# Laidlaw Project Report

Mapping the Steppe: Identification and condition assessment of archaeological sites in arid zones in Syria

Author: Zachariah Weissand

Supervisor: Kristen Hopper

2022

**Contents**

## 1.1 Abstract

The modern arid landscape of Syria, which was likely more hospitable during the neolithic (Morandi Bonacossi, 2014), is host to an array of stone-built features that may have been used for hunting from the neolithic onwards. These 'desert kites' are typically comprised of a funnel, enclosure and pits(Crassard et al., 2020); all indicative of being used as a 'game drive system'. However, this composition is not uniform (Barge et al,. 2015); this report collates the analysis of the kites and other stone-built features located to the north-east and southwest of Palmyra in the Eastern arid margins of Syria. It looks at differences in their complexity, distribution and geomorphology in order to better understand the use of kites in the ancient world.

## 1.1 Introduction

Kites are an important feature of the Levantine neolithic as they are a key archaeological record of communal existence, subsistence, and engineering. The reason behind selecting two study areas in the arid eastern margins of Syria for remote sensing survey was due to the largely excellent preservation conditions and partially due to time constraints. Having only 6 weeks to work on this report I chose to focus on areas that had been less well studied than the plateau immediately east of the centre of the Palmyra range, where the density of kites was known to be significant and relatively well studied. (Hesse and Afinset, 2013; Morandi Bonacossi, 2012; Schou, 2014) I chose to focus on the edges of the densest distribution of kites east of the Palmyra range as it allowed me to assess whether there were differences between kite formation in the basalt landscape of Southern Syria and the central Syrian desert. In addition, looking at a range of sites on the fringes of where kite construction stopped highlighted the factors influencing their construction by being able to assess the absence of elements integral to their use.

## 2 Methodology

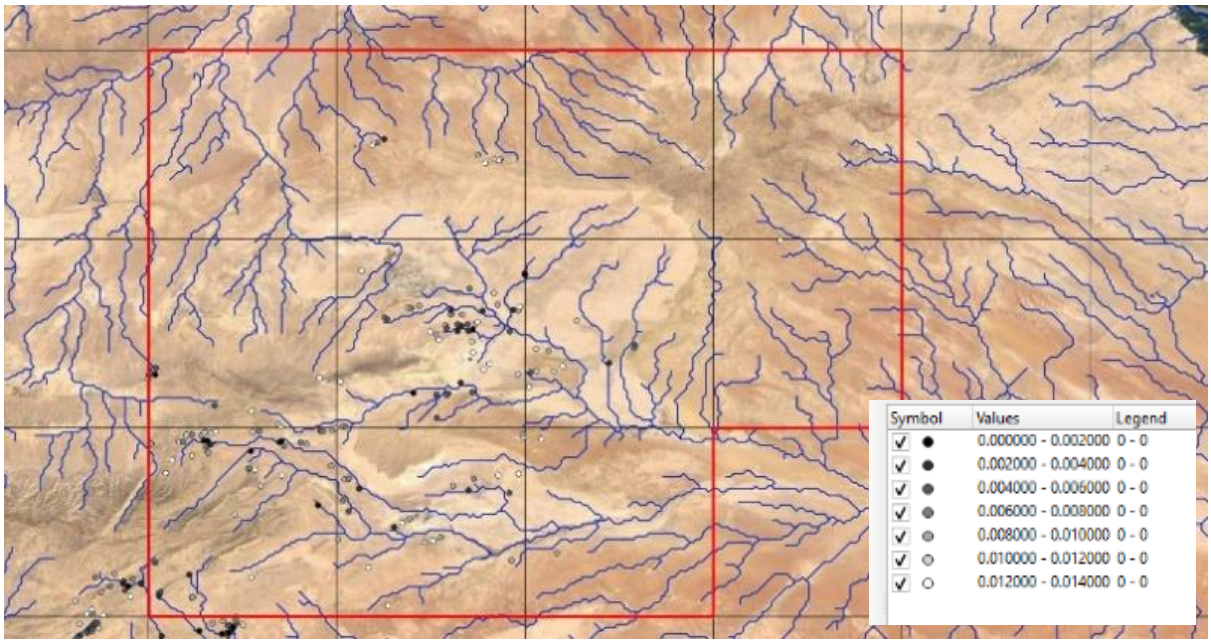
The remote sensing survey started with the collection of points associated with kites from the 'Globalkites Interactive Map'. This visual representation of kite density allowed for the selection of 17 EAMENA grid squares for remote sensing survey. Eleven of these were in the Syrian desert to the North-East of Palmyra, while six of these were in the Syrian desert to the east of Damascus. Using the rapid surveying technique, utilising historic and modern imagery, the grid squares were inspected to ensure all kites and other notable features were recorded on Google Earth Pro. Polygons were then drawn around these features and once all the grid squares were completed this data was uploaded into QGIS. The kites were then cursorily analysed and the data recorded in the EAMENA bulk upload sheet using set

criteria. This is comprised of various categorisations from archaeological to condition assessments. Finally, the data was extensively analysed in comparison to geomorphological and hydrological data to determine factors affecting the creation and use of these features.

## 3.1 Location (Hydrological Data, Elevation, Climactic and Soil Data)

### 3.1.1 Hydrological Data

The data gathered is indicative of wadis (seasonal streams) being intrinsic to the decision to construct desert kites. As seen in Figures 1 and 2 there are minimal breaks from pattern of building kites next to wadis, many of the kites that seem further away have funnels that extend towards the wadis. However, this data is limited in that the hydrological data cannot account for which ancient wadis would have been in use at the time. To account for this I have focused on the largest wadis as they are the most eroded from being the most common waterways. But this cannot provide an accurate distancing for all kites. The images here are intended to provide a representation of the structuring of chains of kites along hydrological paths. While it is partially true that chains can be seen near lacustrine water sources, such as lakes (Morandi Bonacossi, 2014) this association has more to do with the fact that wadis drain into these water sources (and are located leading to them) than the lacustrine water sources themselves. Animals prefer to drink flowing rather than stagnant water where there was a high chance of parasitic infection (Akkermans, 2003) and wadis provide optimal watering facilities with a low mean velocity and accessible banks. The higher water balance in the arid margins of Syria during the neolithic is evidenced by the precipitation data of the Soreq Cave (Hewett et al., 2022; Figure 3), as well as the higher Lisan Lake Level (Kempe and Al-Malabeh, 2013). Therefore it is reasonable to suppose that even the smaller wadis would have provided ample hydration and possibly fertile grazing land around them.



