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QUANTITATIVE APPROACHES TO SACRED ROMAN SPACES IN SOUTHERN COASTAL LATIUM

1. Introduction: the research area and period

The geographical area under study is situated in central Italy, S of Rome. It is delimited by the Aurelian Walls and the Tiber in the N, the western slopes of the Alban Hills, the Lepini and Ausoni Mountains in the E, and the Tyrrhenian Sea in the W (Fig. 1). The southernmost points are the Circeo massif in the SW and Terracina in the SE. While the research area can be perceived as a coherent region in a geographic sense, the situation is more complex in social terms for the 4th century BC, as various ethnic groups – among them Latins, Roman colonists and Volsci – were present (Bellen 1994; Cowan 2009; Teichmann, 2017; Livy's texts are the major ancient sources).

The timespan from the late 4th century BC to the early 4th century AD was chosen primarily for three reasons, although religious interactions between Romans and their neighboring populations predate this timeframe:

1) The Roman rule over the area was secured and stabilized from this time onwards as expressed for example by the construction of the Via Appia.
2) The number of earlier rural settlement sites is quite limited and therefore less suitable for quantitative analyses.
3) The formation of what is nowadays perceived as canonical Roman religion went through particularly important stages of development between the 4th and the 1st century BC (Rüpke 2012, 1).

Therefore, it was decided to concentrate on the Mid- and Late-Republican as well as on the Imperial period. The research period ends in the early 4th century at the advent of Late Antiquity, which was characterized by paradigmatic changes affecting demography, economy, society and religion – such as the rise of Christianity.

2. Sanctuaries in the research area

While it is impossible to cover myths and cults of southern Latium here in detail (see e.g. Ceccarelli, Marroni 2011; Jaia 2011; Maras 2011; Marroni 2012a; Zevi 2014; di Fazio 2019), it matters to get at least an idea of this unique religious landscape (Fig. 2). According to myths, numerous events, many of them related to the foundation of Rome, have supposedly taken place right here. Among these are the encounter of Odysseus and the magician Circe – as the island Eea was identified by numerous Greek writers and Roman authors with the Circeo massif – as well as the arrival of Aeneas in central Italy and the foundation of *Lavinium*.

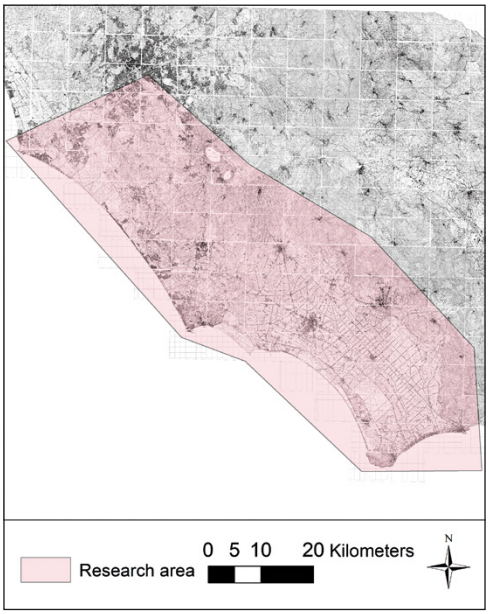

Fig. 1 – The research area.

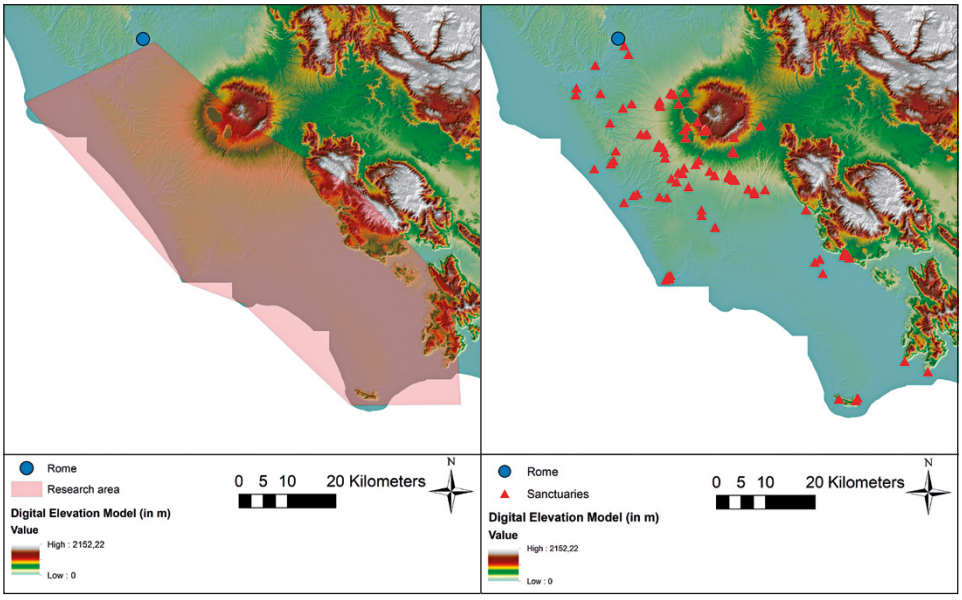

Fig. 2 – Digital Elevation Model of the research area and (in the right) distribution of the sanctuaries.

Fig. 3 – From the top to the bottom and from left to right: the Circeo massif; the sanctuary on Monte S. Angelo at Terracina; the temple of *Diana Nemorensis*; the sanctuary of *Iuno Sospita* at *Lanuvium*; view from Monte Cavo; the grotto of *Faunus*; *Heroon* of Aeneas at *Lavinium* (photos taken by the Author).

