

Hippos of the Decapolis and its Region 18 years of Research



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English front page: Mount Sussita, with the Ein-Gev stream flowing below it and the Sea of Galilee to its west.
Looking south (photo by M. Eisenberg)

Hebrew front page: Mount Sussita plateau and the Sea of Galilee to the west (photo by M. Eisenberg)

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A Geospatial Study of the Chora of Antiochia Hippos from the Hellenistic to the Byzantine Periods

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Introduction

Ongoing research into the city Antiochia Hippos has recently added the focus on the territory (chora in Greek, *territorium* in Latin) of the city, in order to better understand the relationship between the city, its agricultural hinterland, manufacturing, commerce, the road network and defenses. This article will deal with the latter two issues.

The goal of the current GIS-based geospatial study of the region is to explore functions of the various fortifications built throughout the chora (Fig. 1) of Hippos and eventually clarify the extent of the chora itself and the nature of its civic administration. Four hypotheses were put forward regarding the functional modes of the fortifications that were to be examined during the research:

1. It is assumed that the foundation of Hippos after 200 BCE started a process of development of agricultural lands and local roads connected to the intra-regional road network. Unfortunately, no information is available about the status of Hippos at that time. A military settlement would be expected to develop a network of garrison posts in naturally strong positions – in the case of Hippos probably on the ridges or hilltops above the surrounding valleys (Cohen 1978: 9, 19–25) for the defense of the territory and the approaches to the city. Since

the foundation of a military settlement usually preceded the foundation of a polis (Cohen 1978: 37–41; 2006: 238) we may assume this was also the case with Hippos (for the choice of site, foundation and military architecture see Eisenberg 2014, Eisenberg 2016: 613; Eisenberg 2017). The existence of a city would have necessitated the development of local roads. A road around the Sea of Galilee was probably in existence, and two ascents to the Golan are thought to have been used: the Lawiye spur and the Ein Gev Stream (Roll 2009: 7–8). The inaccessibility of the Ein Gev Stream from Mount Sussita meant that the route must have been located in the valley south of Sussita and continued toward the saddle and then eastward to Afik (and possibly south to Kfar Haruv) and further.

2. Following Alexander Jannaeus' conquest at the end of the 2nd century BCE, the system of garrison posts defending the approaches to the chora was probably destroyed; it could have been renewed only after Pompey's restoration after 64 BCE. In the Early Roman period we would expect to see a distribution of fortifications similar to the late Hellenistic period. A growth in the number of settlements during the Early Roman period (Hartal 2012) would have necessitated the extension of local road networks.

