THE ROMAN ROAD SYSTEM IN THE GOLAN: HIGHWAYS, PATHS AND TRACKS IN QUOTIDIAN LIFE

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ABSTRACT

Roman Imperial Roads (highways) built, maintained and organized by the Roman army and provincial authorities were studied in the Golan Heights since Schumacher's surveys in the 1880s. However, most of these were obliterated by building and agricultural activity since the beginning of the 20th century. Local ancient road system, linking individual communities and their agricultural land was never studied, since it barely leaves a trace in archaeological record. This paper presents reconstruction of inter-provincial highways passing through the southern Golan Heights, and local road system in GIS using cumulative focal mobility network (CFMN) analysis. The CFMN provides outline of natural corridors of movement in the region. From CFMN it is possible to extract path with higher mobility potential which will be tested against present evidence for Roman Imperial Highways, since it is assumed that corridors with high mobility potential would be suitable place for construction of (inter-)provincial road. Path with lower mobility potential might indicate local road system, so it would be possible to connect agricultural communities with the land they exploited; which in turn may have implications for site prediction and site-catchment analysis exploring quotidian movement of people and goods in the landscape. Two case studies in this respect are presented: the city of Hippos and settlement of es-Safuriyye.

Keywords: Golan Heights, city of Hippos, Archaeological GIS, Roman Roads, Focal mobility network

INTRODUCTION

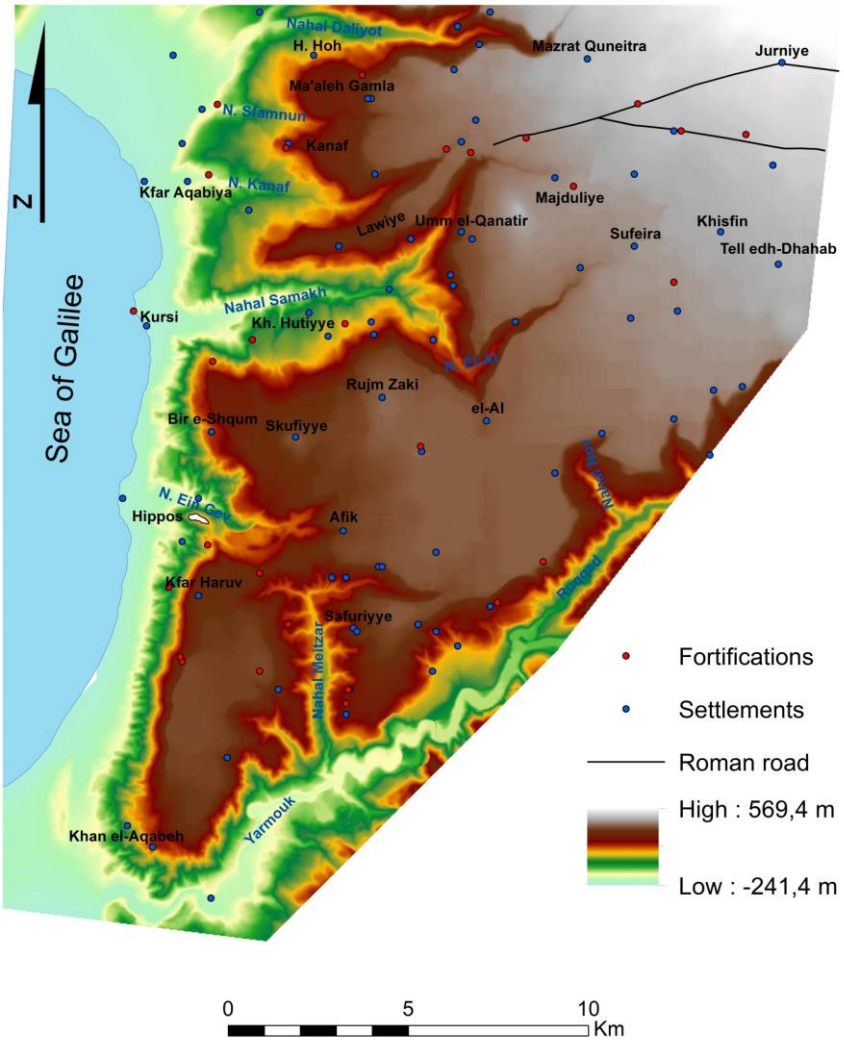
The study of Roman Imperial roads (highways), their construction, milestones and associated installations is well established area of research (Thomsen, 1917; Chevallier, 1997; in the Levant e.g. Bauzou, 1985; Roll, 1994, 2009).

