

Research Article

Jørgen Christian Meyer, Eivind Heldaas Seland*

Water, Communication, Sight, and the Location of Fortifications on the Strata Diocletiana (Syria) in Late Antiquity

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Abstract: The *Strata Diocletiana* was a military road in Late Roman Period Syria. It ran from Damascus to the Euphrates by way of Palmyra. The road was fortified and received its name during the reign of Diocletian (284–305 CE), following the Roman sack and subsequent garrisoning of Palmyra after the city's failed revolt 272–273 CE. The *Strata Diocletiana* is only one of several attested routes between Palmyra and western Syria and one of two between Palmyra and Damascus. In this study, we seek to understand why this route was chosen for the new fortified road. We compare the location of Late Roman fortifications along the *Strata Diocletiana* to the modern distribution of water in the Syrian Desert and the theoretical least-cost paths between Palmyra and Damascus, and Palmyra and the fortress of Sura on the Euphrates. The argument is made that some parts of the Roman road network in the Syrian Desert were planned in order to control major water sources along the desert rim, but that the new military road between Damascus and Palmyra in the late third century CE was constructed with the aim of monitoring and controlling access to settled regions from the desert, in addition to ease and speed of communication. The conclusions have bearings not only on our understanding of the Late Roman defence and communication system, but also on nomad-settled interaction in Late Antiquity and the use of GIS methodologies in the reconstruction of ancient communication networks.

Keywords: Palmyra, Roman roads, GIS

1 Introduction

The Syrian Desert is a semi-arid region on the borders between present-day Syria, Jordan, and Iraq (Figures 1 and 2). It extends from the edges of agricultural land in western and northern Syria towards the Euphrates to the east and the Arabian Desert to the south (Grant, 1937; Lancaster & Lancaster, 1999). In the Roman period, the Syrian Desert was part of the south-eastern frontier of the Roman empire. The northern and western sections of this frontier were under direct Roman control, as evidenced by inscriptions by Roman soldiers and magistrates (e.g. Konrad, 2001; Mouterde & Poidebard, 1945). Deeper into the desert, Rome relied on semi-nomadic allies, prominently the city of Palmyra, which although part of the Roman Empire, enjoyed considerable autonomy, and whose elite upheld a strong pastoral identity and maintained tribal, diplomatic, and commercial ties with the

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* **Corresponding author: Eivind Heldaas Seland**, Department of Archaeology, History, Cultural Studies and Religion, University of Bergen, P.O. Box 7805, N-5020, Bergen, Norway, e-mail: eivind.seland@uib.no

Jørgen Christian Meyer: Department of Archaeology, History, Cultural Studies and Religion, University of Bergen, P.O. Box 7805, N-5020, Bergen, Norway, e-mail: jorgen.meyer@uib.no

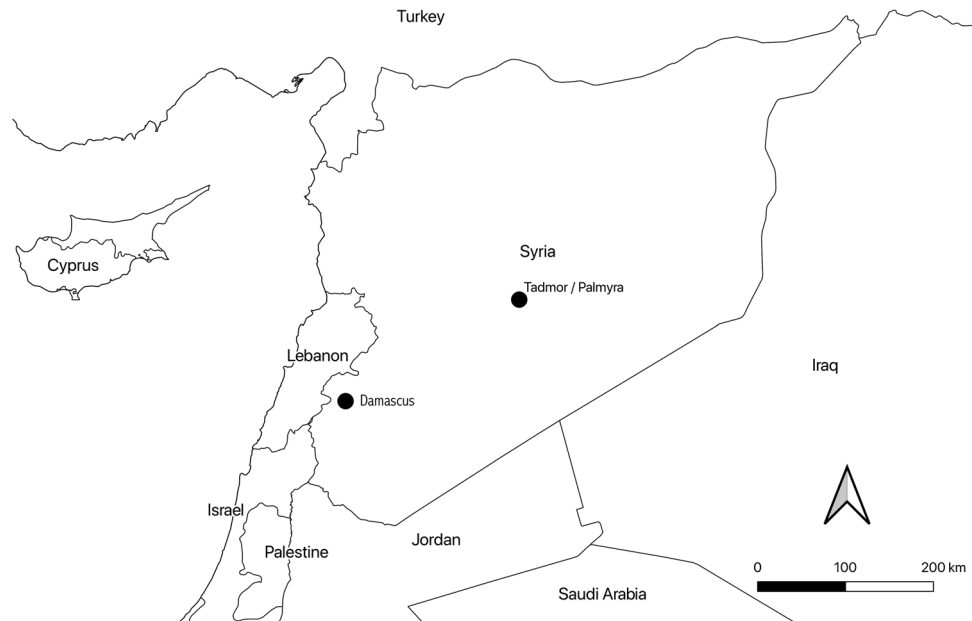


Figure 1: Location of Palmyra. Eivind Heldaas Seland. Made with Natural Earth.