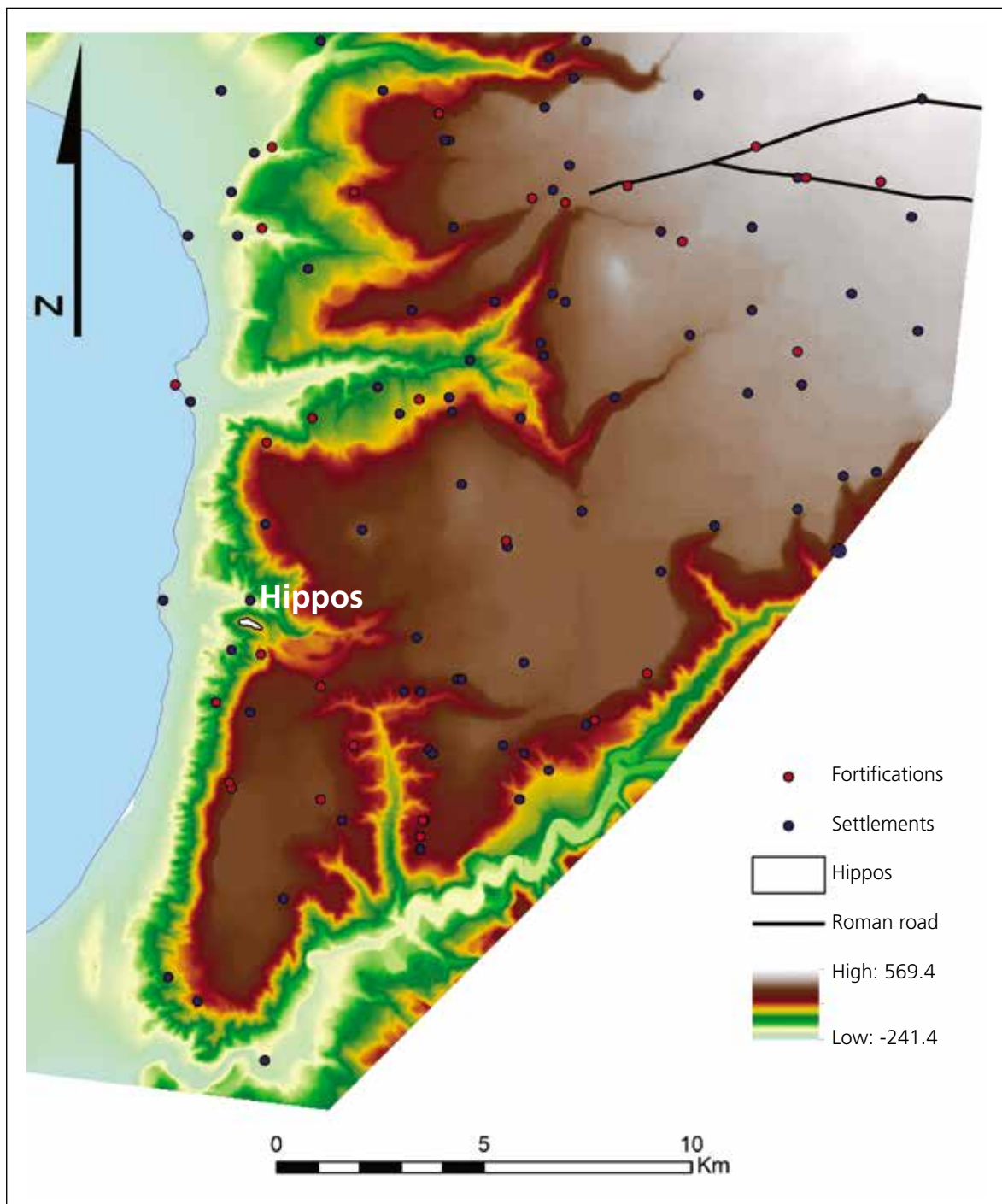


Fig. 1: Map of the study region.
 (A. Pažout, based on Archaeological Survey of Israel by IAA. The DEM was provided by the Survey of Israel).