Nevertheless, we must bear in mind that the reasons behind building these Roman Imperial roads were mainly military-strategical and they were designed to connected garrisons, important cities as administrative, commercial and transportation hubs (Isaac, 1990). However, local roads connecting individual settlements, their agricultural land, towns and eventually even main Imperial highways did exist. The reason they are not usually studied is simple – there are no traceable remains of them in the field. Recently, some scholars tried to reconstruct local communication networks using combined methodology of GIS modelling and field survey (Grey *et al.*, 2015) in order to explore everyday experience of local population in moving across rural landscape and accessibility of various settlements. This paper focus on these questions in an area of the southern Golan between the Sea of Galilee,

the Yarmuk and Ruqqad rivers and up to Nahal[1] Daliyot in the north, a region that roughly centers on the city of Hippos-Sussita, located 2 km east of Sea of Galilee (Fig. 1).

The main goals of the study can be summarized as: 1) Establish natural corridors of movement 2) Establish route hierarchy in the region and recognize main roads from secondary and local roads in the Roman period 3) Explore the relationship between the hinterland of the settlements and the road system, their connectivity and accessibility.

Fig. 1: The study region with place names mentioned in the text



[1] Nahal in Hebrew means "stream", however in the article it is used in a wider sense, referring not only to (seasonal) streams themselves but mainly to the valleys formed by them.

Before continuing we shall briefly describe what is known of the Roman Imperial road system in the area. The region was surveyed by Schumacher in the 1880's who was able to trace several roads that disappeared since then, some of them were probably Roman or Medieval (Schumacher 1888, 61-5). Avi-Yonah updated Schumacher's conclusions in the 1960's (Avi-Yonah, 1966). Most up-to-date information are to be found in Urman (1985), in the Introduction to the Golan Survey (Hartal et Ben Efraim, 2012a) following the surveys conducted since 1967 war, and in Roll (2009). The main routes which cross the region are: a) a road around the Sea of Galilee, known from several milestones found north of Hippos and in the vicinity of kibbutz Ha-On and several sections in the vicinity of Kursi (Urman, 1985); b) a road that ascends at Khan el-Aqabeh in the direction of Kfar Haruv-Afik-Hispin, roughly corresponding to the modern road. Exact continuation of this road past Hispin is uncertain. The remains of the original road were described by Schumacher (1888, 63-4). This road however was probably not a "Roman Imperial highway" as there are no known milestones associated with it and available evidence for road construction is from the rule of ʿAbd el-Malik at the turn of $7^{th}/8^{th}$ c. CE (Elad, 1999); c) a road through Lawiye spur below kibbutz Ramot, where several milestones were found. It forks at the head of the spur in the east into two directions – north-east and south-east. Both sections can be traced in the field with several milestones and watchtowers along their courses (Ma'oz, 1982; Hartal et Ben Efraim, 2012b). d) A road connecting city of Hippos with the lake road a), also attested by several milestones, whether this road continued further east past Hippos is not clear.

METHODOLOGY

The goals outlined in the introduction will be explored using GIS tools, with the region as a case study. The model is based on incomplete archaeological evidence and on several assumptions concerning the nature of movement in different natural environments (valleys, steep slopes etc.). Nevertheless, it will be shown that the model itself is rather robust and have predictive potential which can be used as a tool for predictive-postdictive approach in archaeology (Arnoldus-Huyzendveld *et al.*, 2016). The results of the analyses were correlated with old topographical maps of the region in order to assess proposed corridors versus historical evidence.

1) Natural corridors of movement

In order to explore movement of people in the environment, establishing natural corridors of movement seems to be most promising approach (Verhagen *et al.*, 2013). The Cumulative Focal Mobility Network (CFMN) approach is based on direction-less movement from source point (Fábrega-Álvarez, 2006). It computes least-cost path for a source point that shows all easiest accessible routes for a given point (focal mobility network). These focal mobility networks for all points are then added together and their density is computed in 50 m search radius. Where mobility networks for multiple points converge, there they form natural corridors of movement (Déderix, 2016). The CFMN was computed for 51 points spread evenly across the study region using r.walk module in GRASS GIS. R.walk computes anisotropic cost of movement (direction dependent), this was used in order to see if places of descend from the Golan plateau would be the same as ascents. The focal mobility networks for the source points were extracted using hydrology tools, after computing cost surfaces for each point. Arbitrary friction surface was used excluding very steep slopes (>40°) and bottoms of valleys (due to seasonal flooding and ubiquitous presence of waterfall steps) from

the analysis. This operation was repeated for settlements (55 Early Roman and 71 Late Roman settlements[2]) as well as for the examination of potential differences.

2) Route hierarchy

Apart from establishing the natural corridors of movement, CFMN can serve for extraction of route hierarchy, as it was explained in the previous paragraph the natural corridors of movement are formed where the focal mobility networks of the source points tends to converge. Therefore corridors can be classified according to density of these joints. The high value shows corridors more favorable (more preferred) to movement and thus "higher" in the hierarchy, assuming these would be the major routes in the region, possibly identical to the supposed Roman highways. CFMN were reclassified using ½ standard deviation and the resulting categories were grouped as Major-Secondary-Local roads.

