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An Exploratory Spatial Analysis of the Churches in the Southern Mani Peninsula, Greece

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Original Study

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Abstract: The Mani Peninsula is home to hundreds of Orthodox Christian churches that were built within the last millennium. As in other parts of the Eastern Mediterranean countryside, the topological relationship between churches and settlements is a critical factor in understanding the significance of the sacred landscape. Many churches are situated in the central part of a village or on its very edge, but others – what are referred to as "outlying churches" or *exokklisia* – are built at great distances away. In this paper, we make the first attempt to assess the spatial relationship between the spaces where people worshipped (the churches) and the spaces where they lived (the settlements) at a regional scale, focused specifically on the Middle Byzantine period and later (mid-9th century CE to the present day). Comparing these patterns across the Byzantine, Ottoman, and Modern periods allows us to frame Mani's sacred infrastructure within a changing, diachronic perspective. The results point to a change in the topological relationship between church and settlement that is best described as the "nucleation of the sacred landscape."

Keywords: Rural communities, sacred landscapes, Christianity, post-medieval period, statistical analysis

1 Introduction

Churches and other forms of sacred infrastructure are the physical manifestation of a broader and, at times, less tangible sacred landscape. In this paper, we investigate the spatiality of sacred infrastructure as a means of understanding the transformation of a sacred landscape over the long term. While *location* can mean many things, in this paper we use the term to refer to the topological relationship between churches and permanent settlements. In rural areas of the Eastern Mediterranean where Byzantine Orthodox Christianity once prevailed, churches can be located within the heart of a settlement, on the settlement's outskirts, or in remote places kilometers away from the nearest living person. These latter types of churches are commonly referred to in Greece as *exokklisia* (outlying churches).

As with any kind of sacred infrastructure, churches are built and used as places of worship not by the residents of a settlement, but rather by the members of a *community*. While a settlement is a physical place on a landscape, a community is essentially a construct that simultaneously transcends and embodies physical space. In the words of Yaeger and Canuto, a community is "an ever-emergent social institution that

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generates and is generated by suprahousehold interactions that are structured and synchronized by a set of places within a particular span of time" (2000, p. 5). From this perspective, churches and settlements both serve to reinforce community identity in a spatial sense, as well as through "practices of affiliation" (Yaeger, 2000) or "enactments of community" (Mac Sweeney, 2011) – essentially, the repetition of group activities. In the case of Orthodox churches, liturgical services, candle lighting, and the maintenance of church grounds are all practices of affiliation that link members of a community together and connect them to the sacred landscape in and around them (Figure 1). The importance of churches to Greek communities is highlighted by ethnographic research: when a community relocated or founded a new settlement, a church was usually constructed within a few years (Forbes, 2007, p. 355). The intrinsic connection between settlement and community is important to keep in mind as we explore the physical relationship between churches and settlements.

Figure 1. Material signs of the active maintenance of sacred infrastructure: a burning candle, empty water bottles, and framed modern icons in the 13th-century church of Agios Georgios, Paliochori (June 2014).

The focus of this paper is the southern half of the Mani Peninsula, Greece, from the Middle-Late Byzantine periods through the modern day (Table 1). While extensive research has been conducted on the region's churches already – particularly in terms of their architecture, decoration, and dedications – this relationship has yet to be examined from a landscape perspective. Where did people build churches in relation to village space? Did the topological relationships between church and village change significantly over time? Does a spatial perspective help us understand why some churches fell into disrepair while others were renovated?

We set out to answer these questions from a long-term, regional-scale perspective by exploring the potential spatial relationships between churches and settlements through statistical analysis. First, we compiled a substantial inventory of churches and settlements through fieldwork and a study of remotely

sensed imagery. In order to achieve a data standard for comparing the features' locations, we coded their foundation and occupation phases in terms of three broad chronological categories: "Byzantine," "Ottoman," and "Modern." Second, we coded topological relationships based on each church's relationship to its nearest contemporaneous settlement, assigning it a category of "inside," "edge," or "outside." Third, we used these categorizations to build contingency tables and apply statistical analysis in order to look for potential patterns in the data. These statistical tests include the Chi-Square statistic, Correspondence Analysis, and two-way Analysis of Variance (ANOVA). The patterns that emerged from these analyses, based on the chronological and topological categories, provide some exploratory insights into the questions highlighted above and lay the groundwork for more detailed studies.

Table 1. Chronological Periods in the Peloponnese, Greece.

Years (CE)	Period Name	Simplified Designation in This Paper
324–843	Early Byzantine	–
843–1204	Middle Byzantine	Byzantine
1204–1463	Late Byzantine	
1463–1685	First Ottoman	Ottoman
1685–1715	Venetian	
1715–1821	Second Ottoman	
1821–1950	Early Modern	Modern
1950–present	Contemporary, Modern	

2 Research on Churches in the Eastern Mediterranean

The earliest churches in the Eastern Mediterranean were built during the period of Christianization in the 5th to mid-7th centuries, a subset of the Early Byzantine period that is typically referred to in scholarship as Late Antiquity. One of the driving concerns of research about this period is to determine the scale and character of change that took place across the Eastern Mediterranean at this time. From Anatolia to the Peloponnese, a rich and ever-growing body of literature points to a turn away from public space and concomitant monumental public works programs toward smaller-scale private constructions. It is against this backdrop that most studies of early Christian basilicas and churches are framed (e.g. Brown, 2010; Caraher, 2003; Crow & Hill, 2018; Horster, Nicolaou, & Rogge, 2018; Niewöhner, 2017; Sweetman, 2010, 2017). The next two centuries (mid-7th to mid-9th) are frequently referred to as the "Dark Ages" of the Early Byzantine period (Decker, 2016). From an archaeological perspective, our ability to date material culture to this stretch of time is notoriously difficult. Churches can sometimes be dated to the later Early Byzantine period if they have evidence of iconoclastic wall painting. Pottery, however, can be impossible to date securely, and the traditional ceramic chronologies from the 7th–9th centuries are currently being revised (e.g. Armstrong, 2008; Vionis, Poblome, & Waelkens, 2009; Vroom & Kondyli, 2015). This uncertainty is probably a contributing factor as to why archaeological surveys have identified few Early Byzantine settlements based on distributions of surface finds (for critical syntheses, see Cassis, Doonan, Elton, & Newhard, 2018; Gregory, 2009; Sanders, 2004).

