

# SUMMARY AND CONCLUSIONS

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## 1 AIMS AND APPROACHES

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This thesis is the result of studies performed in the context of two separate multi-annual research projects conducted in widely separated parts of Europe. Between 1994 and 1997 I was part of the Wroxeter Hinterland Project (WHP) directed by Dr Vincent Gaffney at the Birmingham University Field Archaeology Unit (BUFAU). The aim of this project was to relate the growth, flowering, and decline of the Roman *civitas* capital Viroconium (modern-day Wroxeter, Shropshire) to its largely indigenous hinterland, which in the late pre-Roman Iron Age was settled by the tribe of the Cornovii. From 1997 to 2001 I conducted my dissertation research at the University of Groningen within the Regional Pathways to Complexity (RPC) project. Within this umbrella project directed by Dr Peter Attema (RUG) and Dr Gert-Jan Burgers (VU), I studied methods of comparison of settlement dynamics and land use from late protohistory until the Roman Imperial period in three Italian regions – the Pontine region in southern Lazio, the Salento Isthmus in Puglia, and the Sibaritide on the Ionian gulf in northern Calabria. Both projects are similar in that they focus on the combined ‘classical’ issues of Romanization and urbanization, apply a regional scale of analysis, and attempt to restore indigenous populations and elites to their ‘rightful’ place in history.

### PROBLEM ORIENTATION (CHAPTERS 1 & 2)

The archaeological problem definition in both projects revolves around the relationship between the internally driven dynamics of the indigenous societies and the role of external colonizers. Whilst the latter was widely perceived until recently to be the driving force behind supra-regional processes such as centralization and urbanization, perspectives have changed since the 1980s and indigenous roles are now seen to be as important as that of the colonizing powers, if not more so. Because such a perspective can receive little or no support from historical sources, archaeologists must employ other tools such as ethnographic comparison; they must also compensate their lack of knowledge of the indigenous non-urban landscape with new targeted fieldwork and the study of indigenous patterns of land use and settlement.

The methodological problem consists in the combination of two facts. Firstly, the available archaeological data was for the most part not collected with modern landscape archaeological aims in mind; rather, for the past century or more, archaeologists have worked within a classical culture-historical paradigm which has defined the goals and scope of archaeological research. More-over, it has become evident that patterns in archaeological data *at any spatial scale* can be caused by systematic biases in the these data have been collected and turned into archaeological records. When, as in landscape archaeology, it is intended to study archaeological remains in conjunction with the landscape, ways must be found to address this problem. Secondly, there is no accepted methodology for deriving regional and supra-regional interpretations of settlement dynamics *on the basis of the archaeological remains alone*. That is, we do not know how to do landscape archaeology without the culture-historical prejudice. In the terminology of New Archaeology, there is a general lack of middle range theory, needed to link the archaeological evidence to the culture-historical interpretation in a substantive manner. Much of this thesis consists of explorations into this gray area. The comparison of regional patterns and long-term trends in settlement and land use is approached here from a geographical point of view, which has mainly been implemented through the (study of the) application of geographical information systems (GIS) software. A large part of this thesis

therefore consists of articles presenting and illustrating aspects of GIS methodology that were found to be directly relevant to the analysis and interpretation of regional archaeological data.

Chapter 2 presents these archaeological and methodological problems in detail, using examples taken from the three Italian RPC project study regions, and beginning with a brief review of regional settlement dynamics as these are presented in recent literature. The societal processes considered most important for the 1st millennium BC, and the most important archaeological concepts, theories, and methods that are used in this thesis, are isolated and discussed.