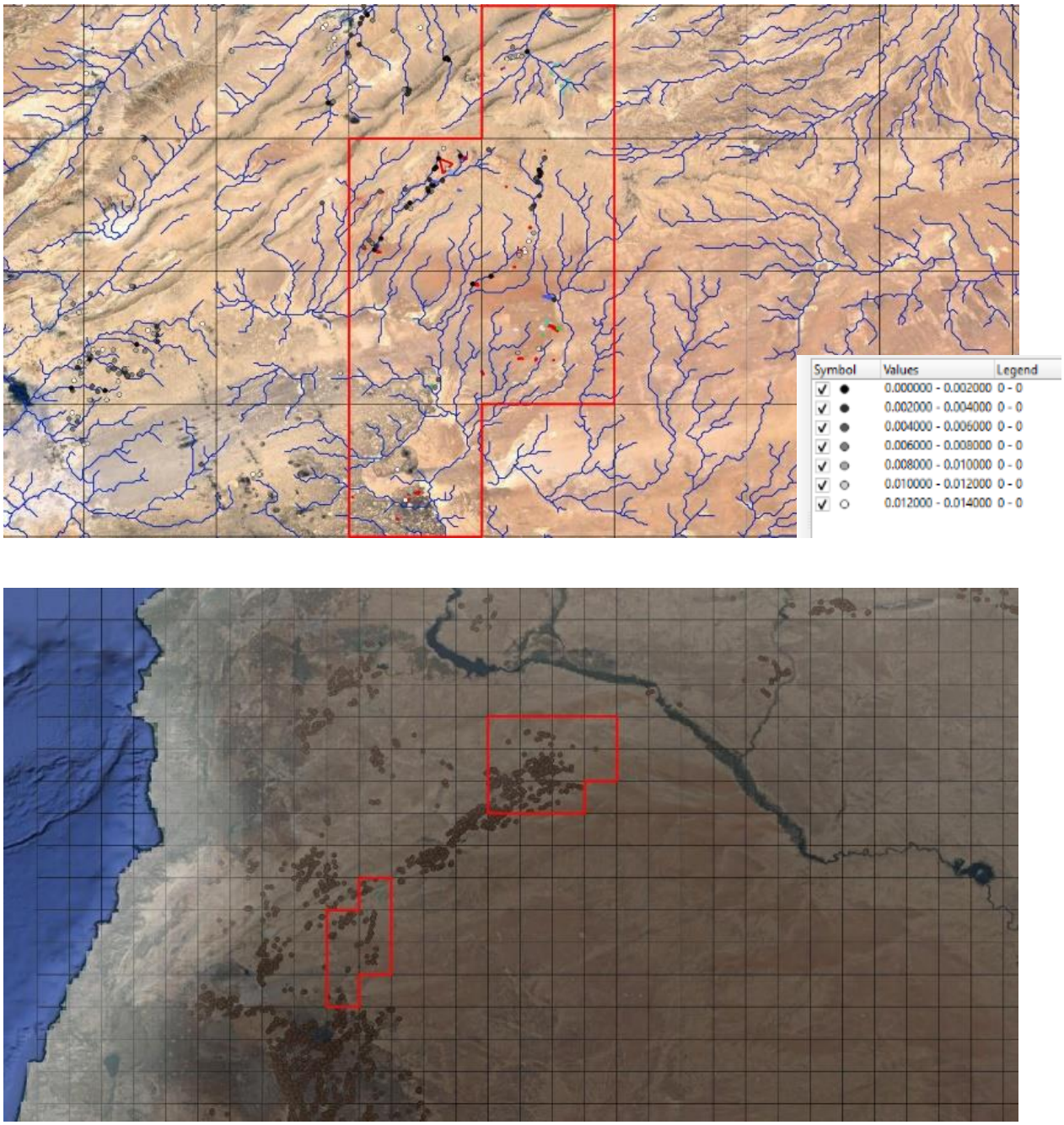



*Figure 3 - Hindcast Precipitation Map*

### 3.1.2 Elevation

Figure 4 shows that the majority of kites exist along ascents into higher elevations, this can be explained by the geological processes of wadi formation and the assumption that kites are being used during the rainy season, likely winter, when the wadis flowed and gazelle would have migrated to these pastures (Chambrade and Betts, 2021). Wadis form along the alluvial fans underlaid with impermeable coarse alluvial deposits so that the rainwater flows into a stream, as shown in Figure 5. The formation of wadis would lead to a higher volume of water at higher elevations, attracting more animals and therefore more hunters. Another reason for kites existing at higher elevations is the utilisation of geomorphological 'blinds' (Crassard et al, 2022). The slopes of the Palmyrean range can be seen to have been used to disguise the pit traps so that the prey was trapped more often.