Archaeological research proves the existence of ancient cults as those for *Iuppiter Latiaris* on Monte Cavo (the ancient *Mons Latiaris*: Finocchi 1980; Cecamore 1993; Ghini 2004, 41; Smith 2012, 270; Linke 2013), for *Diana Nemorensis* on the shores of the Lago di Nemi (Ceccarelli, Marroni 2011; Ghini, Diosono 2012; Ghini 2014; Braconi *et. al*. 2013; Pasqualini 2013) and for *Iuno Sospita* at *Lanuvium* (Attenni 2008, 2014; Torelli 2009). All these cults can be traced back at least to the Bronze Age or maybe even further (*Iuppiter Latiaris*: Cecamore 1993, 23; 1996, 57; *Diana Nemorensis*: Bruni 2009; Ghini, Diosono 2012, 121; Ghini 2014, 91; *Iuno Sospita*: Zevi 2012, 2016; Santi 2014, 47-51). These sanctuaries were of great importance for the Latin peoples even before Rome had turned into a hegemonic regional power (Fig. 3).

The sanctuaries of *Iuppiter* and *Diana* (Cato *Orig*. 11, 56; Schneider 2006, 271-274; Ceccarelli, Marroni 2011, 72; Ghini 2014, 91) had served a political function for the Latin league, which ceased in importance due to Rome's rise to power. As a consequence, personal aspects of veneration replaced more political ones (Ceccarelli, Marroni 2011, 72; Ghini 2014, 91), though a political or at least symbolic dimension was maintained for the communities (Schneider 2006, 269-270; Linke 2013, 86). Examples can be seen in the option to celebrate a *triumphus in monte Albano* at one's own expense (Plin. *HN* 50, 15-126; Liv. 26, 21, 6-9; Liv. 33, 23, 3), if no triumph at Rome was granted by the Senate, and in the restoration of the cultic tradition of the *rex Nemorensis* by the Emperor Caligula (Suet. *Calig*. 35, 3; Ghini, Diosono 2013, 231-232).

After Rome's successful conquest of southern coastal Latium, which was completed in the second half of the 4th century BC, religion could be used either to show close mythological ties or to underline – in contrast to Rome's supposed Trojan legacy – the independence from Rome (Pasqualini 2013). These cults were associated with monumental complexes.

Besides the sacred places of over-regional importance, numerous minor sanctuaries existed. These could vary significantly in their spatial expansion, importance and architectonic form. Many of these were related to everyday needs and concerns of the rural population, covering aspects such as wellbeing of the flocks, fertility, health or birth.

Most of the minor rural cult places can be dated to the Republican era. Material evidence consists in many cases of single votives or votive pits, while no archaeological traces of a temple or other elements of a sanctuary could be recorded so far. If only a single religious artefact is known (such as a votive) with poor archaeological context, it is unclear whether a site has to be interpreted as a sacred space, as it may originate from a workshop producing votives as well, for example (Bonghi Jovino 2005 for a methodological comparison of votive deposition and ritual). While a continuous use can be observed for most of the major sanctuaries, it is often difficult to say, when cultic activity ceased in many other sanctuaries. This can be the case, if the material evidence for later phases is less specific, or if for example only pottery was discovered and no material, which had an explicit cultic function, or if the material evidence is very limited, which might imply an infrequent cultic activity by single worshippers.

3. Settlement data

The data on settlement sites and infrastructure (Fig. 4), used for the analyses derived from published and archival archaeological sources[1].

[1] In particular, published archaeological maps of the research area, supplemented by the archival data for the "Carta dell'Agro Romano" (*Comune di Roma* 1988), unpublished theses,

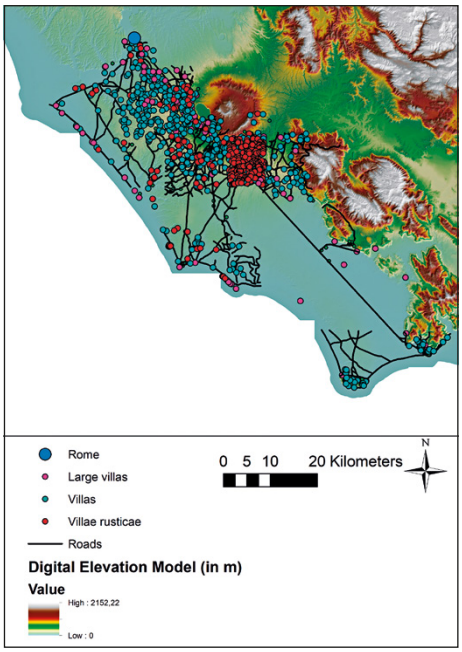

Fig. 4 – Distribution of villas, *villae rusticae* and infrastructures.

Archaeological maps disseminated the results of field surveys from the 1920s onwards and had to be georeferenced and digitized. Most of the archaeological map data was collected by individual researchers, who tried to cover the extent of a map sheet of the IGM Italian Military Map (scale 1:25.000).

Methodological issues arise comparing different data sets: as the authors of the archaeological maps did not always specify their site classification, data had to be standardized, using various categories. Site categories comprise, for example, large luxury (or elite) villas, which are – besides the properties owned by the Emperor and his family – the highest class within the settlement hierarchy. They are characterized by an accumulation of various luxury indicators (such as sculpture, mosaics, etc.) and particularly large areas covered by the buildings. The term *villa rustica* is used for minor habitation sites, where luxury indicators are scarce or absent while indicators for production

research data collected by the Regione Pontina Project and its team members (Satijn 2020) as well as numerous specific articles. All sources used for the Province of Rome research area are listed in Teichmann 2017, 153-155 and for all other research areas in Teichmann 2020, 239-244; the respective data for latter extra-urban settlement sites can be accessed via the digital catalogue of Teichmann 2020: https://phoibos.at/OA/PhHS_7-Katalog.zip).

are present (for details of the definition of villas used within this project, see Teichmann 2017, 122-123; for general literature on villas and rural production sites see Attema, De Haas 2005; Steiner 2005; Viitanen 2010; Venditti 2011; Becker 2012; Dyson 2012; Terrenato 2012; Volpe 2012). A functional site differentiation based on poor surface assemblages is often difficult or impossible. Therefore, additional site classes were used comprising scatters of surface finds with/without building material.