3) Connectivity and accessibility

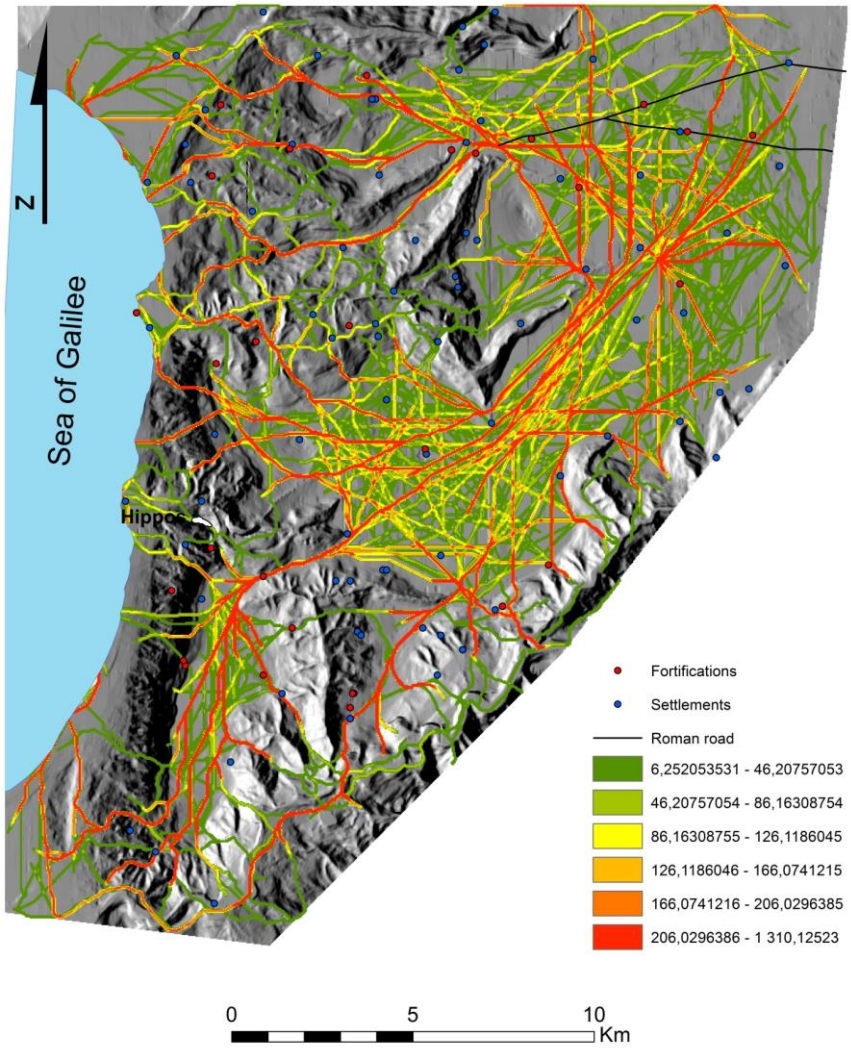
From the previous analyses it is clear that those are sufficient for exploring connectivity of settlements among themselves, e.g. their location in the hierarchical route network. However, with site catchment analysis it is further possible to: a) estimate travel time from locations (to their neighbors and/or high order routes in the communication network) and b) estimate extent of the agricultural hinterland of the sites and how they relate to communication network. The site catchments were calculated using r.catchment module in GRASS GIS with "pessimistic" friction surface reflecting time penalties on slopes (Zakšek, 2007).

RESULTS

The general model computed for 51 points, spread evenly across the study area (Fig. 2), shows both the natural corridors of movement and also the caveats of the method. While on the slopes and valleys it usually follows one route that branches close to flatlands, in flat or gently sloping areas the analysis gives more complicated picture. Here the routes follow most direct course between points so there are many parallel routes that only slightly diverge from each other. However, it is still possible to extract route hierarchy. These would constitute rather wide corridors of movement (few hundreds of meters). Secondly, using anisotropic cost of movement and due to the fact that majority of points in the regular grid used for computing general model are located on the plateau of Golan tends to make more places of descent.

[2] Based on database of the Archaeological Survey of Israel by Israel Antiquities Authority (Hartal & Ben Efraim, 2012a).

Fig. 2: Natural corridors of movement as modelled through Cumulative Focal Mobility Networks analysis. Values indicate density of connections within 50 m search radius classified according to ½ standard deviation.