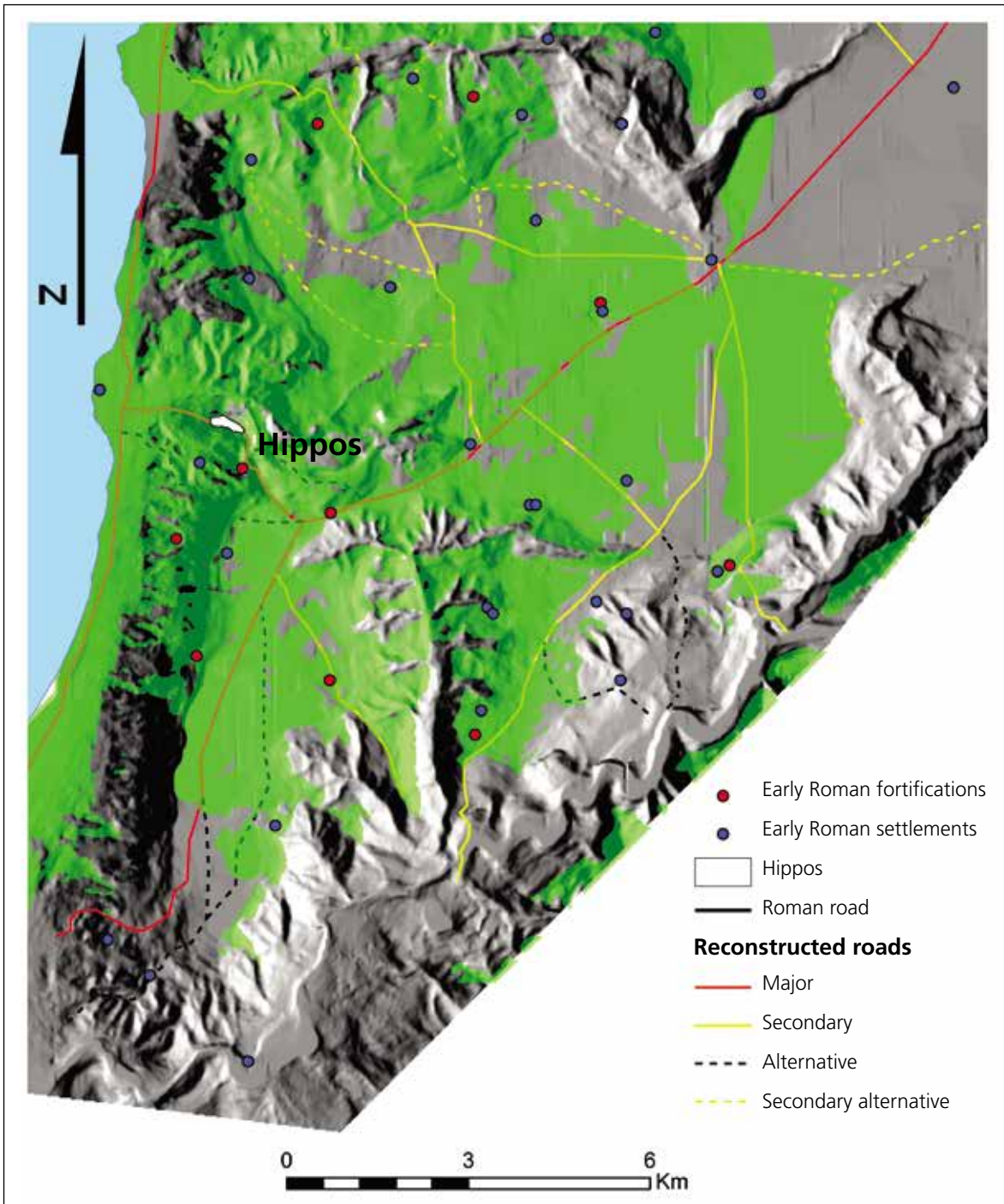


Fig. 2: Visibility map for the chora of Hippos between the Samakh Stream and the Yarmouk River (A. Pažout, based on the IAA Survey of Israel. The DEM was provided by the Survey of Israel).

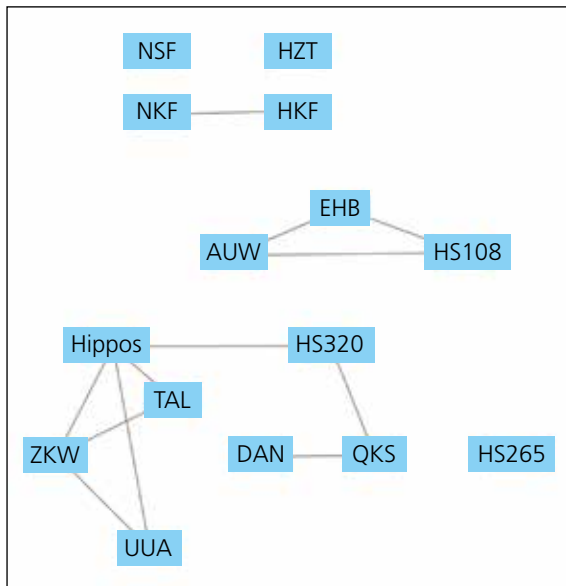


Fig. 3: Visibility network in the Early Roman period (A. Pažout).

3. In the Late Roman period (2nd–3rd centuries CE), after involvement of the Roman army in the administration of the provinces had grown stronger, the focus clearly shifted from external toward internal security, especially road security (Isaac 1990: 77–89, 101–103; Fuhrmann 2013: 203–215; France and Nelis-Clément 2014), realized through the building of new roads and the repair of older ones. The pattern of site distribution would be expected to closely follow the roads with way stations and watchtowers along them. The Khan el-Aqabeh ascent in the southwestern corner of the Golan Heights probably rose to prominence during this period, although there is as yet no evidence of any sort for the construction of a road through that ascent in the Roman period but only during the rule of ‘Abd el-Malik (late 7th/early 8th centuries CE) (Schumacher 1888: 63–64; Elad 1999: 76–79; Hartal and Ben Efraim 2012: site no. 72).
4. The time of the Tetrarchy and the Byzantine period saw differentiation emerge between the civilian and military administrations, with

stronger involvement of local authorities in security and policing (Isaac 1990: 177–183; Aubert 1995). It is possible that older military installations continued in use, although this probably did not occur frequently. The developed road system would have been maintained without major extensions.