Regarding the date range of sites, a similar problem exists: surface finds might not represent the full range of occupation or might be only broadly datable, leading sometimes to the dating of sites just as "Roman" without further differentiation. This is often the case for older publications (as for example the older volumes of the *Forma Italiae* series, such as Lugli 1926, 1928), where less attention was paid to pottery compared to standing building remains. Pottery typologies and classification systems were much less advanced in older days as well. Therefore, the number of sites documented in recent publications (e.g. Lilli 2008) is much higher than in older publications on areas located in the vicinity (e.g. De Rossi 1970).

A further problem consists in the use of heterogeneous concepts for the same site type used by different authors. A new evaluation and approximate standardization of site data was necessary to make sure that the same criteria are applied to all sites. The presence of or absence of evidence for classes of finds or features that are diagnostic for the dating (such as Black gloss or Terra Sigillata) or the functional interpretation (such as luxury or production indicators) were recorded in a GIS-database. It is assumed that the presence of diagnostic material of a certain period indicates that the site was in use at that time: earlier material may suggest the chronology for its establishment, later materials the phases of use.

For the final evaluation and a comparison of the patterns in different areas, differences in supply and discovery rates have to be considered as shown by Witcher (2006) for Southern Etruria.

The used data set is on the one hand statistically quite reliable in respect to the number of settlement sites considered, on the other hand a number of methodological issues, which are typical for the use of legacy data arise: among these the spatial accuracy and extent of recorded sites, the functional interpretation and the chronological range of site use are crucial. In particular, the latter issues matter for spatial analyses, which consider the mutual effects of sites for which a contemporary existence is a requirement.

4. Research questions

Sanctuaries were regarded as one of several man-made landscape elements (besides markets, harbours, etc.) that could have influenced the choice of rural settlement sites (Teichmann 2017, 2018). Some of the sanctuaries

in the research area had – already in pre-Roman times – a function for the whole community as for example the sanctuary of *Iuppiter Latiaris*, the sanctuary of Diana at the shores of Lake Nemi or the sanctuary of *Iuno Sospita* at *Lanuvium*, which was incorporated in the official Roman cult (Liv. 8, 14, 1). In Roman times cults were maintained and incorporated, although one of the former functions of sanctuaries – as political meeting places – decreased. Some sanctuaries were of particular importance for strengthening the political ties between Rome and Latium by referring to common mythological figures such as Aeneas at the cenotaph at *Lavinium* (Sommella 1972; Torelli 2013), which was already mentioned in antiquity (D.H. 1, 64, 5) or the temple of *Sol Indiges* (D.H. 1, 53-56; Giuliani, Sommella 1977; Jaia 2009, 2012; Jaia, Molinari 2012).

Other sanctuaries were more closely related to concerns of the rural population's everyday life such as health (for example the Pantanacci grotto at *Lanuvium*: Attenni *et al.* 2013; Attenni 2014; Attenni, Ghini 2014), the well-being of flocks, protected for example by Hercules (for example the temple at *Lavinium*: Carosi 2014) or fertility and birth (as for example the cult for the deity *Natio* related to Ardea, mentioned by Cic. *Nat. D.* 3, 47). In Roman religious thought, the right performance of rituals and sacrifices had to secure the benevolence of the gods. Therefore, a first research question concerns the role of good accessibility to sanctuaries as a potential preferential factor for the choice of villa construction sites to secure divine favours.

The hypothesis to be tested was: good accessibility to at least one sacred space and – more specifically as a second hypothesis – to one of the region's sanctuaries with over-regional importance might have been a factor, which could have fostered the choice of sites for the construction of villas. Religion and cult were of paramount importance in the ancient world as is evident by the dedication of temples in every town and numerous rural cult places. The agricultural writers Cato, Varro and Columella describe agricultural practice as being closely entangled with a mystical, magical world, which had to be controlled by rituals.

Furthermore, sanctuaries did not only serve religious purposes, but although are to be regarded as places of commerce (Rous 2007, 2009), social communication and self-representation of elites as donators of buildings or votives (such as a famous sculpture dedicated by *Lucius Licinius Murena* at *Lanuvium*: Attenni 2004, 161-162; 2012, 72-74).

A further research question concerned the visibility of sacred spaces. Some of the major sanctuaries – as for example the sanctuary at Monte S. Angelo at Terracina (Lugli 1926, 166-178; Coarelli 1987, 114-116; Ceccarelli, Marroni 2011) or the sanctuary of *Iuno Sospita* at *Lanuvium* – were situated on exposed peaks. Otherwise some sanctuaries were related to natural particularities such as a fountain (as for example close to Campoverde:

Modica 2010) or a cave (as the grotto of *Faunus*: Torelli 2013) or the Pantanacci cave, which tend to be situated in less visible environments.

