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The Habitation Model Trend Calculation (MTC): Ancient Topography – The Mycenaean Spercheios Valley Case Study

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ABSTRACT

The initial goal of the Mycenaean Spercheios-Valley Archaeological Project (MY.SPE.AR.) is to undertake a systematic archaeogeophysical survey of the Spercheios Valley in central Greece. The extensive and intensive survey focuses on locating, documenting, mapping and analysing environmental features in correlation with the archaeological remains of Mycenaean sites in the region. This documentation and analysis have already commenced and will be further implemented with use of technologies such as Mobile GPS, UAV photography, satellite imagery analysis, remote sensing, spatial analysis with GIS, test pits and trial trenches.
The aim of this paper is to examine and compare the results of the standard MTC prediction model method applied in Messenia with another location, that of the valley of Spercheios, in Fthiotida, Greece. In the spatial analysis carried out in Messenia, common features were observed for all the residential places, which in no case could be characterised as random, while the structure of the administration of the society presented characteristics that were compatible with a hierarchical distinction of the functions of each residential ensemble.
The key question is whether we can observe these same characteristics that determine a habitation site (geomorphological, climatological, and geological) in another region. This comparison between two major study areas (the regions of Messenia and the wider valley of Spercheios) may contribute to archaeological research generally by posing new questions and methods of examination of the broader landscape in an area of archaeological interest.

1. Introduction

A new five-year field project commenced in 2018 under the directorship and auspices of the local Ephorate of Antiquities with the collaboration of Dickinson College, the Geophysics Laboratory of the Aristotelian University of Thessaloniki, the Architectural Design and Research Laboratory of the Democritus University of Thrace, the Archaeometry Laboratory of the University of the Peloponnese, and the support of the Mycenaean Foundation, the Municipality of Lamia, and the Prefecture of Central Greece. The Mycenaean Spercheios-valley Archaeological (MY.SPE.AR.) project combines extensive and intensive archaeological survey work, aerial reconnaissance, a geophysical survey, targeted excavation, and digital technology in order to locate, identify, and map all Mycenaean sites in the region of the Spercheios valley.

The study area is located in Central Greece and, more specifically, in the wider area of the Spercheios river valley in the Prefecture of Fthiotida (Figure 1). The Spercheios valley, wedged in-between Thessaly and Boeotia, divides the regions of central and southern Greece allowing only for a narrow shoreline passageway between them. The valley is nearly land-locked, surrounded on three sides by mountain ranges (Mt. Othris, Mt. Oiti, Mt. Timphristos) that delineate clear regional boundaries, while allowing, however, eastward access to the sea (Maliakos Gulf). The Spercheios river flows from the west to the east for some 85 km, meandering toward

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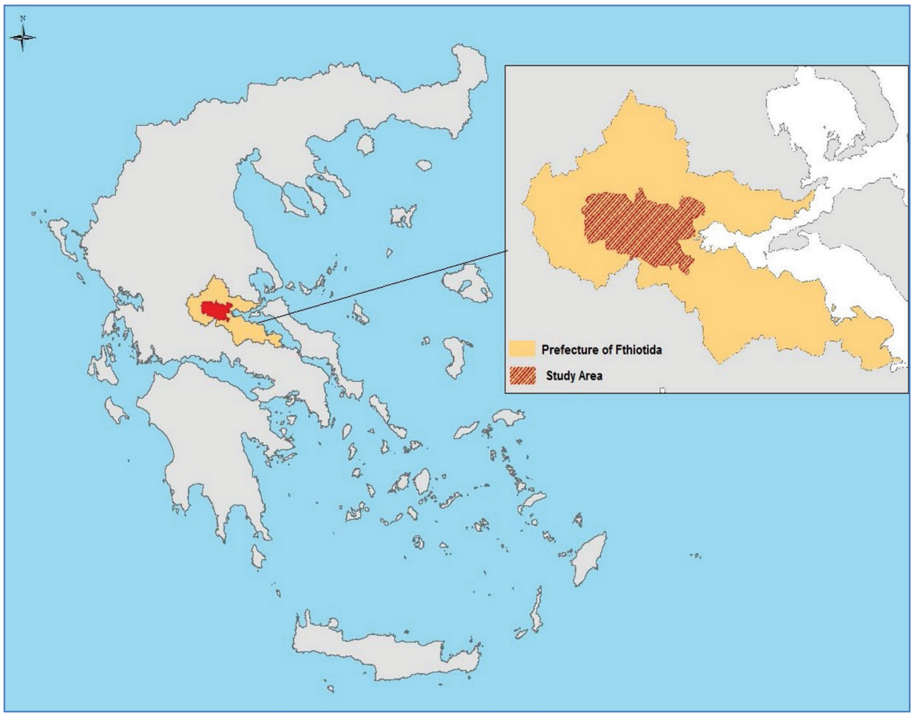

Figure 1. Site location on the map of Greece.

its delta-shaped outlet in the Maliakos Gulf and dividing its basin into a northern and southern part. The southern part is the one that presents the most intense relief, with the highest elevation (Maggidis *et al.*, 2021; Psomiades, 2010).

The difference between the two parts is caused by the fact that the central bed of the river Spercheios lies in a tectonic depression, where the southern part rises while the northern part sinks (Figure 2) due to the earthquake fault of Atalanti (Mariolakos, 1970; Gartzos and Stamatis, 1996; Tzanis *et al.*, 2010; Mentzafou *et al.,* 2020). The hydrologic system of the basin, which includes the river and six main tributaries, forms a well-watered fertile valley with rich alluvial soil (described by Homer as "large-lumped" *Iliad* I.155, IX.363) and having its own micro-climates (Efthimiou *et al.,* 2015, Mertzanis *et al.,* 2018, Spyrou *et al.*, 2021).