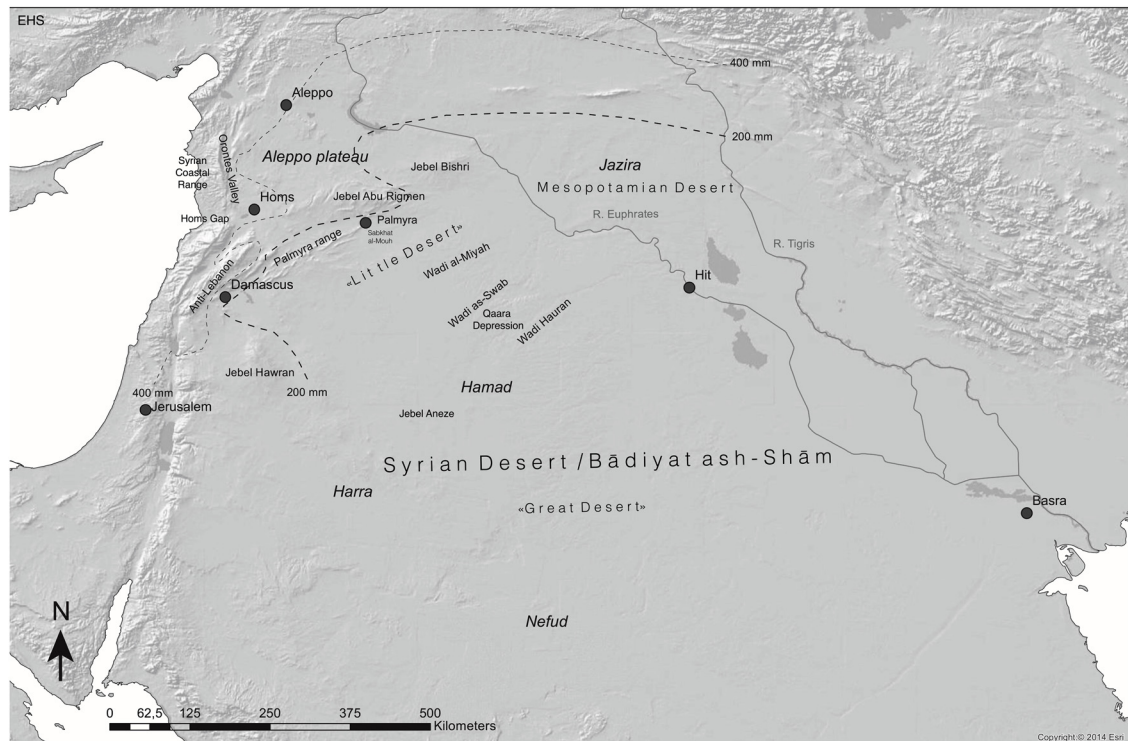


Figure 2: The Syrian Desert. Eivind Heldaas Seland. Basemap © ESRI 2014.

desert population and to the Arsacid and later the Sasanian empires that bordered the Syrian Desert to the east (Gawlikowski, 2020; Raja, 2022; Smith, 2013; Sommer, 2017; Yon, 2002).

The Syrian Desert is classified mostly as arid cold in the Köppen–Geiger climate system (Beck et al., 2018), and commonly described by scholars as a steppe, Arabic *badiya*, rather than a desert (Lancaster & Lancaster, 1999; Wirth, 1971). This is because the region receives substantial rainfall during the winter months, the



Figure 3: Khan al-Hallabat. Jørgen Christian Meyer.

modern mean annual rainfall at Palmyra being 132.7 mm (World Meteorological Organisation, n.d.), and because there is considerable potential for vegetation (grass and scattered trees) in areas that are not subject to extensive grazing (Meyer, 2017, pp. 21–23). The northern Syrian Desert is divided into seven drainage basins, where water converges on the lowest points. This creates several oases served by perennial springs, Palmyra being the most important (Wirth, 1971, pp. 63–64). Within these basins, there is also a significant potential for groundwater wells, especially in the beds of intermittent watercourses, *wadis*, and for the collection of surface water in cisterns and reservoirs along such wadis and in low-lying terrain. Further south, the landscape slopes eastwards to the Euphrates through three large valleys, limiting the access to waters to certain spots and to the zone near the river (Seland, 2019).

That the Romans were able to rely on their Palmyrene allies and subjects for security along this part of the frontier is indicated by a near complete lack of permanent military infrastructure along the desert routes until the late third century CE. This is in contrast to the desert frontier further south, in present-day Jordan, which was fortified over the course of the second century CE following the annexation of the Nabataean kingdom (Castro, 2018; Kennedy, 2004). The situation in the Syrian Desert apparently changed only after Aurelian's sack of Palmyra, 273 CE. In the following decades, forts were constructed at regular intervals and garrisoned with Roman soldiers, according to the late fourth century *Notitia Dignitatum*, mostly with auxiliary forces. Some controversy has surrounded this fortification of the Syrian border in the fourth century. Early scholarship saw it as a system of defence designed to withstand major invasions of the kind that the Late Roman Empire experienced from Sasanian armies in northern Mesopotamia and in the south with the uprising of Mavia and the Tanukhids (378 CE) and during the Arab conquest in the 630s CE. Isaac, including also the fortifications along the *Strata Diocletiana* considered below in his discussion, argued that the scale, situation, and organisation of fortifications and military forces were never intended for, and would certainly not be up to a task like that, and that the military outposts were more likely established in order to facilitate, monitor, and regulate communication in the desert by controlling water sources and crossroads (Isaac, 1990, pp. 177–220). Nevertheless the investment in infrastructure reflects that direct military control was now deemed necessary in order to control the frontier (Figures 3 and 11–13). Palmyra itself was turned into a fortress and became the base of the *Legio Prima Illyricorum* (Intagliata, 2018, pp. 69–82).