The third hypothesis to be tested was that sanctuaries could tend to occupy sites, which were particularly visible from other cultural landscape elements, such as villas, roads or towns. This hypothesis is based on the observation that the visual hierarchization of space was a well-known concept in the Roman world (for theoretical considerations, see Bek 1993; as a case study, the *Ager Tarraconensis*, see Fiz *et al*. 2013, 191). "Seeing and being seen" were part of social competition and self-representation not limited to landscape, but applicable to other aspects of Roman life such as art and text (Elsner 2007). The importance of visual relations would matter only, if sites where in use at the same time. For sites, for which material evidence is scarce and only poorly datable, it is difficult to state the actual date range of usage. Almost all major sanctuaries were in use till the Imperial age, though some will have already been declining as the later villas were erected.

5. Methods

The IGM maps were used as the georeferenced cartographic background (Fig. 5), given that the results of archaeological surveys had often been published on the same scale. Archaeological maps were scanned and manually georeferenced in the ArcGIS 9.2. software using 10 to 20 reference points per map in a rubber sheet mode. The projected coordinate system ED 1950 UTM Zone 33N was used. The archaeological sites were digitized from the map. The surface of lakes and the sea were clipped out and were not considered as part of the data background for the analyses. As there are different levels of spatial accuracy of archaeological data (for example exactly located building remains – surface finds, which may have been moved by erosion – reports of finds in older days, which just refer approximately to a toponym), respective doubts were recorded in the metadata.

Two kinds of analyses were conducted: descriptive site location modelling and viewshed analyses (Teichmann 2017, 112-116).

Site location modelling is based on the idea that quantitative locational attributes of known archaeological sites can be used to identify factors, which were decisive for the choice of these places in the past (e.g. Kvamme 1990, 1992). Statistical tests are performed for various environmental and cultural variables to see if a particular distribution pattern of sites can be observed for the respective variable (Kvamme 1990, 271-272; Brandt *et. al*. 1992). The theoretical background of this approach is closely related to the niche-theory, which was originally proposed by Hutchinson (1957) in biology, but later on successfully adapted for humanities as for example by Hudson (1969) for settlement geography. A wider debate on the advantages of quantitative

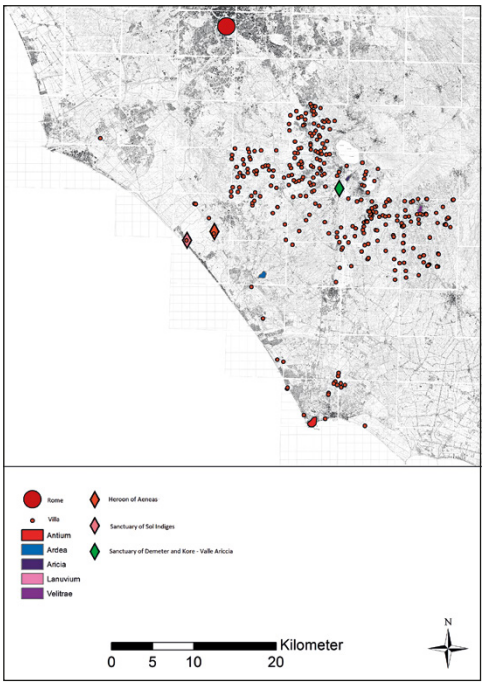

Fig. 5 – Sites within the territory of the southern Province of Rome.

inductive versus deductive approaches in archaeology is to be mentioned in particular for the 1990s (e.g. Kvamme 1990, 2006; Brandt *et. al*. 1992, 271; Gaffney, Van Leusen 1995). For Roman central Italy site location modelling projects conducted by Tondi (2007) and Viitanen (2010) are particularly relevant for a comparison of results.

Viewshed analyses allow for the identification of areas, which could have been visible from an observation point due to topographic conditions. A digital elevation model is used to calculate, whether a direct line of sight existed between two points or whether the view was blocked by obstacles. Although it is easy to add any presumed height of vegetation by map algebra (Kvamme 1999, 177), the present analyses do not consider the original vegetation cover as it is impossible to reconstruct the exact distribution and height of vegetation. Furthermore, landscape modification processes such as erosion have to be considered as a potential source of error, given that the analyses are based on the modern landforms.

Geo-archaeological research was conducted for the research area, but results are limited to specific local case studies and cannot be extrapolated

to a large area reliably (Teichmann 2017). Viewshed analyses have been particularly popular among archaeologists, who implement post-processual approaches as the perception of space of ancient individuals is addressed (e.g. Tschan *et. al.* 2000; Wheatley, Gillings 2000; Wheatley 2004; Conolly, Lake 2006, 9). A possible result is the reconstruction of symbolic landscapes in which visual dominance might be an expression of power for instance (Rajala 2003; 2004, 395). View-shed analyses were conducted with the ArcGIS 10 software using a fuzzy approach.

A cost surface was created based on the slopes of a modern 20×20 m digital elevation model derived of the Italian military map using ArcGIS 9.2. This model is used for example for management purposes of the regional authorities. The surface of the IGM model was filtered by a 3×3 cells neighbourhood filter to smooth the surface slightly, reducing the impact of modern data artefacts. Data for current natural watercourses were provided by the Province of Rome and the Province of Latina as vector data sets.

Water courses were included as elements, which would have slowed down movement, as their crossing would have required additional time. A differentiation was undertaken between major watercourses, and medium and minor watercourses, with related time to be crossed.

The modern hydrology can nevertheless only be regarded as an approximation as it does not equal the ancient situation due to geomorphological changes (Teichmann 2017, 47-77), differences in water levels (Lambeck *et al.* 2004) and drainage (Teichmann 2017, 58). Modern water installations such as channels were omitted from the analyses. The current state of research and the available data do not allow for a proper reconstruction of the ancient water courses on a regional scale as the evidence is limited to specific sites (see for example Feiken 2014). Therefore, any chosen hydrological model would have to be regarded as a reasoned approximation. Possible alternative approaches could consist in using historical aerial photos to reconstruct the hydrological network in the mid-20th century (Tondi 2007 for the south-eastern Campagna Romana) or in digitizing historical maps.