Methodology

The methodology chosen to tackle these problems includes:

- a. Viewshed analysis (e.g. Fachard 2016), in order to explore intervisibility of the fortified sites, the city of Hippos and civilian settlements. If the location of the sites made them mutually visible, then a signaling system of some kind may have been used. In the case of visibility between fortifications and settlements, we may speculate that the function of fortified sites was to control the local population and/or warn them in cases of emergency. Special attention was also paid to visual control of the road network and of the landscape in general. Viewshed is computed using attributes OFFSETA (height of observer), which is set at 5 m for forts, 6 m for Roman watchtowers and 8 m for Hellenistic towers, and OFFSETB (height of what is observed) which is set at 5 m for sites in order to see if the sites are inter-visible, and at 1 m in order to explore the visibility of landscape and roads.
- b. Cumulative Focal Mobility Network approach (CFMN) was chosen for the reconstruction of the road system and its development from the Hellenistic to the Byzantine periods (Verhagen 2013; Verhagen et al. 2013; Déderix 2016). CFMN is based on least-cost path (LCP) analysis that finds the best accessible route from point of origin to destination over a surface that represents cost of movement (hence least-cost). The CFMN approach is actually based



on the idea of “movement without destination” (Fábrega-Álvarez 2006), meaning that all possible movement corridors for a source point are computed (focal mobility network). These focal mobility networks for all points are then added together and where mobility networks for multiple points converge, there they form “natural corridors of movement”. The aim is not only to explore the connectivity and accessibility of the sites (both fortifications and settlements in the assumed system) but also the position of the fortifications in relation to the road network. LCP analysis also enables calculation of approximate travel times between sites, a factor that might also have dictated the choice of a site’s location.

CFMN was first computed for 51 points spread evenly across the study region (the southern Golan between the Yarmouk and Ruqqad rivers, the Sea of Galilee and the Daliyot Stream) in order to discern general patterns of movement in the region (the general model). The analysis was repeated for settlements in each period, and used anisotropic cost of movement (direction-dependent cost of movement across region).

The initial results of the ongoing research are presented below, beginning with two examples of the visibility analysis, moving on to an overview of the reconstruction of the road system in the region and concluding with an inquiry into travel times.

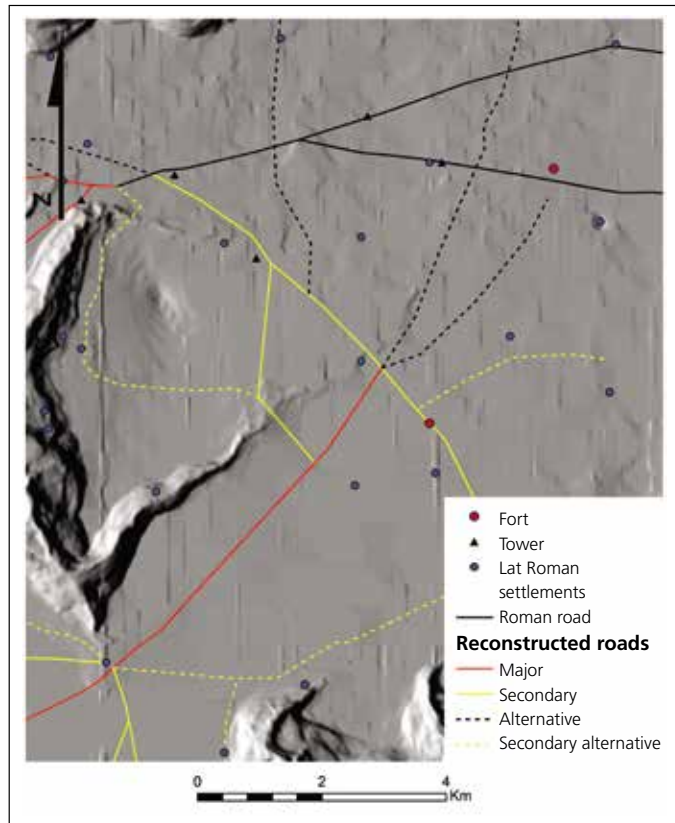


Fig. 4: The northeastern part of the study region showing the road network (A. Pažout, based on The IAA Survey of Israel. The DEM was provided by the Survey of Israel).

