm

In his book, *A Story of Colonial Bungling*, Nadan (2006) attempts to discredit the British view that fellah farming at this time was lacking in economic logic. He argues that the prac-

tices of the fellah were rational and in line with an environment of scarce capital and a surplus of labour. He points out that while there was no overall scarcity of land at the beginning of the mandate, increased population growth in this period meant that land scarcity and a surplus of labour developed in some regions. The Arab population doubled from 340,000 in 1850-1851 to 722, 100 by 1914-15, an annual increase of 1.2%. The subsequent shrinking of available land led to labour-intensive practices such as the building and cultivating of terraces. The agricultural practices at this time were characterized by plentiful and cheap labour, lack of capital and lack of credit for Arab farmers (Nadan, 2006). He defends the distribution arguing that the possession of geographically separated plots was an insurance against risk in the event of natural hazards or raids; it also allowed a farmer to plant crops in the most suitable places (Nadan, 2006: 276). He also maintains that investments and improvements of the land, such as the planting of fruit trees, was possible, either by the community making a shared investment or by the individual requesting the fellow members of the hamula to give him a permanent plot. Finally, he notes that crop rotation was an ingrained element of the system.

Partition left the peasant with more fragmented and unmanageable parcels and also contributed to the dissolution of shared economic planning and thus to social disintegration. Most damaging however, was how the process of land settlement facilitated and accelerated Jewish land purchases and therefore fellahin estrangement from their land. Thus Nadan concludes that land settlement as instituted by the British, was destructive to the Arab rural economy and worked against the Mandatory government's own objectives.

The differing views about the sustainability and the economic viability of the Palestinian Masha'a system and its eventual confrontation with Jewish agriculture are not merely academic because the image of Palestine as an untended wilderness has served numerous ideological goals of Zionism. The often-repeated claim that the settlers made the «desert bloom» is often used as a justification for Jewish possession of the land. This is questioned by Buheiry (1981: 68): «The economic importance of Palestine has traditionally been underestimated, generally for myth construction purposes: a dominant theme, taken for granted by the Western world, is the Zionist claim that the region was a desert which bloomed with the arrival of the first wave of Jewish colons-pioneers late in the nineteenth century. In fact, Palestine has always been an important producer of key agricultural commodities and was experiencing a significant expansion of agriculture and allied manufactures at least two generations before the arrival of the first colons from East Europe».

Statistics attesting to the progress in Arab agriculture (Tables 2 and 3) lend support to the contention that the trend towards mixed agriculture was accelerating during the

Mandate, and that had the people not been dispossessed by competing Jewish capital, they too would have evolved a more intensive agricultural system. The most spectacular developments were in the vegetable branch, where output multiplied by a factor of 14 in as many years (Table 2). Melons and other fruit also saw increased production, while cereals significantly decreased their share of production.

TABLE 2
Gross Output for Human Consumption in Arab Agriculture (1931 and 1945)

	Tons		Percent	
	1931	1945	1931	1945
Bread cereals	100,000	140,300	53	23
Vegetables	12,000	189,100	6	30
Melons	22,000	135,600	12	22
Grapes	10,000	34,900	5	6
Figs	6,700	19,600	4	3
Almonds	500	4,000	0	1
Apples, plums	—	3,500	—	1
Bananas	—	4,100	—	1
Other fruit	1,500	7,200	1	1
Sesame	2,000	4,700	1	1
Olives	34,000	78,300	18	13
Total	188,700	621,300	100	100

Source: Kamen (1991: 209).

At the time citrus was the principal cash crop of Palestine. Table 3 shows how Arab land planted under citrus expanded by over 6 times in the 20 years between 1925 and 1945. Regarding citrus exported, in 1930/31 1.6 million cases were exported and in 1938/39, 5.3 cases were exported: more than a tripling of exports (Kamen, 1991).

The impact of Jewish settlement and its capitalist mode of production on the local population was that in many instances the peasant economy was supplanted by the Israeli (settler) one and largely excluded from the benefits of development. A striking example of this is the decline in the olive oil industry in the Arab sector. In the early 1920s, Palestinian production of olive oil was 5,000 tons annually and revenues from exports to Egypt amounted to PL³ 342, 000. The development of a capitalist Jewish industry for other lower cost oils flooded the market and combined with the development of a Jewish olive oil industry led to the collapse of the local one. Unable to compete, Palestinian exports dropped to PL 52, 091 by 1936, after which point no figures are given and it is assumed that oil was only consumed directly by the producers (Zu'bi 1981: 105).

This example shows that not only did the Jewish industry stunt development; it actually precipitated a process of «de-development» in some cases.

TABLE 3
Citrus Planting and Export, 1925-1945 (Hectares)

	Total	Arab Owned	Jewish-owned	Jewish owned as % of total
Planted by the end of 1925	3,050	1,900	1,150	38
Planted 1926-1939	26,950	12,500	14,450	54
Total planted by end of 1939	29,950	14,400	15,550	52
Total planted at end of 1945	25,000	12,000	13,000	52

Source: Kamen (1991: 208).