The total size of the Spercheios valley area amounts to 683,225 acres (276,610 ha), while its perimeter is about 165 kilometres. Administratively the area belongs to two municipalities, the Municipality of Lamia (the largest part, 79%), and the Municipality of Makrakomi, the rest (21%) of the total study area (Figure 3a). Regarding the administrative division of the area, it is worth mentioning that the entire study area includes 44 local communities, 33 of which are under the Municipality of Lamia and the other 11 under the Municipality of Makrakomi.

The selected boundaries of the study area were chosen such that they are identical and tangential to the already implemented boundaries of the local communities (Figure 3b). This was done for two main reasons: firstly, the use of the already existing boundaries would make the descriptive identification of the land easier when determining positions, and for the writing of necessary technical reports to the authorities and institutions involved; secondly, the geographical simplification of the boundary design would require no new key of spatial design features to be identified. Furthermore, there was no restriction on the geographical distribution of space. The extended proposal of the convergence of the geographical boundaries with those of the study area was chosen, even though they are separated from the natural geomorphological characteristics such as rivers, gorges, mountains, *etc.* (Malaperdas and Zacharias, 2018; Malaperdas, 2019; Malaperdas and Zacharias, 2019). The modern coastal area and the delta of the river Spercheios were not included in the archaeological investigation, since these areas have been largely silted up with alluvial deposits from the river in post-Mycenaean periods.

In June 2018, the archaeogeophysical survey commenced in the Lamia Municipality under the directorship and auspices of the local Ephorate of Antiquities, focusing initially on sites documented from publications and previous field reports (Simpson and Lazenby, 1959; Kase, 1972; Kase, 1973; Chourmouziadis, 1979; Simpson, 1981; Dakoronia, 1991; Dakoronia, 1994; Dakoronia, 1999; Karantzali, 2013; Karantzali and McGeorge, 2013; Karantzali, 2016; Karantzali, 2018; Maggidis *et al*.,2021). Using DGPS and mobile GPS devices, sites excavated or discovered in the past were located, identified and recorded along with new sites found throughout the survey area. These coordinates, accompanied by photographs and descriptions, were imported to ArcGIS for further geospatial and geomorphological analysis, and also included aspect, slope, hydrology, geo-seismic evidence, geomorphology and geology of the area.

In order to accomplish this, a TOPCON GPS positioning station was utilised to collect archaeological data, spatially integrate data into the area, and record the coordinates of archaeological sites on-site. The phase "kinematic approach"

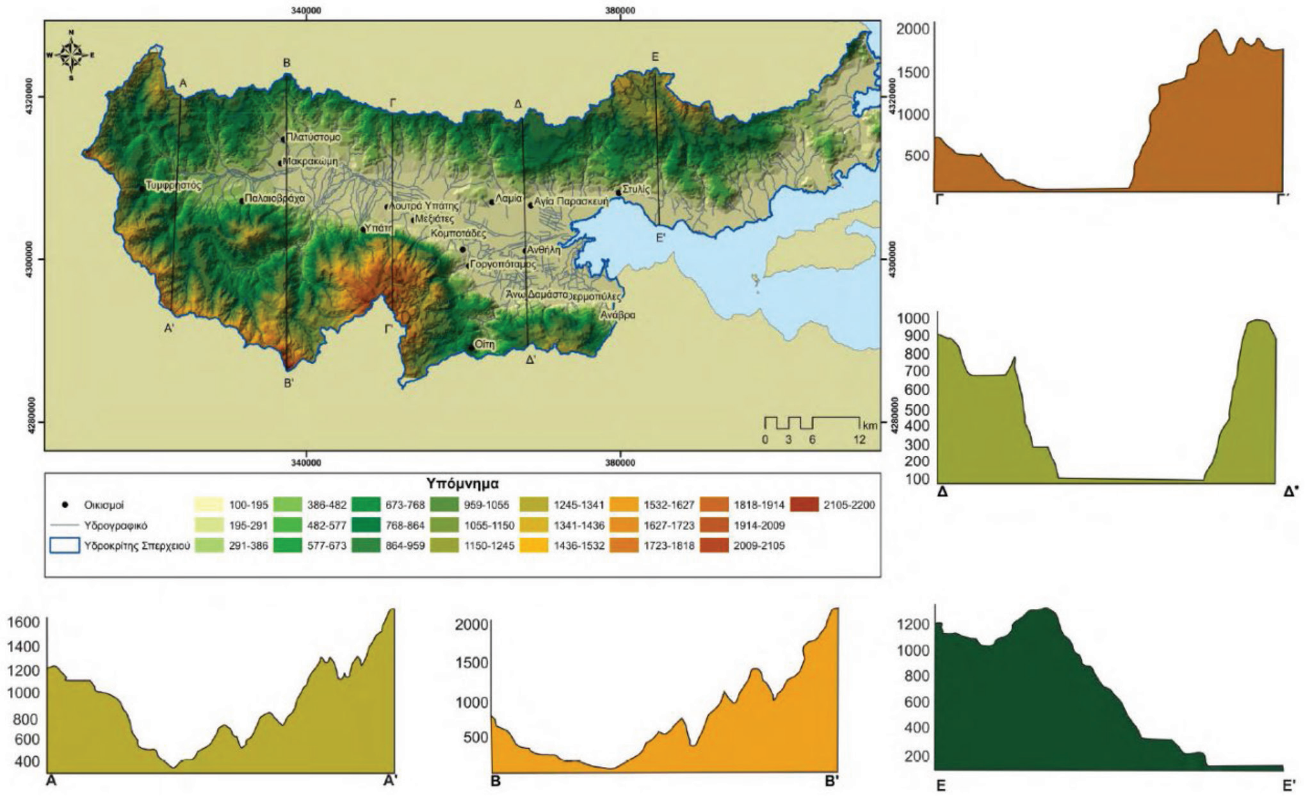

Figure 2. The topographic sections in the basin of Spercheios (edited by Karli, 2013).

