

# DESERTIFICATION AND ANCIENT DESERT FARMING SYSTEMS

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## Summary

The Negev, in the south of Israel, is an arid area where the natural conditions do not allow for subsistence agriculture. Nevertheless, numerous remnants of well preserved ancient agricultural systems are scattered over thousands of sq. km in the region. These form a tremendous network of terraced wadis and a special system of runoff water harvested from slopes and wadi floods. This type of desert agriculture has been the subject of several studies in the past, with a special focus on the functioning of the system and its dating in the Nabatean period (2<sup>nd</sup> century B. C. – 2<sup>nd</sup> Century A. D.).

According to recent studies, these agricultural settlements reflect two waves of occupation. A first one might be dated in the Byzantine period (4-7<sup>th</sup> centuries A.D.),

while the second should correspond to the Early Islamic period (7-8<sup>th</sup> centuries A.D.). The establishment of these large-scale desert settlements can be attributed to the policy of the Byzantine and the Umayyad empires, which encouraged agricultural settlements in the frontier regions as a barrier against nomadic invasions.

## 1. Introduction

The Negev is a desert in the southern part of Israel (Figure 1) covering an approximate area of 10,000 sq. km. It is part of a continuous desert region extending from the Sinai Peninsula in western Egypt (60,000 sq. km) to the south Jordan desert. The average annual rainfall is less than 100 mm, and this does not permit any crop production. There are very few natural water sources and agricultural land is restricted to the borders of the wadi banks. The potential for herding is minimal and allows only for small herds, which are not sufficient to make a living off.

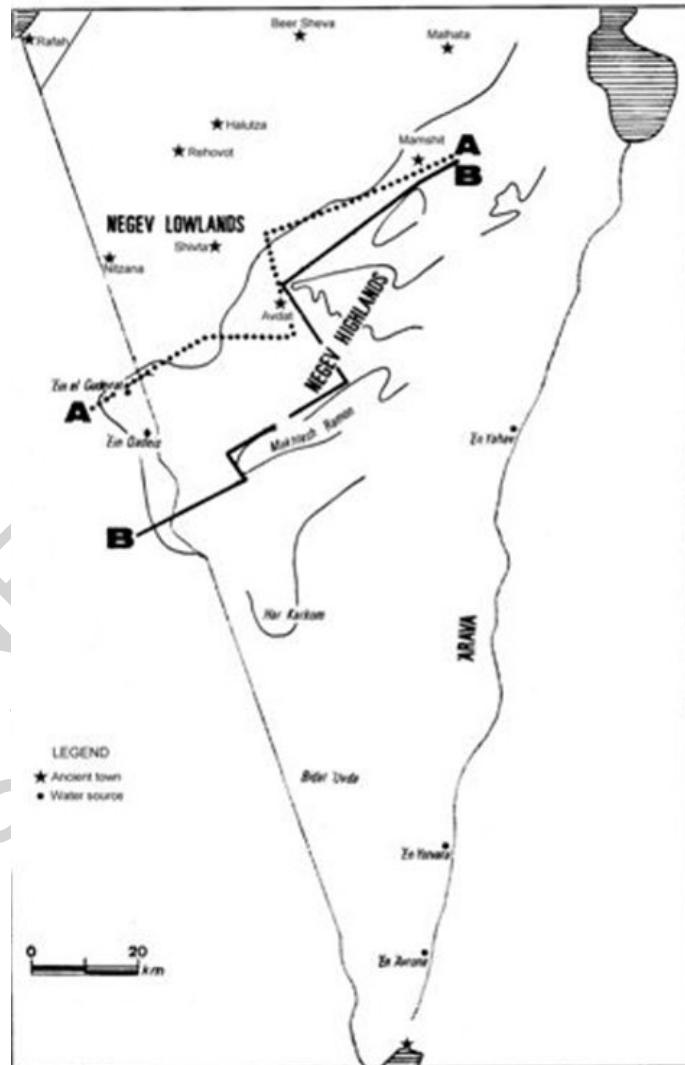


Figure 1. Location map of the Negev, with the situation of sites mentioned in the text. (Line A-A marks the limit of the Byzantine settlement; line B-B marks the expansion of the agricultural settlement in the Umayyad period)

The Bedouins, the nomadic population of that desert, engage in goat husbandry and in poor seasonal agriculture in the wadi beds. This type of farming is totally dependent on the unpredictable floods in the wadis, but it is only of secondary importance in the Bedouin economy which depends primarily on close relations with sedentary population for its food supply. The areas where this is best achieved, and which allow for some limited and meager subsistence, are located either north of Beer Sheva or in a narrow strip along the sea shore of the northern Sinai. These areas constitute also a natural boundary between the desert and the agricultural areas; their average annual rainfall is 200 mm, and this permits to harvest a crop yield once in every second or third year.