Natural corridors of movement

Going from north to south and from west to east the proposed natural corridors of movement would be as follows:

1) Corridors between Nahal Daliyot and Nahal Samakh from north to south.

a) One ascends Ma'aleh Gamla and from there onto the Golan plateau through Horvat Zeiteh to the head of Kanaf spur and Lawiye spur. A possible branch ascends from Nahal Daliyot at Horvat Hoh.

b) A corridor through Kanaf spur with two alternative starting points – one north-west from Horvat Kanaf on the lower part of Nahal Sfamnun, other on south-west from Nahal Kanaf north from Kfar Aqabiya. It joins Ma'aleh Gamla corridor at the head of the spur.

c) Lawiye spur ascent, which should correspond to the Roman Imperial highway, starting north-west of the moshav Ramot and joining previous two corridors at the head of Kanaf spur. Alternative ascent onto Lawiye starts south-west of Ramot on the lower course of Nahal Samakh, close to Kursi.

2) A corridor(s) from Nahal Samakh

They ascend below Skufiyye/Bnei Yehuda and continuing to east and south in direction of el-Al and Afik. Another possible corridor would connect Lawiye spur and Golan plateau via Khirbet Hutiyye.

3) Ascents between Nahal Samakh and Hippos.

a) The northern ascent of the three seems unlikely. The slopes below edge of the Golan plateau are rather steep and there is no evidence from historical maps for any routes in the area.

b) Two southern ascents – one below Bir e-Shqum and other beginning at Nahal Ein Gev seems more probable. They would continue eastward to Afik.

4) Between Hippos and Yarmouk

a) A corridor that goes right through the ancient site, connecting the lake road with the the Golan plateau, albeit it is low in hierarchy (see further).

b) An ascent below Kfar Haruv, which again constitutes problem due to steep ridges and lack of historical evidence for routes in the area. However presence of several structures of Roman date, such as Nahal Sussita Spur (Hartal et Ben Efraim, 2012d: site 80) and Tal fort (Eisenberg, 2014: 96-7), close to the corridor gives certain possibility for its existence although on different course.

c) Further corridors are located at Khan el-Aqabeh ascent in the south with two possible branches. After reaching the Golan plateau, corridor continues towards Kfar Haruv where it connects to ascents from vicinity of Hippos and turns east towards Afik.

5) From Yarmouk valley

Apart from possible corridor through the Yarmouk valley itself several possible ascents emerge.

a) Two are on both sides of Nahal Meitzar, western one connecting with corridor from Khan el-Aqabeh, the eastern one continuing north-east towards el-Al.

b) Several other ascents are located between Nahal Meitzar and Ruqqad River. Although there is evidence for trails in historical era, these ascents probably represent local routes due to unfavorable nature of terrain.

6) Corridors between Nahal Samakh and Yarmouk River.

As it was indicated above ascents generally tend to connect to several major parallel corridors on the flat Golan plateau. What is clear is the existence of corridor that roughly corresponds to modern road 98 from Khan el-Aqabeh through Kfar Haruv, Afik and el-Al, to which ascents from north-west (Nahal Samakh) and south/south-east connects. Thus they create a very dense network of corridors on the Golan plateau.

7) From el-Al to north.

The 2.5 km wide "isthmus" between Nahal El-Al and gorge of lower Nahal Nov forms natural bottleneck where parallel corridors from the west move closer to each other. From

there they continue together to Sufeira (modern settlement Hispin) where branching takes place.