(RTK – Real Time Kinematic) was applied by the TOPCON GPS station to precisely calculate a location with a variance of a few millimetres to one centimetre. The Transverse Mercator Projection TM87 of the Greek Geodetic Reference System 1987 (EGSA '87) was used to gather coordinates and analyse data. The Greek Geodetic Reference System (GGRS87) is a uniform projection system that is utilised in both the private and public sectors in Greece.

In the field survey, priority was given to visiting sites that had been excavated or located in the past. The research team physically visited all these locations, which have only been mentioned descriptively in the bibliography. Field trips were organised in collaboration with the local Ephorate of Antiquities and with the guidance of local guards and workmen. During these visits, the research team would also inspect the local geomorphology and environment (on foot and with the use of a drone-mounted camera) in order to identify significant natural features or essential sources in the vicinity of the located sites (*e.g.*, low hills and water sources for settlements, soft bedrock for cemeteries of rock-cut chamber tombs) as potential diagnostic evidence for inhabitation. As a result, eight new sites, so far unknown, were located and identified in the process, thus enabling the application of geocumulative geospatial analysis

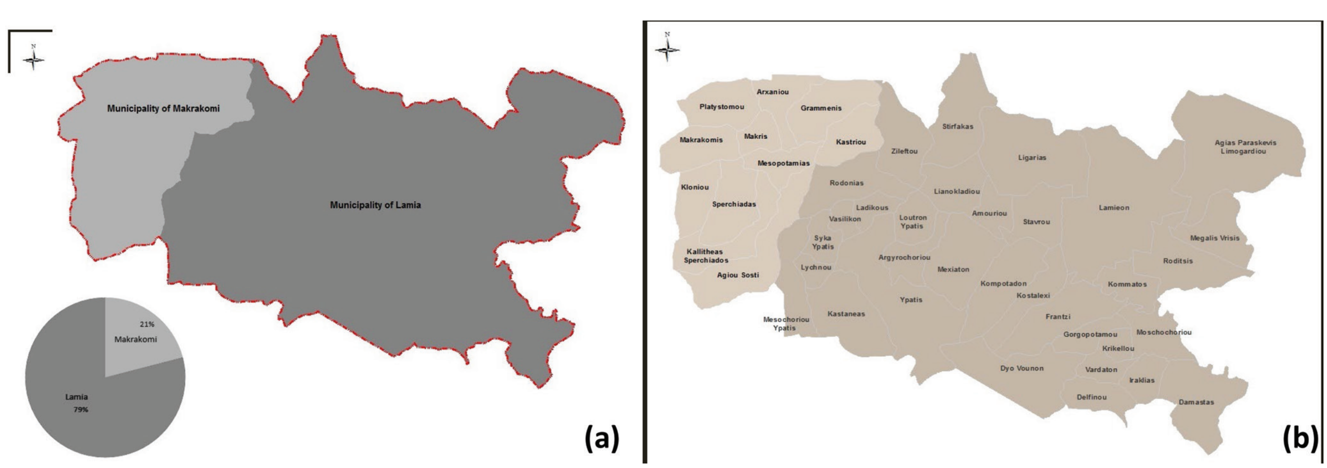

Figure 3. a) The administrative division of the study area within the boundaries of the municipalities. b) The administrative division of the study area based on the boundaries of the local communities.

and frequency/spatial distribution models to explore the interaction between environment and site distribution, trace contact patterns and hierarchical dynamics among sites, and identify second-order centres and possibly a first-order administrative centre in the region. The use of GPS in the field was highly effective for recording coordinates and geo-referencing, but also for plotting, positioning, laying out, and measuring equal parallel transects for the systematic field survey of selected sites by the research team. All the data collected from the field survey, in combination with the bibliographic references and the pre-existing GIS data, formed the framework for the partial reconstruction of the historical landscape. As the research continues all the new data and the small discrepancies that may occur will be incorporated into the model.

2. Methods

The methodology provided in this work is based on the latest knowledge of the predictive models that we currently use now, with the goal of evolving them and proposing an overall new way of thinking about predictive models in the future. These new models also take into account a crucial factor: the incorporation of critical thinking into each model's decision-making process. The new model proposed in this study is called the Model Trend Calculation (MTC), and it is based on Popper's Three Worlds theory (Popper, 1978). Since the idea of critical thinking is a basic principle in epistemology, a theorem based on Popper's Three Worlds theory was established to define the new model (MTC) in a decision-making framework and simplify it in terms of future use by researchers. The full analysis of the habitation Model Trend Calculation (MTC) has been presented in detail by Malaperdas and Zacharias (Malaperdas and Zacharias, 2019).

The MTC prediction model incorporates a number of criteria deemed critical in the selection of a habitation location. The MTC model was also modified to meet the requirements of research by creating multiple raster files that were multiplied by their respective weights (Saha, Gupta, and Arora, 2002; Pandey, Dabral, and Chowdary, 2008; Kouli, Loupasakis, and Soupios, 2010).

The central idea of a predictive model based on Popper's Three Worlds theory offers significant advantages over past predictive models, including recent publications (Argyriou *et.al*, 2017; Oguz-Kirza, 2017; Healey *et. al*., 2017), and theoretically it can serve as a guide for future Archaeological Sites Prediction models.

