



Sedentary Zone in the Negev

During the Byzantine Period

Settlement Distribution and Runoff Farming

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Ph.D. Thesis

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Abstract

This study examines the **sedentary zone in the Negev Desert (a)** during the Byzantine period as well as settlement distribution and ancient agriculture. The research is based on data collected in archaeological surveys of ten specific areas in the Negev (each area is equal to 100 km²), most of which have not yet been published.

Earlier studies conducted in this area focused mainly on ancient agriculture – ‘runoff farming’ and the large settlements in the Negev – the ‘Negev cities’.

This study is an interdisciplinary attempt to examine all the issues involved in the permanent Negev settlements and the interrelationships between them, and to develop a comprehensive picture of Negev settlement during the Byzantine period.

There are a few controversial questions relating to the region, including the following:

- Was the development of settlements in the Negev during the Byzantine period the result of climatic conditions or the desire of the central government to reinforce the empire’s borders?
- Was the settlement distribution pattern of the Negev unique to this area or was it similar to other regions of Palestine?
- What was the population of the Negev during the Byzantine period and what criteria were used to calculate it?
- What crops did the ancient farmers in the region grow? What were the yields of the various crops and what was their relative proportion in the ancient agricultural fields?
- Were the grain crops grown in the region sufficient to sustain the population or was it necessary to import produce from other regions?
- How, if at all, can we distinguish the transition of ancient Negev settlement, between contiguous eras: from the Nabataean and Roman to the Byzantine and from the Byzantine to the early Islamic?

The average annual rainfall in this area – which is only 100 mm – the big deviations from this average and the likelihood of several continuous years of drought, compelled the ancient farmers to boost the water supply to their fields, as well as to collect drinking water for human and animal use. This water was collected from surface runoff that flowed down to the wadi bed from higher levels. Many studies show that experience, advanced technological methods and a great amount of work were required to collect significant amounts of water from surface runoff.

The measures taken to ensure adequate amounts of moisture for farming may be attributed to meager precipitation, the type of rainfall in the region, and discontinuity of surface runoff along the slopes. The sparse rainfall in the region is usually characterized by short, low intensity showers, with long intervals in-between, which in turn affects the constant flow of surface runoff. In other words, the chances of the rain falling on the top, or midway on the slopes reaching the bottom are slight and surface runoff flows down the slopes for an average of only 15 meters before seeping into the ground.

The steps taken by the ancient farmers to greatly **increase the surface runoff (b)** included two main components: clearing stones on the surface of slopes to allow uninterrupted flow of runoff and to prevent seepage; building of **accumulation ditches**, 15 meters apart along the slopes.

This intensive clearing of stones, which could not be removed from the fields, resulted in numerous **stone mounds** (*'Tuleilat el Anab'* or grape mounds, according to the Bedouin) and strips of gravel.

We must of course also remember the efforts made along the wadi banks themselves, the construction of systems of **terraced plots**. In larger wadis with wide arable banks, systems of dams, diversion channels and **supporting walls** were constructed. This required immense labor resources. Furthermore, the farmers allocated the catchments slopes proportionately to the field area so that each allotted catchment area was about twenty times the size of the plot.

This increased the volume of water reaching each plot to three-four times the average annual rainfall, i.e. 300-400 mm. When one adds this to the quantity of direct rain falling on the field, the volume of water rises to 400-500 mm. The significance of this fact is that it will enable the ancient farmers to grow similar plants to the Mediterranean region equal to the annual rain quota of 400-500 mm. Clearly, not all the water is available to plant life as a portion will evaporate.

We can call such an agriculture – **intensive runoff farming (c)**.

These steps were taken to ensure **permanent agriculture in this arid region**, as opposed to random agriculture. Of course, such intensive effort can only be made in a small area and in places where sufficient human resources are available, i.e. close to the large Negev settlements. In areas further away from the big settlements it was not possible to conduct intensive agriculture and the farmers were forced to make do with **extensive runoff farming (c)**, whereby the fields received only the quantity of water that flowed naturally down the slopes to the ravine. The amount of water that reached these plots from the slopes was twice the average annual rainfall, i.e. approximately 200 mm. Obviously, this amount of water is borderline and cannot sustain permanent cultivation similar to intensive runoff farming.

It was feasible to cultivate annual grain crops using extensive runoff methods and apparently this is what the ancient farmers did. When calculating **the annual grain yields in these areas**, it is necessary to consider several factors:

- a. As it was not possible to irrigate very large fields, the farmers were forced to make do with the quantity of rain that fell directly on the fields and that flowed naturally down the slopes to the plots. This amount was irregular and fluctuated greatly from year to year. This resulted in years of very meager yields, or none at all, alongside mediocre and good years.
- b. Good yields are based on fertilization. But fertilization was not adequate as manure was scarce. This can be accounted for by the fact that animals were raised in limited quantities because they competed with human population for water and food. From this we can assume that large areas could not be fertilized.