Despite these adverse natural conditions, there exists an array of ancient agricultural systems scattered over the desert. Due to the excellent state of preservation - a characteristic of many desert areas - the ancient systems constitute a dominant feature in the present-day landscape. The main elements in that system refer to an extensive network of thousands km of terraced wadis, numerous farmhouses and various agricultural structures. These terraced wadis change totally the limited agricultural potential of the area, and provide large surfaces of man-made fields, created by the accumulation of alluvial and colluvial soil material retained behind terrace walls in the valley.

The ancient systems cover extensive surfaces, estimated at approximately 3,000 sq. km. in the Negev Highlands, 2,000 sq. km. in the northern Negev around Beer Sheva, and 2,000 sq. km in the north-eastern part of the Sinai Peninsula, south of El-Arish; their extension in southern Jordan is still unknown.

## **2. History of Research**

The existence of ancient agriculture systems in the desert has attracted considerable attention since the beginning of modern archaeological research. Palmer (1870) and Woolley and Lawrence (1915) were among the first to conduct field surveys and describe the systems. In this period, Huntington (1911) attributed the existence of agriculture systems in the desert to climatic changes.

In the 1930s, excavations at Tel Nitzana, an ancient city in the Negev (Figure 1), led to the discovery of papyri documenting daily life scenes and the ancient agriculture systems in the Negev in the 5<sup>th</sup> to 7<sup>th</sup> centuries A.D. The papyri provided clear evidence that the residents of the area engaged in farming and in the cultivation of vineyards. They paid taxes as well, being an indication of an economy beyond subsistence level.

In the 1950s and early 1960s, Glueck surveyed the Negev on a much larger scale. Though his research did not focus specifically on agriculture systems, he mentioned their extensive distribution and the intensity of the findings. Glueck's work in the Negev had a long-term impact by relating the agricultural systems to the Nabatean period (2<sup>nd</sup> century B. C. - 2<sup>nd</sup> century A.D.), with continued existence in the Roman and Byzantine periods, up to the 7<sup>th</sup> century A.D. Glueck (1959) attributed the existence of ancient farming systems in the Negev to the ability of the Nabateans to adapt successfully to the harsh environment.

A scientific breakthrough in the study of ancient agriculture systems took place in the mid-1950s, when a research team headed by Evenari set up a research station near Avdat (Figure 1). Evenari and co-workers focused on the relevance of runoff rainwater management in explaining the mechanism of the ancient agricultural structures, such as: terraced wadis, conducts for collecting runoff rain water, and the enigmatic phenomenon of *Tuleilat el-Anab* (see below). Evenari et al. (1971) showed that the runoff collection systems concentrated rain water from an area that was five times larger than the area actually drained. Thus, the average of 80 mm. annual rainfall, which is not sufficient for agriculture, expands to 400 mm, creating conditions like those of common farmland.

Evenari disregarded however the large number of well-preserved farmhouses, built near agriculture systems, and a key element to the chronological aspect. His dating of the systems was in accordance with the general trend to attribute them to the Nabateans. Among the contributions of Evenari's work are his active attempts to grow trees and plants in a reconstructed farm near Avdat, as well as his suggestions about applying ancient methods for contemporary use. The conditions at that time, unfortunately, did not allow Evenari to put his suggestions into practice.

The research mentioned above initiated many other studies. In 1957 Kedar focused on the soil management aspects of the ancient agriculture systems, and he believed that they were intended to increase the accumulation of loess in wadis and create an infrastructure for agricultural activity. In a study conducted at the same time in the area of Nitzana, that investigated the archaeological aspect of the ancient agricultural remains, the systems were dated to the Byzantine period, later than the common dating to the Nabatean period (Mayerson, 1994).