Unlike all previous prediction models, this one is unique in that it introduces the concept of causality, or the causal relationship between two events (cause and effect), when the second situation emerges with certainty from the first. With this critical thinking, the researcher not only understands the model's probable consequences, but also the precise application of each indicator (index) utilised. Furthermore, the indicators can be revalidated utilising physical observations of the investigated items, as well as the viewpoint of crucial social elements of the observer and the studied case, through the model itself. As a result, there is a clear cause-and-effect relationship (Malaperdas and Zacharias, 2019).

One example of the elevation parameter, which is widely encountered in archaeological publications and prediction models, will be examined in order to better expound on this subject. The elevation quantification is usually deemed sufficient when examining a site in terms of its geomorphological data. However, the elevation parameter alone does not provide a complete picture of the investigated location, because a 100-metre-elevated site could be at the top of a small hill, serving as an observatory, or at the edge of a large mountain range, in the centre of a wide plain or between two tight valleys; in each case the archaeological perception and interpretation would be different (Malaperdas and Zacharias, 2019).

In the MTC model, the precise location is thoroughly stated based on all these geomorphological parameters, in order to study all the elements that will give the whole geomorphology of the site location with the maximum degree of precision. The Hillslope Classification index is coupled with the specific elevation, which examines all probable possibilities for a particular location, ranging from being at the top of a hill to successive subcategories down to ground level (valley floor). Subsequently, the result uses the Topographical Index to determine the accuracy of the position in relation to the site's broader geomorphology, which answers the question of whether the sites are located in a valley or in a hilly area, and at what degree of terrain inclination. Finally, the parameter of Landform Classification is used to determine with absolute accuracy the position under examination, indicating whether a site is located on a hill, mountain, canyon, or on a plain (Malaperdas and Zacharias, 2019).

In this way, the question of habitation position in relation to the geomorphology factor examined by the predictive model is fully answered; moreover, not only is a numerical determination of the position provided, but new questions can be generated, creating thoughts and discussions in the archaeological community. The climatic (with the data analysed relating to indexes of Aspect, Solar Radiation, Heat Load and Wind Intensity) and geological factors (with the data analysed relating to Geological Formation, Wetness Index, and Distance from the Hydrographic Network) also lead to similar results (Malaperdas and Zacharias, 2019).

3. Theories and reasoning

The Mycenaean world flourished in the 14th and 13th century BC (circa 1420/1410–1200/1175 BC). This period (LH IIIA/B) is marked by regional centralisation of power, state formation, and advanced socio-economic organisation, geared towards an efficient surplus, local production and overseas trade, coordinated and regulated by the palace administration and sustained by palatial bureaucracy. In the homeland, the Mycenaean palaces were fortified into citadels, public works were carried out, agricultural production and farming were systematised (Shelmerdine, 2001; Shelmerdine and Bennet, 2008); abroad, the Mycenaean's assumed control over the Minoan colonies and trade outposts in the Aegean and Eastern Mediterranean, and further expanded to the east and west, thus firmly establishing their own trade network and successfully succeeding the Minoans in overseas trade (Iakovidis, 1974; Kantor, 1997; Maggidis, 2009; Karantzali, 2005). The Mycenaean political geography comprised a network of several Mycenaean palace-states that emerged at key inland, coastal or island locations in the Peloponnese, southern mainland Greece, and Crete, achieving striking cultural homogeneity and uniformity in material culture (palatial architecture, ceramic styles, script and language, burial customs and religion) with regional variations and local traditions, known as Mycenaean koine (14^{th} – 13^{th} century BC) (Shelmerdine, 2001; Treuil Rene *et al.*, 1990). Mycenae was the primary centre of this period and was first to be discovered by Schliemann in 1874. Thus, Aegean prehistory was established with the excavations of Schliemann. His findings at Mycenae were so impressive that it was considered natural to use the term "Mycenaean" for similar archaeological sites found in the following years at many Aegean sites (Dickinson, 1994; Sprakes, 2002).

In the course of the 12^{th} century BC, the cumulative effect of combined, rapid and dramatic changes in several socio-economic, political, and environmental variables, triggered by events-catalysts, affected a fragile balance, thus resulting in catastrophic systems collapse which caused the decline and fall of several interconnected states and empires in the Mediterranean (Knapp and Manning, 2016; Cline, 2014; Maggidis, 2009). In Mycenaean Greece, the deterioration of the same system that had supported central palatial authority resulted inevitably in the rapid dissolution of palatial power, and the decentralisation and fragmentation of the Mycenaean palace states (Lemos and Kotsonas, 2020; Knapp and Manning, 2016; Middleton, 2010; Maggidis, 2009; Shelmerdine, 2001).The collapse of the palatial system was accelerated by internal conflicts, which brought either the Mycenaean states against each other or different classes of the population (Hooker, 1976). It was the Mycenaean elite and its diagnostic elements (palatial administration and writing, foreign contacts and luxury goods, monumental art and architecture, representational arts and crafts) that suffered the most from the system meltdown, whereas at the lower level the impact was less direct; despite poverty, isolation, and depopulation on the mainland, the remaining core of Mycenaean society changed more gradually in terms of basic material culture and cultural practices, evolving organically into the Early Iron Age Greece (Karouzou, 2020; Livieratou, 2020; Maggidis, 2019; Knapp and Manning, 2016; Livieratou, 2012; Maggidis, 2009; Lemos, 2002; Shelmerdine, 2001).