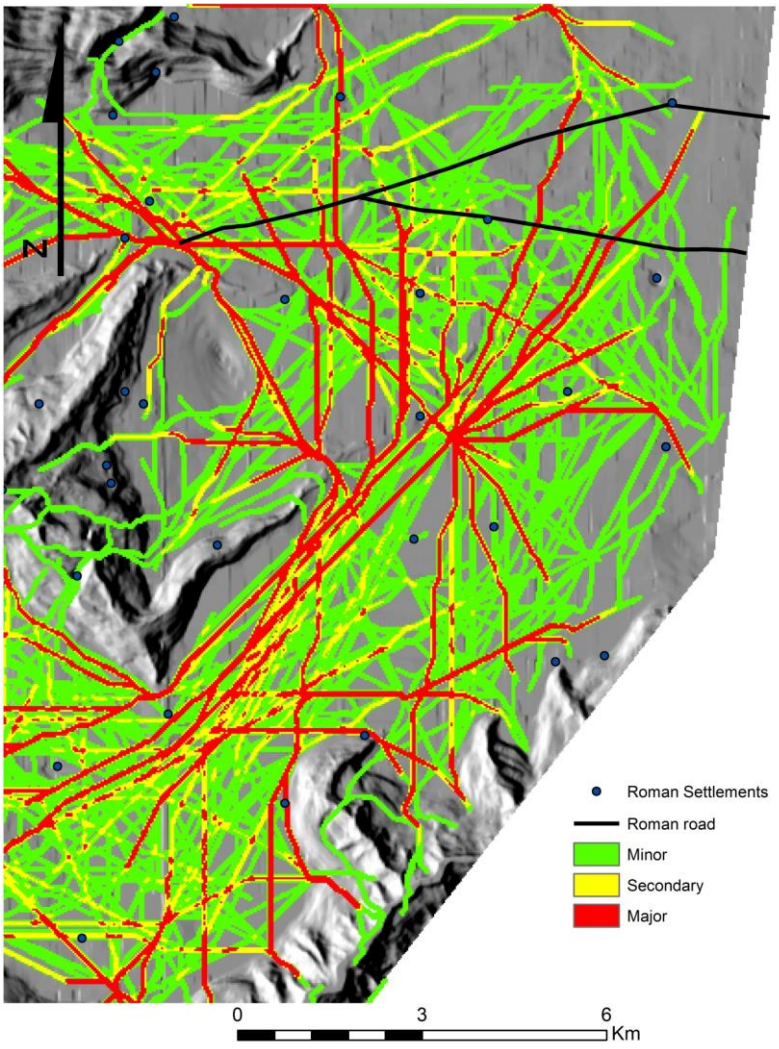
a) In the area of modern settlements Hispin and Ramat Ha-Magshimim the south-west north-east corridor (under 6) meets corridor formed by merger of ascents at the head of Kanaf spur/Lawiye spur.

b) Corridor formed at the head of Kanaf spur/Lawiye spur also branches. One branch leads to Majduliye where it splits – one course goes to Sufeira, while other takes southerly course towards the head of Nahal El-Al.

c) Another branch follows crest of the Golan plateau to the west through Umm el-Qanatir.

d) Several corridors branches off at Sufeira/Ramat Ha-Magshimim, one goes directly to the north in direction of Mazrat Quneitra, two follows north-eastern direction, the more eastern one in direction of Jurniye, other one leads eastward approximately to Tell edh-Dhahab.

Fig. 3: Relationship between extant stretches of Roman road and natural corridors of movement



The models computed for Early Roman (55 sites) and Late Roman settlements (71 sites) shows minor differences from the general model. The places of ascent and main corridors on the Golan plateau are unchanged; some only slightly shifts up and down in the hierarchy. Since the iterations were computed for the settlements themselves, the model obviously produces more local connections between the sites; however these are low in the hierarchy.

If we concentrate on the relation between the known stretches of the Roman Imperial road and the proposed corridors of movement (Fig. 3) we see no clear connection apart from that at the head of Kanaf spur/Lawiye spur where it is known that the Roman highway continued towards kibbutz Ramot. From the point above the Lawiye spur a corridor branches to north-east, but this branch diverges from the course of Roman highway by ca. 18.5° to the north but this branch is low in the hierarchy. The southern branch of Roman highway starting at Samakh reservoir is not paralleled by corridor in the general model. On explanation is that we are dealing with pronounced edge effect since the Roman highway is to be found at the north-eastern corner of the study area.

Route hierarchy

After reclassifying the raster map, applying one half standard derivation and extraction of the route hierarchy we can observe that very few stretches of movement corridors can be classified as secondary routes. Almost all of them fall either to Major or Local bracket (Fig. 4). However an attempt to classify routes using a model supported by archaeological data (milestones) combined with topographical maps, can be made. Major routes through the region would be:

a) A coastal road along the lake (which was not strongly pronounced in the model), model is supported by actual milestones found

b) Lawiye spur road connecting to known Roman roads on the Golan plateau and with secondary branch leading from lower Nahal Samakh

c) Kanaf spur ascent which may have been supplemented with Ma'ale Gamla ascent, although these two routes were probably only secondary to preferred Lawiye road (as indicated by milestones)

d) A major south-west north-east road starting at Khan el-Aqabeh ascent. While we can be rather sure about its course until it reaches ancient Khisfin, past that point the situation is less clear. So far, no intersection of known Roman roads with a supposed north-south road is known, therefore it is possible to offer at least three alternatives according to the model (Fig. 5)

e) The Hippos road is connecting the coastal road a) with a road under d) above. The Hippos road is in fact rather low in the hierarchy but in the Roman period it would have been a major route thanks to the importance of the city. It may have been supplemented by another ascent to the south of Hippos but this is far from clear.