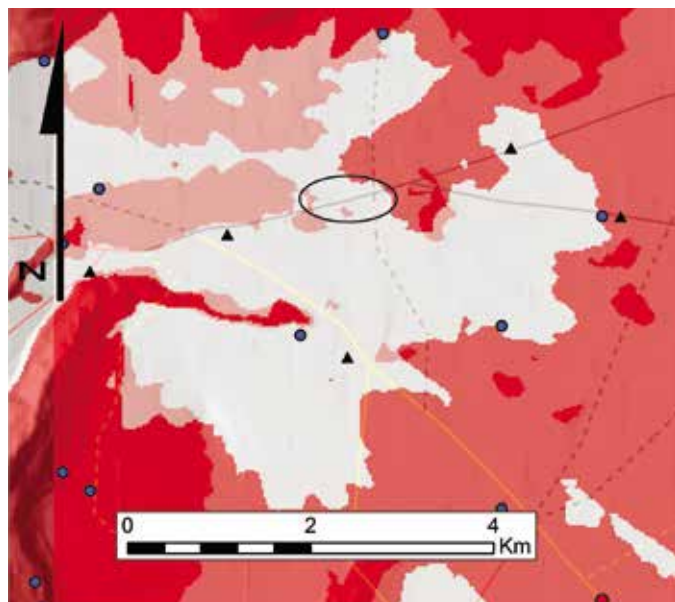


Fig. 5: Prediction of watchtower locations on a Roman road (A. Pažout, based on The IAA Survey of Israel. The DEM was provided by the Survey of Israel).

Visibility Analysis

Viewshed was computed for each fortified site in the region. The results were combined and visibility networks were extracted from them.

In the first example, Fig. 2 shows the area visible from the fortifications and the city walls (in green) with $OFFSETB=1$ m in the Early Roman period. The area between the Samakh Stream and the Yarmouk River can be considered the core of the chora of Hippos. The results show that the fortifications had a very good view of their surroundings as well as of the roads in the chora. Moreover, out of 25 Early Roman settlements in this area, 18 are mutually visible (72%). The visibility network of the fortified sites (Fig. 3) is divided into two groups – one consisting of three sites in the Samakh Stream valley and one centered on Hippos with an outlying watchtower above the Yarmouk River that is not visible from any other site. The arrangement of the sites, their mutual visibility and their good view of the landscape suggests that they were constructed to accommodate a signaling system and to control the roads, especially the ascents to the Golan plateau, and to control the local population.

Fig. 4 shows a segment of an extant Roman road with several watchtowers located along its course. Since these watchtowers were located approximately one Roman mile (c. 1420 m) apart (as is the case in Jordan and Syria: Bauzou 1998). The overlapping viewsheds of the two watchtowers with a gap of two Roman miles between them points to an area where another watchtower, so far unknown, may have been located (Fig. 5, in circle).

Road System

The output of CFMN analysis for a regular grid of points (Fig. 6) shows natural corridors of movement across the region (general movement patterns in the region). It is possible to distinguish

corridors with higher preference from corridors with lower preference for a subject traveling from one point to another and thus a hierarchy can be established between the corridors. We observed that the ascents with corridors high on the hierarchy are Ma'ale Gamla, Kanaf and the Lawiye spur in the north, which converge at the head of the Lawiye spur where they connect to the known stretch of a Roman road. Another corridor ascends from the Samakh Stream. Farther south, there are corridors coming to the Golan plateau from below Bnei Yehuda, although apart from a corridor running through Nuqeib there is no evidence for a track in historical periods. Another important ascent is at Khan el-'Aqabeh where a major corridor starts, running southwest-northeast across the whole region. Possible corridors also ascend from the Yarmouk and Ruqqad rivers in the south. The city of Hippos was also connected to the main corridors; however, the connection is low in the hierarchy.