The region of the Spercheios valley features certain environmental, geomorphological, agrarian, and geopolitical parameters that, if considered collectively, may be construed as diagnostic formative elements of Mycenaean palace states. Due to its key geopolitical location at the crossroads between powerful Mycenaean palace states on either side (Iolkos in the north; Orchomenos, Thebes, and Glas in the south) and other adjacent areas with strong Mycenaean presence (Lokris, Euboea), this region could exert control on land routes and regulate local and interregional trade (Simpson and Lazenby, 1959; Kase, 1972; Kase, 1973; Kase *et al.* 1991; Karantzali, 2013, p.151; Maggidis *et al.*, 2021). Furthermore, the Spercheios valley is agronomically ideal for large-scale agriculture in terms of land size, irrigation, soil quality, and its potential for intensification of cultivation and extensification of arable land, thus securing local autonomy, self-sufficiency, and probably surplus (Maggidis *et al.*, 2021).

Paradoxically, however, the archaeological map of the Spercheios region is incompatible with its geopolitical importance and economic potential. In the last two centuries, archaeological fieldwork has been carried out sporadically in the Spercheios valley (Marinatos, 1940) with rather poor results, partially because field research often aimed not at the surrounding hills (habitual location of Mycenaean settlements), but at the modern valley floor; it was therefore being hindered by local geological processes (deep silting from the river and the sinking of the southern part of the valley floor by 10–20 metres). Recent work by the local archaeological Ephorate (Chourmouziadis, 1979; Dakoronia, 1991; Dakoronia, 1994; Dakoronia, 1999; Papakonstantinou and Sakkas, 2010; Karantzali, 2013; Karantzali, 2016; Karantzali, 2020, pp.906–907) has located and partially excavated a few Mycenaean sites and cemeteries, such as the important cemetery at Kompotades, that has yielded large chamber tombs with exquisite finds, imported luxury goods, and artifacts of high social status – thus indicating a region that may be moderately secluded but not isolated, combining local autonomy and self-sufficiency with interregional contacts (Karantzali, 2013; Karantzali and McGeorge, 2013; Karantzali, 2018; Karantzali, 2021).

Dickinson states that *"The climate, the landscape, and the natural resources of Greece must always be considered in every historical study because they are directly related to the possibilities of the evolution of societies"* (Dickinson, 1994). The same point of view is also shared by other researchers. Nowadays, we know that the ancient Greeks, at least from the classical era onwards, had special knowledge of the bioclimatic conditions prevailing in a place and tried to exploit them (Hughes, 1994; Bradshaw and Sykes, 2014; Solari, 2019). In Xenophon's memoirs (Apomnemoneumata III.8.8-10), Socrates speaks of the ideal solar house (Pantelakis, 1937). At the same time, Hippocrates (On Airs, Waters and Places, I.1.1-16), prefigured the principles of modern bioclimatic architecture (Barrois, 1816). The core of all the theories developed at that time was to ensure a harmonious relationship between man and his environment. Aristotle (*Politics* A.1*)* remarks that ensuring the right climatic conditions is the overriding priority for the establishment of the ideal city, since, in addition to the issue of public health, climatic conditions will also play an enormous role in the self-sufficiency of food by determining the crop of the fields (Tzioka-Evangelou, 2009). In particular, the climate, soil quality, and irrigation potential are key factors for the success of a crop and therefore the welfare of the inhabitants.

Of the total study area in Messenia and on the basis of the residential classification, as presented in their paper (Malaperdas and Zacharias, 2019), the two hierarchically most important categories of settlements were selected to be examined. These constitute thirty (30) of the one hundred and forty (140) Mycenaean settlements of Messenia and characterising classes of Centres and Large Villages. The rationale for this choice is that these two categories, apart from the importance of the sites themselves (based on the archaeological finds, the area occupied by the number of sherds found, the existence of vaulted tombs in association with the sites, and the bibliographic references), are at the same time the clearest example of correlations.

These correlations cannot be random for two main reasons: (a) the factorisation criteria are sufficient in number (twelve, to be randomly identified in such a large and diverse area as the one occupied by the prefecture of Messenia), and (b) the close values of the sample in the Ideal Value of conditions of the model horizon (closed sets) verify that specific conditions prevail in the choice of place of residence by the Mycenaeans in Messenia. Consequently, as the categories decrease hierarchically, there is a gradual corresponding departure from the Ideal Value.

It should be noted that the number of Mycenaean settlements found in the valley of Spercheios is much smaller. For this reason, and in order to reduce as much as possible