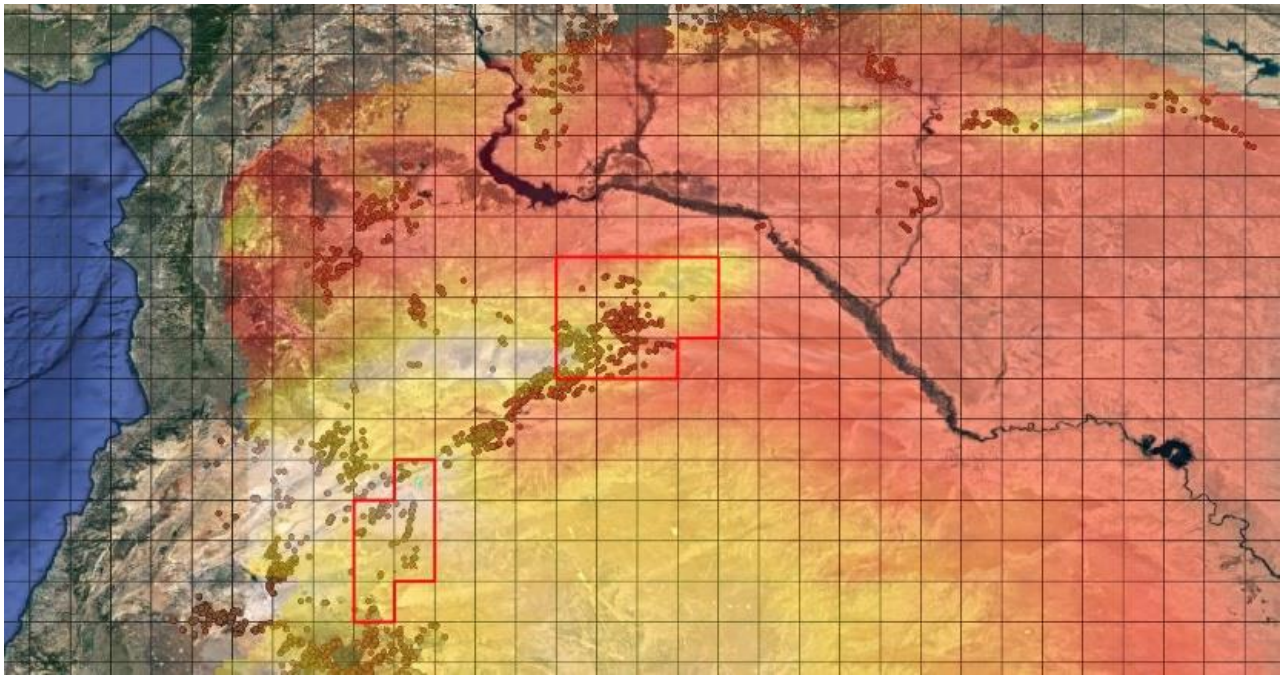


*Figure 4 - Elevation of Syria Map*

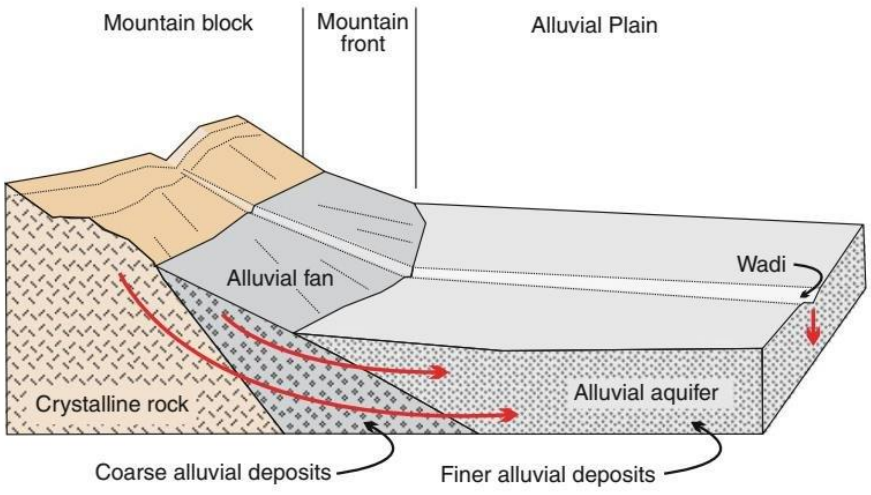



*Figure 5 - Wadi Formation (Henao Casas et al., 2019)*

### 3.1.3 Climatic Data

The climate was significantly different during the Syrian neolithic, instead of being the arid margin that is visible today the landscape would have likely been a savannah where although dry it would have been a hospitable environment for much of the year (Akkermans, 2003). As can be seen by overlaying the landuse map created by in Figure 6 the majority of desert kites were created along the border between moderate pastoralism and marginal agriculture. Based on this the climatic motivation behind building kites can be seen as a hydrological balance where the pastoral animals would have migrated to areas where water was more accessible hence being possible for agriculture to exist in this landscape. It is unlikely the animals roaming across the savannah environment would have kept travelling after they found water and so the migration from the Southern areas of Syria to the Palmyrean range is likely. This idea is furthered by the data outside of my sample also showing the presence of kites and therefore of gazelle at the border of pastoral environments.