Starting in the Middle Byzantine period, a huge number of churches were built all across the Eastern Mediterranean, usually as much smaller and humbler constructions compared to the basilicas of the previous centuries. In southern Crete, for example, Nixon reports an increase from 12 to 100 churches (Nixon, 2012, p. 188, Table 1). Most studies deal with the topics of religious artisanship (e.g. wall painting, sculpture, and wood carving), church construction, and systems of patronage. Thus, while we know much about Orthodox churches from an art historical perspective (e.g. Ousterhout, 2008), we know less about their archaeological signatures, distribution, relationship to settlements, function as landmarks in community identity, and so on – and particularly in rural landscapes. As Decker (2018) has recently

summarized, the archaeology of the Byzantine period has experienced something akin to a revolution in recent years, with expanded theoretical frameworks and modern techniques for studying everyday life (see also Bowden, 2009). Increasing numbers of archaeological projects are using surface survey, household-scale excavation, and archaeometric analyses to understand subtle aspects of day-to-day life in the Byzantine era, oftentimes incorporating historical and archival sources (e.g. Athanassopoulos, 2016; papers in Davies & Davis, 2007; Gregory, 2013; Kondyli, 2013; Mee & Forbes, 1997; Vionis, 2012). Still, the shift from an overt concern with *sacred infrastructure* to one that incorporates a fuller perspective on the *sacred landscape* (including settlements, agricultural installation, resources, etc.) is still taking place.

There has been far less research on Orthodox churches dating to the years that follow, from the first installation of Ottoman rule in the 15th century up until the modern transformations of rural landscapes in the mid-20th century – a span of time that is often referred to in the literature as the "post-medieval period." Whereas research on Late Antique churches tends to take place within the field of classical archaeology, and research on Byzantine churches within the fields of Byzantine studies and art history, research on churches built during the Ottoman years can often be found within the field of Ottoman history. While many of these studies focus on the financial management of monasteries and the taxes imposed on non-Muslims by the Ottoman administration (e.g. Fotić, 2010), there are several important case studies from across the former Ottoman territory that deal directly with religious infrastructure and its relationship to surrounding communities (Demirel, 2005; Given, 2000, 2007; Given & Gregory, 2003; Gregory, 2007; Kourelis, 2002; Tzortzopoulou-Gregory, 2008; Vionis, 2006).

3 The Churches in Mani

The southern half of Mani is an ideal case study for three reasons (Figure 2). First, the peninsula as a whole is separated from the rest of the mainland by the Taygetos mountains, marking it in many ways as a kind of island within the Peloponnese (Panagiotopoulos, 1996). This geographical feature enabled Mani to serve as a refuge zone during periods of heightened conflict and contributed to a high population density especially in the years leading up to the Greek Revolution in 1821 (Seifried, 2015). Historically, the southwestern part of the peninsula was treated as a distinct region, referred to in the Byzantine and early Ottoman periods as "Megali-Mani" (Seifried, 2016, pp. 123–124). Today this area is known as "Mesa (Inner) Mani," and the eastern side of the peninsula is referred to as "Kato (Lower) Mani." The northern part of the peninsula is distinguished by the term "Exo (Outer) Mani." Thus, while all regional analyses should be treated with some care, the definition of the southern part of Mani as a distinct region through time can be supported both geographically and socially.

Second, along with Souli in Epiros and Sphakia in Crete, Mani is popularly known as one of the only regions in Greece that evaded Ottoman rule (e.g. Fermor, 1958, pp. 47–48). Whether or not this is strictly true, there is clear material evidence that the region was sheltered from outside influence over the course of its history, including during the periods of Frankish rule (1204–1261), Venetian rule (1685–1715), or Ottoman rule (1463–1685 and 1715–1821). For example, the vernacular architecture of the region is extremely localized and generally does not reflect broader artistic trends that appear in the Peloponnese (Saïtas, 1990). More relevant to this paper, the religious infrastructure itself hints at some degree of separation: namely, there are no extant traces of non-Orthodox religious buildings, despite the fact that other parts of the Peloponnese saw the construction of mosques (as in Mistra; see account in Çelebi, 1685/2011, pp. 330–338) and the conversion of standing religious infrastructure into Catholic churches (as in Pylos/Navarino; Davies, 2004, p. 64). Further, the only reference to a Muslim community ever existing in the region suggests that the residents were killed soon after they arrived (Komis, 2005, p. 320). It is likely that if any Catholic or Muslim religious structures had been built (e.g. within the fortress strongholds that were garrisoned by the Venetians and Ottomans at different times), they were later destroyed.

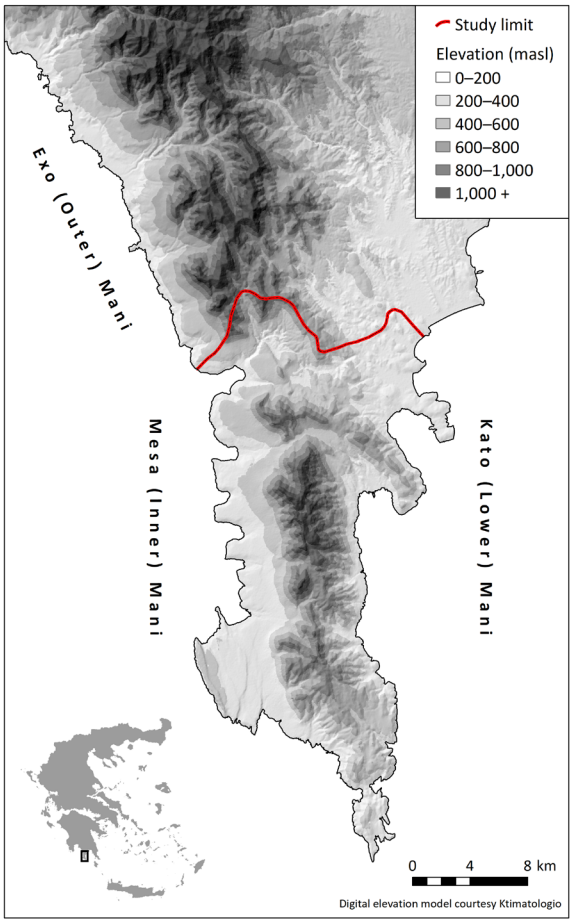

Figure 2. Map of the southern Mani peninsula.

Third and finally, the southern part of Mani is home to a dense concentration of Orthodox churches (by our calculation, at least 492 churches within a study area of 350 km^2, or 1.4 per km^2). These churches form an important corpus of religious architecture from the Byzantine and later periods. Over the past few decades, hundreds of Byzantine churches have been studied through excavations and architectural surveys. The most thorough sources of information about these churches are the book-length publications by Nikolaos V. Drandakis (1995, 2002, 2009) and the updated catalog by Angeliki Mexia (2011); additional reports appear in the proceedings of the Athens Archaeological Society (*Praktika* and *Ergon*), the *Deltion of the Christian Archaeological Society*, and the regional journal *Lakonikai Spoudai*. For churches dating to the post-Byzantine years, the reports by Eleni Deliyianni-Dori (1994, 2005) are the main source of information about recent work.