Two main routes (with several branches and connections) existed between Euphrates, Palmyra, and Damascus in Antiquity (Mior, 2016; Figures 4 and 5). A northern route followed the trajectory of the modern (and ancient) road to Homs westwards across the Ad Daww plain, before turning southwest along the Jebel Woustani range, passing the important site of Heliaramia/Qasr al-Heir al-Gharbi, and the oasis of al-Qaryatayn, probably ancient Nazala (Mior, 2016, pp. 53–56). The route known as the *Strata Diocletiana* runs directly southwest from Palmyra and proceeds south of the Jebel Rawaq range. It is documented through Roman fortifications and milestones (Bauzou, 1989; Mior, 2016), and was first identified by the Czech explorer Alois Musil during his travels in the region before WWI, and later through the aerial and ground surveys conducted by René Mouterde and Antoine Poidebard in the 1920s (Mouterde, 1930; Musil, 1928; Poidebard, 1934). The *Strata Diocletiana* continued skirting the Jebel Abu Rigmen range northeast of Palmyra, passing through the oases of Arak, Sukhne, Tayibe, and al-Kum, gradually turning straight north towards the Euphrates, reaching the river at Sura, opposite from present-day Raqqa (Figures 4 and 6). This road is older than the southern branch, dating at least back to the first century CE (Bauzou, 1989; Konrad, 2001; Seyrig, 1932). Additional routes westward from Palmyra led to Epiphania (Hama) and Emesa (Homs) (Bauzou, 1989; Magnani & Gregoratti, 2020). In this article, we ask the rationale behind the routes selected for the *Strata Diocletiana*, in particular, for the itinerary chosen for the investment in a new road between Palmyra and Damascus, marked by milestones and fortified outposts, at the turn of the fourth century CE.

2 Methods

We agree with Isaac (1990) that the fortifications were never designed to withstand large scale invasions, but also with Castro (2018) that there is no necessary opposition between defensive function and territorial control. We propose three hypotheses for the organisation of the transport network: (1) That the routes

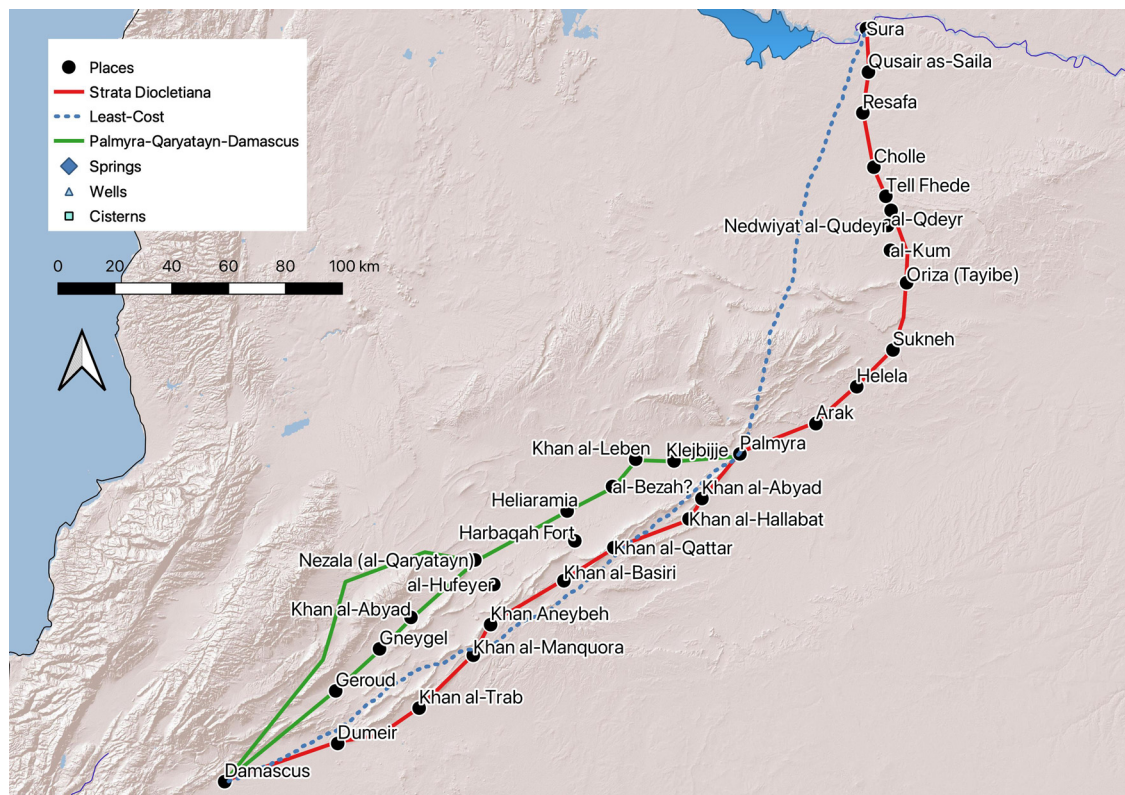


Figure 4: Strata Diocletiana and LCPs Sura–Palmyra–Damascus. Eivind Heldaas Seland. Basemap © ESRI 2014.