Fig. 4: Route hierarchy extracted from Cumulative Focal Mobility Networks analysis

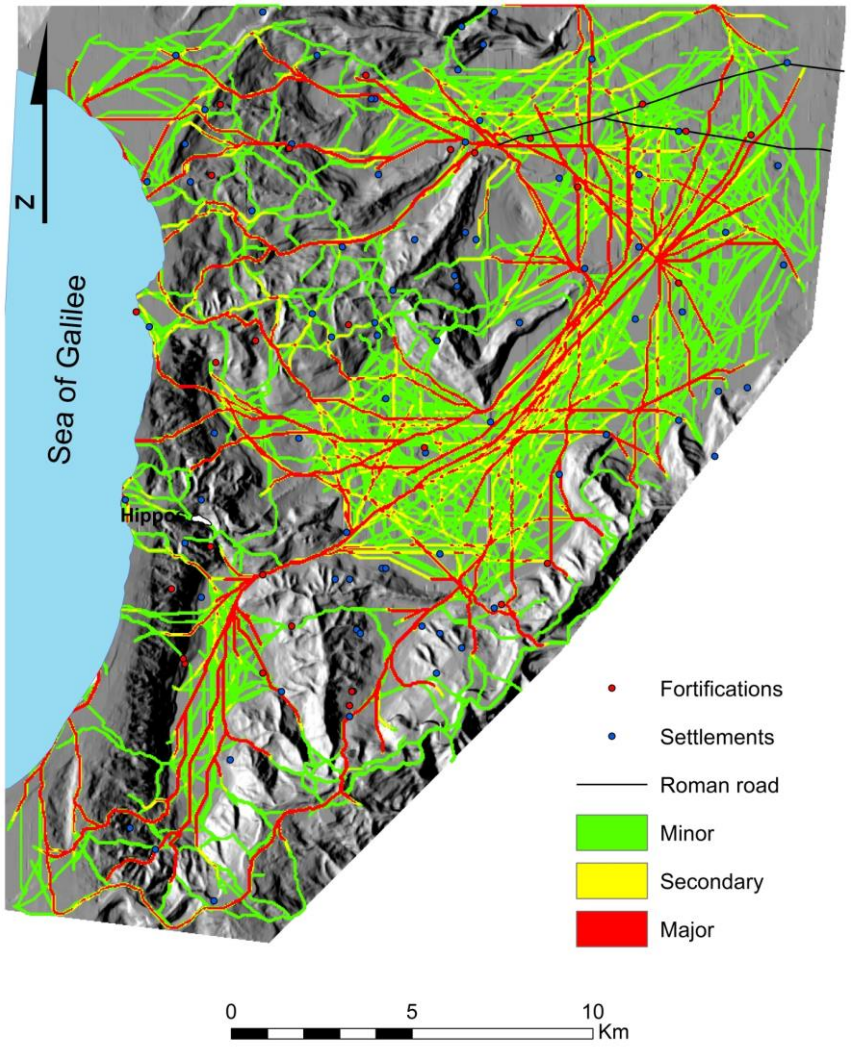
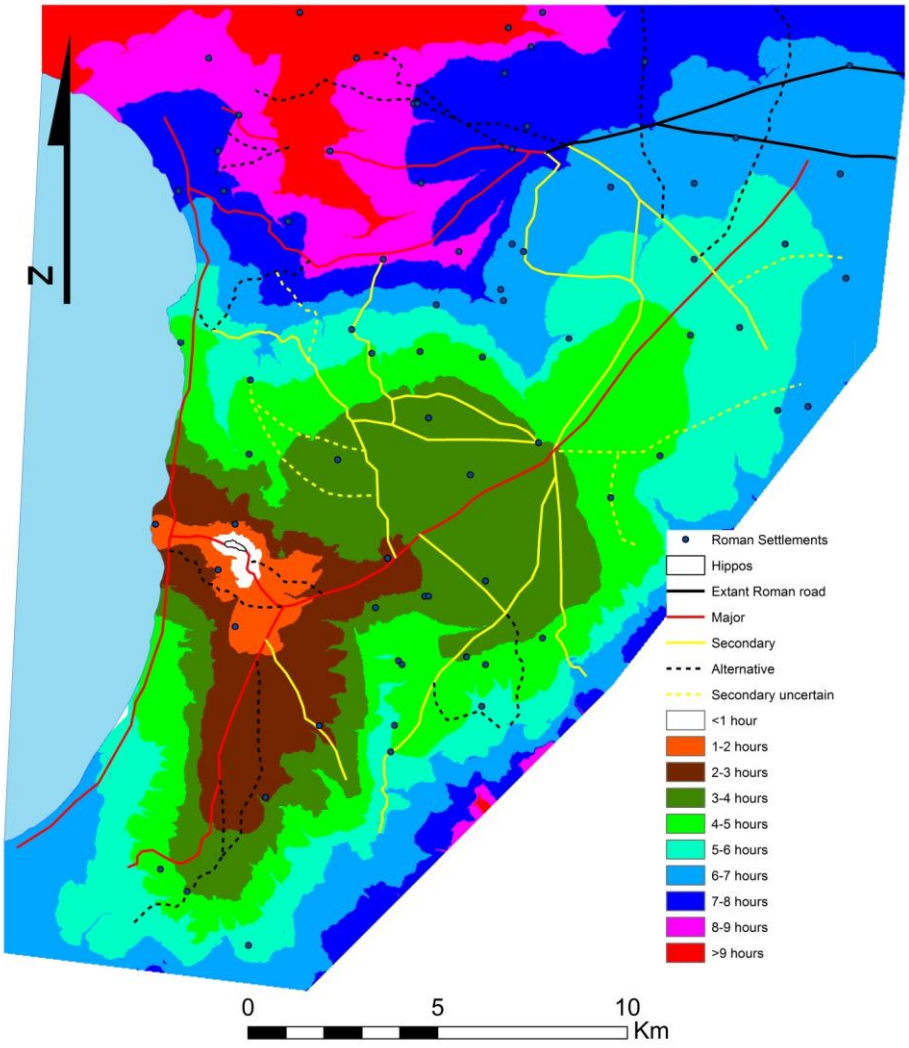