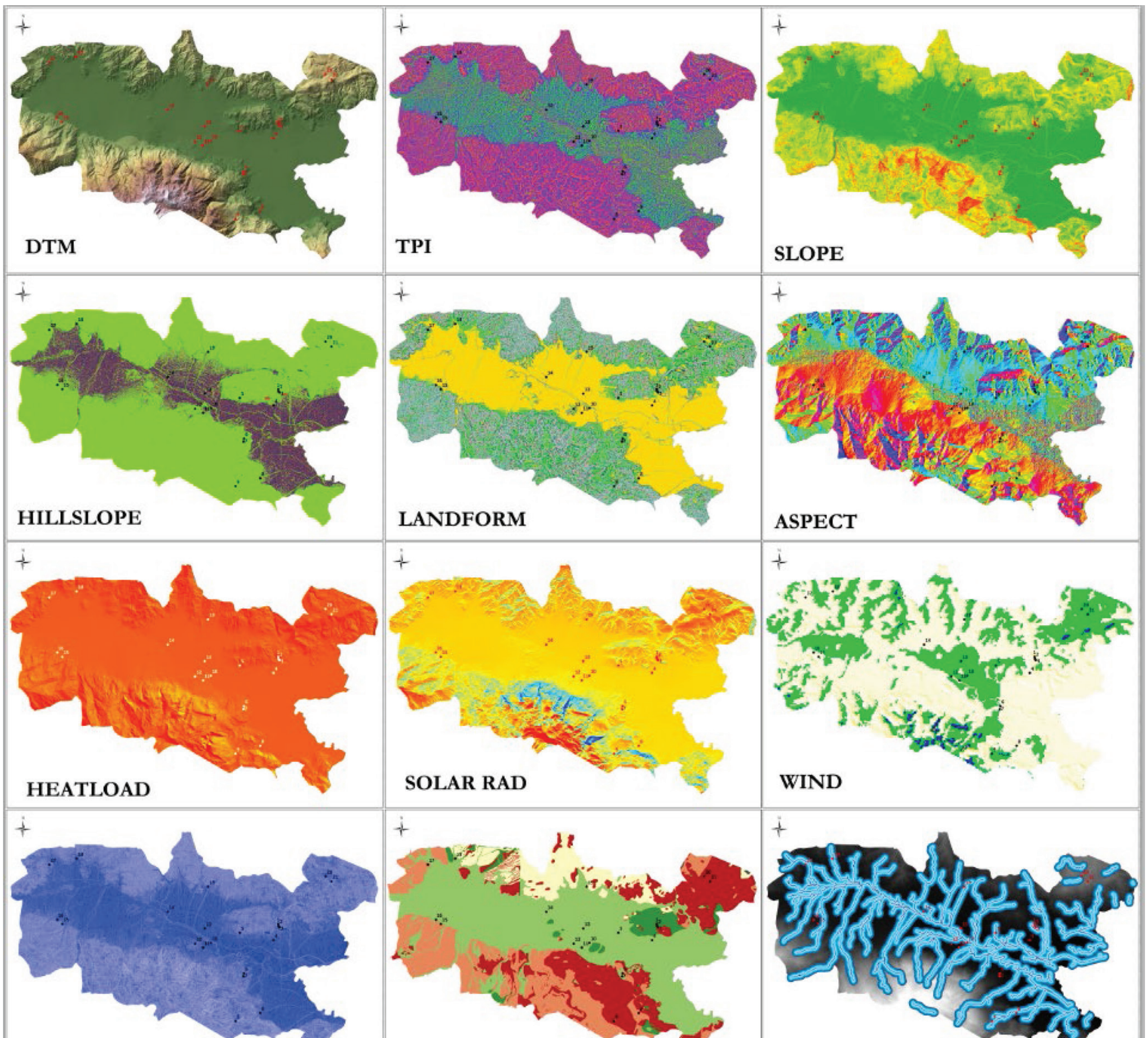

Figure 4. A GIS cartographic composition of the Examining Factors.

the inequality of the number of places between these two study areas, we decided to finally focus on the first two and most powerful habitation categories.

4. Results: Applying the model; the case study of Fthiotida

In the second study case, in the Prefecture of Fthiotida, new characteristic data were observed which differ from the first case study, that of the Prefecture of Messenia. For this reason, the MTC model was adapted and reconfigured based on the new conditions we encountered in Fthiotida. After analysing the data for each habitation site, the weight of the factors was redefined and the factors were recalibrated, giving the final classes of the model (Figure 4).

More specifically, for the creation of the final prediction map of the MTC model, all the parameters with the corresponding weighting factor were used. The three factors (Geomorphological, Climatological, and Geological) operated together to give an aggregate of the final result and more specifically, the following equation was used:

$$\mathbf{MTC = 0.372 * FMr + 0.274 * FCl + 0.354 * FGl}$$ [1]

[1] Where MTC represents the residential suitability index, FMr represents the Factor GeoMorphology, FCl stands for the Factor Climate and FGl represents the Factor Geology.
MTC = 0.045 * Elvindex + 0.088 * Slpindex + 0.118 * HClindex + 0.066 * LFrindex + 0.055 * TPIindex + 0.105 * Aspindex + 0.054 * Solindex + 0.052 * Htlindex + 0.063 * Wndindex + 0.149 0.079 Wetindex + 0.126 * Hydindex - where Elvindex = Elevation Index, Slpindex = Slope Index, HClindex = Hillslope Classification Index, LFrindex = Landform Classification Index, TPiindex = Terrain Position Index, Aspindex = Aspect Index, Solindex = Solar Radiation Index, Ht Load Index, Wndindex = Wind Intensity Index, Glfindex = Geological Formation Index, Wetindex = Wetness Index, Hydindex = Hydrographic approximate Index.

Likewise, these parameters in the MTC model that were developed for the prefecture of Messenia, were classified into five final categories, ranked from those with the lowest satisfaction rates of the model's criteria to those with higher values, which are also the areas with the highest probability of habitation (Figure 5).

There were ten places considered residential sites. Based on the predictive map, six of them were classified in category 4 (moderate to high probability), three in category 5 (high probability), and only one, in category 3 (moderate probability).

The initial observation is that the model gave satisfactory results as nine of the ten residential sites were classified in the highest settlement probability categories of the model (Categories 4 and 5) while only one of them was in the immediately lower one (Category 3).

It is also noteworthy that for the first two categories of the model (Category 1: low probability and Category 2: low to moderate probability) and despite the fact that they occupy a significant percentage (37%) of the total study area, none of the examining sites are located in such areas.

One of the main criticisms of the prediction models is the fact that most of the time researchers are satisfied with a computer image, which is extracted by the model, without the possibility of matching this data with the necessary archaeological research and field examination, at least for those selected sites that have a higher probability of prediction.

This is mainly because the first site prediction models were developed for environmental, ecological and spatial studies. When, for example, a waste treatment plant had to be sited, with specific conditions and constraints, the scientists examined the locations derived from the model, without the need for on-site investigation and autopsy, which is not the case for archaeological research.