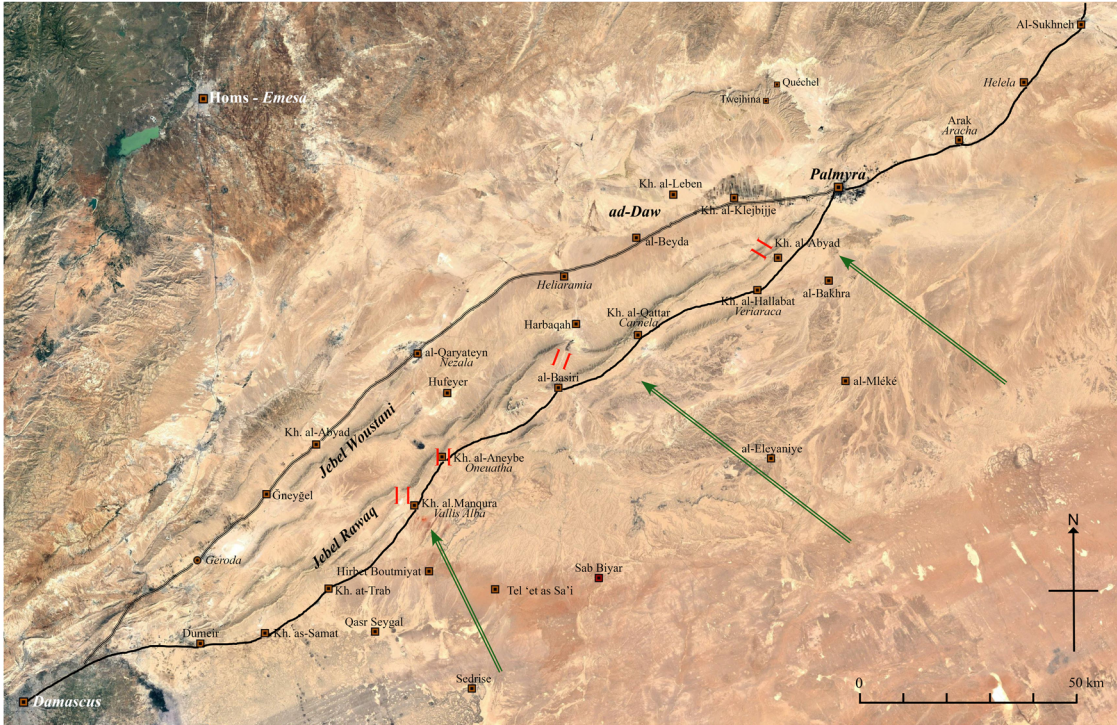


Figure 5: Palmyra–Damascus. Sites and routes. Jørgen Christian Meyer. © Google Earth 2020. Image Landsat/Copernicus.

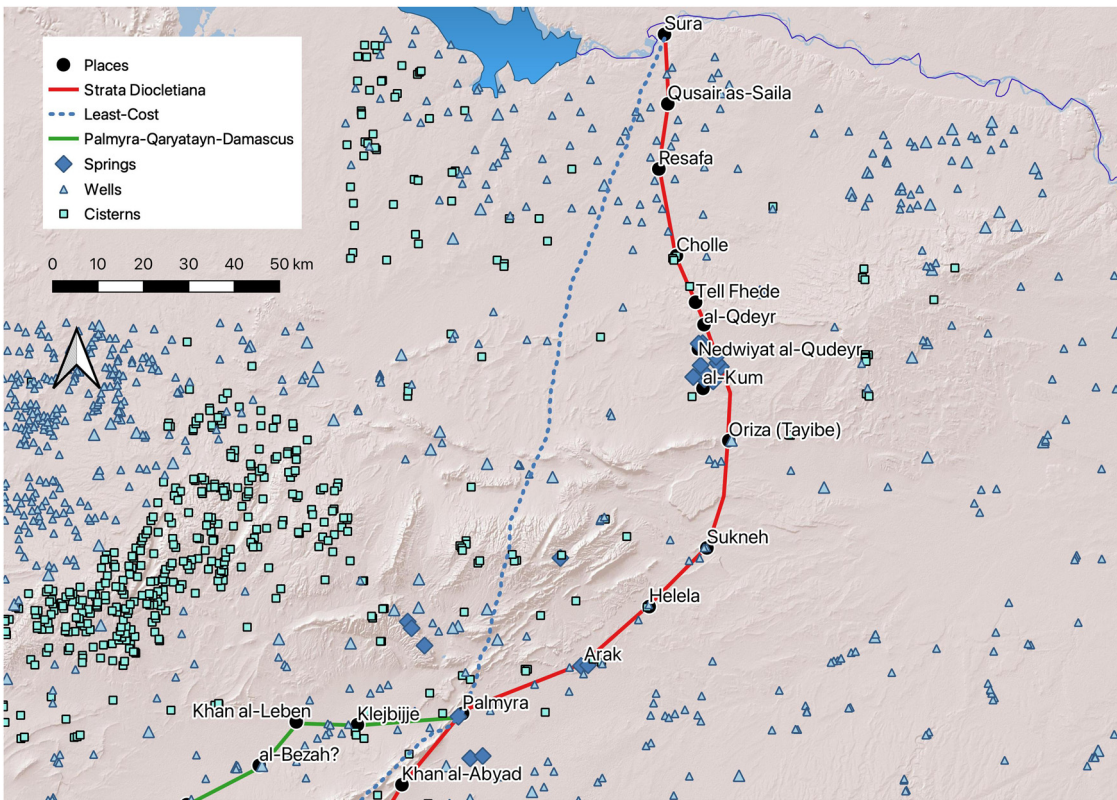


Figure 6: Palmyra–Sura. Sites, routes, water, and LCP. Eivind Heldaas Seland. Basemap © ESRI 2014.

were chosen in order to facilitate swift communication; (2) that the routes were determined by the need for water for garrisons and travellers; and (3) that the Roman military roads were constructed in order to secure territorial control, including control with water sources, communicational bottlenecks, and existing settlements. In order to test these, we compare the layouts of the routes in question as documented by archaeological features, with known water sources and Roman-period archaeological sites in the region, the theoretical least cost paths (LCPs) between Damascus, Palmyra, and the Euphrates, and the viewsheds of the new military outposts established at the turn of the fourth century CE, as well as important topographical features.