Fig. 5: Travel times for the city of Hippos



These major routes would be connected by secondary routes mainly going north-south, such as ascents from Nahal Samakh towards Afik and el-Al past Rujm Zaki. An ascent from Yarmouk valley could possibly fall into this category as well; however their importance was probably only very local. Two secondary routes may have existed between Nahal Kanaf and Nahal El-Al, one through Majduliye, other through Umm el-Qanatir. Although the latter would be probably again of only local importance, while the former through Majduliye would continue towards Ruqqad River. From a look at the map (Fig. 2) it is also clear that many settlements are located directly on or very close (within few hundred meters) to the proposed communication network and thus in direct relation to natural corridors of movement (27 out of 55 Early Roman, 37 out of 71 Late Roman settlements are closer than 500 m). Exceptions are to be found mainly on the slopes further from the ascents and among

several sites on the Golan plateau. However, it is important to bear in mind that the proposed reconstruction of routes is a rough approximate especially on the Golan plateau. Therefore, if we considered wider corridors instead of route network, actually more sites would be directly connected with the natural corridors of movement.

Connectivity and accessibility

Only two case studies in site catchment analysis and connectivity will be shown, these are the city of Hippos and randomly chosen small to medium size settlement of Safuriyye, located on a hill above eastern slopes of Nahal Meitzar.

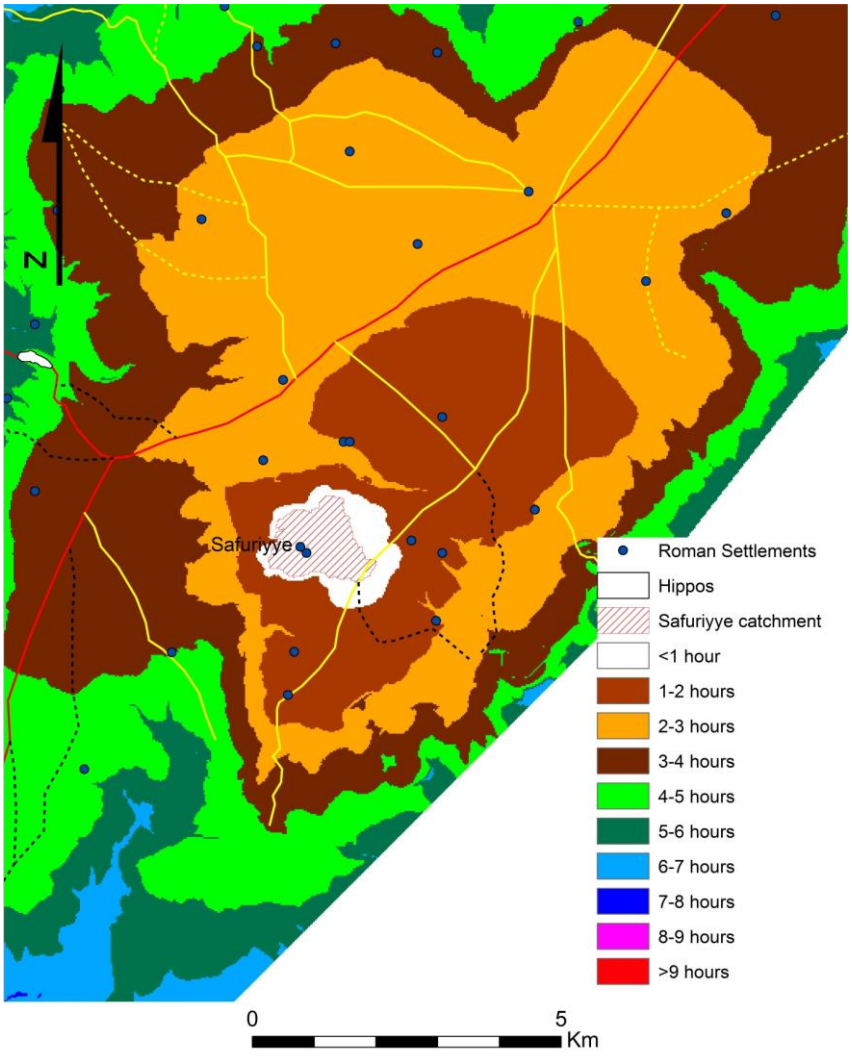
Hippos was founded as a Hellenistic colony and developed into *polis* after the battle of Paneion in 200 BCE, during the first half of the second century BCE. Assuming the new colonists were given agricultural land in the *chora* (territory) of the city (Cohen, 1978; Billows, 1995) we may estimate location and extent of this agricultural hinterland based on site catchment[3]. For Hippos, only the travel times were computed as it was assumed that agricultural land was not located further than 3 hours of travel from the city (Bintliff, 2008). The travel time map (Fig. 5) however presents several problems; first, since Hippos is located on a very steep hill the analysis shows very little area covered during first two hours of travel (i.e. low average speed of traveler of around 1 km/h). Nevertheless, moving beyond certain point from Hippos, the area covered and average speed rise to a more realistic 3-3.5 km/h. Secondly, a map showing only travel times from point of departure lacks important information for the estimation of agricultural hinterland – it does not exclude slopes too steep for cultivation or terracing, nor does it show suitable agricultural land elsewhere. Nevertheless, it is possible to define wide area where to locate the hinterland of Hippos. It would be located mainly to the south of Hippos on the flat plateau extending behind Kfar Haruv, in the valley to the east towards Afik and in the coastal strip around Ein Gev. Obviously, since both CFMN and r.catchment module use similar algorithm for computing cost surface it is possible to correlate the location of natural corridors of movement resp. reconstructed routes vis-à-vis estimated travel times.