The network of corridors on the plateau is more complicated, but general patterns can be discerned. Routes starting between the Samakh Stream and the Yarmouk River join the main southwest-northeast corridor between Apeh and El-'Al. The corridor then runs to es-Sufeira, where it branches in several directions.

It is important to note that CFMN analysis for settlements in each period (34 in the Hellenistic period, 55 in the Early Roman period, 71 in the Late Roman and 67 in the Byzantine period) shows almost identical results to the general model above. This indicates that the method is reliable and can be used for reconstructing the Roman road system in the southern Golan. Also significant is the close association between the proposed corridors and the fortifications, which are usually located on the slopes or on the edge of the plateau. These include, e.g. Ḥorvat Kanaf, the fort at 'Emeq ha-Boqrim, the tower at ad-Dan and the fortlet at Qa'at el-Ksar flanking the Mezar Stream and the Hellenistic fort above the Ruqqad River.



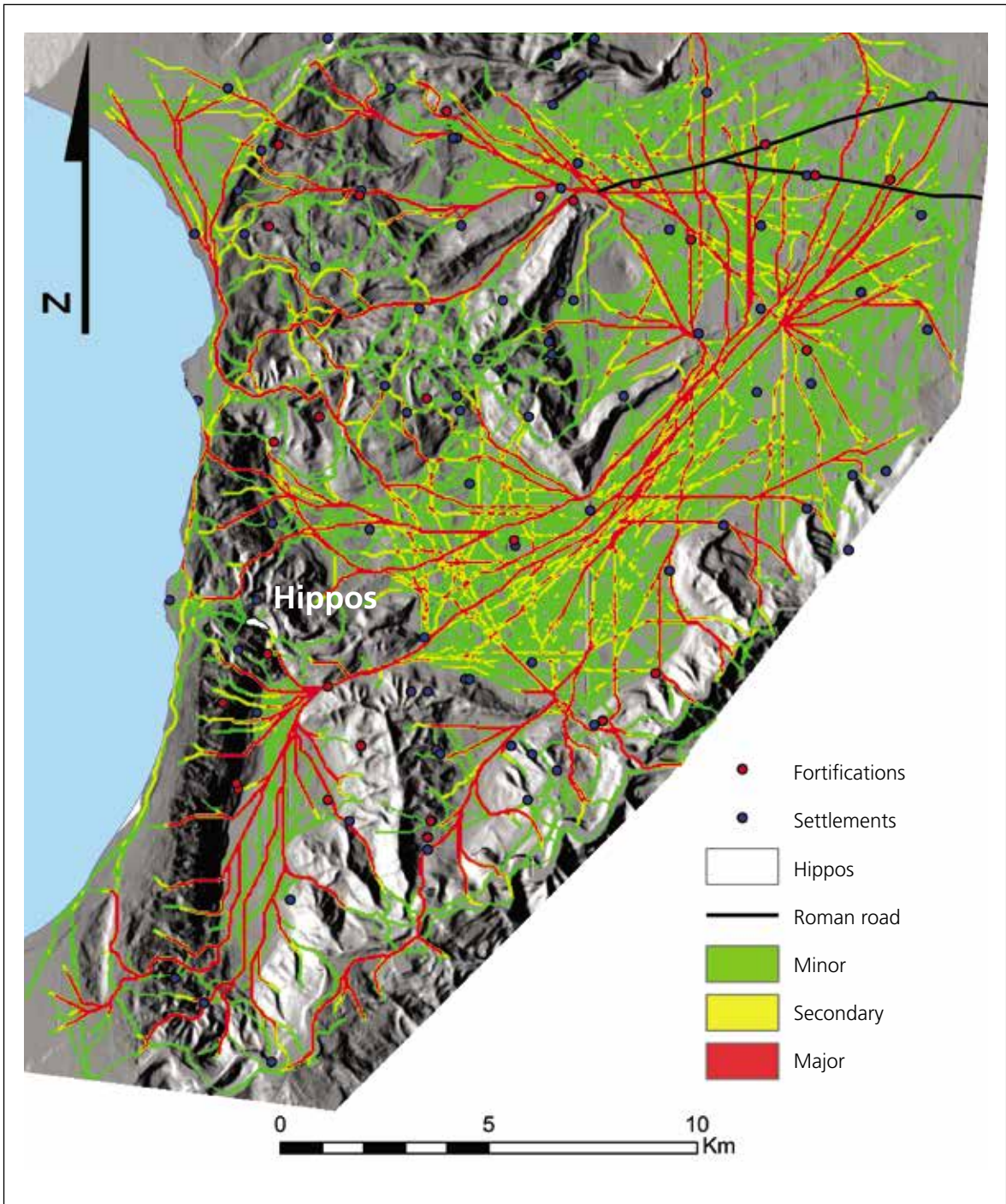


Fig. 6: Results of Cumulative Focal Mobility Network analysis showing hierarchy of natural corridors of movement (A. Pažout, based on The IAA Survey of Israel. The DEM was provided by the Survey of Israel).