Because most of the published research deals with churches with preserved wall paintings or Byzantine sculpture, many of the undecorated churches in Mani are still unknown to the scholarly community. Simply put, no one knows for certain how many churches there are. In the early 2000s, the Hellenic Ministry of Culture organized a program called the "Network of Mani Museums" to focus, in part, on the region's religious infrastructure. In addition to organizing an exhibition on "Tales of Religious Faith" (Hellenic Ministry of Culture, 2005), an architectural survey was carried out to record all of the standing cultural heritage in Mani and document their location with a Geographical Information System (GIS). As a result of this survey, 1,444 churches were reportedly registered in both the northern and southern halves of the peninsula (Kalamara, Efremidis, & Moschou, 2009, p. 370). Unfortunately, the geospatial data from this project is not available to researchers. The information is provided in the form of maps published as part of the exhibition that show the general locations of the churches according to broadly defined time periods: "Early Christian" (i.e. the

Early Byzantine), Middle–Late Byzantine (9th century to 1453), "early Post-Byzantine" (1453–1600, roughly corresponding to the First Ottoman period), "churches built after 1600" (1600–1830), and modern (1830–early 20th century).

4 Methods

4.1 Recording the Churches and Settlements

Despite the rich body of scholarship on Mani to date, the lack of available geospatial data led to a new study being undertaken to record the churches and permanent settlements within the southern half of the peninsula (Seifried, 2016). The project resulted in the digitization of 492 churches and 312 settlements dateable to the Middle–Late Byzantine through Modern periods. One of the major limitations of the dataset is that the available chronological information varies widely in terms of its level of detail. While we may know the exact foundation date of one church, for example, another may only be datable to a broad time range on the order of several hundred years. This discrepancy in chronological resolution is not the fault of any single researcher, but rather reflects the predominant interests in the field as a whole: Byzantine churches with preserved iconography have received far more scholarly attention than have unpainted or post-Byzantine churches.

In order to conduct the kind of diachronic and regional-scale landscape study we are undertaking in this paper, it was necessary to standardize the chronological information into three categories (see Table 1): *Byzantine* (Middle and Late Byzantine), *Ottoman* (First and Second Ottoman, Venetian), and *Modern* (Early Modern and contemporary). Only churches and settlements that could be dated to one of the three general time periods were included in our analysis (Figure 3). Distinction was made between when a church or settlement was built/founded and in which periods it was used/occupied. Although coarse in resolution, this dataset enables us, for the first time, to examine the spatial relationships between churches and settlements at a regional scale over the span of the past millennium.

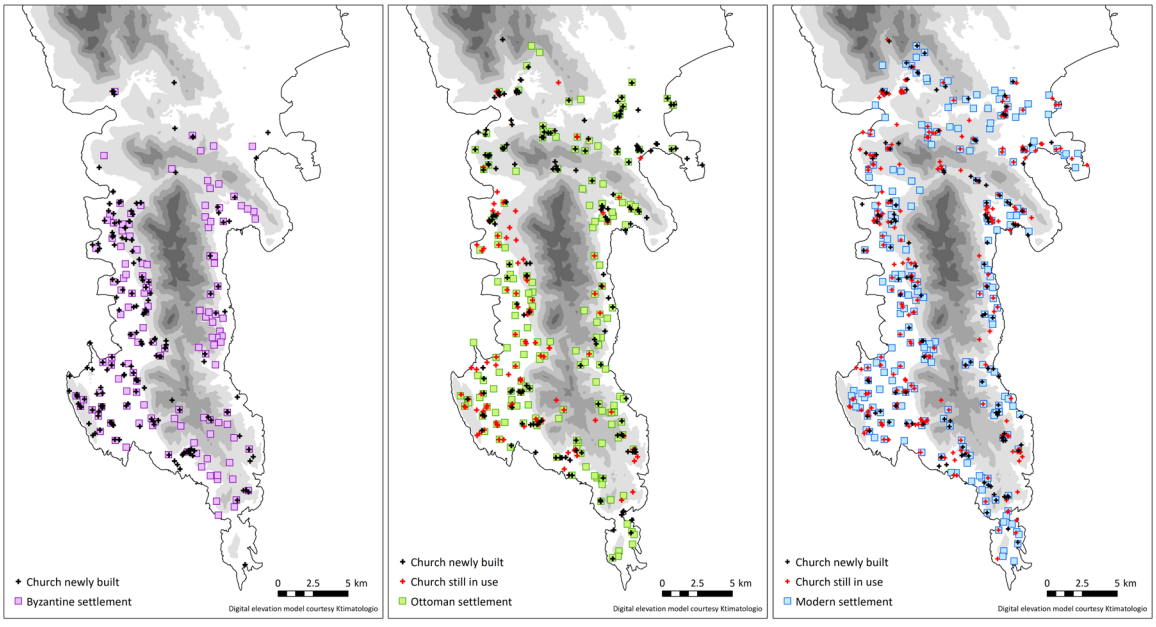

Figure 3. Location of the churches and permanent settlements dated to the (a) Byzantine, (b) Ottoman, and (c) Modern periods.

Remotely sensed imagery was visually inspected to digitize potential features and create a preliminary geospatial database for the churches and settlements. Imagery included WorldView-2 and QuickBird scenes from September 2011 with a resolution of 0.6 m (panchromatic) and 2.4 m (multispectral), provided by the DigitalGlobe Foundation; historical aerial photographs purchased from the Hellenic Military Geographical Service (GYS) for the years 1945–1973, ranging in scale from 1:15,000 to 1:42,000; and Google Earth imagery. Additionally, a 1:50,000 modern road atlas produced by Anavasi was used to identify toponyms, historical (abandoned) villages, modern villages, and the locations of many known churches (Matsouka, 2009). A non-systematic strategy was used to inspect the aerial imagery and identify key targets for further investigation on the ground, and imagery was continually consulted in tandem with field reconnaissance to identify new features and correct misidentifications.

Field reconnaissance was carried out in the spring and summer of 2014, and additional visits were made in summer 2016 and summer 2017. The goals of the fieldwork were to ground-truth the remote assessments and determine chronological phases of construction and use for each feature in the database. In total, 60 percent of the churches (293/492) and 70 percent of the settlements (260/371) reported in this study were documented in the field. Individual features were photographed and located with a handheld GPS, and chronological phases were assessed based on built architecture and surface ceramics, if present. Additionally, there are many churches and settlements located in areas that are difficult to access today, but nevertheless can be identified in remotely sensed imagery. These features were only included in our study if information about their layout and chronology was available in published sources.

Throughout the fieldwork, published studies of the churches and vernacular architecture were consulted with the aim of refining the dating of these features. Especially for the churches, these sources often provided detailed information about foundation and renovation dates based on architectural style, wall paintings, and dedication inscriptions. Many of the churches identified in satellite imagery or in the field were successfully identified by name and linked to published references. The maps published by the Network of Mani Museums also were consulted and used to identify additional church locations (Hellenic Ministry of Culture, 2005). However, because of the coarse resolution of the maps (approximately 1:240,000) and the lack of coordinate information, it was possible to identify only a portion of the churches marked on the maps.

The final geospatial database used in this study is made up of two point layers: one for churches, and one for settlements. The churches were digitized as polygons and later converted to points for the purposes of visualization and analysis. The settlements were digitized as points placed at the centroid of the pre-Modern built area, which itself was determined by inspecting historical aerial photographs and assessing architecture during field reconnaissance. All digitization work was carried out with Esri ArcGIS software (various versions).