Accordingly, we see that the annual yields of ancient crops were **similar to the yields of the Bedouin farmers today (c)**.

During good seasons, these yields can reach between 40 and 50 kilograms per dunam¹. This estimate also matches Mayerson's calculations (Mayerson, 1962, 227) regarding the annual yields from the fields of Nessana (papyrus 82).

This study examines two different regions of permanent settlement. One region is defined as the inter-settlement district and includes a wide area of 900 square kilometers, from Beer-Sheva in the north to Sde-Boker in the south. This region is in the proximity of several large Negev settlements, but does not include any of them.

The second settlement region studied is the Shivta region, including the township itself and the agricultural fields surrounding it. The purpose of studying this region is to examine whether this area is representative of the large Negev settlements.

The inter-settlement district (d) includes nine archaeological survey maps, most of which focus on one area 20 kilometers wide by 40 kilometers long, between Beer-Sheva and Sde-Boker. The main research tool for studying this area is data provided by survey maps, of which only two have been published. Data was collected by retrieval of information from the survey files, entering them into databases and printing maps that include this data. Following this, visits were made to the research areas using these maps to examine the findings in the field, especially regarding the farmstead buildings, to be detailed below. Following these visits, the maps were updated according to the findings and **these maps were compared with Kedar's maps (e)** of ancient agriculture (Kedar, 1967, in Hebrew).

Simultaneously, an attempt was made to compare similar settlement sites, farmsteads from two contiguous eras: **Byzantine and early Islamic (f)**. Since the issue of pottery shards is problematic (as detailed in the study), distinction was made according to **architectural criteria (f)**, settlement distribution patterns and other characteristics. This data was arranged in comparison table.

The research assumption states that the distinction between Byzantine period farmsteads and those of the early Islamic era is unmistakable. In general, it can be said that most Byzantine farmsteads are found very close to the large Negev settlements, and that between five and ten farmsteads are usually visible on each map, throughout the inter-settlement district.

When comparing the archaeological maps with the abovementioned ancient agriculture maps, it is apparent that practically all the potentially arable land in this area was exploited, while those unsuited for cultivation were used for grazing by the permanent settlers or by the nomads.

Presumably, the permanent inhabitants of the inter-settlement district operated self-sufficient or autarkic farm units of about 100 dunam¹ of cultivated fields per farmstead, which provided almost all their needs. Most of the cultivated area was used for grain crops, with a small section designated for cultivation of fruit trees.

In all probability, each farm unit also had a flock of about 20 to 30 sheep and goats. In view of this, we can assume that a similar area of extensive runoff agriculture would provide only sufficient yields for self-use and not for trade.

¹ One dunam = 0.1 hectare

In view of the abovementioned limitations of the inter-settlement district, it appears that the **population in this region was very sparse** and the entire region reached a population of only 1,200 to 1,500, i.e. population density of 1.3 to 1.6 per square kilometer.

Nonetheless, the **general map of the area (g)** shows that there was no shortage of **water cisterns (h)**. This study assumes that all the cisterns in the area were in use at the time, including those from earlier periods, and that not all the cisterns that existed at the time are visible today. The map also shows that in specific suitable areas, many hewn underground cisterns were located close to one another, without any relationship to the settlement sites, probably as emergency stores to be used during dry years. We can therefore assume that there was no shortage of drinking water in the settlements.

The second settlement area researched for this study is the **Shivta region**. **The township itself (i)** has been surveyed and described by several researchers who referred to its physical structure, water systems, and location within the region. According to this depiction, it was a large village, similar to the other large Negev settlements, except for Halutza, or similar to the Jewish towns in the Galilee and Golan.

Shivta residents lived comfortably in fairly **large courtyard buildings**. Although not all the houses are identical in size and some of them were more luxurious, it can be said that this was a relatively egalitarian society with a relatively high level of cooperation. This cooperation can be seen within the township itself, in the **wide streets, nice churches, water systems** and the conduit canal that carried water from a distance of 2.5 kilometers to the settlement. However, the more significant results of this cooperation can be seen in the agricultural systems around the settlement, especially the agricultural system at Nahal Lavan. These systems, which are found along the banks of the wadi, are impressive in size, and in the planning and labor invested in their construction.

About 25 Byzantine period farmsteads, mainly to the south at Nahal Zeitan (j), are visible in the survey. When calculating the **population density** of the Shivta region, it is necessary to take the population of the township, the farmsteads, the monastery at Mitzpe Shivta and a limited number of the nomadic population, into account. Hirschfeld (2003) estimated the Shivta population at about 2,200, to which we can add another 500 to 600, based on the sources mentioned above. Therefore, the population of the Shivta region was between 2,700 and 2,800.