Centralization, urbanization, and colonization are introduced as the most important, but at the same time problematic, concepts. Centralization is a process affecting all of society: power (whether religious, economic, political, military or administrative) becomes progressively concentrated in the hands of fewer families or persons, settlement structure is tending toward nucleation, and economic life (production, storage, trade, and exchange), cult, and construction is progressively mobilized and concentrated in a fewer number of locations. The process, occurring generally in the Mediterranean between the Bronze Age and the Archaic, is thought to have ultimately been driven by demographic expansion, through the gradual increase in supra-regional contacts and the successful introduction of Aegean technology (olive culture, storage of oil in pithoi). Urbanization (and, in its early stages, proto-urbanization) in its indigenous form is a direct consequence of the process of centralization, but has in all four study areas been deeply affected by the external imposition of urban forms – the Greek colonies in the Italian south, and the Roman colonies in south Lazio and central Shropshire. This colonization by Greeks and Romans was not a unitary phenomenon but took place for many different reasons and across several centuries. In its early phase, lasting perhaps a century, it was characterized by relatively small populations planted for economic or strategic reasons (late 8<sup>th</sup> – 7<sup>th</sup> century Greek colonies in the Tarantide and the Sibaritide, 5<sup>th</sup> century Roman colonies in south Lazio). Population and settlement expansion, and its attendant encroachment on and eventual domination of indigenous societies, occurred only later (6<sup>th</sup> century expansion of the Greek colonies, 4<sup>th</sup> century expansion of the Roman colonies). The geographical progression of this latter phase can to some extent be attested archaeologically in the material evidence associated with Hellenization and Romanization: this occurs in the 5<sup>th</sup>/4<sup>th</sup> century on the Lepine side of the Pontine plain, in the late 4<sup>th</sup>/3<sup>rd</sup> century in the Salento Murge and the foothills and uplands of the Sibaritide, with the late 3<sup>rd</sup>/2<sup>nd</sup> century Roman conquest of the Greek south, in the late 2<sup>nd</sup>/1<sup>st</sup> century in the coastal side of the Pontine plain, and in the 1<sup>st</sup> century AD in outlying provinces of the Roman empire, such as Shropshire.

This review of concepts is followed by an analysis of the theoretical basis for interregional comparison, presenting the advantages and disadvantages of the various approaches and opting for a quantitative approach that stays closer to the archaeological data than the hitherto usually applied qualitative, socio-political explanatory models. Finally, a brief preliminary exploration of qualitative and quantitative comparison between the three study regions is presented.

The introductory section of the thesis ends with a chapter (3) introducing in more detail the problematic of Romanization in the Wroxeter Hinterland and the aims and approaches of the WHP, using two articles published in 1996-7 in conference proceedings. The first article defines the aim of the project – explaining the anomalous existence of Wroxeter itself, which was the fourth largest town in Roman Britain but seemingly lacked the developed rural hinterland needed to support it. The project's goal is defined as an attempt to establish Wroxeter's place in Millett's (1990) models for urbanization and Romanization in outlying provinces of the Roman Empire, both through the study of the available archaeological records and through an extensive program of systematic field survey. The second article uses both direct evidence and theoretical arguments to reject three current explanations for the existence of a flourishing provincial Roman town in a barely Romanized hinterland; namely 1) that Wroxeter had been an overly ambitious foundation and never reached high population levels, 2) that the rural population remained hostile to the colonizer and resisted acculturation, and 3) that Wroxeter never developed a strong economic base. The first of these explanations was refuted directly by the project's full geophysical and aerial photographic study of the town itself, and the two remaining explanations are rejected as well on the basis of the argument that the obvious economic and demographic health of the town *implies* that a wealthy pre-

Roman hinterland existed and that the native Cornovian elite was happy to invest this wealth in the town. An alternative explanation for the apparent economic and cultural contrast between town and hinterland is then presented, based on two arguments: firstly, that the wealth of the native pre-Roman Cornovians took on archaeologically invisible forms (cattle, salt) probably as a consequence of poor access to foreign trade routes (hence a lack of means to generate prestige through the acquisition and redistribution of foreign goods), and secondly, that our current knowledge of late Iron Age and Roman settlement and land use in the region is biased by a lack of systematic research.