4.2 Assessing Church Location

In Greece, outlying churches that are located far from a settlement's core of houses and public spaces are usually referred to – both popularly and in scholarly research – as *exokklisia* (literally, "outside churches"). However, while spatial distance is an essential part of what it means to be an *exokklisi*, there is no universal distance threshold that can be used to define where this category starts and stops. Churches located near a settlement but outside its residential fabric, such as cemetery chapels, can be especially difficult to categorize.

To address this potential challenge, we employed a three-part typology of church location. "Inside" churches are those that are clearly situated within the core of a settlement with buildings in all directions around the church. "Edge" churches are built on the outer limits of a settlement's built space or up to a short distance away (thus encompassing the cemetery chapel mentioned above). "Outside" churches are built so far from permanent habitation that they cannot be clearly associated with a particular settlement from a purely remote-visual perspective. This three-part spatial categorization recalls de Polignac's division of Classical Greek sanctuaries into urban, suburban or peri-urban, and extraurban types (the latter of which were typically 5–15 km away from the nearest town; de Polignac, 1995, pp. 21–22). However,

any similarities between our classifications stop there, owing to the vastly different contexts in which our studies are situated.

Assessment was based on a church's topological relationship to the outer bounds of a settlement's built infrastructure, and each church was assigned a location category for every period within which it was in use. Thus, a church may be categorized as "outside" in the Byzantine period, but if a settlement were built nearby in the Ottoman period it would then be categorized as "edge."

4.3 Statistical Analysis

Statistical analysis was carried out based on three sets of data: (1) chronology of foundation or use (Byzantine, Ottoman, Modern), (2) church location in relation to settlement (inside, edge, outside), and (3) planar distance from each church to its nearest settlement. We chose to use planar distance instead of topographic mainly to avoid introducing unknown variation arising from the complexity of the built landscape. To achieve a realistic assessment of topographic distance, the calculation would need to take into consideration the myriad field walls and terraces built across the landscape (which obstruct movement) and the footpaths and roads (which facilitate it). Further, the chronology of these features would need to be known so that only contemporaneous features were factored into the calculation. At present, we do not have access to such a dataset for all these built features in the landscape of southern Mani. Rather than calculate distance based purely on terrain – as if the landscape between the church and settlement were bare – we opted for a simpler, straight-line calculation.

Altogether three statistical tests were employed: the Chi-square statistic, Correspondence Analysis, and Analysis of Variance (ANOVA). Only the occupation phases of the settlements were taken into account. For churches, however, both foundation and use dates were considered. The aim was to unpack potential differences in the sacred landscape *as a whole* versus the sacred structures *built anew* by the people living in a certain period of time.

The Chi-square statistic was used to test the overall association between church locations and chronological category. The aim of the statistic is to determine whether the observed frequencies of church locations dated to different periods differed from the frequencies that would be expected by chance. The null hypothesis was that no relationship existed between these two categorical variables.

Correspondence Analysis is a statistical technique in which data reduction using a non-linear projection makes it possible to visualize complex data (van der Heijden, Mooijaart, & Takane, 1994). Here, the relationship between church chronology and church location was investigated using two distinct contingency tables, one for church foundation dates and one for occupation dates (Table 2; see also Figure 4). The analysis was performed in R 3.5.2 using the "ca" package (Nenadic & Greenacre, 2007). The mapping parameter was set to "symbiplot" because it scales rows and columns to have variances equal to the square roots of eigenvalues. The resulting correspondence is a symmetric biplot, but without row/column metric preservation.

Table 2. Contingency Tables for Church Chronology and Topology.

	Foundation			**Use**		
	Byzantine	**Ottoman**	**Modern**	**Byzantine**	**Ottoman**	**Modern**
Inside	39	63	55	39	86	145
Edge	79	68	49	79	116	142
Outside	63	47	30	63	80	102

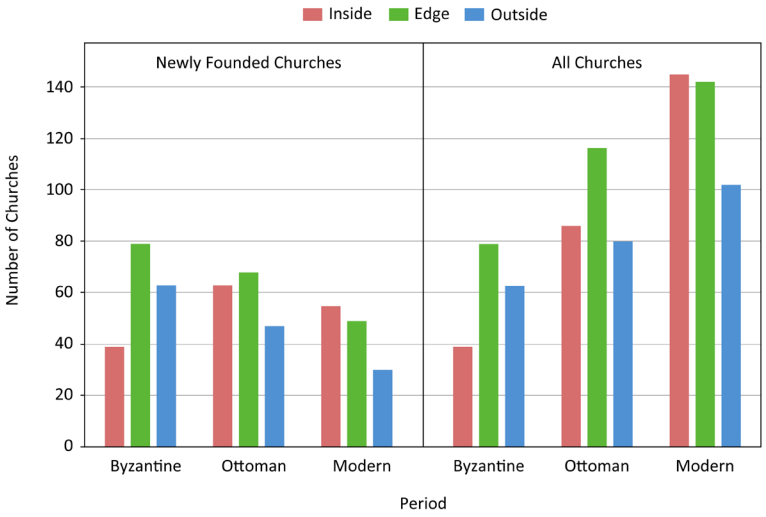

Figure 4. Visualization of the data in Table 2: number of churches in each topological category, by period.

ANOVA is a useful statistical technique when categorical variables have continuous outcomes, and it is used to identify the mean difference between more than two groups. In this case, there were two categorical variables (chronology and location), making a two-way ANOVA most suitable and allowing for the assessment of potential interaction between grouping variables. The continuous data was the planar distance from each church to its nearest settlement centroid. Six shapefiles were generated for the churches (three for period of foundation, and three for period of use), and planar distance values were calculated in QGIS using the "Distance to Nearest Hub" tool for each of these datasets. ANOVA was conducted in R 3.5.2 using the Companion to Applied Regression (car) package (Fox & Weisberg, 2011). Therefore, to compensate for the expected statistical variations in the sum of squares, the Sum of Squares Type was set to III since the interaction term (church location in a given period) was expected to be significant.

5 Results

5.1 Exploratory Data Analysis

A visualization of the breakdown between the chronology and location categories suggests that important changes were taking place regarding where the churches that people built and renovated were located in relation to settlement space. Figure 4 shows the numbers of churches in each location category and how those categories changed over time. In Figure 5, we see a marked increase in both new settlements and new churches between the Byzantine and Modern periods. Considering only the newly built churches, there is a noticeable decrease in "edge" and "outside" churches over time, but "inside" churches do not change in a steady direction. The importance of "inside" churches becomes clear only when looking at all the churches in use during a given period, and particularly so in the Modern period.

The patterns suggested by the bar charts (Figure 4) are validated by the two chi-square statistics calculated from the foundation and use contingency tables. The resulting p values were 0.003014 ($\chi 2$(d.f. 4)=16.004) and 0.004957 ($\chi 2$(d.f. 4)=14.88), respectively, indicating that there is a significant association between the locations of churches and their chronological categories for both datasets. To some extent, the mean distance between newly founded churches and their nearest settlements decreased over time, from 345 m in the Byzantine period to 301 m in the Ottoman period, and then finally 209 m in the Modern period. In order to reveal the structure of these relationships more fully, we turn to the results of the Correspondence Analysis.