Our data for the cost-path analysis consists of the ASTER digital elevation model (DEM) by NASA and Japan Space Systems (JSS), which has a 30 m resolution. This means that the whole earth except the polar regions have been 3D mapped in $30\text{ m} \times 30\text{ m} \times 30\text{ m}$ cells. On basis of this, a cost raster was produced, which describes the energy cost of travelling through each cell. Using the LCP plugin by FlowMap Group in the GIS suite QGIS, we modelled the theoretical LCP from Palmyra to Damascus and from Palmyra to Sura (Figures 4, 6, and 7). LCP has become the standard method for reconstructing connectivity archaeologically in recent years. As pointed out by Herzog, results of such analyses may vary considerably according to DEM and LCP-algorithm chosen by scholars, raising issues about replication and validity of results (2022). With regard to elevation data, the NASA/JSS DEM is currently the best available for Syria. The LCP plugin chosen accounts only for slope, not for land cover or mode of transport (wheeled or pedestrian). The environment of the Syrian Desert, with no perennial waterways, no vegetation obstructing movement, and hard gravel surfaces, alleviates these problems, arguably making the LCP well suited particularly for the area between Damascus and Palmyra.

The presence of water was modelled using a dataset of more than 2,200 sources of water in the Syrian desert as they appear on cold war era military maps, divided into springs, major wells, minor wells, and cisterns and reservoirs (Seland, 2019; Figure 8). While we cannot assume that modern and ancient patterns of water distribution are identical, they must nevertheless be quite similar, as the climate has not changed significantly (Raja & Seland, 2022), and the location of water sources is determined mainly by stable

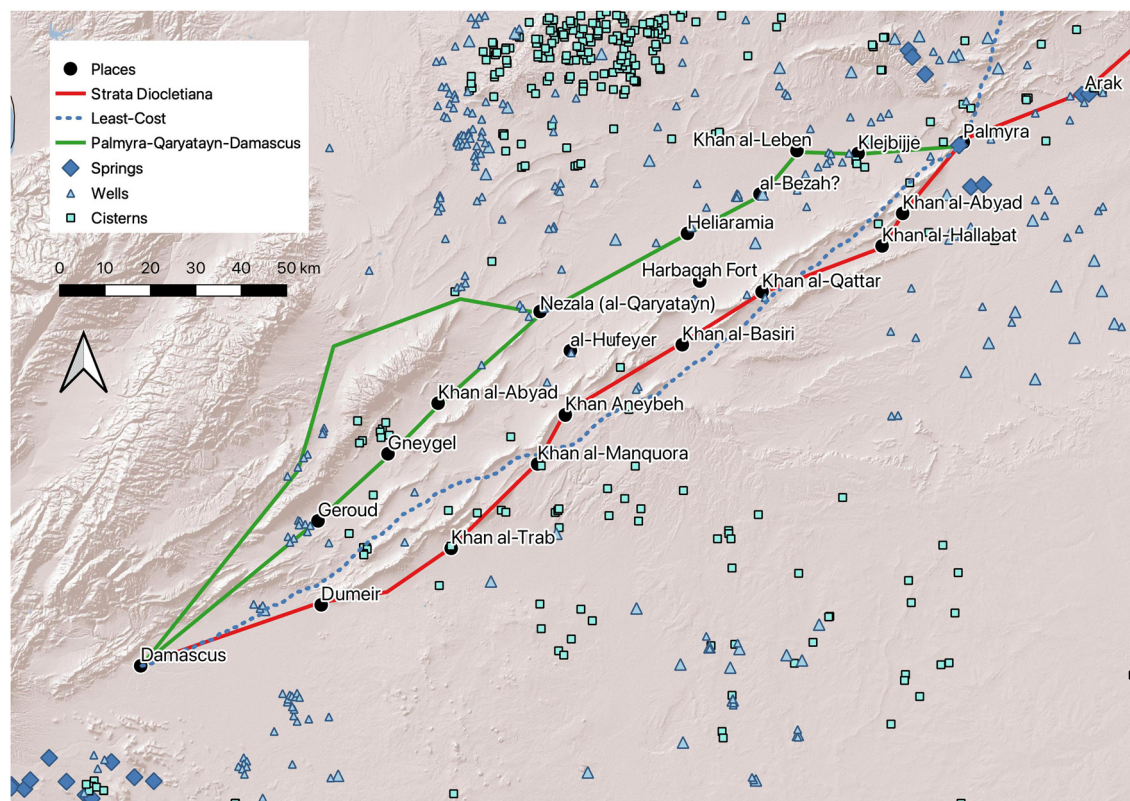


Figure 7: Palmyra–Damascus. Sites, routes, water, and LCP. Eivind Heldaas Seland. Basemap © ESRI 2014.

topographical features, as water supply is secured mainly by surface runoff and subterranean aquifers. Additional surface water may have been available through the construction of cisterns or reservoirs (e.g. Figure 11), while ancient wells that have not been maintained would have needed to access the same subterranean waterways that are still available today.