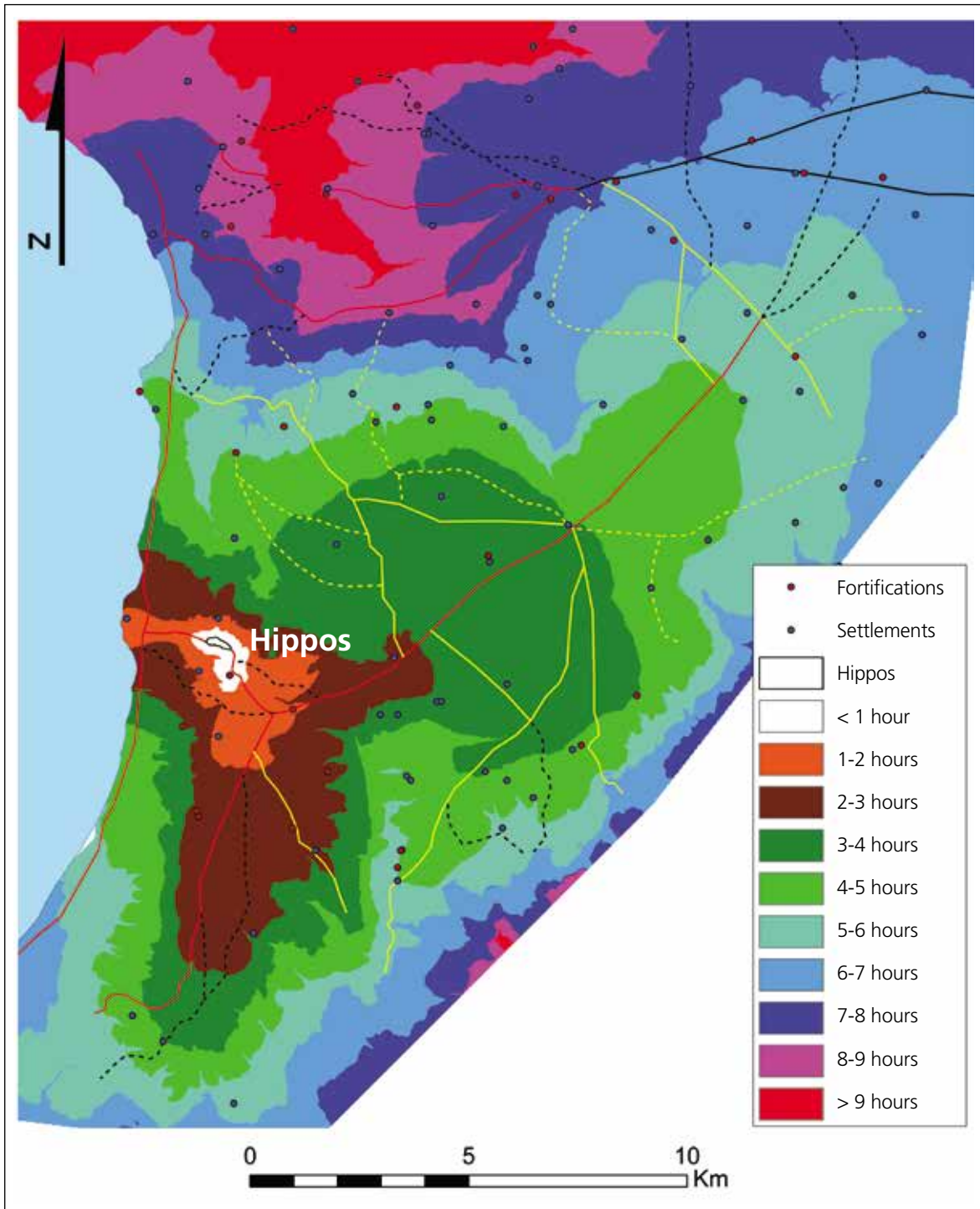


Fig. 7: Travel times from the city of Hippos
 (A. Pažout, based on The IAA Survey of Israel. The DEM was provided by the Survey of Israel).



Travel Times

The estimated travel times for the city of Hippos were computed using the *r.walk* module in GRASS GIS, which computes anisotropic cost of movement, with a “pessimistic” cost map (friction surface) reflecting time penalty on steep slopes (Fig. 7). The results show that practically the entire area between the Samakh Stream, the Yarmouk River and as far as Tel Nov in the east is easily accessible in less than five hours of walking. This region would more or less reflect the extent of the chora as it is alluded to in the ancient sources (Dvorjetski 2014). Moreover, we noted that practically all of the fortifications in the area between the Samakh Stream and the Yarmouk River are located exactly within the five-hour walking range, very often at the very edge of this range. Now moving to consideration of sites from all periods, it would seem that all were border forts built to protect the approaches to the chora and to the city itself. The only exceptions are located on the southern slope of Samakh Stream valley, which are a distance of between five and five and a half hours’ walk.

Conclusions

As demonstrated, GIS can offer indispensable tools for analyzing region-wide phenomena, such as visibility networks, road systems, connectivity

and accessibility of the sites. The picture emerging from this study is that in the area between the Samakh Stream and the Yarmouk River there was substantial concern for defense and control of the approaches to the chora of Hippos beginning in the Hellenistic period and continuing at least to Late Roman period. However, farther to