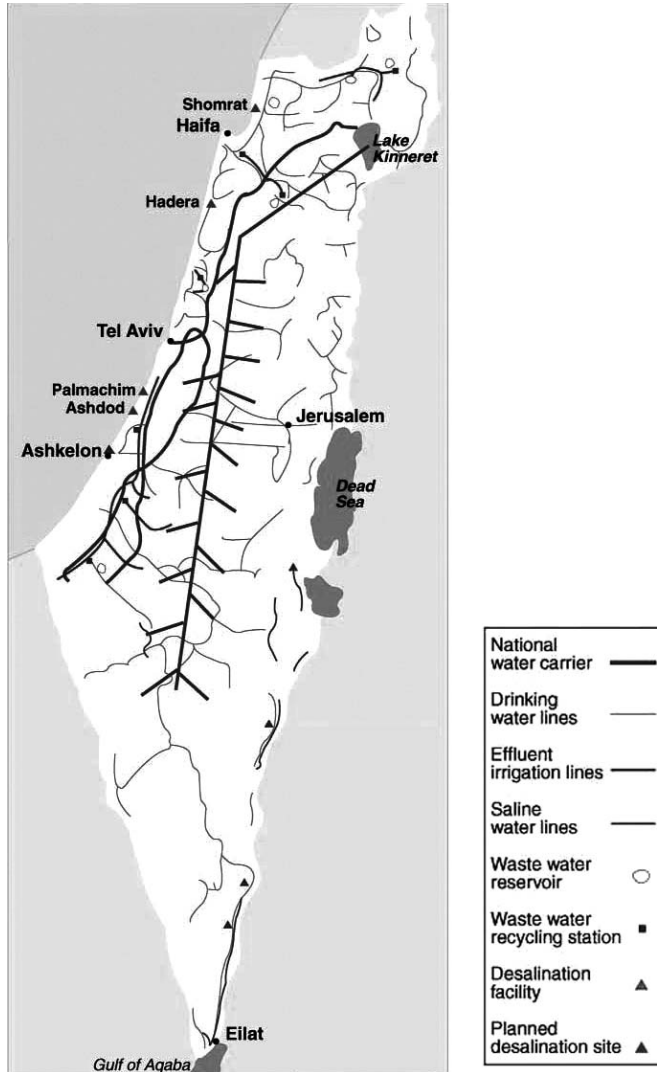
3. ISRAELI AGRICULTURE. DEVELOPMENT OF A RESOURCE IN SERVICE OF AN IDEOLOGY

Israel's agricultural system is characterized by an intensive system of production employing the latest engineering techniques and biotechnology. It contributed 3% to GDP and employed 2% of the population in 2006. Agricultural output in 2008 was worth about \$5.5 billion, of which 20 percent was exported (Statistical Abstract of Israel, 2008).

Israel's agricultural system has evolved in large measure due to political and historical factors that extend back beyond the establishment of the state of Israel. In Israel, endogenous drivers of agricultural policy, including religion, culture, socioeconomics and demographics, take on monumental importance. Foremost among these is the role of Zionism in shaping agricultural and water policy. Agriculture was integral to the realization of the Zionist project since its inception. The settlers were led by a pioneering spirit and a back to the earth ethos, which aimed to wed the people to the land. This agrarian vision had two branches –conquering the land through its transformation and redemption, and simultaneously the creation of a new Jewish man. «In exile, the story goes, the Jewish people have been separated from nature, forbidden to work the soil and forced to be urban. The Jewish people will go back to the land, and the will be rebuilt by the land. In their return Jews will again tend to the earth and draw strength from their renewed biological rootedness» (Schoenfeld, 2004: 6).

3. PL is Palestinian Pound, equivalent to the sterling pound.

MAP 2
National Water Carrier, Israel



Source: Reprinted with permission from Tal, A. (2006): «Seeking Sustainability: Israel's Evolving Water Management Strategy», *Science*, 313, 1081-1084.

The central goal of Zionism was to create a geographical Jewish presence in Israel/Palestine. Collective agricultural settlement of the land was seen as an integral part of this process due to its role in population dispersal, securing peripheral areas and nurturing a bond between the Jews and their homeland. The other important goal for agriculture was self-sufficiency, in light of Israel's inability to trade with her neighbours. For these

reasons, Israeli is one example of a country pursuing agriculture despite its unprofitability, not to mention the unsuitability of the ecological environment to the agricultural activity (Da'na, 2000: 419) This can be most clearly evidenced through Israel's policy of water development. As Lipchin remarks (2003: 69): «In a country with naturally scarce water resources it is astonishing to see that Israel's water policy does not reflect this natural scarcity». For example, for a long time much of Israel's land mass was used to grow cotton, a water and pesticide hungry plant, rather than food (Richter & Safi, 1997: 211).

The Zionist historical claim to the land also extends naturally to water resources. In Israel all water resources within the country belong to the state, which runs a highly centralized system of water management and development. Through the National Water Carrier (see Map 2), completed in 1964, water is diverted from the North (average rainfall 600 mm) where it is considered to be «abundant», to the water poor south (average rainfall 150 mm) at highly subsidized rates, allowing for the growing of a wide array of crops, many ill-suited to the arid conditions (Shevah, 2000). Similarly water is conveyed up the high altitudes of the Golan heights to support agricultural enterprises for defense purposes. Beside the economic cost, this also carries an extremely high energy cost (Temper, forthcoming).

Yet Zionist ideology also interfaces with agricultural policy in numerous other ways, contributing to the unique character of the Israeli agricultural system. These include: the establishment of collective farms, including kibbutzim and moshavim, to defend against attackers in the early years; large capital inflows from the Jewish Diaspora, the United States and German reparations, permitting modern technologies; a preference for expensive Hebrew labour, including prohibitions against Arab labour; and large subsidies to the agricultural sector of inputs such as water, due to their strategic importance in laying claim to the land. Along with the agrarian vision, the Jews brought with them a European modernizing initiative, which saw the need to redeem the landscape and shape it to the settlers' will. This implied a series of sweeping changes in agricultural production methods and land use patterns, which would transform the country.

3.1. Early Settlement during the Yishuv (1882-1948)

3.1.1. The Policy of Hebrew Labour

During the period of large scale Jewish immigration to Palestine from 1882-1939, two categories of settlers came. The first were referred to as capitalists, who set up farms or businesses operating under capitalist conditions, hiring the cheaper Arab workers. The first

agricultural settlements set up in 1882 by Baron Rothschild followed this pattern under the Palestine Jewish Colonization Association (P.I.C.A.) The Hope Simpson report describes the relations between the PICA settlers and the Arabs as excellent. The Jews often developed and improved their Arab neighbours' land along with their own and employed Arabs to tend their plantations, cultivate their fields, and pick fruit. «As a general rule,» writes Hope-Simpson (1930: 50), «the P.I.C.A. colonisation was of unquestionable benefit to the Arabs of the vicinity».

In contrast, the settlements set up and funded by the World Zionist Organization (WZO) and the Jewish National Fund (JNF) instituted a policy of «self-labour». This implied that each settler, or each cooperative group should have no more land than the area that they were able to cultivate with their own labour. The settlements of the WZO expanded quickly only following World War 1. Shafir (1996) details the evolution of the relationship between the WZO and the second wave (aliya) of immigrants (1904-1913) which led ultimately to the exclusive Hebrew labour policy and the deterioration of the relationship between Arabs and Jews in Palestine.

The second wave of immigrants was made up primarily of Eastern European workers, many inspired by Bolshevik ideas. The new immigrant workers soon realized that Palestine, still semi-feudal at the time, had no labour opportunities for them and they could not compete against skilled and cheap Arab labour. Jewish farmers, up until then, had preferred the more affordable Arab worker. For example, 200 families in Zichron Yakov employed 1, 200 Arabs (Aharoni, 1991: 58). The new labour activists came to realize that they had to convince Jewish employers to hire fellow Jews and that they could only succeed in doing this if the planters perceived Arab labour as threatening their personal and collective existence (Shafir, 1996: 10). The labourers, and the Labour movement they gave birth to, needed the Zionist movement as their new patrons, while the Zionist movement needed the workers to engage in the most difficult and least rewarding tasks in the settlement process and to provide the image of the pioneering settler for the world community. The Kibbutz is the idealized representation of this alliance, and the first one, Degania, was established in 1909. The kibbutz emerged as the organizational manifestation of an ideological position that the Jew be «neither the exploited nor the exploiter» (Shafir, 1996).