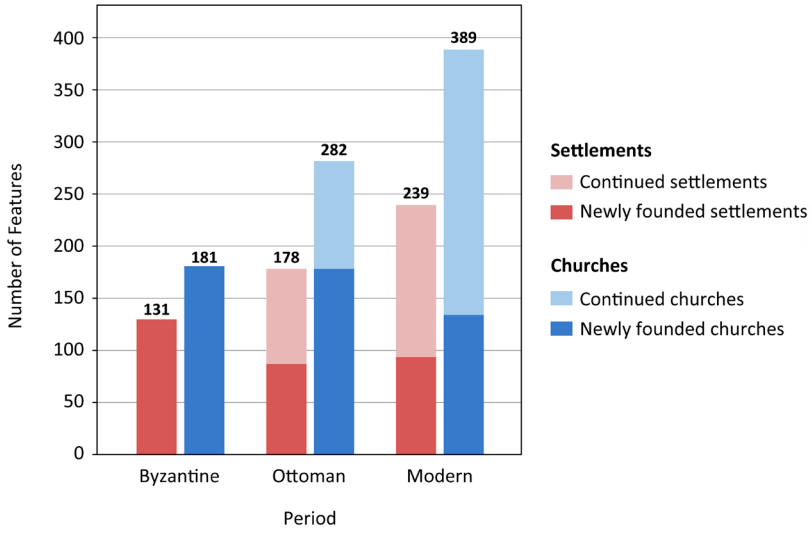

Figure 5. Total number of churches and settlements in each period.

5.2 Results of the Correspondence Analysis

The Correspondence Analysis of the foundation contingency table highlights two clusters: Modern-Inside and Byzantine-Outside (Figure 6). In Correspondence Analysis, the length of a line connecting a label to the origin reflects the strength of an association; thus, these two associations can be interpreted as strong. Both the location labels (Inside and Outside) and period labels (Byzantine and Modern) are located at opposite sides of the origin, meaning that they are negatively associated. This further highlights the separation between the Modern-Inside and Byzantine-Outside clusters. The darker lines for the Byzantine and Inside labels indicate these categories provide higher contributions to the correspondence. The Ottoman and Edge categories are negatively associated (being on opposite sides of the origin), but because they are located close to the origin the association is not only weak, but also speculative. Finally, it is important to note that the data was not normalized by row or column, but rather mapped for symmetry. This means that we should not evaluate the distances between the labels as a function of distance (i.e. metrically), but rather in terms of their topological relationship to one another.

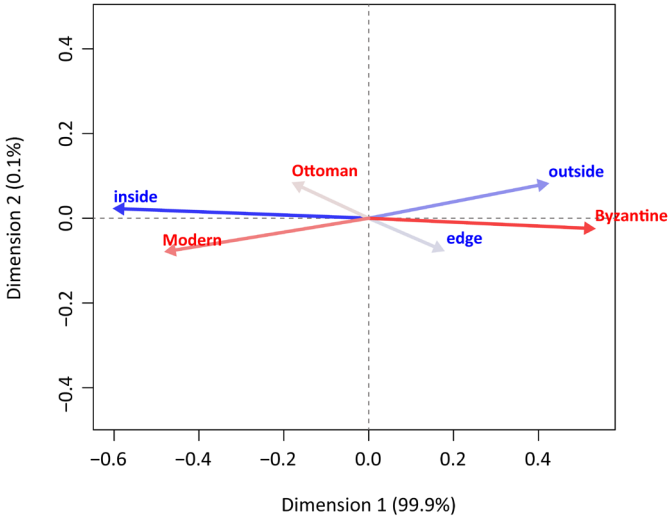

Figure 6. Correspondence Analysis of the churches' period of foundation and location in relation to settlement.

The Correspondence Analysis of the use contingency table is similar: once again, the Modern-Inside and Byzantine-Outside clusters are highlighted as strong associations (Figure 7). Thus we can conclude that the foundation of new churches in these periods did not fully affect the church-settlement topologies. However, now that all the churches in use have been taken into account (including those founded in an earlier period but later refurbished), the Edge label is clearly associated with the Ottoman period. As in the previous analysis, the power of this association should be considered weak, as both labels are located close to the origin. One difference, however, is that the Ottoman label is now fully orthogonal to the Byzantine label. This suggests that the categories are fully independent, indicating no relationship between their church-settlement topologies.

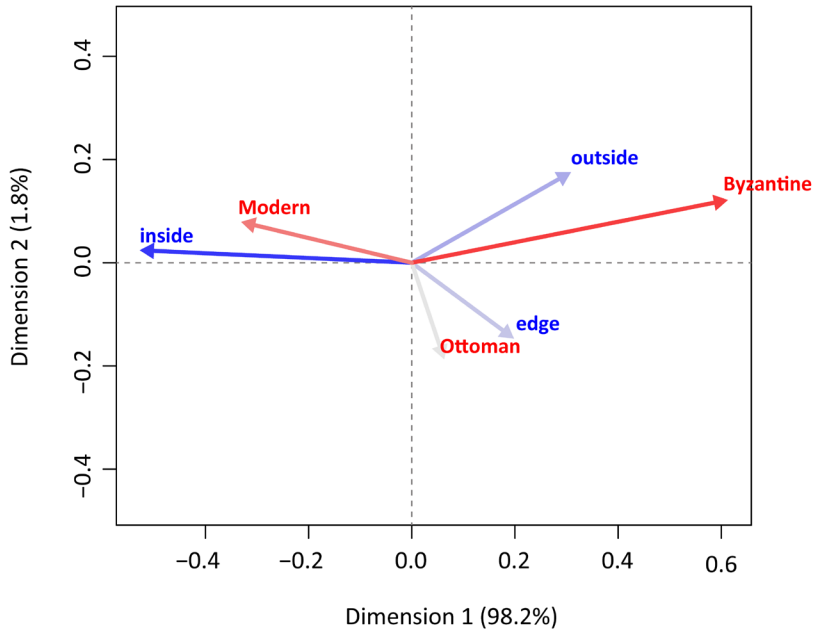

Figure 7. Correspondence Analysis of churches' period of use and location in relation to settlement.

5.3 Results of the ANOVA

Before running the ANOVA, a box plot was generated to inspect the distances between each church and its nearest settlement, grouping the data by the assigned topological categories and periods (Figure 8). Initial observation suggests that the assigned topological categories (inside, edge, outside) satisfactorily align with distances, as the mean distance values and quantiles are distinct from one another. However, some overlap does exist for "outlier" distances, especially within the "inside" and "edge" categories, indicating that the separation between the topological groups is not clear-cut.

The ANOVA results for the foundation dataset support the above observations (Table 3). The location category is highly significant and, thus, can be used as a predictor for understanding church topologies. Period alone, however, is not a powerful variable; it becomes fully meaningful only when considered in interaction with location.