When looking at the map of ancient settlement in the area, it is easily discernible that Shivta is not located on any primary route, and on many maps it does not even appear close to a secondary route. Therefore, the question that arises is: **what brought about the economic prosperity of Shivta**, which is reflected in its size, its houses and its large churches? Lacking evidence of other factors, it would appear that Shivta's economy was based on agriculture and the trade of agricultural products.

What were the crops grown in the Shivta region? Kedar (1957) calculated that the cultivated fields in the region came to about 5,600 dunam, of which 60% were cultivated using intensive runoff agricultural methods and the rest were cultivated using extensive runoff methods, i.e. without artificial diversion of runoff, as described above.

Hypothetically, if we assume that grain crops were grown in all the fields in the region, we can estimate that during a good season the maximum yield as mentioned above could reach 50 kilograms per dunam, meaning that, the yield for the entire region reached 280,000 kilograms. If 10% of the yield is deducted for waste and seeds for the next season, the remaining yields reaches 252,000 kilograms before taxes.

According to various estimates, the annual per capita wheat consumption in the ancient world was between 200 and 250 kilograms. From this, we can calculate that the grain yield in the Shivta region was sufficient for a population of between 1,000 and 1,260 – less than half of the estimated population in the region. It was therefore **necessary to import grain to this region** similar to other permanently settled areas of the Negev.

If grain crops were grown in only part of the cultivated fields in the Shivta region, what was grown in the other part? To answer this question, it is necessary to look at high-value crops that would exceed local needs and could be traded. The income received from this trade should be sufficient to purchase grain and other requirements for the population, as well as being able to sustain the rather high standard of living estimated for the Shivta inhabitants.

It appears that the Shivta inhabitants achieved all this by **cultivating vineyards and producing wine that was exported** from the region, and probably also from Palestine. There is evidence to support this assumption, despite the fact that the Nessana Papyri refer mainly to grain crops and olives for oil production and do almost not refer to vineyard cultivation.

The three **winepresses (k)** found in Shivta are evidence of vineyard cultivation. Another five similar winepresses were found in other Negev settlements and a further five outside of the area, but close by. It is very possible that there were several more similar winepresses in the area that have not yet been found. These winepresses have especially large storage cells surrounding large 30 square meters treading areas and one or two collection vats in which the must was collected for the first fermentation stage. According to calculations, these winepresses can each produce more than 100,000 liters of must per season and about two million liters of wine can be produced from the winepresses in and close by the Negev region.

What was this immense quantity of wine intended for? Researchers believe that this type of winepress could produce three types of wine, of varying qualities, according to the method of juice extraction. One type, of especially high quality, was intended for export to rich connoisseurs. The second type was good wine that was also intended for export, while the third type was poorer quality wine, probably for local consumption.

According to Kingsley (2001), large quantities of wines from Palestine were exported to all the Mediterranean countries, mainly via the southern ports of Ashkelon and Gaza. A significant part of the wine was marketed in specially made storage-jars known as ‘Gaza amphorae’.

Other evidence of wine production, found in the area of permanent settlement in the Negev, especially in the Shivta region, are **towers**. These are no less important than the winepresses. After the first fermentation stage in the vats at the winepress itself, special conditions had to be created for the second fermentation stage that continued for several months, after which the wine was stored until it was sold. The wine could be fermented and stored in caves or cellars, and in towers.

Dar (1986), who studied the towers in western Samaria, concluded that these towers were used for the second fermentation stage and for storage of wine. This fermentation and storage was achieved in small, three to five meter for one-side buildings, which were constructed of massive hewn stones. The roofs were also constructed of massive stones and except for small 1.00 meter by 1.40 meter openings; the buildings were almost completely sealed, artificially providing the required dark, cold conditions and even temperatures. The small cracks between the layers of stones allowed the free escape of carbon dioxide (CO₂) produced during the fermentation process.

Much effort and money was invested in building these towers and their function had to justify this cost. According to their small size and imperviousness, they were obviously not used for dwellings. Their distribution and proximity to the settlements indicate that they were not used as watchtowers for protecting pre-harvest yields. Winepresses were often located close to the towers, which reinforces the assumption regarding their role in the production of wine. The western Samaritan towers were used during the Hellenistic and Roman eras.

Concentrations of similar towers were found in the Negev just a few kilometers away from Avdat, and very close to Shivta, mainly at Nahal Zeitan and Nahal Drorim, as well as at Nahal Lavan, some 3.5 kilometers away from Shivta.

Many similarities were found when comparing the Negev towers with the western Samaria towers. The dense distribution of the towers, especially close to Avdat and at Nahal Lavan, indicates that these towers were not watchtowers. The effort spent in building them, which is similar to the efforts made in the Samaria area, indicate that they were intended for a more important function that would justify this effort.