Ancient roads were included as elements that facilitated movement (for a modelling approach on the transport network of *Latium vetus* between the Early Iron age and the archaic period, see Fulminante *et al.* 2017). The roads were digitized from the archaeological maps (see above) and data on roads, in particular road pavements *in situ*, were added from available publications, which generally focus on the major roads (e.g. Via Appia, the so-called Via Severiana along the coast and the road connecting *Lanuvium* to *Antium*).

Based on these parameters the time needed to reach the next sanctuary was calculated for sites of various site types using the algorithm proposed by Herzog (2009). Values observed at the sites were compared to the values for all cells of the original map sheet of data collection (the respective

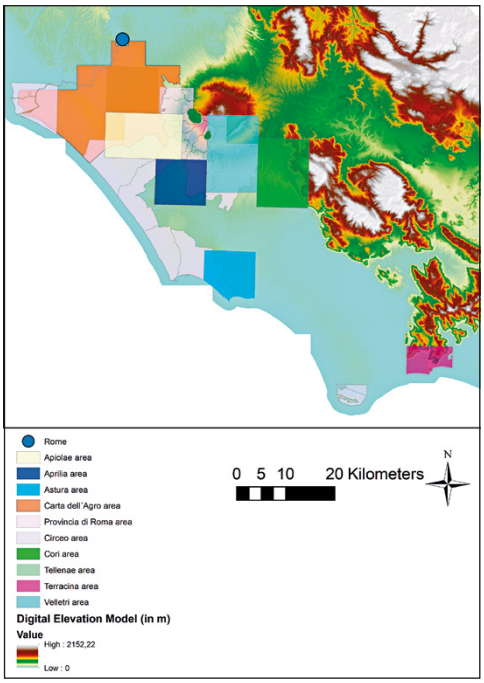

Fig. 6 – Micro-areas for which archaeological maps exist in the study area.

archaeological map sheet). The ArcGIS tool "value to point" was used to extract the value of the raster pixel on which the site was situated. The map sheet data consisted of the values of all raster cells of the respective archaeological map. The calculations were conducted using the JMP software from SAS.

The distribution patterns of observations at sites were compared to the overall distribution pattern by using the Wilcoxon/Kruskal-Wallis test (VanPool, Leonard 2011, 263-270), the Median test (VanPool, Leonard 2011, 253-259) and the Kolmogorov-Smirnov test (Fletcher, Lock 2005, 113). Statistical significance cannot be equalled to archaeological or cultural significance as a pattern can still be meaningful although it is under a statistical confidence level, while it is possible that statistical patterns do not possess a cultural significance. Nevertheless, statistics are arguably a good starting point for further considerations.

Given that there are significant differences in the state of research and publication between micro-areas (Fig. 6) in the overall study area, it was impossible to undertake a single analysis for all data in the study area as gaps in the data would have biased the results. Therefore, a "nested approach"

was chosen, using different areas of analysis, which match the extent of the originally published archaeological maps.

Viewshed analyses were chosen to understand the visual connection of sanctuaries with their surrounding landscape (Teichmann 2017, 133-134). Visual relations between sanctuaries, villas, settlements and roads had to be analysed.

6. Methodological considerations

The size of sanctuaries could reach from a few square meters to many hectares and could change in the course of time as further buildings could be added to the complexes. Therefore, polygons would theoretically be more suitable to represent sanctuaries (for a general discussion, see Mink, Stokes, Pollard 2006), but the information on sanctuary boundaries is too scarce for many of the minor sanctuaries, therefore in practice all sanctuaries were treated as point data. Uncertainty, whether a site can be called a sanctuary or not, is difficult as a site either has to be included in spatial analysis or omitted. It would be possible to analyse "fuzzier" or alternative scenarios, but in the end, the additional effort is not justified by the potential results.

To examine all rural sanctuaries together in one analysis means to mix up cults for numerous deities with different cultic roles and functions. It is not to be assumed that "just any" sanctuary would have done for any religious need. Otherwise we know, for example from inscriptions found on Monte S. Angelo, that several gods could be venerated besides the main deity to which the sanctuary was dedicated (Ceccarelli, Marroni 2011, 479). A further issue is that we are informed by ancient writers that some sanctuaries were on private property (Cic. *Mil.* 31, 86) and would therefore have been in private use. Due to the archaeological sources it is difficult to differentiate between a private and a public sanctuary in case of the minor sacred spaces as long as it is not recognized as an integral part of a larger building complex (Bassani 2012). If access to a sanctuary was reserved to a particular group, it probably did not have to fulfil the same criteria as a public place of worship.

Another issue concerns the differences between urban, extra-urban and rural sanctuaries. All towns in southern coastal Latium possessed places of worship, which would contribute to their role as "central places" besides functions for jurisdiction, commerce, administration and entertainment. In a spatial analysis, one crucial question concerns the cost-distance from settlement sites to sanctuaries. This works fine for rural sanctuaries, while it is impossible for urban sanctuaries to differentiate between the "attraction factor" of a sanctuary in the town compared to the other attraction factors of urban life.

Therefore, it is convenient to run separate locational analyses for "settlements" comprising all the mentioned "attractors" and for rural sanctuaries. This paper focuses exclusively on rural sanctuaries.

7. Results

7.1 *Location modelling*

The first results concern cost-distance analyses to all known major sanctuaries of regional or trans-regional importance (Tab. 1).