It is important to bear in mind that the actual roads trodden by soldiers, travellers, and animals in the Late Roman period are not known and will likely never be, as they were not paved and unlikely to be discernible among the myriad of ancient and recent tracks through the landscape. The routes have been identified on a point-to-point basis from remains of military infrastructure in the region, mostly milestones and fortifications. Such have been reported by travellers and explorers since the early nineteenth century, and have since to varying extent been subject to archaeological survey and in a few cases excavations. For the purposes of this study, such published locations have been located on satellite imagery. Most locations were also visited by Meyer during fieldwork in Syria 2004–2011. Satellite imagery was also used to manually identify important topographical features facilitating or hindering movement from the desert towards frontier roads and the settlements behind them. In order to better appreciate the locations of the fortifications constructed along the southern branch of the road-system at the turn of the fourth century, their viewsheds were calculated and visualised in QGIS, using the same ASTER DEM as the LCP-analysis and the Visibility plugin by Zoran Čučković (Figure 10). Following Castro's work on Roman fortifications in southern Jordan, viewpoints were set at 9.75 m above ground level, in order to simulate the position of guards positioned on walls (2018, p. 47). The viewshed limit was set to 10 km. While it would not be possible to spot movement of individuals over such large distances, this is considered as the maximal distance on which smoke signals may be visible (Castro, 2018, pp. 46–47; Fábrega-Álvarez & Parceró-Oubiña, 2019), which seems a sensible analogy to the dust clouds raised by groups of people and animals moving in the arid landscape. In any case, fortifications were too far apart for intervisibility being a serious consideration, and published surveys from the Strata Diocletiana have thus far not documented intermediary observation posts and watch towers similar to those known from southern

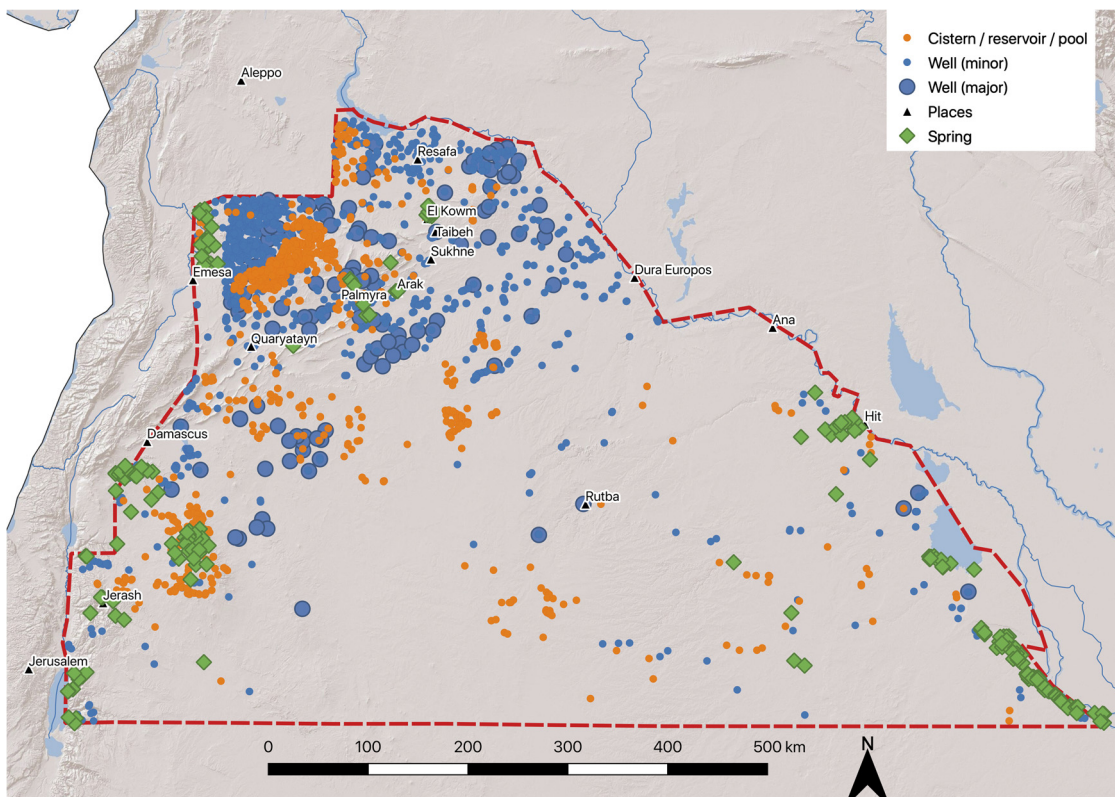


Figure 8: Water sources in the Syrian Desert (Seland, 2019) CC-BY. Basemap © ESRI 2014.



Figure 9: The mountains of Jebel Abu Rigmen meet the plains at Sukhne. Jørgen Christian Meyer.

Jordan (see Meyer & Seland, 2016). Nevertheless, the viewsheds indicate in which directions the garrisons of the Roman forts had unobstructed views.

3 Results

Starting with the route from Palmyra to the fortress-town of Sura on the south bank of the Euphrates (Figure 6), the existence of a road here is attested from the first century CE onwards, through a milestone dated 75 CE, found at the oasis of Arak, ca. 60 km east of Palmyra (AE 1933, 0205). A second milestone from the reign of Constantine attests that the road was still in use in the period 324–327 CE (CIL 03, 06717). The road may be traced onwards to the Euphrates on the Late Roman roadmap known as the *Tabula Peutingeriana* (Miller, 1916, pp. XI, 1–2) through the villages of Sukhne, Tayibe, and al-Kum, and the Byzantine-era fortress-city of Sergiopolis. Several Roman fortifications along the road have been subject to archaeological investigation (Konrad, 2001).