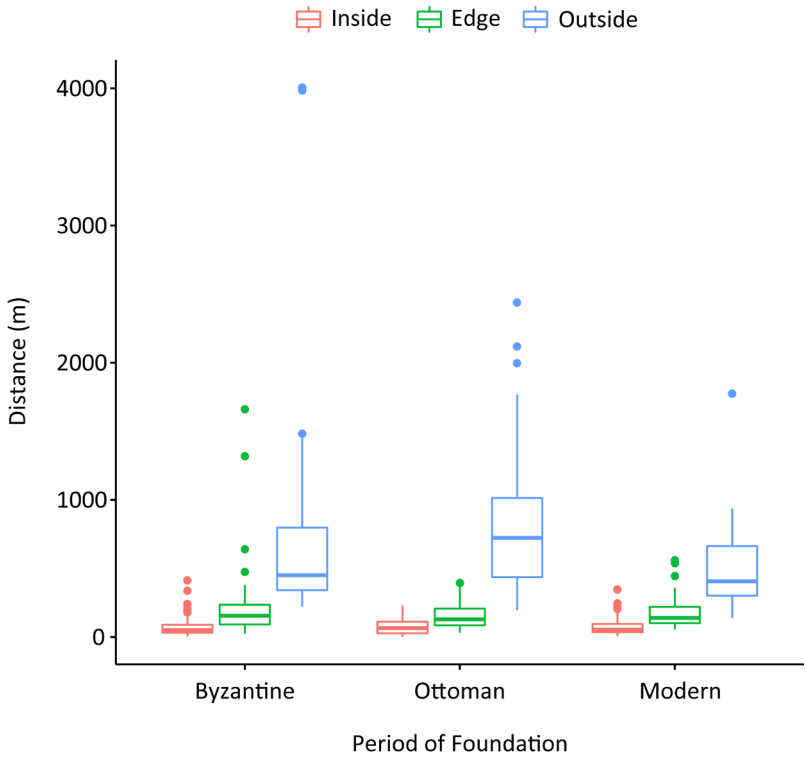

Figure 8. Box plot of distances between newly founded churches and their nearest settlement.

Table 3. ANOVA Result for the Response Variable: Distance of Newly Founded Churches to Settlements.

	df	F Value	p-value
(Intercept)	1	415.985	2.2e-16
Location	2	127.672	2.2e-16
Period	2	3.999	0.034178
Location:Period	4	3.717	0.005432

It is important to note that the current analysis violates the assumption of homogeneity of variance, especially for the location variable (Levene's Test p-values are 2.2e-16 and 0.03605 for location and period, respectively). While the non-normality of data is less of a concern for ANOVA (Blanca, Alarcón, Arnau, Bono, & Bendayan, 2017; Schmider, Ziegler, Danay, Beyer, & Bühner, 2010), Harwell and colleagues (1992) report the impact of unequal variances for unequal sample sizes on alpha (Type I error) and power of the test. However, the impact becomes negligible again under conditions of non-normality, which is the case for the foundation dataset. Therefore, ANOVA remains robust despite the violation of the homogeneity assumption.

The box plot for the use dataset illustrates a similar distribution in distances between churches and settlements (Figure 9). The additional data makes the separation between periods more pronounced (i.e. the location categories only slightly overlap within each period), but the "outlier" church locations again add complexity to the topological analysis.

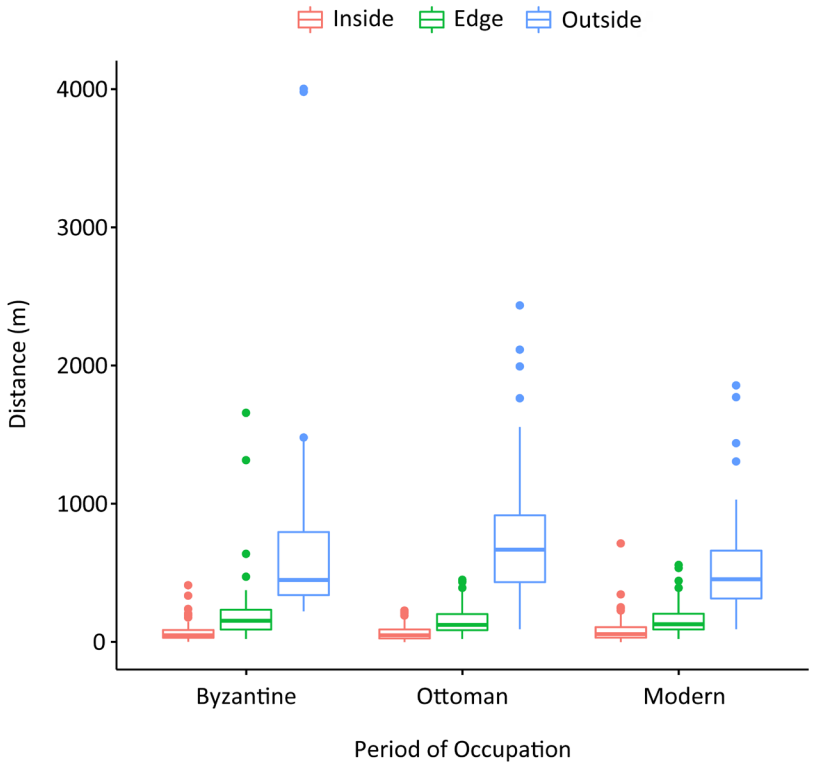

Figure 9. Box plot of distances between all churches in use and their nearest settlement.

The ANOVA results for the use dataset also support the results of the box plot (Table 4). Once again, the location category is highly significant, and chronological category is not a powerful variable when considered in isolation. However, the interaction variable (Location:Period) is highly significant, suggesting that the use of location and period together can be helpful in explaining the distances between churches and their associated settlements. As in the ANOVA results for the foundation dataset, the current analysis violates the assumption of homogeneity of variance, especially for the location variable (Levene's Test p-values are 2.2e-16 and 0.02802 for location and period, respectively).

Table 4. ANOVA Result for the Response Variable: Distance of Churches in Use to Settlements.

	df	F Value	p-value
(Intercept)	1	912.875	2.2e-16
Location	2	298.936	2.2e-16
Period	2	5.926	0.027831
Location:Period	4	5.473	0.0002365

5.4 Monasteries

In the analyses reported above, all churches were essentially treated as equal in terms of their functions and meanings within the community. The location typology does not inherently imply a functional division, even if, in practice, most "inside" churches tend to be used for regular liturgical services and most "outside" churches for less frequent events, such as *panayiria* (annual celebrations on the feast day of a patron saint). Nevertheless, churches do fulfill markedly different roles in the social fabric of a region: monasteries,

episcopal churches, parish churches, private chapels, and cemetery chapels all have different, but also potentially overlapping, functions. It is worth exploring one of these functionally unique categories in brief detail to see how they might contribute to the regional-scale analysis.