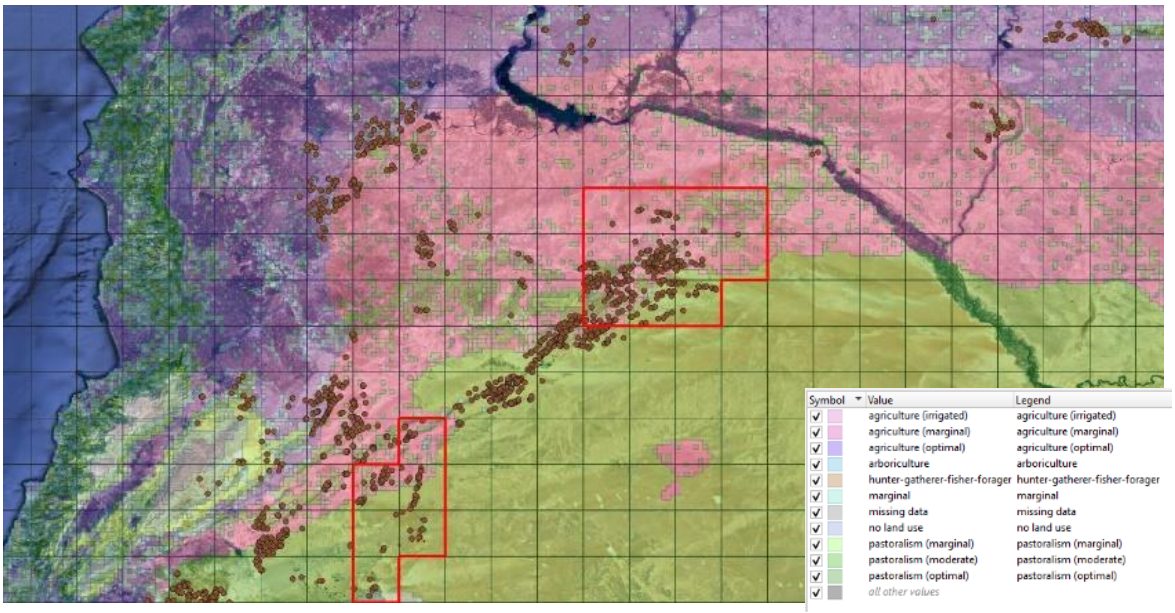



*Figure 6 - Landuse Map*

### 3.1.4 Soil Data

Kites east of the Palmyra in study area 1 are evidenced in Figure 7 to appear most commonly on 'Soils on Inland Hills' and 'Flintstrewn desert outwash'. These surfaces are the ideal areas for the building of desert kites as the inland hills provide 'blinds' for trapping gazelle and the wadis that cause the gazelle to migrate in that direction, while the flintstrewn landscape comprises the ideal building material for kites as it is an abundant, sharp and enduring stone. Whereas the gravelly soil found further south of Palmyra in study area 2 contains basalt extruding from the black desert, which can be effectively used to build kites. On the other hand Michael Fradley (2022) contends that there may be desert kites in the South-East of Syria and the gravelly soil has caused them to be concealed from being covered by millennia of sand and gravelly soil. Although, the likelihood of this is small due to there being no anomalous instances of kites in these regions, yet further remote sensing work needs to be undertaken in these regions.

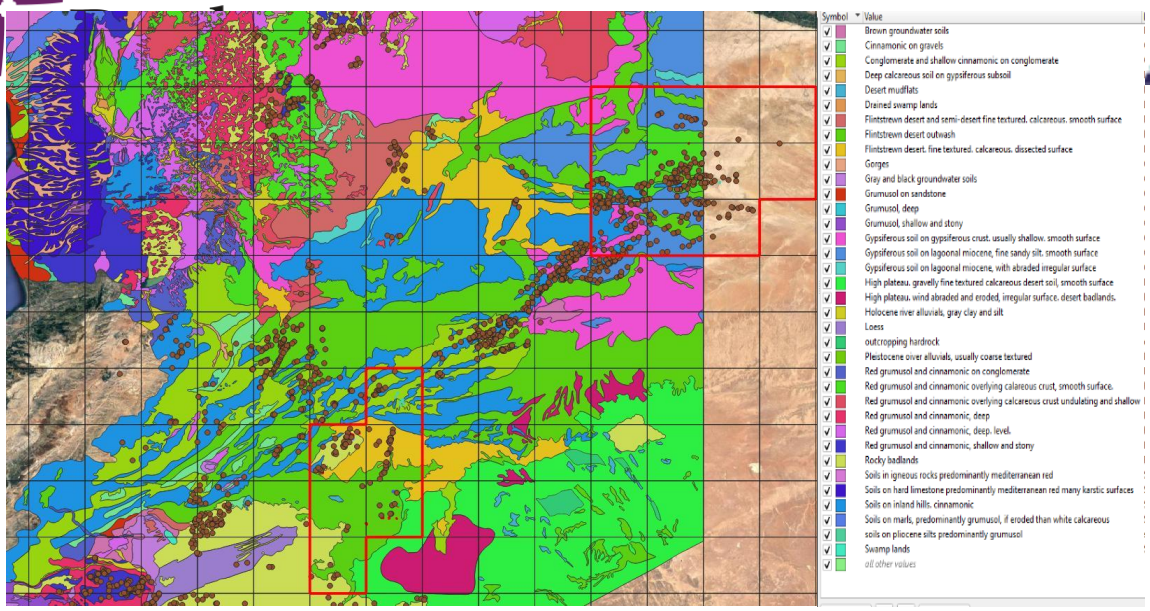



*Figure 7 - Soil Map of Syria*

## 3.2 Orientation

There have been many theories surrounding the orientation of kites from being based on the topographic orientation of the Palmyra range, facing South-West and North-East according to the slopes of the mountains. (Morandi Bonacossi, 2012). Others have contended that the orientation is based on migratory patterns of onyx and gazelles. They would spend winter and spring in Al-Hamad (southern Syria) where it is rich with pastures and water, while in the summer they would utilises the Palmyra oases(Chambrade and Betts, 2021) or areas adjacent to the Palmyra range, aligned with ancient lava flows (Barge et al, 2015). After analysing modifications made to funnels there was no conclusive orientation shift that would indicate changes in gazelle migration on a wide, uniform scale. However, most face South-East, the same direction as the playa-connecting wadi system discharges water (Kempe and Al-Malabeh, 2013) and therefore could potentially be altered due to changes in watering spots over different seasons (Morandi Bonacossi, 2014). Animals avoid stagnant water and usually choose to return to the same watering spots seasonally, meaning it is reasonable for this to be the cause of orientation. The fact that the stones from the original funnel walls were rarely recycled shows the need to retain the original funnel wall for reversion when the wadi flow is higher, with the most common modification being a widened funnel. However, greater research analysing all orientations of kites in relation to wadis would expand this idea.

## 3.3 Use and Notable Examples

A central motivation behind this project was the aim of uncovering information about the use of kites and possibly the lives of those behind the kites. The key questions at

play are surrounding the subsistence practices of those using the kites; the chronology of the kites and any a priori ideas that were connected to their construction.

First, we wanted to consider the evidence for whether those building and using the kites were practicing a nomadic subsistence strategy. This would mean they followed the migration patterns of particular animals and subsisted solely off hunting and gathering with a less essential reliance on trade. Alternatively, they may have been engaged in a semi-pastoral existence, using the kites when the harvest was insufficient or as an addition to agricultural production.

*Figure 8 - Settlement in the Southern Syrian Desert*

If the kites were used by groups practicing a nomadic subsistence strategy there may be a varying level of evidence for this in the archaeological record, due to the visibility and extent to which they relied on a pastoral subsistence (Morandi Bonacossi, 2012). If the kites were being used by groups practicing a semi-nomadic subsistence strategy involving seasonal movements from a settlement to the region with kites, we would expect to find evidence of permanent or semi-permanent settlements near agriculturally productive regions. The evidence for this could include leaving the fertile crescent and settlements such as Jerf al Ahmar and Tell Aswad which are believed to have been occupied since 9500bce (Weiss et al., 2006). These areas are suitable for dry farming as there is no evidence of irrigation systems this early, and therefore it is reasonable to suppose they could have sustained seasonal occupation. This idea of semi-pastoral subsistence is furthered by settlement evidence from within an area associated with several desert kites. Figure 8 shows a small settlement located parallel to 2 desert kites, Figure 9, which exist within the meander wall of the settlement (Kempe and Al-Malabeh, 2013). This supports the idea of an at least semi-permanent residence for the use of desert kites as stone-built homes would have taken substantial

effort, this also could have acted as a permanent base for members of the group to travel North and hunt using the kites along the Palmyra range from the basalt desert. However, determining whether the settlement is contemporaneous with the wide-spread use of kites cannot be ascertained with any certainty without ground-truthing the site.