As shown in Figure 6, the road does not follow the LCP, which runs in a direct line through the Abu Rigmen mountains northeast of Palmyra, but instead proceeds from village to village at a short distance south and east of the mountain edge. These villages are located in flat or gently sloping landscape, at oases with perennial groundwater springs or wells, or in the case of Arak, a qanat (tunnel) tapping groundwater from the nearby mountains. These settlements have a history of habitation paralleling that of Palmyra itself, and in the case of al-Kum documented back to the Neolithic period and even before (Tensorer et al., 2007). The furthest distances between water sources are 20–25 km, well within a day's march for soldiers and animals. Groundwater wells appear in clusters near the settlements and road stations, indicating that water supply was perennial and robust. The first four stations from Palmyra (Arak, Helela, Sukneh, and Oriza/Tayibe) are positioned at the intersection of plains and mountains, and have clear view and command of the area to the south and east (Figure 9).

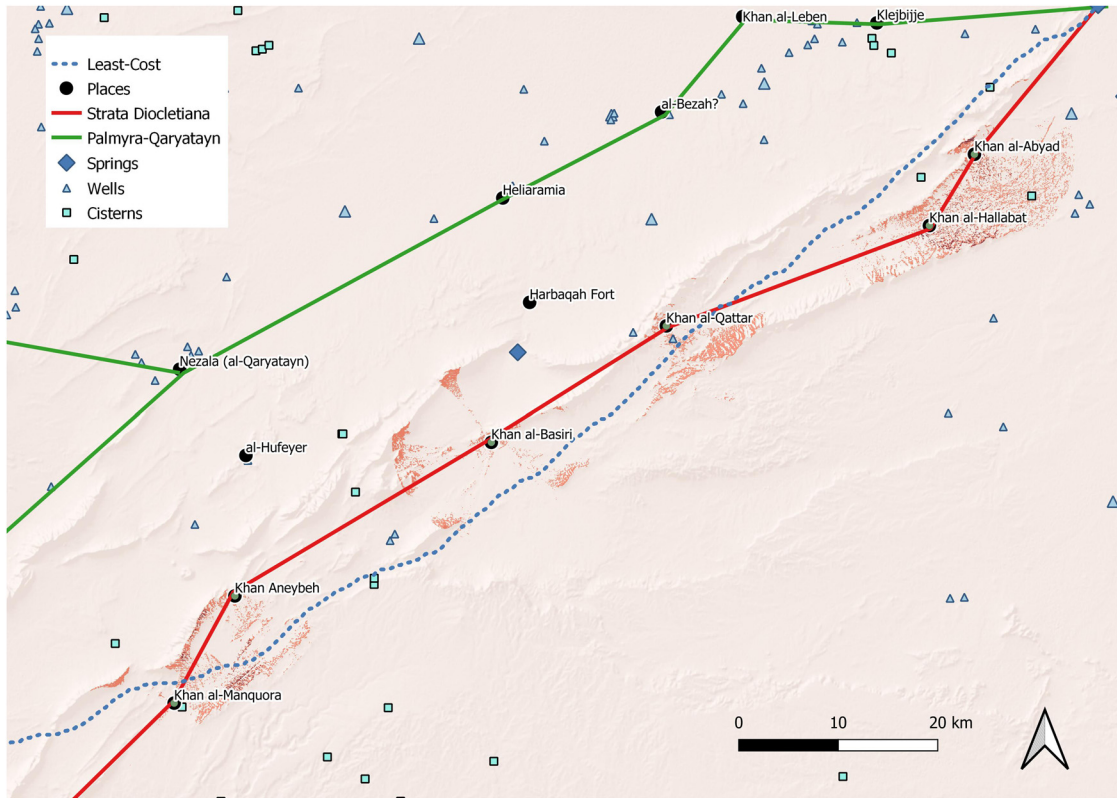


Figure 10: Viewsheds of Roman forts between Dumeir and Palmyra. Basemap © ESRI 2014.

The LCP between Palmyra and Sura passes directly through the mountains. Water is available along the route, but along the mid-section of the path there is a stretch of almost 60 km with only two small wells midway, rendering the water supply vulnerable for larger groups of travellers (Figure 6). The pass followed by the LCP is more than 1,250 m above mean sea level (Palmyra is at c. 400 and Sura at c. 260). While the LCP analysis indicates that the route through the mountains might have been faster than the one used for the road, and modern tracks visible on satellite images confirm that movement along this trajectory is indeed possible, it was clearly not suitable for large groups of people and animals due to difficult topography and a vulnerable water supply. There are no recorded Roman military installations close to the LCP between Palmyra and Sura. Thus, the LCP analysis did succeed in identifying a possible passage between Palmyra and the Euphrates, but apparently not the one considered most practical by ancient travellers. In this case, the need to connect existing settlements and to control important sources of water seem to have been more important than speed of communication when deciding the itinerary of the military road.

Turning to the two routes connecting Palmyra with Damascus, there is more overlap between the LCP and the southern branch, fortified at the turn of the fourth century CE (Figure 7). The LCP runs parallel to the military road until the site of Khan al-Manqura (ancient Vallis Alba, Figures 11–13), where it crosses the ridge of the Jebel al-Rawaq/Palmyra range and descends to Dumeir through the mountains rather than along the plain. This section of the LCP runs through rugged terrain, crossing numerous small wadis, which are likely not well reflected in the 30 m resolution NASA/JSS DEM, but which may have rendered it unattractive for ancient travellers, as indicated by the lack of visible modern tracks on satellite imagery. Despite this divergence along parts of the route, the LCP and the military road remain parallel. Roman forts are positioned at irregular intervals ranging from c. 10 to c. 50 km, not along the LCP itself, but rather at nearby locations well suited to monitor traffic through the passes of the Palmyra range, along the road, and movement of nomads or raiders approaching through the wide wadis that provide access from the deep desert further south (Figures 5 and 10).