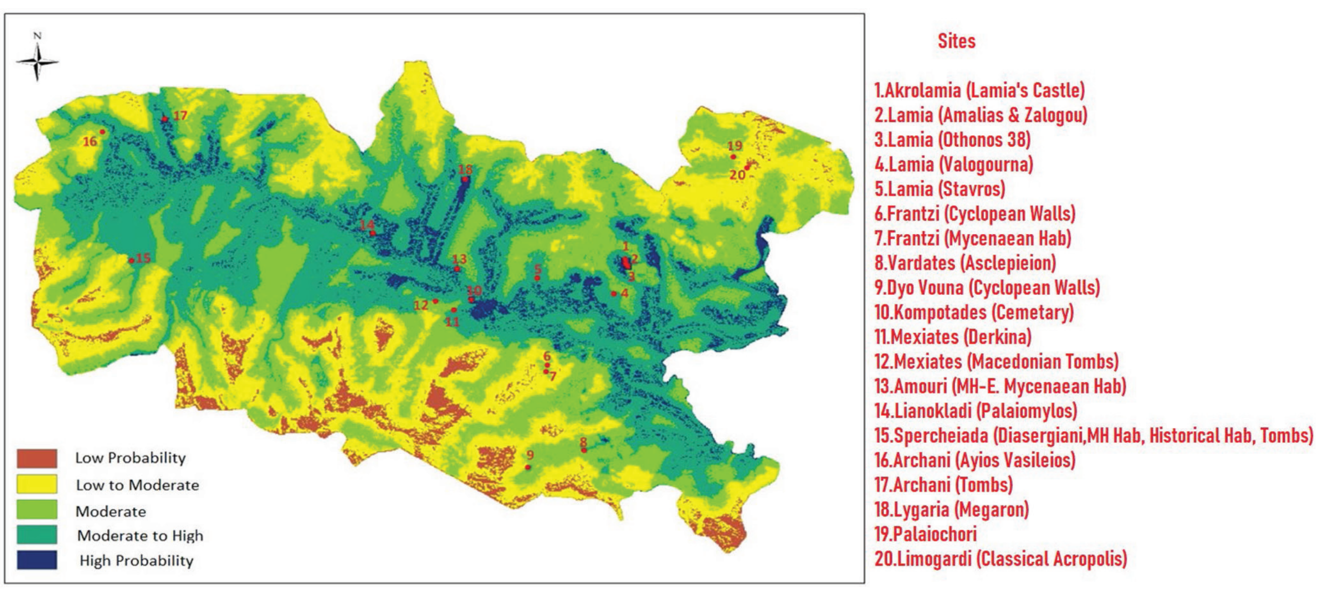

Figure 5. Predictive map of the MTC model applied in the Spercheios Valley case study.

Figure 6. (a) Field survey in suggested site 1 (b) Archaeological Section after survey in suggested site 2.

For this reason, and following the completion of the MTC model prediction results, two in situ surveys, were carried out on indicative, high probability sites (Category 5) suggested by the model in collaboration with the project archaeologists in charge of the MY.SPE.AR. Project (Figure 6). Sites were selected in areas of high-density concentration and where there is potential for fieldwork, avoiding private land as far as possible. Sites that yielded archaeological material (shells, pottery, stone tools) during the surveys were reported to the competent authorities for further investigation.

Finally, the required surveying were conducted, a list of eight (8) new sites was created, derived from the model and presented visually on the Google Earth map (Figure 7). Again, all the locations relate to high probability areas based on the prediction model. As part of the MY.SPE.AR. Project, surface surveys are planned to be carried out at some or all of the new locations.

5. Discussion

If we compare the same features between the two different study areas examined in this paper, significant differences are observed. This is only logical, considering the geomorphological area of the Spercheios Valley is very different from the landscape in Messenia.

The valley of Spercheios is surrounded on three sides by high mountains. The highest elevations are found at its southern and western boundaries, namely, the mountain range of Vardousia (2,437 m), the mountain of Oiti (2,152 m), and the ridge of Timfristos (2,316 m). The south-eastern part of the valley, which exits into the sea, is delineated by Mount Kallidromo (1,372 m). To the north, Mount Othris (1,727 m) completes the geomorphology of the area.

The valley of Spercheios is essentially the flat part of the basin, surrounded by high ridges. Small hills, with

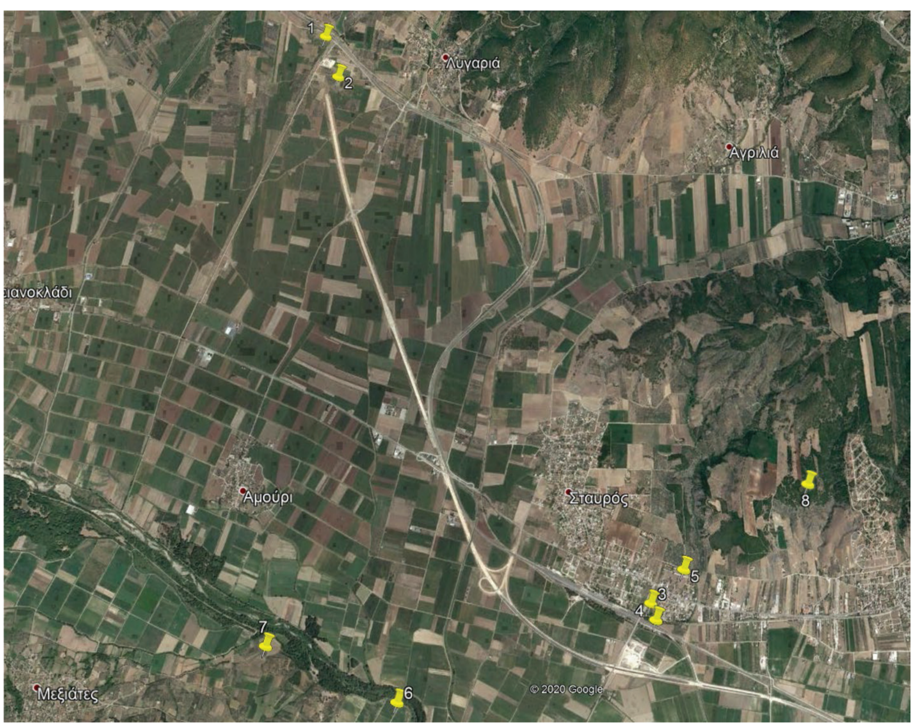

Figure 7. Suggested sites for surveying based on the MTC model.