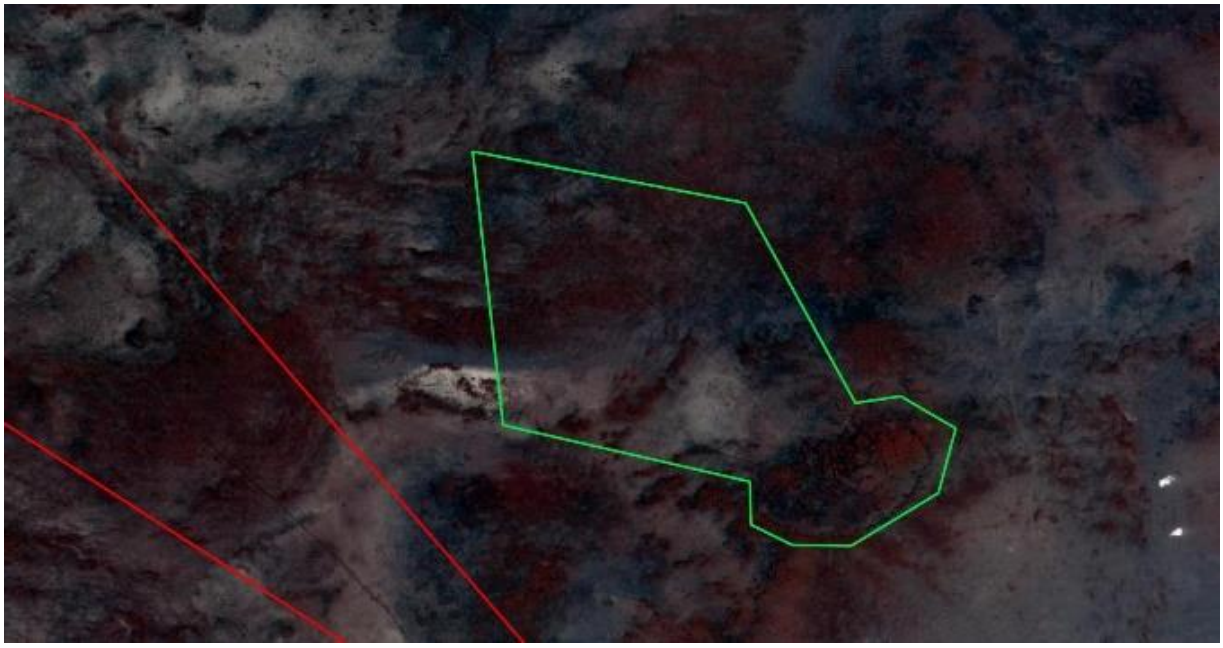


*Figure 9 - Kite Parallel to Settlement*

The chronology of kites is contested, but most scholars suggest a peak in their use circa the 7th millennium BCE (Akkermans, 2020). While the arid environment of the desert does preserve a lot of the archaeology, there has been use of this same environment in later centuries (Chambrade and Betts, 2021) which adds complexity to the archaeological record. Ethnographic accounts up until the 19th century describe the use of kites still taking place, yet there are rock art depictions of hunts from the Hemma Plateau in Syria (Figure 9) that date back to the neolithic. This creates the contention as to whether the kites are original or the result of restorations over the years. In attempting to unravel this archaeological Theseus' paradox it is important to look at amendments and modifications made to kites to determine a relative chronology. Figure 10 exemplifies the modifications that are commonly made to desert kites with the enclosure being narrowed with more pit traps added and the funnels being widened, possibly to account for varying wadi flow over periods of time. However, the variations can only be dated relative to other incarnations (e.g. earlier or later), and the original construction dates of the kites cannot be determined this way.