Altogether 25 monastery churches were included in the study (Table 5). Two of the churches' location categories changed over time as the monasteries were abandoned and new settlements established around them, but the location categorization for the other 23 churches remained stable over time. In the Byzantine period, monastery churches were only ever located on the edges or outside of a settlement. While a few monastery churches were located within settlements in the Ottoman and Modern periods, the more obvious pattern is their predominant contribution to the "outside" category. As places where wealth and land ownership was concentrated throughout history, it is no surprise that they tended to be built in places far from the villages and towns where most people lived. Thus, if we were to remove the monastery churches from the analyses above, we would expect to find even stronger ties between the Modern period and "inside" churches and the Ottoman period and "edge" churches (see Results of the Correspondence Analysis).

Table 5. Monastery Churches by Period of Use and Location.

Location	Byzantine	Ottoman	Modern
Inside	–	4	5
Edge	2	5	5
Outside	3	16	15
Total	5	25	25

6 Nucleation of the Sacred Landscape

The churches that were built, maintained, and sometimes left to ruin in Mani over the past millennium are just one part of a multi-faceted infrastructure of sacred spaces. In Lekakis' work on the island of Naxos, he framed churches as part of the "living heritage" of a local community (Lekakis, 2018, pp. 378–379). The key word here, "living," implies the day-to-day activities of ritual practice and the mundane tasks of upkeep that bind members of a community to the sacred landscape. Elsewhere in the Peloponnese, newly settled communities in Methana in the early 19th century often situated themselves near already existing churches. Forbes wrote that, "being co-religionists of the original builders, the incoming population would not only have seen but also accurately 'read' the messages of this aspect of the material cultural record left by previous, apparently unrelated, generations" (Forbes, 2007, p. 354). This passage underscores the fact that a living community does not need to have a direct connection with a church's founders in order to consider it sacred or worthy of upkeep. In Mani, as elsewhere in the Eastern Mediterranean, it is commonplace for passersby to cross themselves when they encounter a church – whether or not the building is ruined, they attend liturgies within its walls, or they have any connection to the people who built it.

For a church to fulfill the role of "living heritage," however, it must be properly maintained over the course of time. In her study of Sphakia, Crete, Nixon explored the concept of church "death":

> A sacred structure in ruins, in this case a church, sends a powerful message: it represents the visible disintegration of a particular landscape, and a break in the continued communication of memory. Each church in the sacred landscape of Sphakia … is a particular node in a public memory network. If a church 'dies', then part of that network is gone: it is not just the church that will be forgotten, but the landscape as well. This restored and now refunctioning church has therefore been brought back to life, and the surrounding landscape has also in some sense been resuscitated. (Nixon, 2012, p. 209)

In many cases, as Nixon's example demonstrates, the life history of a church is not linear (birth to death) but rather cyclical (birth, death, and rebirth). This implies a recurring phase of active curation, which if unexecuted will result in a longer or even permanent state of death. In Mani, this cyclical phasing can be seen in the refurbishing of ancient churches that have been abandoned for some time and their reframing as part of its new "living heritage." The recently renovated 12th century church of Agios Nikoloas in Ochia is

one of countless examples of how the local community (as well as, in this case, the archaeological authority) have directed resources to the upkeep of sacred infrastructure built long, long ago (Figure 10).

Figure 10. The 12th-century church of Agios Nikolaos undergoing renovation by the regional archaeological authority (May 2014). The renovation was completed soon after this photo was taken.

A holistic perspective of a sacred landscape should therefore encompass not only the spatial location of sacred infrastructure, but also its temporality: whether churches are maintained or left to crumble into ruin, whether they are resurrected through repainting and reroofing, whether they are chosen as sites of future settlement or continue to stand in isolation as *exokklisia*. The cyclicality of time is already an inherent feature of the Orthodox liturgical calendar, which begins anew each 1 September. The process of birth, death, and rebirth also can be read within the yearly celebrations held for each church on its saint's day (*paniyiri*); for many *exokklisia*, this is the only day of the year when a liturgy is celebrated within its walls. The repetition of celebrations and the annual upkeep they entail are a kind of recurrent renewal that keep alive the sacred infrastructure of rural Christian communities.

Keeping this living connection between churches and communities in perspective, we turn now to the patterns suggested by the statistical analysis. The first finding – and perhaps the most surprising for anyone unfamiliar with Orthodox communities – is that there are many more churches than settlements (see Figure 5). In fact, this is a pattern that is common across the Eastern Mediterranean. Whereas a single place of worship might be expected to fulfill all the sacred needs of a community, Orthodox churches actually served different roles and thus more than one was usually built. These needs were not limited to celebrating liturgies and serving as a space for burial – individual churches were also built to commemorate near-death experiences or encounters with the divine. Altogether this flexible and multi-faceted relationship with the faith led to a proliferation of churches across rural landscapes.

A second broad pattern is the steady increase in the number of churches and occupied settlements between the Byzantine and Modern periods (see Figures 4 and 5), which reflects the documented increase in Mani's population in the Second Ottoman and Early Modern periods especially (see Komis, 2005). Although there were periodic dips stemming from crises like environmental factors, war, and disease, from a *longue durée* perspective the area became more densely inhabited over time. Thus, as more settlements were founded, new (and oftentimes multiple) churches were built to serve the new or expanding communities in these areas.

Most importantly, the statistical tests point to a third pattern, what we call "sacred landscape nucleation." The Chi-square statistic indicates that a change was taking place with regard to the topological relationship between churches and settlements over time, but it does not inform about the nature of that change. The descriptive statistics – and specifically the mean distance between churches and their nearest settlements – point to a possible direction: that churches were located closer and closer to the settlement cores over time (shifting from 345 m to 209 m). The fact that this shift is relatively small is somewhat unexpected given the regional scale of the analysis and the difficulty of the terrain. With the exception of the northern part of the study region, all of the inhabitable parts of the coastal plains were densely populated throughout the periods under study, leaving little room for a community to "spread out" or even found new settlements at great distances away. However, it still reflects patterning at the regional scale that the rest of the statistical analyses tease apart. The ANOVA, for example, shows that period (whether of construction or use) is meaningful only when the location category is also considered. In other words, from the perspective of measured distance, churches were not closer or further away from settlements in the three time periods, but we can begin to detect meaningful differences when we consider how the churches relate topologically to the settlement's built space.

The Correspondence Analysis gives us clues as to the nature of the change detected by Chi-square and ANOVA. The results of the tests underscore the importance of "outside" churches in the Byzantine period and "inside" churches in the Modern period, regardless of whether we consider only those churches newly founded in a given period or all the churches in use at the time. When we factor the latter into the analysis, a weak association between "edge" churches and the Ottoman period appears. This trend – what the data show is a significant shift from "outside" churches to those located firmly within a settlement's core built space – is what we term "sacred landscape nucleation." Forbes' analysis of the churches in Methana suggests that this pattern is not region-specific, as starting in the mid-19th century churches were usually built in the center of settlements rather than at their edge (Forbes, 2007, p. 356). By no means does this interpretation imply a total reliance on or devotion to a single topological category of church; if anything, the analyses show how important all kinds of churches were in the lives of Mani's residents over time. It does, however, suggest that larger social changes were taking place that became embedded in the spatial patterning of sacred infrastructure, specifically through the choices that community members made about where to build new churches and which older churches to continue renovating and maintaining.