The Kibbutz was an organizational system of communal production and consumption. The alternative organizational form was the moshav, which employ cooperative principles regarding production but maintain traditional forms of consumption, live in nuclear families and spend their profits as they please. Kibbutzim and Moshavim still accounted for three quarters of the total area producing crops in 1999. The socialist-col-

lectivist ideology was reinforced through several mechanisms. Firstly, it was thought that private ownership of the land would lead to a preference for Arab labour. Second was the conviction that under the harsh conditions of Palestine only communal settlements could survive. Thirdly, was the idea that without an agricultural basis connected to the land, no Jewish economy or state could emerge. There were three functions which the kibbutzim had always taken on themselves –absorption [of immigrants], settlement, and defense».

The Zionist settlement plan had the twin goals of conquest of the land and conquest of labour, as it was seen that the first could not be achieved without the second. The new immigrants, using Marxist ideology, argued that using Arab labour on Jewish farms was tantamount to colonialism, and thus instituted a policy of exclusively Jewish labour and Jewish produce. The result of this was the creation of a distinct Jewish enclave economy «projected onto the indigenous Palestinian population but separate from it» (Weinstock, 1973: 52). The pragmatic goal behind the ideology was to suppress the competition of cheap Arab labour, thus guaranteeing the comparatively high wages of the Jewish worker (a necessary condition for attracting immigration) and a market for Jewish goods.

The Zionist labour policy was successful, although the costs were high. Prime among these was the growing resentment between the two communities, evidenced by the 1929 riots and subsequent Arab revolt of 1936. The Hope Simpson report attributes the Hebrew Labour Policy in part to the economic difficulties of the fellah and for that reason recommends halting land sale to Jews. He writes:

Actually the result of the purchase of land in Palestine by the Jewish National Fund has been that land became extra territorial. It ceases to be land from which the Arab can gain any advantage either now or at any time in the future. Not only can he never hope to lease or cultivate it, but, by the stringent provisions of the lease of the Jewish National Fund, he is deprived forever from employment on the land (Hope Simpson, 1930: 54).

3.1.2. The «California Model»

The policy of Hebrew labour also had important ramifications for the agricultural system, particularly the labour-saving technologies employed. The citrus industry is representative of the forms of production favoured by farmers, originally in the private sector and then in the Kibbutzim –a model adopted from California (Karlinsky, 2000: 28). He writes, «Orange growers were keenly aware of a comprehensive model, replete with ra-

tional, social, organizational, and agro-technical elements that could be held up as a prototype for duplication and a standard for self-criticism».

According to Karlinsky (2000: 28), the attraction lay not only in the fact that climactic conditions are similar in the two regions and that California was the largest citrus producer at the time. «The main advantage of the California model over the others –and, because of this, its special attraction for the Hebrew farmer– lay not only in production tonnage and climatic conditions, but in the unique synthesis of high-level technological development, centralized organization, and close co-operation between free enterprise and government.» The California «gospel» was also promoted by the Director of the Central Bank for Co-operative Institutions, Zvi Viteles, who promoted «the need to divert the citrus' industry's direction towards small private units that would employ minimum hired labour, and be based on advanced technology and co-operative organization (Karlinsky 2000: 31). The other element adopted was the synthesis of public and private capital, including investments in infrastructure (water delivery and roads) that would facilitate investment.

The California Model, first adapted to the citrus industry and later expanded to other products, helped with the creation of a separate Zionist economy in Palestine through the introduction of labour-saving machinery, which reduced the need for Arab labour. The second goal –that of maintaining the farmer's income at the same level of the urban dwellers, was only accomplished with the help of large subsidies. For example, the agricultural industry uses two thirds of all the water in Israel, at highly subsidized rates, and water is kept the same price all over the country, even in the desert and the mountains in the north, where costs of transportation are much higher. High agricultural incomes were also achieved through highly subsidized inputs, producers' cartels, avoidance of surplus through the use of production quotas, and absorbing the surplus by destroying it when necessary (Aharoni, 1991: 212), or dumping it into the Palestinian market.

3.2. The Birth of the State (1948)

Following the 1948 war, the state of Israel was founded on 78% of the territory of Palestine, considerably more land than the partition plan had proposed (52% of the territory was earmarked for the Jews under the plan, who represented 7% of the population at the time). About 418 villages were depopulated or destroyed during the war and 714,000 Palestinians lost their lands (Isaac *et al.*, 2004). Arab ownership fell from 570,000 ha in 1945 to 76, 800 ha in 1949/1950 (Lewis, 1996), a loss of 87% of the area. The expropriated land was among the most fertile and productive. Almost all Arab-owned citrus groves and banana plantations were lost.

Under various provisions that the Israeli parliament, the Knesset, promulgated beginning in 1948, vast quantities of land were expropriated. These included the Emergency Land Requisition Law which authorized expropriation «for the defense of the state, public security and the absorption of immigrants; a law enabling the minister of agriculture to take control of «waste» (uncultivated) land; the Absentees' Property Law of 1950, which allowed the government to seize the land of both external and internal refugees. The latter were referred to as «present absentees» (Quigley, 2005: 107). In 1953 The Land Acquisition Law gave the government title over the lands acquired under the Absentees law of 1950. «It provided for compensation but most Arabs refused it, preferring to preserve their claim to the land (...) The value of the lands taken from the Palestinian Arabs was estimated at 100 million pounds. It included stone quarries, 10,000 acres of vineyards, 25,000 acres of citrus groves, 10,000 business establishments, 95% of what became Israel's olive groves and 50,000 apartments.» The government expropriated 85% of the land of the Bedouin of the Negev desert (Quigley, 2005: 108-109). For example, in 1951-52, former Arab groves produced 1.25 million boxes of fruit, of which 400,000 were sent abroad. Arab fruit sent abroad provided 10% of Israel's foreign-exchange earnings from exports in 1951. In 1949 the olive produce from confiscated Arab groves was Israel's third largest export, after citrus fruit and diamonds (Jiyiris, 1976).

3.3. Land Use Changes in Israel (1943-2001)

When studying Israel/Palestine, one must be aware that due to conflicting claims and political reasons, data must be approached with caution. Official published statistics are often used to serve political purposes. The choice of time-scale under study also takes on great relevance. For example, the Israeli government has the habit of describing changes since 1948, the founding year of the state of Israel. Thus the claim that «Since...1948, the total area under cultivation has increased from 165,000 ha to some 420,000 ha (Fedler, 1998)» may be true. Yet this achievement is qualified by the fact that the vast majority of this land was under cultivation by Arab farmers prior to 1948. As Alan George points out, «Israel began its life with a vast stock of abandoned farmland and in the early years of the state this land was reclaimed at an impressive rate». While the area under cultivation doubled from 1948-49 to 1952-53, 350 of the 370 new settlements were located on refugee property (George, 1979).