*Figure 9 - Rock Art depiction of a hunt, Picalause et al., 2004.*

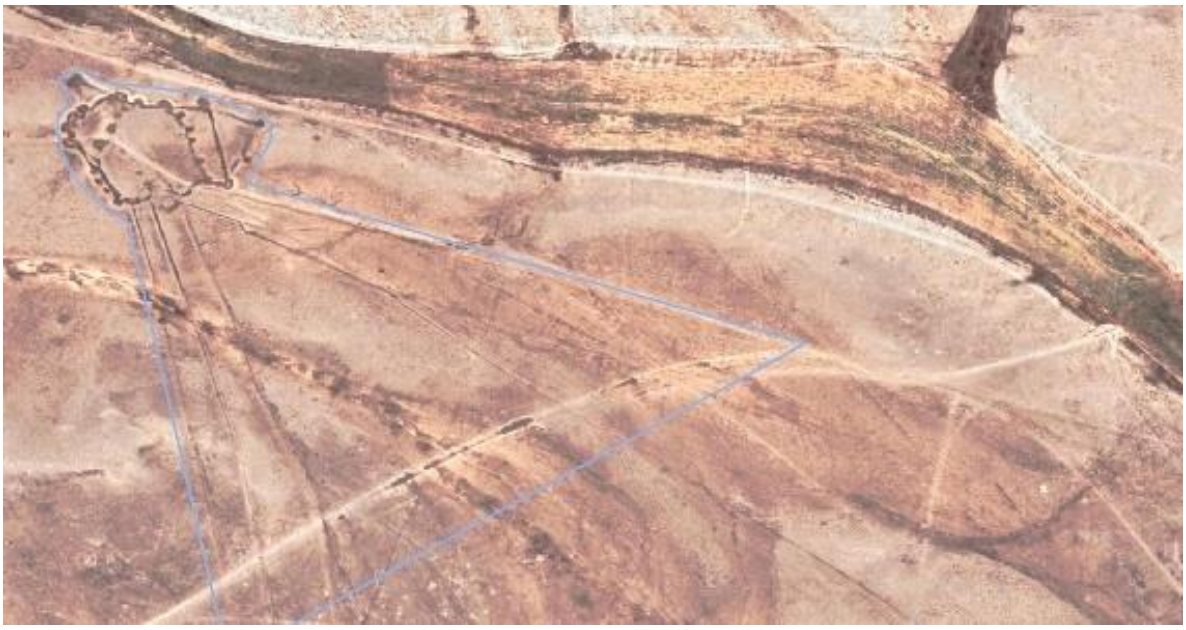


*Figure 10 - Modified Desert Kite SY1023*

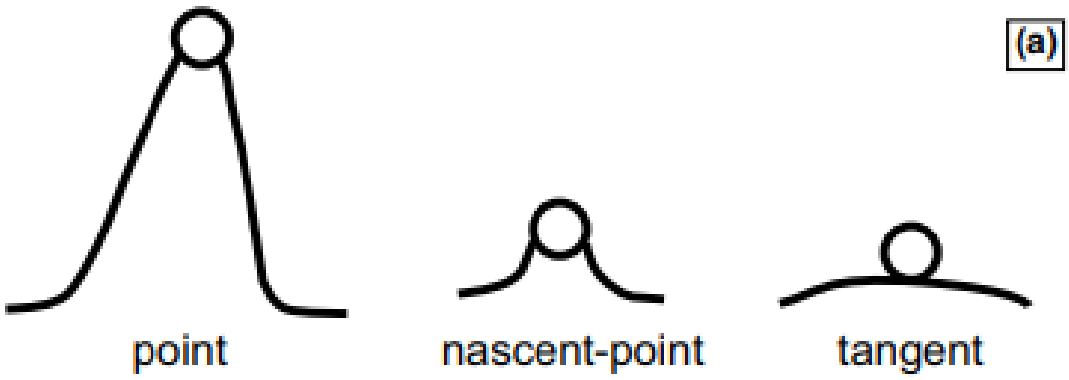



*Figure 11 - Pit trap design, Crassard et al., 2022*

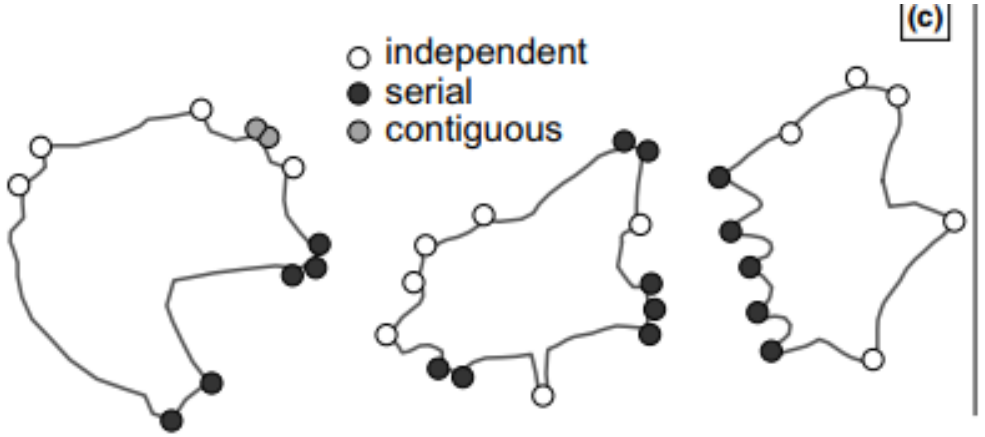



*Figure 12 - Pit trap placement, Crassard et al., 2022*

There have been suggestions that diversified kite architecture correlates to expressions of identity as there appears to be no increase in hunting efficiency through variations (Fradley, 2022). However, this cannot be verified without experimental archaeology to support this hypothesis. Attempting to presume a priori ideas surrounding kite construction from the remnants is next to impossible because the only assumptions that can be made are that there needed to be a significant communality to construct the kites and use them.

## 3.4 Classification

When determining how to classify the kites recorded in this project, a key factor involved was simplicity. The categorisations needed to be accessible and recognisable for every researcher. As funnels were often the least visible sections of kites, with their condition being affected by the materials being recycled, modern threats and weathering, these antennae, as they are called, -(Figure 13) were not a suitable means of classification. The most visible and stalwart section of kites tended to be the enclosures and while there are many aspects of the enclosures such as pit trap design and placement, the most commonly seen distinct variations were 3 models.