The phenomenon of *exokklisia* has been explored to a limited degree in Greece and Anatolia, but all these studies point to the varied roles that outlying churches play in sacred landscapes. It is worth pointing out a two-part topological categorization ("inside" vs "outside") is most common in the literature on *exokklisia*. For this study, we added a third category, "edge," in the hopes of teasing apart spatial distinctions, but knowing full well that the distinction might not reflect the conceptions of space held by the local residents of the time. In fact, it is impossible to know whether even the "inside" vs. "outside" distinction was valid for the people who built these sacred spaces to begin with. In Nixon's study of the sacred landscape of Sphakia, she underscored the seeming discrepancy between her interpretation of church spatiality (what she called the "grammar of location") and the explanations that local people provided for why they were built where they were (Nixon, 2006). In particular, she outlined four spatial factors that she believed contributed to the choice of location for *exokklisia*: (1) proximity to important resources and new activity, (2) visibility by land and/or sea, (3) marking of liminal spaces, and (4) marking the location of earlier significant structures.

Other studies of *exokklisia* provide similar reasons for the siting of these buildings. A recent study in Mani, for example, highlighted two churches that were situated near threshing floors, Nixon's first rule

in the "grammar of location" (Germanidou, 2018, pp. 391–392). In these cases, the churches presumably accentuated or marked the productive landscape with a sacred presence. In Cappadocia, the outlying rock-cut chapels built in the Byzantine period formed a "sanctified boundary" around the residential area and served as markers on the landscape, Nixon's third rule (Kalas, 2009). On the island of Tinos, more than 550 Orthodox and Catholic *exokklisia* have been catalogued, most of which were built within the last few hundred years (Vidali, 2009). Explanations for this fascinating group of churches range from dedicatory offerings after a near-death experience, to markers of encounters with a divine power, to liminal spaces for negotiating the worlds of the living and the dead (Vidali, 2009, pp. 24–26). Finally, Forbes' work in Methana provides another perspective on the role of *exokklisia* in Early Modern society, specifically as spaces for celebrating the *paniyiria* and the gathering together of multiple communities that normally were too far away to interact on a day-to-day basis. The location of the churches high in the mountains made the gatherings the perfect place for social mixing. Further, the very journey to *exokklisia* (or "extra-mural churches," in his words) gave Methanites an opportunity to experience the landscape in a new way (Forbes, 2007, pp. 365–374).

In part, the nucleation of Mani's sacred landscape may be connected to the shift toward settlement nucleation and neighborhood-oriented social organization that began in the Ottoman period and continued into modern times. Today, many of the settlements in Mani feature large churches in the center of their residential fabric, usually situated next to large public squares (*plateies*) that can be used for communal events. Local communities began building these central churches starting in the Early Modern period, making use of easier access to modern building materials to create taller, wider, and longer structures that could accommodate more people. But this still does not fully explain the shift in the allocation of community funds, as building a large church in a public space was undoubtedly a bold financial undertaking for any rural community. One possible explanation is a shift in the ways that people "enact" their communities. We know from ethnographic research that outlying churches in the Early Modern period provided space for annual celebrations (*panayiria*). Is it possible that they served a similar role also in the Byzantine period, perhaps to an even greater extent? What archaeological or historical evidence do we have for *panayiria* at outlying churches in the distant past? On the other hand, community is also enacted in the remembrance of those who are no longer alive – in funerary services, memorial services, and the frequent ritual activities of attending to the graves and bones of loved ones. It is likely that a study of the spatiality of cemeteries would uncover significant patterns that may help explain the nucleation seen here. Likewise for churches situated at the edges of a settlement, which in Kalas' words may establish a "sanctified boundary" around its residents, the decreased importance of these churches in the Modern period could reflect a fragmentation of community identity at the settlement scale and a turn toward membership at the neighborhood or family scale.

7 Conclusion

The exploratory spatial analysis presented here suggests that the sacred landscape of the southern Mani peninsula was transformed over the course of the past millennium. As in other parts of the Eastern Mediterranean where Orthodox Christianity was the predominant religion, many of the churches in Mani are located "inside" a settlement, while others are located far "outside," beyond the reach of day-to-day living activity. In this paper we also define a third topological category of churches on the "edge" of a settlement's built space. The statistical tests employed, including Chi-square, Correspondence Analysis, and ANOVA, point to a shift in the topological relationships between churches and permanent settlements that we term the "nucleation of the sacred landscape," wherein over time sacred infrastructure was located physically closer to the core of settlement areas. Whereas the Byzantine period was more strongly associated with "outside" churches, the Modern period was more closely linked to "inside" churches.

Further research – and studies of local cases, in particular – is needed to help clarify the pattern of sacred landscape nucleation presented in this paper. Our study has some inherent limitations that could also be explored through different approaches. For one, using historically informed settlement boundaries (rather

than GIS-assigned centroids) to measure proximity between churches and the built space of a settlement would help resolve some of the distance-related ambiguity between topological categories. Our typology is a simple Cartesian representation of these spatial relationships, and as such it necessarily blurs some of the complexity inherent within the sacred landscape. Second, a more complex approach to measuring the distance between church and settlement could be used, particularly one that considers slope of the terrain and the route network that was in place prior to the construction of modern infrastructure (e.g. Seifried & Gardner, 2019). As other studies have noted, the accessibility of outlying churches depends to a great degree on the roads or paths that connect to them, and using planimetric distances could mask this variation (Forbes, 2007, p. 92; Nixon, 2012, p. 209). Finally, the broad chronological divisions we used are very likely obscuring changes in the sacred landscape not only geographically (e.g. Inner Mani vs. Lower Mani), but also at a finer temporal scale. Previous research suggests that some of the biggest changes to the social fabric of Mani's communities probably took place at some point between the First and Second Ottoman periods (Seifried, forthcoming, 2016). Thus, we might expect that the spatial relationships between churches and settlements in the First Ottoman period would be more similar to those of the Byzantine, and that those of the Second Ottoman period would be more similar to those of the Modern. Grouping these two periods within a single "Ottoman" period may be one reason this stretch of time does not stand out in the statistical analyses.

As the first preliminary spatial analysis of Mani's rich ecclesiastical heritage, this study contributes to a broader understanding of how sacred landscapes intertwine with the development and maintenance of community identities. In particular, it underscores that the spatiality of sacred infrastructure is a critical variable for understanding the landscape as a whole. Churches are part of the "living heritage" of a community, and as such they are manifestations of the "enactments of community" that people undertake in order to bind themselves together. Our preliminary results about sacred landscape nucleation point us to further research questions that can only be explored through historical and anthropological inquiry: namely, why did people begin building churches closer to their places of residence, or conversely, why did people in the past build churches far away? In effect, we illustrate how exploratory spatial analyses can lead the researcher to ask more targeted questions about the way people enact their communities and interact with the landscapes around them. As studies of sacred landscapes continue to be carried out, it is essential to keep the communities – both past and present – who imbue these features with life at the forefront of our research questions.

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