For the settlement of Safuriyye both catchment area and travel times were computed (Fig. 6). The Arab village with significant ancient remains (Hartal et Ben Efraim, 2012c, site no. 36), including tombs, quarries and agricultural installations, extends on ca. 6 ha on a hill above Nahal Meitzar. A catchment area of 150 ha was assigned to the site assuming ca. 10 ha of agricultural land for 15 nuclear families each, excluding slopes above 30°. The area covered extends to some degree to the slopes north and south of the hill itself, majority of it however is located to the east in the flat area. Incidentally, this area on the Golan plateau intersects with one corridor/proposed route starting in the Yarmouk valley east of the mouth of Nahal Meitzar, which continues towards el-Al. Comparing this catchment area versus estimated travel times it is possible to observe, that all of the catchment/hinterland is located within one hour walking distance from the village. We may hypothesize that accessible agricultural land of the village may have well extended beyond assigned catchment area, assuming maximum of three hours walking distance. The three hour walking distance in fact covers great area of the Golan plateau between the Yarmouk River and Nahal Samakh and many settlements including Afik and el-Al, neatly following natural corridors of movement. The main south-west north-east corridor running through the Golan plateau is accessible in slightly more than two hours of walking. The city of Hippos would be located only slightly

[3] Needless to say, we don't have historical records clarifying the nature of Hellenistic settlement; therefore this assumption is largely conjectural. Nevertheless, it may be used for estimation of agricultural hinterland for the Roman period city as well.

more than four hours of travel. Thus it is possible to say that village together with its hinterland was well connected to the road system and easily accessible with its neighbors although it is located further from the main corridors.

Fig. 6: Catchment area of 150 ha and travel times for Safuriyye



CONCLUSIONS

The goal of this paper was not only to reconstruct the Roman period road system in the southern Golan Heights but extend simple line drawing on a map and include local communities in the big picture. It was demonstrated that while CFMN approach shares several caveats with least-cost path methodologies, it is nevertheless useful in exploring general patterns of movement in vast areas and further in connecting settlements with their neighbors and hinterland. Also, as it was demonstrated on two case studies – the city of

Hippos, the center of the region during the Roman period and an "average" village of Safuriyye, that settlements, whatever remote they may seem at first sight, are in fact well connected to other settlements in the area and natural corridors of movement. This of course may have implications for the study of site locations via existing routes and vice versa. This paper could have gone one step further and include also agricultural installations, dams, water reservoirs, quarries and cemeteries into the analysis. However that would go beyond the scope of this article.

Generally, the models, as the one that was just presented, have predictive potential for site location. And, it must be stressed, these models should be tested in the field and then be updated using newly acquired data in order not only to provide prediction for site/feature location but mainly to provide explanation for their location choice (predictive-postdictive approach).

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