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## 2 FIELD WORK IN ITALY (1998 – 2000)

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Our knowledge of the archaeology of all three RPC regions was, at the start of the project, composed mainly of Italian studies that took place from the 1960's onwards, and Dutch research projects combining excavation and survey from about 1980 onwards. Gaps in this knowledge can, for most of this period, be traced in a fairly straightforward manner to the archaeologists' preponderant interest in 'high' classical culture to the detriment of earlier and later periods, linked to a disregard of 'low' culture and the rural landscape in favor of cult places and urban settlements with their architectural remains and their cemeteries. It is unfortunate that the lack of information about the spatial coverage of these studies means we cannot even take the relatively robust classical patterns for granted. Likewise, the large-scale Agro Pontino survey conducted by the University of Amsterdam, which applied a random transect sampling strategy from which to extrapolate over all of the Pontine plain, remains unfortunately unpublished, and their methods of collecting and recording ceramic data do not seem to allow detailed pattern analysis. Regarding the later more intensive and systematic Dutch surveys of the 1990's, their location within the study regions was evidently biased toward urban settlements and their immediate hinterlands and ignored rural and 'marginal' parts of the landscape. In short, the available data displayed significant geographical, chronological, and typological biases. During the period 1998-2000 the RPC project team, through its program of intensive and systematic archaeological field surveys in all three study regions, has contributed towards the filling of these various gaps in the existing archaeological record. Four preliminary reports on this fieldwork, published with other members of the RPC project team, were presented in chapters 9-12, preceded by a summary of the overarching goals and results of the RPC fieldwork program in chapter 8. At the same time attention was also turned to the development of a suitable methodology for conducting the field surveys themselves and for the analysis of the resulting data. These two topics are summarized in the following sections.

### 2.1 FIELD WORK

#### PONTINE REGION

The 1998-1999 RPC surveys at the foot of the Lepine mountains near the deserted Medieval village of Ninfa, and around the Lago di Fogliano on the Pontine coast, were reported in chapters 9 and 10. Although the original aim of the Ninfa fieldwork was the continuation of a mapping program of so-called 'platform' villas, the study area also fell just inside one of the map sheets of the *Forma Italiae* series of archaeological maps (Cora, Vittucci Brandizzi 1968) and could therefore be used to examine the degree to which this older Italian data set had succeeded in capturing the diachronic archaeological landscape. It was demonstrated that the study area contained, in addition to the almost exclusively Roman monumental remains mapped by Vittucci, many smaller and less obtrusive Roman sites. Moreover, the area contained ample remains of an intensively used pre-Roman (Archaic and post-Archaic) landscape which had not been registered by her at all. In view of these results, the settlement history of this landscape unit (the 'northern colluvium', which also includes the proto-urban settlement at Caracupa/Valvisciolo) now appears to have more in common with that of the core area of Latial society in the Alban hills than with that of the Pontine plain proper, for which intensive settlement and land use has not been demonstrated until the middle Republican period. Following the recognition of variations in size, situation, and status of

the Roman rural villa sites in the Ninfa area, we have now begun to delineate the contours of a more detailed rural Roman settlement hierarchy. The following conclusions regarding urbanization and colonization were drawn:

- Archaic settlement in the Ninfa area, while dispersed, appears to have been quite dense – an indication that the population certainly was not ‘urbanized’ (in the sense of ‘nucleated’) to a very high degree. It may be that incipient Latin urbanization was halted in the northern colluvium by the end of the Archaic as circumstances became less favorable through sporadic warfare, and the inhabitants were forced to resettle into smaller and more easily defended sites on the Lepine scarp during the late and post-Archaic (550 – 350 BC). Some of the latter would then have been targeted for the early (i.e., early 5<sup>th</sup> century) strategic Roman colonization.
- The fact and nature of Roman colonization in the Lepine slopes is to a large extent predicated on the presence or absence, between the Archaic and Roman periods, of a post-Archaic hiatus in the settlement history of the area. Dispersed post-Archaic settlement existed in the Cisterna area only a few kilometers to the west (Attema 1993:181ff) and we may therefore assume that there was settlement continuity throughout the post-Archaic. The nature of the change from slight buildings and thick augite tempered pottery in the Archaic, to tile-roofed buildings with cisterns and depurated amphora and fine wares in the Republic remains to be explained. Are we looking at the transformation of temporary shelters into permanent habitations? Was the indigenous population moved to make way for new Roman settlers whose farmsteads were constructed according to some colonial base plan, or do the changes visible in the archaeological record reflect the gradual integration of the local Latial rural economy into the same regional economic and cultural networks that also include their Roman allies?