the east, past Rujum Fiq, there is no evidence yet for such an arrangement. A possibility that needs to be examined is whether there was greater concern for internal security in the Early versus the Late Roman periods, as suggested by the mutual visibility between fortifications and settlements. The Roman imperial highway system with its installations was imposed on the region without regard for the defense of Hippos and it represents different strategic and military concerns that spanned the eastern provinces.

However, the main potential for geospatial analyses lies in their predictive abilities. Combining models for routes in the region, overlying visibilities, and approximating travel times, it is possible to predict the locations of previously unknown sites, which obviously need to be verified by fieldwork. At this point an extensive survey of fortifications has already begun and several assumed Hellenistic and Roman watchtowers have been selected for excavation in order to verify their dating.



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תקצירים

מחקר גיאוגרפי-מרחבי של תחום אנטיוכיה היפוס מהתקופה ההלניסטית ועד התקופה הביזנטית

אדם פאזוט

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המחקר המוצג במאמר זה הוא חלק ממחקר גיאוגרפי-מרחבי מתמשך של תחום אנטיוכיה היפוס (סוסיתא) מהתקופה ההלניסטית ועד התקופה הביזנטית. מוצגים בו מחקרים אחדים מבוססי שיטות GIS, שמטרתם לברר מגוון תופעות אזוריות הנוגעות למיקומם ולתפקודם של מערכות הגנה וביצורים בתחום סוסיתא. בין השאר נבדקת אפשרות קיומה של מערכת איתות צבאית וכן האפשרות לאתר מערכת דרכים מנהלתית. המחקר בוחן גם את האפשרות "לנבא" מיקומם של אתרים ולאמוד את הזמנים שנדרשו להגעה מיישובים וממתקנים צבאיים במרחב לעיר עצמה. הניתוחים הממוחשבים המוצגים במאמר הם כלי בסיסי להצגת השערות מחקר שייבחנו בהמשך כחלק ממחקר שדה.