Table 1. Similarities and differences between the two cases (Messenia and Fthiotida)

Factor	Main Differences and Similarities
Geomorphology	The valley of Spercheios, which is essentially the lowland part of the basin, is a flat area surrounded by high ridges. Small hills with maximum altitudes of around 200 metres make up the landscape of the valley. In contrast to Messenia, the highest mountain in the valley is Mount Taygetos, located in the eastern part of the prefecture, while its geomorphology is varied throughout the western part of the prefecture. Smaller mountains and hills emerge in the landscape forming many geomorphological variations that during the Mycenaean period were more favourable to the places of habitation.
Climate	Regarding climatic factors, there are no significant differences between Fthiotida and Messenia, although in Fthiotida the climate is colder, especially in the winter months. Regarding the aspect that was the most important climatic factor in the case of Messenia, it is observed that here too the majority of places are located in lands of a southern orientation in general (Malaperdas and Panagiotidis, 2017).
Geology	In terms of geological factors, it is observed in both cases that the geological formations around the vast majority of sites are suitable for both cultivation and construction material.

a maximum elevation of about 200 metres, compose the landscape of the valley. Regarding the slopes of the terrain, the whole northern part defined by Mount Othris presents small and gentle slopes in a smooth relief in contrast to the southern one, which is formed by the mountain range of Oiti and has steep morphological slopes in an intense relief with deep ravines that feed the river Spercheios.

In order to better understand the difference in terms of the geomorphology we observe that in Messenia the highest mountain is Mount Taygetos, which is located in the eastern part of the prefecture (2,407 m). According to Higgins, Mount Taygetos regulates the climatic conditions for the whole prefecture; as a result, the rainfall in the Messenia Prefecture is twice than in the neighbouring Laconia Prefecture, making the Messenia soils more fertile (Higgins, 1996, p.51). Examining the study area in terms of climatic factors, no significant differences are observed with those presented in Messenia, although in Fthiotida the climate is colder, especially in the winter months. In general, the climate of the valley of Spercheios belongs to the subtropical Mediterranean zone, with hot, dry summers and wet, mild winters, while the areas with elevations above 500 m are characterised by a mountainous continental climate with cold winters (Efthymiou *et al.*, 2005).

In terms of geological factors, it should be noted that almost the entire plain and semi-mountainous part of the Spercheios valley is composed of Quaternary deposits, alluvial deposits, ridge cones, lateral ridges, erythrocyte deposits of the Neolithic age, and sedimentary deposits of the Pleistocene (Karli, 2013). In other words, porous rocks are also found here, in extensive and high-yield aquifers suitable for both cultivation and construction material.

The main differences and similarities regarding the main factors and between the two examined areas are summarised in the Table 1.

6. Conclusions

In summary, the results obtained after the examination of the factors between the data for the two study areas display small differences, mainly in the first two factors, those of geomorphology and climatology. The different geomorphology of the two regions contributes to this. The valley of Spercheios is a lowland area, surrounded by high mountains that define the terrain and regulate the climatic conditions of the entire valley. The region of Messenia presents a greater diversity in terms of its relief and the area under examination is much larger. Despite the differentiation of the geological layers between the two areas, it is observed that the habitation sites in both case studies are located in geological formations suitable for soil flexibility and their likely usage as building materials for all kinds of construction by the ancient societies, but also for agricultural exploitation.

However, as mentioned above, it is important to emphasise the fact that in the case of the Spercheios River valley, the number of habitation sites is significantly reduced compared to those of the region of Messenia. The data examined appear to have some common characteristics, but will require new as well as further data to be able to draw more reliable conclusions.

On the other hand, the results of the implementation of the MTC Predictive Model in the region of Fthiotida are clearer and particularly encouraging. The model appears to be highly accurate, recognising nine out of ten habitation sites in the highest occupancy probability categories 4 and 5. It is worth mentioning here, that, in general, for the forecast model to be considered satisfactory, the first two hierarchically residential categories are expected to be in those categories of the model: (5) High probability; and (4) Moderate to High probability.

The important advantages of the MTC prediction model that apply in the case of the Spercheios valley are the following:

a) It can be easily adapted to questions of interest to the researcher, incorporating and creating more complex and critical thinking in the final prediction model.
b) It is not just another computer-aided model of predictive results, but a model that can be a useful guide to field archaeological research.
c) Based on the methodology developed for the creation of the MTC model, access to interdisciplinary

questions is easier and faster; to some extent, this is because the factors are already standardised and can give a better evaluation of the results.

We will continue this research, as – with the completion of the five-year project and following the processing and categorisation of the new sites produced by the project's team of archaeologists – we hope to have a new list of more settlement sites and can review their characteristics and possible variations. This will be particularly useful, as it will provide a new insight into the pattern of features; we will be able to know the sample size that our model will need in order to work to a satisfactory degree. Finally, with the planned fieldwork at eight (8) more potential sites produced by the predictive model, we will always be able, with the help of archaeological fieldwork, to test and evaluate the effectiveness of the predictive model.

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