The Fogliano fieldwork area was selected because it represents the coastal landscape of the Pontine region, regarded as economically, politically, and demographically ‘marginal’ on the basis of both classical and more recent historical sources. The results of the survey support this hypothesis for the time up to and including the middle Republican period, establishing a basic settlement history that can probably be extrapolated to the whole Pontine coastal landscape. Sporadic ceramic evidence was encountered for what was probably non-intensive land use and impermanent settlement in this landscape of ancient beach ridges, valleys, and coastal lagoons from the Bronze Age onwards, and the number and ceramic density of sites only begins to increase in the Archaic period. In the absence of sufficiently diagnostic ceramic types, the intensity of land use during the post-Archaic and middle Republican periods must remain unclear for the present, but a clear departure from the *status quo ante* occurs with the remarkable growth in the number of rural villas during the late Republican period (200 – 50 BC). As this growth takes place mostly in the single largest available continuous and flat area of suitable sandy (eolian) soils, we interpret it as the development of a rural village. This rural socio-economic development was tentatively connected to the production and supra-regional trade in fish and fish products that emerged in this period along the Pontine coast, but apparently lasted not more than two centuries since none of the sites appears to have been in use after the early Imperial period; a decline that is in line with general economic trends in the expanding Roman empire.

The results of these surveys were put in the context of diachronic developments in the wider region: the development during the Bronze Age, Iron Age and Archaic period (i.e. to the 6<sup>th</sup> century BC) in the core areas around the Alban massif and Rome of, first, centralized settlements and, later, peer polity city states is reflected by a similar, but late and stunted, development of more marginally located polities such as Caracupa / Valvisciolo on the Lepine footslopes and Cisterna di Latina on the south-eastern margin of the Alban massif. During the post-Archaic and Republican period the growing political, military and economic influence of Rome expressed itself archaeologically first in the establishment of colonies on the Lepine margin and mixed farming on the colluvial slopes and (though much less so) along the Via Appia. Only much later did it result in the exploitation of the coastal landscape for fish farming, pottery production and leisure industry. The apparent dismantling of the Lepine olive culture and the near abandonment of settlement there and in the coastal area following the early Empire indicates that the

Pontine region generally became economically marginalized as the Roman Empire moved its large-scale agriculture and service industries elsewhere.

#### SALENTO ISTHMUS

Just as at Fogliano, the aim of the field survey conducted in 1999 near the town of Ostuni in the Salentine Murge (chapter 11) was to map in detail some previously barely studied ‘marginal’ landscape units. The limestone plateau of the Murge had long been seen as constituting one of the social, economic, and geographical margins of the lowland urban society developing in the early Hellenistic period in the Salento. Whereas research by the University of Lecce and the Free University of Amsterdam had been concentrated on these lowland central places and their immediate hinterlands, the Ostuni survey for the first time offered a chance to chart in detail the long-term history of sections of both the high Murge and the transitional zone toward the coastal plain of the Adriatic. On the micro-regional scale of interpretation, one of the major conclusions that were drawn on the basis of the survey is that, in broad outline, both landscape units demonstrate parallel shifts in artefact densities and distributions from the Bronze Age to within the early Imperial period:

- With regard to the landscape history of the protohistoric, classical, and archaic periods, the almost complete absence of finds dating from the Late Bronze Age until the 4<sup>th</sup> century BC confirmed that society during that period probably had a strongly nucleated structure, centering on strategically located cliff and hilltop settlements. Archaeological material dating to these centuries is restricted to the cave site of S. Maria d’Agnano, where the Archaic formalization of cult activities can be argued to have supported territorial claims on the surrounding land. The fluidity of protohistoric land use strategies was illustrated when the survey unexpectedly found widespread and often dense scatters of a very homogeneous *impasto* dating to the Middle Bronze Age. These scatters, occurring in large numbers in both upland and lowland settings, must be interpreted as the remains of a system of shifting cultivation that was in use for a relatively brief period, and in which family groups periodically relocated to exploit fresh or regenerated parts of the landscape. During this time no large and permanently inhabited settlements would have existed in the area.
- For the Hellenistic and Roman periods the survey confirmed the expected low intensity of land use, in that individual farmstead sites were found to be located approximately 1 km apart in both landscape units. On the other hand the survey provided surprising evidence that ‘colonial’ ceramics, building materials, and building styles had already penetrated far into the Murge during the early Hellenistic period. The development of an indigenous-Hellenistic urbanized society on the Salento Isthmus was therefore complemented by a contemporaneous Hellenization, possibly even colonization, of even the most remote areas. This suggests that essentially all of the population was involved in and affected by this process. For both survey areas, a basic continuity of occupation throughout the Roman Republican and Imperial periods can be deduced, with the possible exception of the late Imperial period in the upland area.

#### SIBARITIDE

For the survey in the Sibaritide (2000; chapter 12), field work was aimed at testing several hypotheses generated on the basis of Lorenzo Quilici’s large-scale topographic survey of the late 1960’s, while at the same time charting in more detail part of the archaeological hinterland of the protohistorical settlement and cult place on the Timpone della Motta near Francavilla Marittima, excavated in the 1990s by M. Kleibrink. From Quilici’s survey, as from other similar surveys conducted for the *Forma Italiae* series, had emerged an intensively settled but almost exclusively classical (Hellenistic-Roman) landscape. Within the survey zone, these farmstead sites appeared to cluster into loose-knit villages linked by Quilici to a (hypothetical) regional and supraregional infrastructure. The RPC survey tested these ideas by means of a field work transect through the foothill zone, designed to reveal the existence of any systematic chronological and geographical biases or lacunae.

The results of the survey confirmed most of Quilici's ideas. In view of the very sporadic presence of protohistoric surface ceramics the foothill zone appears not to have been intensively used before the archaic expansion of the sphere of influence of the Greek colony at Sybaris. The adverse conditions for retrieval of protohistoric ceramics on the intensively worked terraces must be taken into account when interpreting the archaeological record of relatively well-preserved upland protohistoric sites. Despite the historical date for the establishment of Sybaris around 720 BC and the archaeological evidence for continued use of the sanctuary and necropolis at neighboring Timpone Motta into the late 6<sup>th</sup> century BC (Attema et al. 2000), no securely datable materials from this period were found. Given our experience with the very low visibility of coarse Iron Age impasto wares among the naturally occurring stones in the survey area, we concluded that neither ourselves nor the Quilici team were able to identify such material with any degree of reliability; we cannot therefore infer much from its absence. For the Archaic, much will depend on a closer dating of the coarse wares, which make up more than half of the finds by weight, through association with datable fine wares or through typological comparison with excavated material within the region. The large numbers of classical sites do indeed originate, for the most part, in the early Hellenistic period; and they do indeed cluster along the edges of specific landscape units (gently sloping plateaus of marine origin). Among the 'new' small classical sites identified by the intensive survey several are located within clusters identified by Quilici, while others are scattered all over; the material recovered from these mostly small Hellenistic farmsteads is remarkable for its uniform poverty.

In other respects, however, Quilici's thoughts on site distributions and settlement history have had to be modified as a result of our survey. Despite the deterioration of the soil archive in the intervening decades about twice the number of sites mapped by Quilici were recorded in the same area by our more detailed and complete coverage. Large and small Hellenistic sites were found to occur in other landscape settings (among them secondary plateau edges of fluvial origin) besides the ones identified by Quilici as well, and most appeared to be discontinued in the Roman period. The survey also established that just over half of the undiagnostic surface ceramics in the transect displays fabric characteristics *potentially* placing them in the Classical/Archaic rather than the Hellenistic period. If this dating can be confirmed it has obvious consequences for the settlement history of the Sibaritide as a whole, substantiating historic accounts of the *imperium* of Sybaris.