Yet while the agricultural area may not have expanded substantially in area since the mandatory period, it changed environmentally and made impressive productivity gains. During the Mandatory period, population density was greater in the hill regions due to greater security there from Bedouin raids, as well as the risk of malaria infection in the

lowlands. The draining of the swamps such as the Hula and the subsequent eradication of malaria enabled Jewish agricultural settlement in the lowland areas and the coastal plain. The expansion of desert agriculture, made possible by the National Water Grid, pushed the agricultural frontier further. Yet despite the exhortations of Israel that they have made the desert bloom, Table 5 shows that we are not talking about huge tracts of land brought under cultivation⁴.

TABLE 5
Cropping Patterns in Israel, 1943-2001 (hectares)

	1943	%	1960	%	1980	%	2000-2001	%
Orchards	83,100	19,1	72,200	19,8	88,600	21,8	84,840	25,7
Citrus	26,700	6,1	32,800	9,0	39,600	9,7	25,330	7,7
Field Crops	278,000	63,8	245,200	67,3	259,300	63,8	184,960	56,0
Wheat	133,400	30,6	59,300	16,3	97,600	24,0	64,150	19,4
Barley	118,200	27,1	59,600	16,4	26,700	6,6	2,030	0,6
Rough Fodder	—		67,100	18,4	39,700	9,8	64,050	19,4
Cotton	0		10,500	2,9	62,200	15,3	14,620	4,4
Vegetable*	30,600	7,0	26,300	7,2	35,500	8,7	55,110	16,7
Miscellaneous	44,000	10,1	15,900	4,4				
Irrigated Area	36,200	8,3	130,500	35,8	203,000	50,0	186,600	56,5
Rainfed area	399,500	91,7	234,000	64,2	203,400	50,0	143,660	43,5
Total Cropped Area	435,700		364,500		406,400		330,260	

* Includes potatoes and melons. Source: Own elaboration from Survey of Israel (1985), and *Statistical Abstract of Israel* (2002).

From Table 5 we can see that changes in cropping patterns from 1943-2001 are not as drastic as might be expected. This weighs against the assertion that Fellah farming and cropping patterns were irrational or «uneconomical.» The most visible change from 1943-2001 is the decline of wheat production and most spectacularly of barley, which went from occupying a third of the total crop area to less than 1%. The expansion of irrigation is the other notable change, increasing by more than a factor of 5 in little more than 50 years.

We also see several reversals in cropping patterns: the area under citrus doubled from 1943 to 1970, reaching its peak area of 42,000 hectares in that year and then declining. By 2000, citrus only occupied 20,000 hectares –an area remarkably similar to that of 1943. This is explained by the shift away from water-intensive crops. Other water-hungry

4. While the 1943 is the highest, this figure includes all of greater Palestine, while from 1960 this excludes the occupied territories.

crops follow similar trajectories. The commercial production of cotton began in 1954 and by 1980 it accounted for 13.7% of agricultural output by value. In 1980 the area under cotton, 62,190 hectares, was second only to wheat and despite its irrigation intensity, it represented 70% of all crops grown in the Negev Desert. Yet by 1990, this figure shrank to half and by 2000 only 11,100 hectares were planted with cotton. A report from the State Department of Israel explains this decline due to the global drop in cotton prices (Levy, 2002)⁵. Water-saving may also play a part, although cotton, a non-edible crop, is irrigated with effluents from wastewater. The decrease of these crops has been accompanied by growth in the vegetable sector and in the flower sector. The area devoted to vegetables did not increase much until after 1980, which is when greenhouses and hothouses devoted to export-oriented vegetable crops began to appear. Approximately half the vegetables are grown in covered conditions –and half of this is in the desert, while all flowers are grown in greenhouses with roses grown in heated greenhouses.

3.4. The Technological Fix –Israel’s Water- Saving Technologies

In the first 50 years of Israel’s history, irrigated land has increased from 50,000 ha to about 220,000 ha –covering approximately half of the land considered arable estimated at 430,000 ha. Meanwhile the water used has increased from 400 MCM to about 1200 MCM annually. Agriculture consumes 60% of fresh water resources of the country, down from 77% in the sixties (Shevah, 2000).

Renewable water resources in the lower course of the Jordan equal 3.3 billion cubic metres, with Israel having control of 2 billion (344 cm per capita annually), 1 billion for Jordan (157 cm per capita) and 296 million cm for Palestine (93 cm/capita). All three countries thus fall far below the minimum annual threshold of 1000 cm recommended by the World Bank. By 2000, about 2500 wells across the country were drawing water in excess of aquifer recharge rates (Ferragina, 2008: 163). As acknowledgement of the scarcity of water resources has progressed, the agricultural sector has adopted a variety of technologies to increase the efficiency of irrigation and to harvest alternate sources of water for irrigation. Israel’s most famous agricultural technological innovation is drip irrigation, developed by the Netafim Corporation and first introduced in the sixties to permit agricultural settlement in desert areas.

The technology was developed at Kibbutz Netzarim by water engineer Simcha Blass in the late 50s. Netzarim, founded in 1946, was one of the first Kibbutzim in the Negev initiated by the JNF, despite the tough conditions and unsuitability for agriculture for strategic reasons to help secure the inclusion of this area in the foreseen Jewish state in

the UN partition plan⁵ (Lehn, 1988: 81). The gambit was successful, as the whole area of the Negev was partitioned to the Jewish state. Rainfall averages from 100-180 mm. Their website⁶ lists the problems they confronted when founding the Kibbutz –no water at all for several years and highly saline soil that made agriculture close to impossible. In 1965, Simcha Blass and the Kibbutz signed a contract to start the Netafim company and produce his design of spaghetti micro-irrigation drippers. The corporation today operates in 112 countries with annual sales in 2006 of \$397 million. Drip irrigation has now been expanded to many other regions due to its many advantages, chief among them irrigation efficiencies of 80% or more. Approximately 50% of the irrigated area in the country is now under drip irrigation (Melamed, 1988).