As of the 1960s and 1970s, research on the environmental aspects of the ancient agriculture was accompanied by comprehensive archaeological-historical research, focusing on the ancient towns of Avdat, Shivta, Halutza and Rehovot in the Negev. These studies examined the role of the Nabateans and their descendents in settling the Negev from the second century B.C. to the seventh century A.D., with emphasis on the aspect of material culture, architecture, and analysis of historical sources (Negev 1986; Tsafir 1986).

Some of the later studies emphasized also on geopolitical aspects, and attributed the establishment of agricultural systems to the policy of the Byzantine Empire to stabilize the frontier and the periphery by encouraging agricultural settlement. State-sponsored peripheral settlements would explain the establishment of such large-scale systems, i.e. state subsidies made it possible for these systems to exist during the frequent drought years characterizing this harsh type of environment.

In the mid-1960s, teams of the Archaeological Survey of Israel began working in the Negev. The survey aimed to systematically document remains, and represents progress in the mapping of ancient agriculture systems, and in the analysis and dating of the remains of structures located in the vicinity of agriculture systems. In this respect the absence of Nabatean findings linked to ancient agriculture systems is particularly noteworthy.

Significant progress in the documentation of agriculture systems, including archaeological excavations, was made in the frame of the Negev Emergency Survey, conducted from 1979 to 1990. Ten teams worked on the project, and systematically surveyed about 5,000 sq. km of the area. About 12,000 archaeological sites were documented (Haiman 1995). The survey results revealed no link between ancient Negev agriculture and the Nabateans.

In the light of the findings of the Negev Emergency Survey, which include documentation of many hundreds of farm houses and excavations in some of those houses, it appears that the agricultural systems should be dated to the 5th-8th centuries A.D., up to the end of the Umayyad period (ca. 750 A.D.). These structures should be viewed as peripheral Mediterranean agricultural settlements during the Byzantine Empire (Haiman 1995), of the type that was known in North Africa as early as the Roman period (Barker 1996).

From the 1970s onwards, further progress was made in studies on the environmental aspect of ancient agriculture systems, as researchers examined the flow of runoff rain water and conducted geomorphological tests of agricultural terraces. One of the important conclusions reached in these studies, is that the systems were intended to function with a rain load that is similar to that of today. Another study, by contrast, dealt with fluctuations of reservoirs in Israel during the ancient period. According to that study, the climate during classic periods was more humid, and allowed for the existence of ancient agriculture in the Negev (Bruins 1985).

Surveys and excavations carried out over the past three years, under the auspices of the Israel Antiquities Authority, indicate that the sedentary land in the north of the Negev Highlands, e.g. the Beer Sheva Valley, contains abundant remains of ancient agriculture systems of the type found in the Negev Highlands. These discoveries, which are only at the early stages of the study, have a decisive impact on some conclusions of previous studies.

### **3. The Agricultural Systems**

Surveys and excavations conducted in the above mentioned agricultural remains shows two waves of settlements; the first in the Byzantine period (4-7<sup>th</sup> centuries A.D.) and the second in the Early Islamic period (7-8<sup>th</sup> centuries A.D.).

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## Biographical Sketches

**Moti (Mordechai) Haiman** is a research archaeologist in the Israel Antiquities Authority and teaches at the Department of Land of Israel Studies at Bar Ilan University. He holds a Ph. D. in Archaeology (1992). His expertise is archaeological surveys and multi-disciplinary studies on ancient settlements in the deserts. He participated in projects as head of a survey team in the Negev Emergency Survey (1980-1990), and as head of the survey section in the Israel Antiquities Authority. His current research involves the participation in a multidisciplinary study (archaeology, geomorphology, micromorphology and botany) of ancient desert farming in the Negev desert with a focus on environmental protection.

**Peter Fabian** is a research archaeologist in the Israel Antiquities Authority and teaches at Ben-Gurion University. He is Ph. D. candidate at Ben Gurion University. His main expertise is on Roman and Byzantine archaeology, and in this context he conducted excavation work in various sites in South Israel, such as Beer Sheva and Avdat.