## 2.2 FIELD METHODS

Topographical and field surveys can cover relatively large areas, but the diversity of approaches, the potential for significant bias, and the lack of an accepted approach to statistical analysis of the resulting data mean that their interpretation is a matter often left exclusively to the judgement of the survey director. The promise of the large field survey projects based on regional sampling designs of the 1970's and 1980's, of providing a firm basis for regional extrapolation and statistical inference, has not been fulfilled, and more recent survey projects (including those of the RPC) have elected to map the surface record at a certain resolution, rather than sampling it at a certain fraction. Accordingly, the RPC surveys were used to experiment with methods for more objective recording of archaeological landscapes (summarized in chapter 8). In order to alleviate the resulting substantial load of administrative procedures, experiments were also conducted with automated and digital field recording (chapter 7).

### FIELD PROCEDURES

With regard to methodology, the 1998 Ninfa survey provided a valuable first insight in and confirmation of the limitations of the old topographical style of regional survey, confirming the need to develop methods for the registration of *continuous* spreads of ceramics across the landscape (as opposed to *discrete* spreads in the form of 'sites') in later field surveys - a lesson taken to heart in experiments during the 1998 survey campaign at Fogliano. The conduct and recording of the fieldwork there and in all later surveys was based on geographical collection units (land parcels of circa 1 hectare) instead of archaeological units (sites) or agricultural units (fields), and the problem of selective recording was fought by adopting a policy of collecting and bagging all surface material per unit, leaving the classification of finds by an expert to a later stage.

In addition to the realization that the history of settlement and land use in the Pontine region can be more easily understood if we analyze it in terms of relatively small physical landscape units than if we attempt to do so for the region as a whole, the Fogliano survey also highlighted a problematic recognized earlier by British archaeologists during the analysis of surveys in the Aegean. This problematic regards the interpretation of the often very low 'off-site' finds density of ceramic from various periods carpeting the Mediterranean landscape. Efforts to obtain a better understanding of the factors that influence the probability of retrieving surface finds by revisiting find spots from the 1998 campaign in 1999 and 2001 led me to believe (with others) that even a single ceramic find should, under certain circumstances, be interpreted as indicative of the existence of a local subsurface reservoir (site). The importance of factors influencing the survival and visibility of ceramics in the plough-soil was shown to vary greatly, more-over, depending on the manner of production and age of the material. This causes protohistorical ceramics, for example, to have a much lower probability of retrieval in a field survey than is the case for classical Roman and Hellenistic ceramics, and is an obvious cause of bias.

The experience gained in these earlier survey campaigns in the Pontine region was employed to improve aspects of methodology, and later surveys in the Salento and Sibaritide were conducted with a higher spatial resolution (units of 0.25 ha) and a more rigorous registration of factors affecting visibility. An appendix to chapter 8 presents the annotated field forms developed in the course of these surveys; they represent the current stage in an ongoing process of developing field administration procedures that satisfy internationally accepted standards of good practice in the conduct of field surveys.

- By applying a detailed survey method, focusing on the documentation of the density distribution of artefacts rather than of sites, it has become possible to assess accurately the variability in quality and quantity of this surface material in the light of both cultural and natural formation processes.
- The goal of formal comparison of survey results can only be reached if procedural standardization and rigor are applied in the recording and processing of field data. This will involve greater use of digital recording and wireless transmission methods to increase the precision and efficiency of field surveys; the more detailed recording of landscape parameters that may affect not only site location, but also site visibility; the realization that survey biases may differ, and must therefore be assessed separately, for each landscape unit and category of archaeological material; and the development of widely accepted definitions of such crucial concepts as 'site', 'off-site', and 'scatter'.