Rather than flooding the plant, drip irrigation allows continuous application of water and fertilizer to the roots of the plant, spoon-fed through narrow tubing with drippers to regulate flow. The benefits of drip irrigation are most noteworthy in marginal soils, as sprinkler irrigation causes considerable water losses due to a poor infiltration rate. The major drawback of drip irrigation is its prohibitive cost. Especially considering that it is often used in conjunction with automated irrigation devices, including computers that centrally control all aspects of irrigation. These technologies have decreased water requirement per unit of land from 8,700 m³/ha in 1975 to 5,450 m³/ha in 1998 (Shevah, 2000), raising water delivery efficiency from 64% in the 1960s to 90% today (Tal, 2002: 14). Other non-conventional water resources in Israel include reclaiming wastewater effluents, cloud seeding and desalination.

3.5. The Effluents of Affluence

Beginning around 1970, sewage came to be viewed by the Israeli agricultural community as a valuable nutrient resource in agriculture. It was discovered that agricultural yields from sewage-irrigated plots were up to two to three times greater than plots irrigated with normal water, even when fertilizer was added (Tal, 2002: 223). Israel was the first country in the world to make effluent recycling a part of its water management strategy. By 2000, Israel was recycling 300 MCM of wastewater for agricultural usage, a reuse rate of 66%, compared to the US rate of 2.4% (Tal, 2002: 224). Due to pathogens and bacteria, raw sewage is only permitted in crops such as cotton, fodder and produce that are not consumed raw. However, these proscriptions were often ignored causing a public health crisis throughout the 70s and several outbreaks of cholera (Tal, 2002: 227).

5. This strategy proved very successful. An early example of the tactic of creating facts on the ground.

6. www.hatzerim.org.il/info/files/hatzerim_eng.htm?nojump

Desalination technology is also making inroads with several small and medium plants operating including a 10,000 CM a day desalination plant in Eilat, with much more capacity planned (Shevah: 2000). Other research is being devoted to the use of brackish water for irrigating high salinity resistant crops as well as biotechnology research into breeding salinity-resistant crops, particularly oranges. The effects this will have on soil salinization will apparently be addressed at a later date.

Israel is a major consumer as well as a producer of agro-technological inputs. Exports of agricultural inputs in 2000, including chemicals and fertilizers, were almost double those of exports of agricultural produce. A key to land reclamation by the early settlers was fertilizer use. Fertilizer imports expanded from 1,077 tons in 1922 to 14,698 tons in 1937, causing problems of nitrates in ground water in rural wells. By 1970, 300 wells had reached the recommended 45 mg per liter ceiling, with some showing levels of up to 100 mg per liter (Tal, 2002). The powerful lobby in Israel prevents the tightening of laws regarding fertilizer use, so Israel has turned to treatment options for wells instead. For example, an electro dialysis provided by Israeli companies can reduce nitrate concentration by 50%, at a cost of one shekel (approx US \$0.20) per cubic meter. This price rises as concentration increases. Not much thought is given to how poor Palestinians, who share well water with Israel, will pay for this process.

From the 50s to the 70s pesticides containing organochlorines were used extensively. DDT and BHC, sprayed on cowsheds, contaminated cow and human milk. During the late 70s, studies showed concentrations in breast milk of BHC of up to 2500 parts per billion (ppb) –800 times higher than the US level of 3 ppb. A correlation was found between these levels and the rising risks in breast cancer in Israel in the 1960s and 1970s. With the elimination of organochlorine pesticides, these levels dropped. These have now been replaced by organophosphate pesticides, which come with their own accompanying health risks (Richter & Safi, 1997). Integrated Pest Management is currently being more widely adopted.

4. AGRICULTURE IN THE WEST BANK (1967-2000): MODERNIZATION AND DE-DEVELOPMENT

The Arab-Israeli war of 1967 resulted in the occupation of the West Bank, including East Jerusalem, the Gaza Strip, the Golan Heights and the Sinai Peninsula. Previous to 1967, the West Bank had been the most important agricultural area of Jordan exporting 80% of vegetable production and 45% of fruit production to Jordan and the Arab World (Butterfield *et al.*, 2002: 2).

The situation of Arab farmers deteriorated after the occupation as Israel gained complete authority over the land and water of the region. After the occupation, the agricultural sector suffered considerable decline, primarily due to new restrictions placed on them for land and water access. Between 1968/1970 and 1983/1985 the percentage of agricultural contribution to the overall GDP in the West Bank fell from 37-54% to 19-25% (Awartani, 1993). Between 1969 and 1985, the agricultural labour force, as a percentage of the total labour force, fell from 46 to 27.4% (Isaac *et al.*, 1994).

A common Israeli claim is that Israeli policies had a favourable influence on the socio-economic conditions of the OPT (at least until the 1st intifada in 1987). This is demonstrated by showing increases in per capita income, higher rates of consumption expenditure and advancement in educational enrollment as statistical proof of this development. In the agricultural sector claimed benefits include «increased productivity and the opening up of the Israeli market», which have led to large increases in agricultural income (State of Israel, 1986). While it is true that at the outset there were important productivity gains due to technology transfer from Israel and access to new markets, the Israeli figures should be taken with a grain of salt. Claimed growth rates of the value of agricultural output and net income in agriculture for the West Bank and Gaza Strip of 12-13 per cent during 1969 to 1975 were taken with 1967/68 as the base year. This was the first year of the occupation and the subsequent state of unrest combined with the fact that precipitation was low. When the period 1968-70 is taken as a base, the growth rate falls to 6.5% (Awartani, 1993). Moreover, as Nasser Ali (n.d.) reasons, one must differentiate between (quantitative) growth, and development, which can be seen as improving living conditions and a reorganization of the social and economic system to the people's benefit. Ali writes, «The constraints imposed by the Israeli occupation have not only halted balanced development but have led to de-development in general and in particular of the agricultural sector which has historically been the most productive sector of the Palestinian economy.»

4.1. Draining of Land and Labour

The share of agriculture in the WB GDP fell from 34% in 1970 to less than 16% in 2000. In the Gaza Strip it fell from 31% to 18% respectively. The area under cultivation also dropped, decreasing by 30% in the West Bank, while Table 6 shows the increasing land fragmentation over the 25 years of occupation. In 1970, slightly under 50% of holdings were beneath 2 ha; by 2005, 56% were less than one hectare and almost 75% under 2 hectares (Farsakh, 2004).

TABLE 6
Land Distribution by Size of Holding in the West Bank (1970 and 2004/5)

Size of Unit (ha)	Size of holding	% of total cultivated area		% owners in total holdings
	1970	1970	1970	2004 / 2005
Less than 1*				56.0*
0-2	22,010	10.5	48.0	74.1
2-5	49,970	23.9	29.6	17.1
5-10**	57,950	27.7	13.8	4.4**
10+**	79,180	37.9	8.6	4.4**
Total	209,110	100.0	100.0	100.0

* Holdings under 1 ha only available for 2004/2005. ** For 2004/2005, 4.4% are from 5-8 ha and 4.4% are 8 ha and up. Source: Own elaboration from Farsakh (2004: 2), (for 1970 data) and Palestinian Central Bureau of Statistics, 2005.