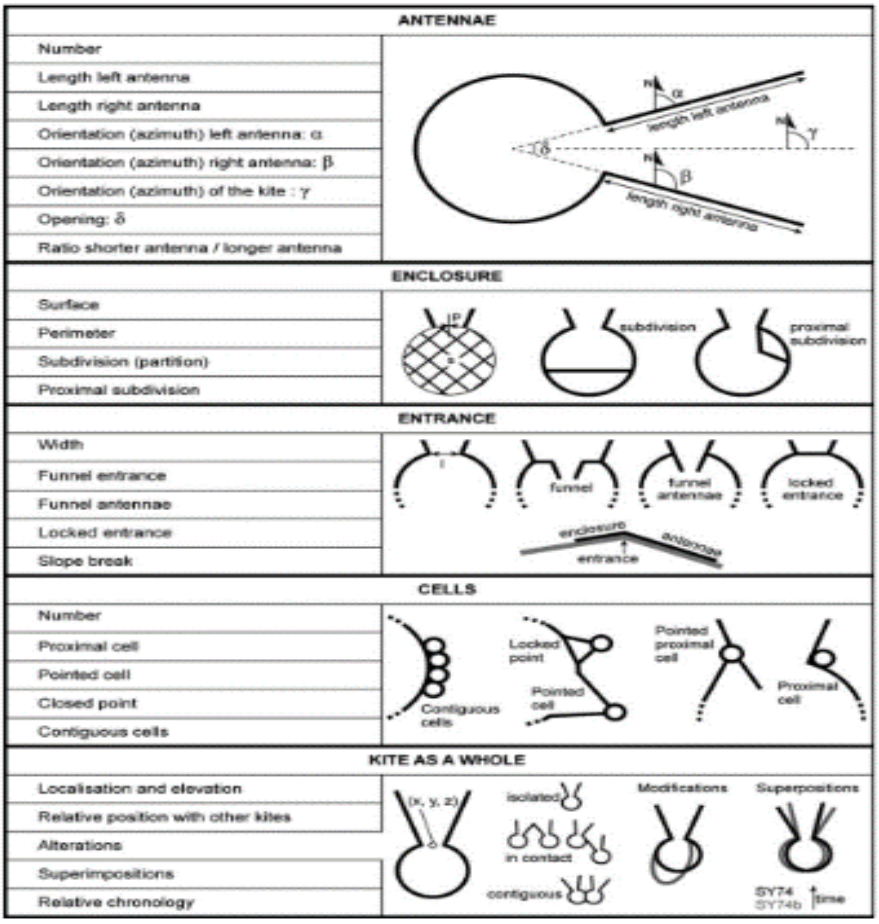



*Figure 13 - Kite classification chart, Barge, Brochier and Cassier*

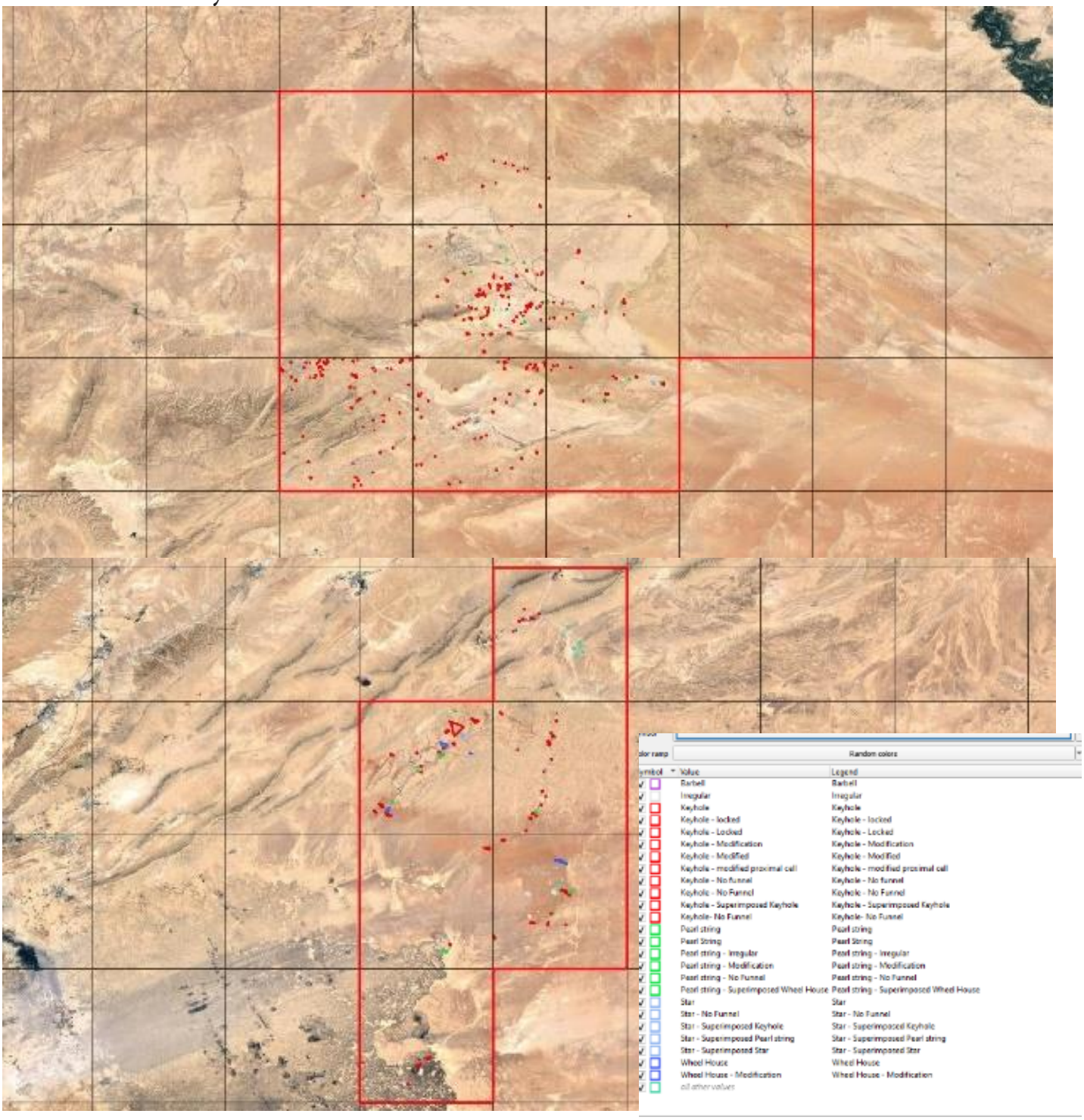



*Figure 14 - Kite Classification Map*

Firstly, the keyhole model, which was the most common and basic variation consisted of a simple funnel and enclosure with several independent, tangential pit traps. There is some variation within this category in which enclosures are not always in line with funnels and, instead curve around into a foetal position. However, whether this was a strategic design difference or just adapting to the geography is unclear. Secondly, there was the star-shaped model which involved independent pointed traps dispersed at a distance. The incorporation of funnelling within an enclosure likely indicates that this was a later, possibly more advanced design as it was more complex to build and

integrated two levels of game drive. A pre-existing enclosure classification that was adopted is the wheelhouse (Crassard et al., 2022; Kempe and Al-Malabeh, 2013), which lacked pit traps instead having a series of smaller enclosures inside the enclosure. Although, these may have originally been keyhole designs where the enclosure was used for pastoralism by later communities. Finally, there is the pearl-string variation consisting of serial or contiguous nascent-point pit traps, a design used for either increased productivity in the amount of prey able to be trapped or as an amendment to walls being ineffective at keeping gazelle in the enclosure. An additional point to note are the modifications and superimpositions made to kites (Figure 13), these structures have existed for several millennia and have had variations and upkeep over the years which were noted in the classifications.

## 3.5 Condition Assessment

As the arid margins of the Syrian desert range are typically far from urbanisation there are not many modern threats to the kites. However, there is the occasional road intersecting a funnel or emerging desert industries such as oil refineries or wadi gold prospecting. While there are a few cities dotted across the region they do not appear to coincide with areas of kite formation and therefore can be assumed to not have been constructed on top of kites. The kites have been affected by weathering but it is minimal compared to other structures of their age due to the arid conditions of the desert. Some funnels are missing but whether they were designed without them or not is uncertain as it is clear to see the funnels exist on a wide spectrum of visibility with some only existing as a shadow on satellite imagery, but it is unclear as to where funnels have been deliberately altered or the affects of time have just taken place.