In the study areas of the southern Province of Rome (Amendolea 2004), Terracina (Lugli 1926) and Velletri (Vinciotti 1999-2000; Strini, Ciccotti, Manganello 2001; Lilli 2008), and the southern part of the "Carta dell'Agro Romano" (*Comune di Roma* 1988) villas were situated in a far lower cost-distance to the next major sanctuary compared with a random distribution for the respective study areas.

Villas from Aprilia's archaeological map (Pompilio 2009) show tendencies for lower cost-distances, although the result is under the level of

Major sanctuaries	Kolmogorov-Smirnov test	Wilcoxon/Kruskal-Wallis test	Median test
Terracina (all villas: 16)	Probability > D-: > 0,0083*	Probability > IZI: 0,0170*	Probability > IZI: 0,0027*
Velletri (all villas: 112)	Probability > D-: 0,0007*	Probability > IZI: 0,0011*	Probability > IZI: 0,0233*
Velletri (villas used from Republican times onwards: 78)	Probability > D-: > 0,0001*	Probability > IZI:0,0022*	Probability > IZI: 0,0700
Velletri (villas used from Imperial times onwards: 17	Probability > D-: 0,0907	Probability > IZI: 0,1865	Probability > IZI: 0,2252
Southern Province of Rome (all villas: 307)	Probability > D-: > 0,0001*	Probability > IZI: > 0,0001*	Probability > IZI: > 0,0001*
Aprilia (all villas: 35)	Probability > D-: 0,0344*	Probability > IZI: 0,0571	Probability > IZI: 0,3980
Carta dell´Agro (all villas: 171)	Probability > D-: 0,0006*	Probability > IZI:0,0017*	Probability > IZI: 0,0017*
Carta dell´Agro (villas used from Republican times onwards: 111)	Probability > D-: 0,0052*	Probability > IZI: 0,0110*	Probability > IZI: < 0,0290*
Carta dell´Agro (villas used from Imperial times onwards: 47)	Probability > D-: 0,0025*	Probability > IZI: 0,0135*	Probability > IZI: 0,0131*
Velletri (villae rusticae: 255)	Probability > D-: < 0,0001*	Probability > IZI: < 0,0001*	Probability > IZI: < 0,0001*
Apiolae (all villas: 112)	Probability > D+: > 0,0068*	Probability > IZI: 0,0069*	Probability > IZI: 0,0376*
Apiolae (villas used from Republican times onwards: 77)	Probability > D+: > 0,0167*	Probability > IZI: 0,0185*	Probability > IZI: 0,0527
Apiolae (villas used from Imperial times onwards: 26)	Probability > D+: > 0,6007	Probability > IZI: 0,6888	Probability > IZI: 0,4328

Tab. 1 – Statistical key values for the cost-distance calculation of villas and sanctuaries for the category "major sanctuaries". The study area, the considered period and the number of villas are given in the left column. The matrix shows the results of the Kolmogorov-Smirnov, Wilcoxon/Kruskal-Wallis and Median tests, comparing the cost-distance (calculated in minutes) of all 20×20 m raster cells in the respective study area compared to the values recorded at the villa sites.

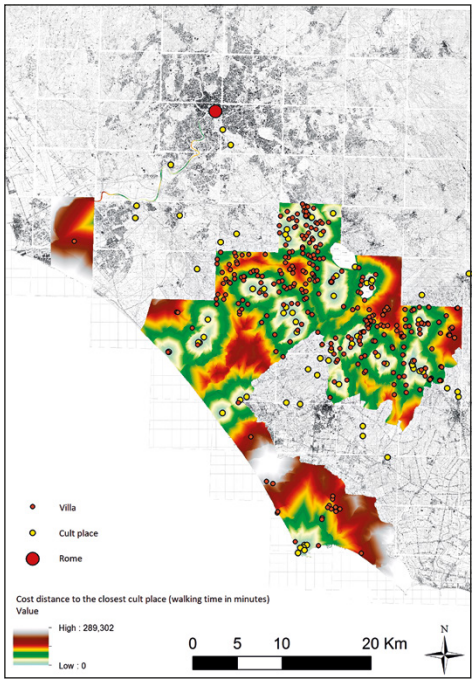

Fig. 7 – Cost-distance to the closest cult place – walking time in minutes.

statistical significance. In the Velletri area as well as in the area of the "Carta dell'Agro Romano" the result is more significant for villas, which were built in the Roman Republican period than for those constructed in Imperial time. For other study areas the picture is less clear as the cost-distance between villas and sanctuaries does not differ that much from a chance-distribution. Republican villas from *Apiolae*'s archaeological map (De Rossi 1970) are situated in a particularly high cost-distance to the next sanctuary, while the values for Imperial time villas assimilate a random distribution.

If local sanctuaries are added to the analysis (Tab. 2), the close cost-distance relationships are even clearer for the areas of the "Carta dell'Agro Romano" and villas in Aprilia's surrounding while the situation is still the same in the southern Province of Rome (Fig. 7). The opposite is the case for the Velletri area, where villas and *villae rusticae* just follow a random distribution if all sanctuaries are considered.