Figure 11: Location of Khan al-Manqura [copyright in image].



Figure 12: Khan al-Manqura facing N, with the approach to the mountain pass in the background. Photo: Jørgen Christian Meyer.



Figure 13: Khan al-Manqura, courtyard, facing S with view across the valley and towards the plain. Photo: Jørgen Christian Meyer.

Taking water into account, however, the fortifications along the southern branch of *Strata Diocletiana* are not situated in connection with major sources. This road, and no doubt the forts themselves, depended on artificial cisterns and reservoirs (Figures 7 and 11). The LCP, diverging in some places 5–10 km from the military road, is actually better supplied with water than the Roman way stations. This is not surprising in itself, as the LCP follows low terrain, which is where easy access to groundwater and suitable conditions for cisterns and reservoir depending on surface runoff may also be expected. The results of the LCP analysis seem to be valid as a prediction of the most energy-effective route between Palmyra and Damascus, but the divergence between the LCP and the actual road chosen by the Roman army indicates that other factors also came into play. The forts are situated in the hillside overlooking the plain to the south of Jebel al-Rawaq. To us, this indicates that visibility/view and control with communication bottlenecks might have outweighed access to water and speed of communication when the road was planned.

The considerations may be exemplified with the case of Khan al Manqura, ancient Vallis Alba, which in the *Notitia Dignitatum* is listed as the base of the cohorts prima Iulia lectorum. The c. 100 m × 100 m fort is situated where the slope starts to rise steeply towards the ridge and the pass. The slope facilitates the collection of water in artificial reservoirs and the location secures view of the road and the plain towards the south (Figures 10–13, Musil, 1928, pp. 31–33; Poidebard, 1934, pl. XXIII, XXIV, XXV, 46).

The northern branch of the Palmyra–Damascus road follows the valley between Jebel Gharbi and Jebel Woustani. Wells are 20–30 km apart between Damascus and Heliaramia/Qasr al-Heir al-Gharbi, but appear in clusters, making the water supply less vulnerable. This road also passes by the oasis of Qaryatayn, probably ancient Nazala, which was home to a permanent population also in Roman times and before (Mior, 2016, p. 56). The ample access to water along this road would also make it attractive to pastoralists moving through the region with their animals. Several Palmyrene inscriptions have been found along this road (PAT 0257, 0317, 0555, 0610, 0716, 0763, 1570), and it is likely that it was the main connection between Palmyra and Damascus

before the sack of the city, thus predating the southern branch of the *Strata Diocletiana* (Mior, 2016). Travellers along this route lacked visual command of the landscape to the south due to the parallel mountain ranges of Jebel Woustani and Jebel Rawaq. This seems to indicate that access to water was more important to travellers in the region than visual and physical control of the communication route before the sack of Palmyra.

4 Discussion

Our three hypotheses were that the course of the routes between Euphrates, Palmyra, and Damascus may be explained by desire to optimise swift communication (1), water for travellers and garrisons (2), or territorial control (3), that is command of movement corridors between desert and settled land, mountain passes, and important water sources. In conclusion, all these three considerations seem to have come into play, but to different degrees in different periods and along different parts of the route. Important wells and springs were associated with forts and waystations, but fortifications were also situated in places lacking water, but strategically located with regard to sight and communication. Here water had to be provided from cisterns and reservoirs. Along the northern part of the road, between Palmyra and the Euphrates, the route connects military installations and centres of population rather than following the most energy efficient direct path. For this part of the road, LCP modelling proved of little use for predicting the layout of the ancient route. Between Palmyra and Damascus it seems significant that the northern, and likely older route, used during the Palmyrene period as indicated by the presence of inscriptions, runs through a valley with comparably ample access to water. Thus, it was suitable to serve caravans and did not depend on permanent garrisons or major infrastructure. Wells and springs were also hotspots of pastoral as well as agricultural activities and in some places, like Nezala and perhaps Heliaramia, supported small, permanent settlements. This route, however, lacked view of the approach from the desert to the south and east.

The new route, established in the late third century, and known as the *Strata Diocletiana*, did not pass by major sources of water, but on the south side of the mountains. It was better situated to control potential threats from the desert, and also provided swift and safe communication by running parallel to the most effective path between Damascus and Palmyra according to the LCP analysis. However, also in this case, the LCP analysis was not able to predict the actual itinerary of the ancient road. Forts were situated near important mountain passes limiting south–north communication, generally on the lower part of the hillslope leading to the pass (Figures 11–13). The viewsheds (Figure 10) indicate that along large parts of the route, forts had full view of the road, facilitating visual command of the terrain. Still, the distance between fortifications, 10–50 km, makes it clear that intervisibility was not a serious consideration. This may be explained by the mentioned passes, which larger groups of people and animals would need to pass. This made it unnecessary to maintain visual control of the entire road. Our suggestion is that the need for a new road that required heavy investment in fortifications, cisterns, and garrisons arose directly from the sack and occupation of Palmyra, which severed social ties between the city and the pastoral population of the Syrian Desert, and thus made heavier military presence necessary in order to monitor and protect communication both along the desert frontier and between the desert and settled lands further north and west.

Abbreviations

- AE *L'Année épigraphique*. Paris: Presses universitaires de France (1888–).
- CIL *Corpus Inscriptionum Latinarum*. Berlin: Berlin-Brandenburgische Akademie der Wissenschaften (1853–).
- PAT Hillers, Delbert R., and Eleonora Cussini. 1996. *Palmyrene Aramaic Texts*. Baltimore, MD: Johns Hopkins University Press.

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