According to Farsakh (2004), The Palestinian economy has been transformed in the past 30 years from an agrarian economy to a service-oriented economy directed towards Israel. This transformation took place through Israeli influence in the rate of Palestinian labour transfer, the level of productivity and exposure to external markets, and above all the ability of Palestinians to control their land and its use. The primary concern of the occupying power was to prevent Palestinian capital accumulation and competition with Israeli agriculture, and maximize Israeli appropriation of land in the West Bank/Gaza Strip.

One of the most powerful impacts on the agrarian sector of Palestine was the effect the occupation had on labour release and transfer. The number of farm workers in the WB fell from 42.5 thousand in 1970 to 29.8 thousand by 1987, before picking up again as a result of the first intifada and the consequent restricted access of labourers to Israel (Table 7). However, unlike the Lewis model of development (Lewis, 1954), these workers did not move to more productive sectors of the domestic economy, but were absorbed as day labourers in low-paying Israeli jobs in construction and agriculture. Palestinian wage earners in Israeli agriculture increased from 2.6 thousand in 1970 to 6.2 thousand by 1987 (Table 7). During this period, Palestinian labour employed in the Israeli economy, including the settlements, represented over one third of the Palestinian labour force. This strategy of allowing out-migration of labour is viewed by Farsakh as one means of preventing the transfer of Israeli and foreign capital to the OPT (Farsakh, 2004: 3).

TABLE 7
Distribution of Workers Employed in the West Bank
and Israeli Agriculture (1970-2000) (Thousands)

Years	Total Number in Domestic Agriculture	Farmers Employed. Dom. Agr.	Wage Earners. Dom. Agr.	Wage Earners in Israeli agr.
1970	42.5	34.0	8.5	2.6
1973	30.0	26.0	4.0	3.4
1974	36.2	27.4	8.8	4.5
1977	31.0	28.1	2.9	4.5
1980	31.7	28.9	2.8	4.0
1985	28.4	25.8	2.6	5.1
1987	29.8	27.4	2.4	6.2
1990	37.8	36.0	1.8	5.5
1993	37.4	34.8	2.6	4.0
1995	32.7			5.7
1997	46.9			
2000	44.6			10.4
Total Change per Period				
1970-1980	-10.8	-5.1	-5.7	1.4
1980-1987	0.9	1.3	-0.4	2.5
1987-1993	7.6	7.4	0.2	-2.2
1995-2000	11.9			4.8

Source: Farsakh (2004: 4). Based on Israeli and Palestinian Central Bureau of Statistics labour data.

4.2. Rising Productivity

Another impact of the occupation has been technology transfer from Israel to the OPT (see Table 8), along with rising productivity. Purchased inputs as a percent of the value of production rose from 15% to 30% from 1967 to 1985 (Kahan, 1987). The number of tractors in the WB rose from 488 units in 1970 (418 ha per tractor) to 3560 units in 1985 (47 ha per tractor.) In 2005, 11, 385 tractors were in use in the WB (PCBS). Fertilizer use increased from 33 kg per ha in 1969 to 95 kg per ha in 1981.

TABLE 8
Fertilizers, Animal Power, Tractors, Labour in the West Bank (1967-1985)

	Fertilizer (000 tons)	Tractors (Units)	Animal Power (units)	Labour Employed	Cultivated Area (000 hectares)	Labour per Tractor	Cult. Area (ha)/Tractor	Fertilizer (tons) /Cult. Area (ha)	Animal Power /Cult. Area (ha)
1967/68	4,000	120	47,000	*	*				
1969/70	6,800	488	45,000	44,400	204	91	418	33	0,22
1972/73	9,500	800	*	*	*				
1974/75	14,500	1,400	27,406	*	*				
1975/76	15,000	1,300	27,340	31,700	199	24	153	75	0,14
1979/80	18,000	1,883	20,863	*	*				
1980/81	18,500	2,145	*	28,500	195	13	91	95	
1981/82	*	2,606	20,603	*	*				
1982/83	*	2,944	*	*	*				
1983/84	*	3,311	20,671	29,200	172	9	52		0,12
1984/85	*	3,560	20,489	28,300	167	8	47		0,12

* No Data. Source: Own elaboration from Kahan (1987: 134).

4.3. Mechanisms of Control: Expropriation, Integration and Externalization

Israeli control over the West Bank is laid out in military order 2 (June 7, 1967) placing power of government in the hands of the West Bank commander of the Israeli Defense Forces (IDF). Legislation is in the form of military orders of which over 1500 have been issued. General security measures, military orders concerning water, transport, planting and labeling allow a great level of control over Palestinian agriculture (Drury et. al, 1992). The occupation is characterized by expropriation, integration, and externalization: expropriation of the resources, particularly water and land; integration of the economies, leading to a captive market and a captive labour force; and externalization of the environmental costs.

4.3.1. Expropriation

Israel has taken possession of some 150,000 ha of land in the West Bank since the occupation –representing approximately 27% of the total land area. Moreover, two of the three aquifers Israel depends on lie principally under the West Bank, with the water draining into Israel. Thus over a third of the water that Israel uses originates in occupied territory. To protect its water resources and to avoid saltwater intrusion into the mountain aquifer, the Water Unit has banned the drilling of any new Arab wells in the occupied areas since 1967 (Khoury, 1980: 77). With regard to total water consumption, an Israeli uses 1959

cubic meters per year (CM/year), compared to an average Palestinian use of 238 CM/year (Butterfield *et al*, 2000). Two million Palestinians (1/3 of the population) control only 8% of the water resources and 13% of the land (Tal, 2002: 357). Israeli restrictions have drastically limited the irrigation of Palestinian land so that today only 6% of the West Bank land cultivated by Palestinians is under irrigation, the same proportion as in 1967. By contrast, about 70% of the area cultivated by Jewish settlers is irrigated.

This extremely limited development of irrigation is one salient aspect of West Bank agriculture when compared to both Israel and to the East Bank of Jordan. This has the effect of increasing risk and discouraging investment. «An agricultural system operating under such uncertainty would not be in a position either to risk heavy investments in mechanization or to carry a high financial burden in the form of wage costs... In the absence of an assured water supply, the risk of making other forms of capital investment seriously restrains the required impetus toward technical change in the sector» (Van Arkadie, 1977). This has led to the preference for low-risk, low-input crops such as olives on one hand, and a small percentage of capital intensive livestock breeding and cash crop production on the other. Farmers have been particularly impacted by the expropriation of the Eastern Slopes of the West Bank, a region traditionally used for grazing of flocks. As a result they have turned to hybrid species imported from Israel, such as the Assaf sheep and Friesan cows, which are suited to high input breeding and thus have had to turn to costly feed imports.