# 4 Conclusion

Overall, this research project has culminated in the creation of a dataset identifying and analysing nearly 350 desert kites surrounding the Palmyrean range that can be used by researchers attempting to investigate kites. In terms of the conclusions that have been postulated in this report they are based on the assumptions of limited data and an inability to conduct any ground truthing. However, based on the data presented above, it is likely that the construction of desert kites was decided by wadi formation and the subsequent migrations of gazelle and onyx to utilise these sources of water. This explains the presence of kites at areas that shift to high elevations as this is where wadis are created, as well as the hydrological data enabling the visualisation of chains alongside wadis. Determining what seasons the gazelle would have migrated to the

wadis is difficult as the climate was considerably different several millennia ago. It is also feasible that there was little migration involved with herds staying close to the Palmyra range, however, landuse data shows that the South-West of Syria is more ideal for vegetation and therefore would likely have been utilised by for pasturing more than the central areas where the kites appear.

The historic use of desert kites is uncertain, with evidence of use ranging back to 10$^{th}$ millennia BCE it is evident that kites have been periodically used over the years when gazelle populations allowed for it. Based on evidence of indiscriminate killing from the Tell Kuran excavations (Morandi Bonacossi, 2014) it is likely the kites were only used once populations recovered from being hunted to the brink of extinction. However, this evidence is from several thousand years later than the suggested peak of kite hunting (Akkermans, 2003) and population maintenance may have been less important. The lifestyles of those using the desert kites is largely speculated on through a lack of evidence of settlements associated with kites inferring that hunters may have migrated towards kites from distant pastoral settlements. However, the distance required to reach some kites from any known settlement area does promote the idea of nomadic hunters that left minimal archaeological traces as they travelled. Future investigation involving the ground-truthing of the settlement in Figure 8 would yield more fruitful answers. It is highly likely kite use took place over several thousand years as a subsistence strategy when crop abundance waned. This is supported by the several advancing classifications of kites, ethnographic accounts as well kite modifications and superimpositions.

This report has accounted for desert kites in two study zones using differences to identify their design structure and assessed their condition to be generally fair.

## 5 Bibliography


Akkermans, P.M.M.G. and Schwartz, G.M. (2003) The archaeology of Syria: from complex hunter-gatherers to early urban society, ca. 16,000–300 BC. Cambridge: Cambridge University Press.

Akkermans P.M.M.G. (2020) 'Prehistoric Western Asia', In Radner, K., Moeller, N. & Potts, D.T. (eds.) *The Oxford History of the Ancient Near East. Volume 1: From the Beginnings to Old Kingdom Egypt and the Dynasty of Akkad*, pp. 27-94. Oxford: Oxford University Press.

Barge, O., Brochier, J. É. and Crassard, R. (2015) 'Morphological diversity and regionalisation of kites in the Middle East and Central Asia', *Arabian Archaeology and Epigraphy,* 26(2), pp. 162-176.

Chambrade, M., & Betts, A. (2021). Kites of Syria, southern Turkey and western Iraq. *The Gazelle's Dream*.

Crassard, R., Abu-Azizeh, W., Barge, O., Brochier, J. E., Chahoud, J. and Regagnon, E. (2022) 'The Use of Desert Kites as Hunting Mega-Traps: Functional Evidence and Potential Impacts on Socioeconomic and Ecological Spheres', *JOURNAL OF WORLD PREHISTORY,* 35(1), pp. 1-44.

Fradley, M. (2022). Following the herds? A new distribution of hunting kites in Southwest Asia, The Holocene.

Henao Casas, J., Walther, M., Kalwa, F. and Rausch, R. (2019). Numerical and Analytical Assessment of Stormwater Infiltration via Vadose Zone Wells and Infiltration Trenches.

Hesse, K.J. and Anfinset,N. (2013). Palmyrena. Palmyra and the surrounding territory. Joint Syrian-Norwegian project. Surface survey North of Palmyra, April and April–May 2011. Preliminary report. Prehistoric periods. https://bora.uib.no/bora-xmlui/ handle/1956/10476

Hewett, Z., Gruchy, M., Hill, D. and Lawrence, D. (2022). Raincheck: A new diachronic series of rainfall maps for Southwest Asia over the Holocene, Levant, 54:1, 5-28

Kempe, S. and Al-Malabeh, A. (2013) 'Desert kites in Jordan and Saudi Arabia: Structure, statistics and function, a Google Earth study', *Quaternary International,* 297, pp. 126-146.

Morandi Bonacossi, D. (2014) 'Desert-kites in an aridifying environment', In Morandi Bonacossi, D. (ed.) *Settlement Dynamics and Human-Landscape Interaction in the Dry Steppes of Syria*, pp. 33-47*: Vol. Studia Chaburensia 4*. Wiesbaden: Harrassowitz Verlag.

Morandi Bonacossi, D. and Iamoni, M. (2012) 'The Early History of the Western Palmyra Desert Region. The Change in the Settlement Patterns and the Adaptation of Subsistence Strategies to Encroaching Aridity: A First Assessment of the Desert-kite and Tumulus Cultural Horizons', *Syria,* 89, pp. 31-58.

Picalause, P., Cauwe, N., Lemaitre, S., Vander Linden, M., & Van Berg, P. L. (2004). Desert-kites of the Hemma plateau (Hassake, Syria). Paléorient, 30(1), 89–99

Schou, T.P. (2014). Mobile pastoralist groups and the Palmyrene in the late Early to Middle Bronze Age (c. 2400–1700 BCE): an archaeological synthesis based on a multidisciplinary approach focusing on satellite imagery studies, environmental data, and textual sources. PhD Dissertation, University of Bergen

Van Berg, P.-L., Vander Linden, M., Lemaître, S., Cauwe, N., & Picalause, V. (2004). Desert-kites of the Hemma Plateau (Hassake, Syria). Paléorient, 30(1), 89–99.

Weiss, E., Kislev, M. E., & Hartmann, A. (2006). Autonomous cultivation before domestication. *Science (New York, N.Y.)*, *312*(5780), 1608–1610.