The effort made in establishing the intensive runoff agricultural systems in these areas, which is **especially evident at Nahal Lavan (1)**, also indicates a purpose that would justify such efforts.

The purpose was the production of wine.

We should not ignore the fact that there are two significant differences between the Negev towers and the Samaritan towers:

- a. Their dating: While the Samaritan towers are dated to the Hellenistic and Roman periods, the Avdat and Nahal Lavan towers are dated to the Byzantine period, the 5th and 6th centuries CE.
- b. About half of the towers at Nahal Lavan, which were surveyed for this research, were plastered on the exterior - a feature, which would have prevented the escape of carbon dioxide. The ancient farmers probably found another solution for letting the carbon dioxide be released. But we don't know what that solution was, because a fully intact structure has not yet been found.

Most of the abovementioned Negev towers were used in the winemaking process. But, it is important to mention that other towers surveyed in the Negev were used for other purposes, such as watchtowers for guarding remote fields, important routes, other strategic places and fortified farmsteads (the last is described by Rubin, 1991, in Hebrew).

It is very difficult to compare the Shivta region with other large settlement areas in the Negev, because researches on other large settlements have not yet been published and some regions in the Negev have not yet been researched. From the comparisons that could be made, there appear to be similarities in the settlement distribution patterns and the intensive cultivation of fields. However, it should be noted that Shivta was probably the only place that relied solely on agriculture and trade of agricultural products for its economy, while other settlements had other sources of income, such as caravans and pilgrims.

The conclusions of the controversial issues in this research are as follows.

When discussing the issue of the climatic changes, it seems that the distribution pattern of the settlements in both areas researched in this study – the inter-settlement district and the Shivta region – reinforces the opinion that there was **no improvement of climatic conditions during the Byzantine period**. If there had been climatic fluctuation, why are there so few farmsteads in the inter-settlement district and why was it necessary to invest so much human and other resources to produce intensive runoff agriculture in the Shivta region and the other large settlements? The rest of the evidence of climatic changes, both geological and botanical, is not clear-cut and there are aspects that can be interpreted either way.

This study does not deal with the role of the Nabataeans in developing settlement during the Byzantine period. It would appear that most Negev researchers agree that all the large settlements in the Negev were established as commercial stations on the caravan routes, during the prosperity under Nabataean rule. They also agree that a significant number of Negev inhabitants during the Byzantine period were descendants of Nabataean and other Arab tribes. Nevertheless, it is also still unclear how the transition occurred: from stations and fortresses along the trade routes during the Nabataean era to the development of large settlements and the spread of agriculture during the Byzantine period. It is very possible that the massive agricultural development began at the end of the Nabataean era after losing sovereignty and control over international trade. However, it is impossible to know for sure what role the governing authorities had in this development.

It is also impossible to know what happened to the overall settlement pattern at the beginning of the early Islamic period and what may have been the role of the Islamic governing authorities.

It appears that **the settlement distribution patterns of the sedentary zone in the Negev were unlike any distribution patterns of other settlements throughout Palestine**. Even in Beer-Sheva Basin, adjacent to the area under discussion, the distribution of settlements was more dense and widespread than that of the permanent settlements in the Negev.

From this, it is apparent that the special type of settlement in this area – the permanent Negev settlements – is a result of the abovementioned limitations. These limitations made it very difficult to expand settlements in the area and limited them to the confines of large villages.

It therefore appears that population distribution in the Negev started with the Nabataean stations on the one hand and governing authority interests on the other. Furthermore, it is possible to distinguish, especially in the Shivta region, the effects of private enterprise and maximum cooperation between the settlers. It seems that without these, no regime interest would have had any influence.

When calculating the **population density** of the permanent settlements in the Negev during the Byzantine period, it is necessary to consider all the abovementioned factors. The population of the large Negev settlements should be calculated to include the population living close by, but not in the townships, as calculated for the Shivta region, as well as with the small number of people living in the inter-settlement district.

According to population calculations of the large Negev settlements by various researchers, and after adding the inhabitants mentioned above, it could be estimated that the population of the sedentary zone in the Negev was about 27,000 – less than Broshi's (1982, in Hebrew) minimal calculation, but not for the same reasons that he gave.

Broshi claims that the shortage of drinking water was the reason for limited population of the Negev, but as stated above, despite the fact that life cannot be sustained without drinking water, this was not what limited population expansion.

There were many reasons for the limited population as mentioned above, but in general, they can be defined under the title: **the Limits and Limitations of Human Investment**.

These limitations responsible for the restrictions in establishing intensive runoff agriculture in far reaching parts of the area, like as the permanent sedentary zone the Negev, and limiting them to the large settlements where the main part of the population exists, while the inter-settlement districts were almost empty.