Detailed analyses were conducted for specific sanctuaries. For the southern Province of Rome the analysis showed that the distance to the *Heroon* of Aeneas and the adjacent sanctuary of the 13 altars (Tab. 3) and

All cult places	Kolmogorov-Smirnov test	Wilcoxon/Kruskal-Wallis test	Median test
Terracina (all villas: 16)	Probability > D-: > 0,0015*	Probability > IZI: 0,0170*	Probability > IZI: 0,0027*
Velletri (all villas: 112)	Probability > D-: 0,1698	Probability > IZI: 0,1959	Probability > IZI: 0,0889
Velletri (villae rusticae: 255)	Probability > D-: < 0,0001*	Probability > IZI: < 0,0001*	Probability > IZI: < 0,0001*
Velletri (villas used from Republican times onwards: 78)	Probability > D-: 0,0745	Probability > IZI: 0,1174	Probability > IZI: 0,1742
Velletri (villas in use from Imperial times onwards: 17	Probability > D-: 0,3798	Probability > IZI: 0,9212	Probability > IZI: 0,4669
Southern Province of Rome (all villas: 307)	Probability > D-: > 0,0001*	Probability > IZI: > 0,0001*	Probability > IZI: > 0,0001*
Aprilia (all villas: 35)	Probability > D-: 0,0137*	Probability > IZI: 0,0146*	Probability > IZI: 0,0630
Carta dell'Agro (all villas: 171)	Probability > D-: 0,0001*	Probability > IZI: > 0,0001*	Probability > IZI:0,0010*
Carta dell'Agro (villas used from Republican times onwards: 111)	Probability > D-: 0,0004*	Probability > IZI: 0,0002*	Probability > IZI: 0,0009*
Carta dell'Agro (villas used from Imperial times onwards period: 47)	Probability > D-: < 0,0137*	Probability > IZI: 0,0842	Probability > IZI: 0,3972
Apiolae (all villas: 112)	Probability > D+: 0,0026*	Probability > IZI: 0,0960	Probability > IZI: 0,1305
Apiolae (villas used from Republican times onwards: 77)	Probability > D+: 0,0078*	Probability > IZI: 0,1302	Probability > IZI: 0,2099
Apiolae (villas used from Imperial times onwards: 26)	Probability > D+: 0,5089	Probability > IZI: 0,8554	Probability > IZI: 0,4328

Tab. 2 – Statistical key values for the cost-distance calculation of villas and sanctuaries for the category "all cult places", which comprises minor and major sanctuaries.

Heroon of Aeneas Sanctuary of the 13 altars (Lavinium)	Kolmogorov-Smirnov test	Wilcoxon/Kruskal-Wallis test	Median test
Carta dell'Agro (all villas: 171)	Probability > D-: 0,4779	Probability > IZI: 0,3615	Probability > IZI: 0,3201
Carta dell'Agro (villas used from Republican times onwards: 111)	Probability > D-: 0,3863	Probability > IZI: 0,8284	Probability > IZI: 0,5064
Carta dell'Agro (villas in use from Imperial times onwards: 47)	Probability > D+: 0,0013*	Probability > IZI: 0,0051*	Probability > IZI: 0,0131*
Southern Province of Rome (all villas: 307)	Probability > D+: 0,0001*	Probability > IZI: 0,0058*	Probability > IZI: 0,0347*
Apiolae (all villas: 112)	Probability > D+: 0,0002*	Probability > IZI: 0,0002*	Probability > IZI: 0,0081*

Tab. 3 – Statistical key values for the cost-distance calculation of villas and the *Heroon* of Aeneas.

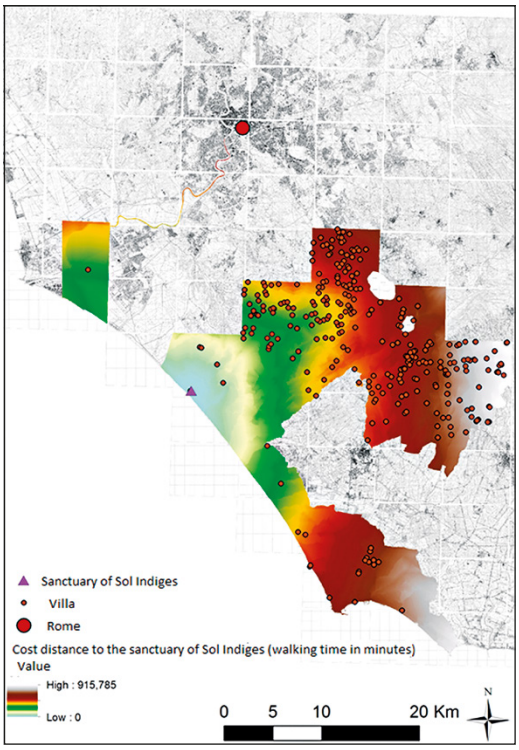

Fig. 8 – Cost distance to the sanctuary of *Sol Indiges* – walking time in minutes.

to the Temple of *Sol Indiges* did not have a positive impact on the settlement patterns as sites tended to be in a particular high cost-distance. The same is true for the "Carta dell'Agro Romano". Both sanctuaries were particularly important in the earlier days of the study period, but had lost most of their attraction in Imperial time. The Temple of *Sol Indiges* was still in use in the 1st century AD as building activities could be observed (Jaia 2012), but in the course of the Imperial period the sanctuary was abandoned and the spot was occupied by a *villa rustica*. A very strong locational significance can be observed for the Republican sanctuary at Valle Ariccia, which was dedicated to Demeter and Kore.

Villas erected in Republican time are situated in a low cost-distance to the grotto of *Faunus*, while villas, which were constructed in Imperial time are randomly distributed. Even though only little is known about this sanctuary, it is obvious that the peak of its activity was in Republican time, while it is unclear whether it was still in use in Imperial time. It is

not entirely clear, whether a causal relationship with the Republican villa distribution pattern exists. Analyses for the Terracina area prove that villas were situated in a particularly low cost-distance to both major sanctuaries, the one situated on top of Monte S. Angelo as well as to the sanctuary close to the Punta di Leano (Lugli 1926; Ceccarelli, Marroni 2011, 497-498; Di Fazio 2013). Analyses for the Circeo massif (Lugli 1928), where the sanctuary of Circe (Le Pera Buranelli 1994; Ceccarelli, Marroni 2011; Marroni 2012b) is situated, show a random distribution of villas in respect to the cost-distance. This sanctuary was situated on a quite exposed spot, far from the main habitation area. A detailed analysis of the spatial relations between the sanctuary of *Diana Nemorensis* and villas in the Velletri area has been conducted: Republican villas were situated in a particularly high cost-distance to the sanctuary, while Imperial time villas assimilate a random distribution.