Apart from military closures, much fertile land and water resources are used by settlements in the West Bank. The total cultivated area by Israeli settlements in the West bank is estimated at some 56,300 ha, accounting for 3.4% of the cultivable area in the West Bank. In addition, there are some 1,148 ha that are used by the settlers as natural pastures for grazing.

As of 2002, Israel has begun construction on a physical separation barrier, which consists of a series of fences separating Israel and the West Bank. The construction of the barrier has involved the uprooting of over 100,000 trees and the destruction of over 30 km of water networks. Moreover, the barrier reaches 6 km into the green line and has alienated over 12,200 ha of land from its owners, in the process separating 51 communities from their agricultural land. The districts most affected are among the most agriculturally productive of the WB. The planned placement of the barrier leaves many lands owned by Palestinians living to the east of the barrier on the other side of it (Hammami, 2005).

4.3.2. Integration

The occupation has also witnessed a process of economic integration without parallel political integration or representation. The OPT are highly dependent on Israel for basic goods and consistently run a trade deficit with Israel. Citrus from the OPT for example is exported to Europe through Israel and then sold back to the Palestinians as processed juices and preserves because no facilities exist to process the raw materials. Almost all of the OPT agricultural imports come from Israel, and are either grown there or imported through Israeli firms. A UN study in the mid 1980s showed that 50 percent of Palestinian imports from Israel had been produced domestically prior to the occupation (Awartani, 1993).

Palestinians procure from Israel some 90 to 100 thousand tons of fruits and vegetables annually (Awartani, 1993). While a small portion of these exports are produce not grown locally, most are products with which the OPT suffers from severe surpluses, yet are offered cheaper by the subsidized Israeli market. Meanwhile 5,000 tons of fresh fruit and vegetables are exported to Israel and around 40,000 tons of oranges are exported to Israel juice processing factories. Therefore, the physical agricultural trade deficit of the OPT to Israel is in the range of 40,000 to 70,000 tons. This fluctuates as Israel uses the OPT as a buffer to fill shortages and stabilize prices. Israel is highly selective about what it allows across the green line and its practice of holding up agricultural produce has a crippling effect on local farmers.

Due to the high levels of subsidization of Israeli agriculture, Palestinian growers operate with considerable comparative disadvantages. For example, in 1981 the total value of Israeli government subsidies to agriculture equaled \$1.5 billion –equivalent to twice the total value of agricultural output for that year (Awartani, 1993). The unique perception of the role of agriculture in building the State has been expressed in generous support programs covering all aspects of production and marketing and the full range of services supportive to agricultural development.

Israel also helps regulate risk, regulates supply through marketing boards and promotes agricultural exports. Israel's subsidies, particularly cheap water, are particularly damaging to Palestinian agriculture, and enervating, due to the fact that the 90% of the water of the (inequitably) shared Mountain aquifer resources originates as rainwater in the West Bank. Presently, more than 85% of the Palestinian water from the West Bank aquifers is taken by Israel, accounting for 25.3% of Israel's water needs. While subsidy levels have been decreasing since the 1980s, Israel has devised other means of restraining Palestinian agricultural activity. Chief among these is the permit system. For example military or-

der No. 1015 (Aug. 27, 1982) gave the power to authorities to require permission for the planting of fruit trees other than that for personal consumption. The appendix to the original order limited its scope to plums and grapes but this was soon expanded to include eggplants and tomatoes (military order 1039) and then onions and onion seeds (order 1015). Potatoes are also tightly controlled. Permits to grow tobacco are not issued and pursuant to military order No. 818, WB farmers cannot engage in floriculture.

Although tree crops are more resistant to fluctuations in rainfall, one manifestation of Israel's control is the preference of the Israeli authorities to annual crops such as vegetables and grains as opposed to permanent crops such as olive, grape, citrus and almond. There are strict regulations on the planting of citrus orchards and numerous uprootings of olive trees. According to the Palestinian Central Bureau of Statistics, over 1 million trees, mostly olive, were uprooted or damaged during the 2nd intifada between 2000 and 2004 (Palestinian Central Bureau of Statistics, 2004). All pest control demonstrations in olive orchards have been stopped since the early 1970s. Israel also tries to stop growth in high value crops such as strawberries, avocados and dates, which are considered to be «Israeli Specialties». This despite the fact that dates are seen as a particularly economically viable crop for the OPT due to its resistance to salinity (Faten & Isaac, 2001). These quotas, while they can be used to prevent gluts in production (as are set in Israel), are used primarily to protect Israeli farmers from Palestinian competition.

Other impediments to agricultural development include difficulty exporting produce due to security restrictions and bureaucratic hurdles regarding transportation. Trucks can be held up at the borders while produce rots. The added transport time also raise prices. The permits system also acts as a barrier to agro-industrial projects due to restrictions on physical planning and infrastructure (construction permits, animal sheds). Finally, Israel acts to suppress the activities of agricultural organizations.

4.3.3. Externalization

All of the pesticides used in the West Bank and Gaza come from Israel. Reference is often made of «anecdotal reports» of the sale of restricted pesticides by Israel to the Palestinian Authority. These however have not been confirmed. What is known is that cases of breast cancer, connected with restricted organochlorines, accounted for 34% of all new cancer cases in women in the OPT from 1990 to 1994, up from 13.8% of all new cases in 1979 (Richter & Safi, 1997: 212). Meanwhile due to the water shortage and Israel's tight-fisted distribution policies, Palestinian farmers sometimes resort to the use of untreated sewage as an irrigation source. As a result of this it was reported in 1994 that wa-

terborne diseases, particularly diarrheal illness, were second only to respiratory diseases in causing mortality among children, which account for 50% of the Palestinian population (Tal, 2002).

The generation of solid waste by settlers and military outposts, which are deposited on Palestinian land is another instance of environmental externalization with different standards in environmental protection on either side of the Green Line. The solid waste generated in West Jerusalem for example, is transferred to the unsanitary dumping site of Abu Dies in the West Bank, which overlays the infiltration area of the eastern sector of the aquifer (Isaac & Ghanyem, 2001).

The Israeli government has constructed seven industrial zones in the West Bank which occupy an area of approximately 302 hectares. It is estimated that these zones contain approximately 200 factories including industries such as aluminum, leather tanning, textile dyeing, batteries, fiberglass and plastics. Since these factories, as well as settlements, are located on hilltops for defense purposes, the flow of industrial and solid wastewater empties into adjacent Palestinian lands (Isaac & Ghanyem, 2001).