#### DIGITAL RECORDING METHODS

Chapter 7 is dedicated to a description of experiments conducted in collaboration with Dr Nick Ryan of the University of Kent at Canterbury during the October, 2000, fieldwork in the Sibaritide. The aim of these experiments was to increase the accuracy and efficiency of the recording and processing of information during and after archaeological field surveys by using programmable, lightweight, and semi-automated digital registration tools (digital field assistants or dFA's). By conducting instant digital recording of landscape parameters and collected materials in the field (that is, without first passing through a 'hardcopy' stage) the efficiency of the work is increased and the danger of transcription error removed. By pairing such digital field recording with automatic and accurate GPS location methods, the mapping of collection units and archaeological entities is no longer dependent on less precise manual methods often involving outdated topographical maps. This apparatus was used successfully to record the surveyors' routes and observations, agricultural field boundaries, and the center and circumference of archaeological sites. The experiments confirmed the potential of the dFA system for both speeding up field recording procedures and reducing the number and size of errors made during the recording process. The system's potential for easing navigation and the sharing of information during surveys was not fully explored, but our experience in (re-)locating archaeological sites mapped in the 1960's indicates that it will also prove useful in that area. With limited enhancements to functionality, and further improvements to the standard spatial accuracy, it was demonstrated that the system can profitably be used in any type of archaeological field survey. With the full technical and procedural integration of a professional version of the kit into fieldwork methodology dFAs may transform fieldwork practice, but

this will require further extensive testing of system components, software, and field procedures.

In recent years, the use of professional GPS surveying equipment in archaeological fieldwork has become much more popular, and some teams are adopting commercially available products in order to obtain GIS-like capabilities in combination with GPS. These high-powered approaches, while providing very high accuracy and versatility, require considerable expense and highly skilled personnel, and cannot yet provide a true field information system. The digital Field Assistant system was argued to be preferable over such alternative approaches, because it is relatively inexpensive, can provide immediate feedback in the field, is portable and unobtrusive, and is designed to perform typical and frequent archaeological fieldwork tasks. With respect to the GPS component of the dFA system, the availability of a good location device is a crucial feature in the recent shift in emphasis of archaeological survey work away from the well-mapped and well-controlled coastal zones of Italy, to the more rugged and less well-mapped inland zones. For archaeological applications where the accuracy requirements are higher than what can be achieved with a single receiver, the addition of a GPS base station for differential correction would give the most satisfactory results. Post-processing, of course, would not offer any improvement in real-time positioning in the field but so far we have not identified any reason why this should be a high priority. Should it become necessary, corrections could be broadcast from the base station and received at the rovers by using conventional wireless-modems.

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### 3 THE METHODOLOGY OF REGIONAL COMPARISON

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The process of compilation, comparison, and interpretation of regional data sets from a quantitative point of view was illustrated in chapter 13, using the Pontine region as an example. Included is a discussion of the desired structure of regional relational archaeological databases, of the need for unambiguous and standardized definitions of archaeological entities such as the 'permanent habitation site', and of the remarkable lack of standardization in fieldwork methods and publication which hampers even the most basic comparison between two or more archaeological data sets. It is shown that traditional regional site databases do not provide a good basis for storing the new data types and emphasis on uncertainty and fuzziness inherent in modern landscape archaeological data. In future, archaeological databases such as that of the RPC project should contain the new types of entities and relations needed to describe accurately all types of archaeological field observations; they should fully document the process of interpretation of these observations along with the interpretations themselves; they should contain mechanisms for keeping track of data quality and for improving data quality through bias modeling if necessary; and they should use formal authorities for the chronological and typological classification of source data and interpretative constructs. To ensure that such databases can be used by others, the need for metadata describing the database itself, and for the development and implementation of explicit and formal classifications was argued.

From the quantitative comparison of the results of all the available surveys in the Pontine region, it emerges very clearly that less intensive survey (such as practiced until the early 1990s) has tended to result in the discovery of a predominantly classical landscape, because sites from this period are the most obtrusive (large and dense scatters containing both tile and ceramics, standing architecture, many diagnostic wares). More intensive survey results in an explosive growth in the number of small and/or diffuse ceramic scatters identified, for which chronological and functional typology tends to be much less clear-cut. A further hurdle to the comparison of survey data sets across projects is presented by the lack of a standardized approach in almost every aspect of their collection, description, interpretation, and publication. This is demonstrated by the example of several incongruent chronological and typological site classifications in recent use in survey projects in central Italy.