7.2 *Viewshed analyses*

No particular visual connections could be observed for villas and sanctuaries in the "Carta dell'Agro Romano". Sanctuaries were situated at locations, which were less visible from roads compared to a chance distribution in the same area.

For the southern Province of Rome viewshed-analyses prove a strong visual connection between the largest and richest villas in the study area and sanctuaries. For villas of average size tendencies in the same direction can be observed, even though they are statistically less significant.

For the Velletri area large villas show a high degree of intervisibility with sanctuaries as was the case for the Province of Rome. None such relations could be observed for average size villas instead. There are strong tendencies for a good intervisibility of roads and sanctuaries.

While the topography of the former areas is characterized primarily by hills, the Aprilia area is quite flat. In the latter area sanctuaries are rare and no particular visibility connections to sanctuaries could be observed.

8. Discussion

In the cultural context of Roman central Italy, one may expect that the vicinity of a sanctuary might be regarded as a factor, which could have favoured – besides numerous other cultural and environmental factors – the choice of settlement sites. A further hypothesis was that sanctuaries might have been situated at locations, which were highly visible from surrounding villas and roads. The results of the quantitative analyses do not match these expectations completely. Villas and *villae rusticae* were situated in a low cost-distance to at least one major sanctuary in the majority of study areas. The ties

between sanctuaries and settlement patterns seem to be closer in Republican than in Imperial time, which was the prime of most sanctuaries considered.

Nevertheless, the low cost-distance cannot be taken as a general rule as other areas show random distributions or even particularly high cost-distances.

The visibility analyses show for two quite undulated areas clear visibility connections between large villas and sanctuaries, which might both be perceived as expressions of power and control, but in respect to all areas and all considered site types, the picture is much fuzzier. The impression shaped by some of the major peak sanctuaries is not to be generalized. In this context it has to be considered that some sanctuaries might have been private ones, which therefore might not have to be exposed to a wider community.

Further factors, which influence the visibility in antiquity, but are very difficult to consider due to the available information comprise vegetation cover and landscape modification processes (Teichmann 2017) as it is impossible to interpolate the existing information to a regional model.

For a final culture-historical and archaeological valuation of the results all the discussed methodological problems and uncertainties have to be taken into account. It is important to stress that the chronological range of the analysis is quite broad and that religious beliefs and cultural practices changed in the course of time. While many of the core elements of Roman religious thought remained the same for centuries and rituals continued to be conducted as established once by the forefathers, other elements had changed. The political role of sanctuaries, which were meant to link the Romans to Latin tribes in mid-Republican times and which were meant to create the narrative of a common heroic past (Jaia, Molinari 2012, 376; Jaia 2014, 481) had lost their function as can be seen for example by the end of the temple of *Sol Indiges* (Jaia 2009, 349; Teichmann 2020, 87-88) in the Imperial period. Other aspects comprise the turn to so called "oriental cults". At the sanctuary of *Diana Nemorensis* for example, not only *Virbius* and *Egeria*, but also *Isis* and *Bubastis* were venerated in Imperial times (Ghini 1993, 277). Mithraism and Christianity attracted an increasing number of followers. Changes in ritual practice occurred as can be seen for example in the terracotta votive offerings of miniature animals and body parts as found for example in the Pantanacci grotto at *Lanuvium* that lost their popularity already in the Republican period.

Nevertheless, the choice of a broad research period for the given analysis is valid due to the nature of the available information as many settlement sites are only datable with a broad range and as numerous sanctuaries seem to have been in use for a long time. Whether functional changes occurred, if they continued to serve religious purposes or were visited for other motives is difficult to say (for the *Diana Nemorensis* sanctuary as an example: Ghini, Diosono 2013, 234).

The presented results underline the heterogeneity of ancient behaviour and the lack of simple explanations. Further research on cults, sanctuaries and settlement sites of southern costal Latium as well as continuous improvement of the analysis tools at our disposition are most desirable. The present paper focused primarily on archaeological legacy data, which is regarded as valuable for the actual scientific discourse. Future research may add further data as collected for example by the SITAR project (http://www.archeositarproject.it/) and by the Roman Hinterland Database Project (http://comparativesurveyarchaeology.org/).

Michael Teichmann
Graduate School "Human Development in Landscapes"
Christian-Albrechts-Universität zu Kiel
mbwteichi@web.de

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ABSTRACT

The present paper aims at studying Roman sanctuaries from the late 4th century BC to the early 4th century AD in southern coastal Latium, a region of crucial importance for the development of Roman religion. Quantitative GIS-based research was undertaken to study sacred spaces in their natural and cultural landscape context. A first research question concerned the role of good accessibility of sanctuaries as a factor, which could have influenced the choice of construction sites for villas. Further research focused on the visibility of sanctuaries in respect to other elements of the cultural landscape such as villas and roads. Cost-distance and viewshed analyses were undertaken to answer these questions. As the analyses are based on published and archived site data, several issues related to the use of legacy survey data had to be faced. Results show that the role of sanctuaries as factors of attraction might not have been extremely high. While a few major sanctuaries with extraordinary visibility conditions are situated in the study area, the overall trend does not confirm the choice of particularly visible spots as a general rule.