Israel has moved a number of its polluting industries from places inside Israel to areas near the 1967 border or inside settlements. One concrete example is Geshuri Industries, a pesticide and fertilizer company forced to close due to a court order in Israel because of negative environmental impacts on land, public health and agriculture, which subsequently relocated from Kfar Saba to Tulkarm in the WB (Isaac & Ghanyem, 2001).

4.4. Land Use Changes in the West Bank 1967-2001

In the West Bank, not much data on land use is available from 1948-1965. However, tracking the changes or lack thereof from the occupation of 1967 is of greater interest as it allows us to see how the occupation has impacted land use and land cover.

The occupation precipitated a series of changes in the local agriculture. Along with modernization came a change in the crop pattern, in many cases either to encourage complementarity with Israeli production, or more likely, to discourage competition. The decrease of the agricultural work force, which sought paid labour in Israel, caused a contraction in agricultural production and abandonment of lands. The expropriation of vast areas of land increased the stocking rate on the remaining grazing lands and a subsequent decline in the livestock population. Finally control over water use contributed to stagnation in the agricultural sector.

Most noted is the lack of growth of the irrigated in the quarter decade from 1966 to 2001. Since 1967 Israel has not given any permits to drill new wells in the West Bank and has not increased water allocations to the agricultural sector. Currently water scarcity constrains even the maintenance of these irrigated zones. Irrigation consumes 67% of all water resources even though only 6% of the area is irrigated and efficiency is relatively high (Faten & Isaac, 2001). The second salient point is the decrease of the area devoted to field crops, which shrank to a third of the area they occupied in 1966. The area devoted to wheat has been halved and the area devoted to beans (chickpeas, lentils and vetch) reduced from 14,380 ha in 1966 to 3,950 ha in 1983.

TABLE 9
Cropping Patterns in the West Bank. 1966-2001 (Thousand Hectares)

	1966	%	1975	%	1980	%	1985	%	2001	%
Field Crops	85,00	40,9	53,8	27,40	52,1	26,70	49,4	24,5	23,2	13,9
Wheat	45,98	22,1	33,0	16,80	22,4	11,48	19,0	9,4	17,6	10,5
Watermelon	7,10	3,4	0,3	0,15	1,2	0,62	2,2	1,1	**	
Vegetables	11,00	5,3	10,1	5,15	3,4	1,74	5,0	2,5	15,4	9,2
Fruit Trees inc. Olive	94,90	45,6	90,1	45,90	95,7	49,05	100,5	49,9	108,8	65,0
Total Irrigated Area	10,00	4,8	8,3	4,23	9,2	4,72	10,4	5,2	16,5	9,9
Total Rainfed Area	198,00	95,2	187,8	95,80	185,9	95,28	159,6	79,2	150,6	90,1
Total Cultivated Area	208,00		196,1		195,1		201,5*		167,18	

* Includes fallow. Source: Own elaboration from Survey of Israel 1985, Kahan (1987: 129) and Palestinian Central Bureau of Statistics Annual agricultural Report, 2002.

When examining cropping patterns in the West Bank, one is struck immediately by the percentage of the area devoted to olive cultivation. Olives have always been an important crop, yet according to the 1980 *Atlas of Israel*, in 1969 the 4,800 hectares of olives represented a quarter of the area under cultivation. This has expanded to over one half of the surface area by 2001. In 2001, permanent crops occupied 65% of the surface area while olives represented 53%. This spectacular growth has several causes. Olives are a preferred crop in Palestine because they can be grown in un-irrigated areas, often on marginal land of low quality. Their other advantage is the low amount of purchased inputs – often restricted to the cost of ploughing (Awartani, 1993). Moreover, due to the low profitability of the olive sector, farmers allocate to this branch, especially during the olive harvest, labour with low opportunity cost – the elderly, women and children and the owners’ spare time. However, perhaps the most important factor in the expansion of olives is the political imperative of showing a presence on the land to protect against expropriation by the Israeli military authorities. According to Cohen (1993: 16) «The need to put land into use is so pressing that Palestinian agronomists and economists encourage the

planting of olive trees, knowing full well that the olive market is currently glutted, and that crop prices are dropping yearly.» Another manifestation of this need to occupy land on the Palestinian side is demonstrated by the reluctance to leave land fallow and the consequent detrimental effects on soil quality of continuous planting.

The other visible effect of the occupation on cropping patterns concerns those crops which compete with Israeli products. The area planted with watermelons drops from 780 hectares in 1966 to a low of 30 hectares in 1975. Following 1980 and Israel's shift away from melon production and other more water intensive crops; production recuperates, reaching 410 hectares by 2001. From 1967 to 2001, production in the WB continued to shift towards export-oriented items and in particular goods which could easily access the Israeli market. By 2001, vegetables occupy 9.2% of the surface area.

5. CONCLUSIONS

This article has attempted to show the driving forces behind the creation of the two distinct agrarian systems which now exist on the territory of geographical Palestine. A historical and socio-economic analysis sheds light on patterns of land use and technology development and application. Beginning in the Mandatory period we see the development of a dual economy in Palestine. A settler-Jewish enclave relying on capital intensive, labour-saving methods; and the traditional economy, excluded from the capitalist sector yet forced to compete with that sector for resources.

The changes in the property rights regimes in the two systems also shed light on the evolution of the systems. The fellah was forced to abandon community economic cooperation and risk-sharing, with the result being severe land fragmentation that in time has made mechanization impossible. Ironically, the success of the settlers has been based on communal forms of agricultural organization and common land ownership –the kibbutz and the moshav. Yet, whether these communities could ever have been profitable without the massive levels of subsidization from the Zionist organizations pre-state and then by the state itself is doubtful.

Yet while the agricultural path chosen by Israel has increased the productivity of the land and multiplied yields, it has also come with a heavy environmental cost. The increasing use of materials and energy has caused widespread pollution, which in the case of Israel, has manifested in the nitrification of the water table, the salinization of the soil, cancer from overuse of pesticides, and the shrinking of the Dead Sea. Meanwhile, the West Bank is another extreme example of an agricultural path that has not been chosen but

rather imposed from the outside, amid severe restrictions regarding access to land and water and controlled access to technology.

In Israel and Palestine we see how conflict over resources and the inequitable distribution of environmental rights and access inevitably leads to unsustainable and uneconomical uses of the factors of production (land, water, labour and capital) and ultimately, the destruction of the shared environment. This phenomenon is particularly evident in the settlements of the West Bank –where the perception of extra-territoriality by the settlers leads to rates of resource use and consumption, which far exceed even those within Israel proper.

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