It is concluded that priorities for future work in the regional or interregional comparison of survey data must lie with the removal of weaknesses in the core classifications employed. Local ceramic chronotypology must be further developed through fabric classification and seriation of survey assemblages, especially for the post-Archaic period. Site type classifications, particularly for the pre-

Roman periods, should be improved through a program of field tests involving surveys, trial trenches, and excavations at a representative sample of site types. Surveys should address the current lack of data for what has traditionally been considered the marginal parts of the ancient landscape; especially the up- and highlands. Furthermore, the intensive surveys conducted in the various landscape units of the Pontine region since the early 1990s now provide a solid basis to revive the idea of a regional stratified sampling design. The conduct of future survey campaigns within such an overarching strategy can result in a more efficient use of limited resources and should generate more easily comparable data for the region as a whole.

### 3.1 MODELING DATA FORMATION PROCESSES

The interpretation of large-scale (wide-area) patterns in archaeological landscapes has in the past always taken place within the context and limits created by the available written sources from classical antiquity. In order to escape from these limitations and base one's interpretations directly on patterns in the available archaeological data, suitable methods must first be developed. Two types of methodological studies were accordingly undertaken. Firstly, studies that aimed at obtaining an understanding of, and control over, the quality of the archaeological data that lies at the heart of regional settlement histories and the comparisons based on them (chapter 4). Secondly, studies that aimed to assess the utility of the GIS toolkit for the analysis and interpretation of patterns in those same archaeological data (chapters 14 and 17).

#### DATA QUALITY

On the regional scale, geographical, typological and chronological biases abound. There is, for example, a great lack of survey data for what has traditionally been considered the marginal parts of the ancient landscape - especially the up- and highlands in the case of Italy; and if theoretical arguments for the 'invisibility' of the majority of small protohistoric settlements are correct, then what appears to be a clear-cut process of proto-urbanization taking place in Italy, may in fact be the preferential discovery of the highest-ranked settlements within a much more widely settled landscape. Chronological biases are especially insidious, as they are built in to typo-chronological classifications which are often imported from outside the region being studied. For example, the early settlement histories of the Pontine region and the Sibaritide are greatly influenced by our (in-)ability to recognize post-Archaic, respectively Archaic ceramics. Rather than continuing to rely for dating on fine wares originating in other regions and often itself dated only by typological association with wares from even further afield, it is therefore of singular importance to study the local fabrics and wares in excavated contexts. Local ceramic chronotypologies must be further developed through fabric classification (cf. Attema 2000) and seriation of survey assemblages.

The problems that currently haunt the interpretation of the results of surveys by one and the same group operating in the same area, are shared to an even greater extent by those intending to assess the archaeological record at a wider regional, or even supra-regional, scale. Currently, students are forced to choose between two equally unattractive approaches to regional and interregional comparison: either to compare the broad characteristics of the data sets while ignoring most of the associated problems, or to spend a huge effort on devising a multitude of correction methods for low quality data sets. Qualitative comparison of high-level interpretative constructs is doable because these are provided ready-made by period and area experts, but unsatisfactory because the interpretations 1) rely on a shared and limited set of theoretical constructs, and 2) are heavily biased by past research trends and results. Rather than continuing to collect data that suffer from these biases, research should be targeted at the development of more reliable methods of collecting data that are truly representative of the extant archaeological landscape, and of standardized ways of describing, archiving, and publishing results. Clearly there is an urgent need to begin to develop landscape archaeological data sets of a sufficiently high quality to allow (inter-)regional comparison – guidelines for which should become embodied in an international standard defining 'best practice in landscape archaeology'.

## BIAS MODELING

The strength of our interpretations of regional archaeological databases, such as are compiled by desktop study and occasional fieldwork, rests entirely on the quality of the data within it. With the exception of a few survey projects designed in the late 1970's under the influence of the New Archaeology, and implemented mostly in the 1980's, none of those data were produced with the express aim of obtaining a representative picture of the regional archaeological landscape. Regional interpretations must therefore explicitly take into account the possibility that the data on which they are based are *not* representative for that landscape. A similar problem has plagued the interpretation of the results of archaeological field walking surveys, which had become increasingly popular during that same period as well. Ever more intensive and systematic field work has brought to light the significant role of numbers of factors biasing the objective retrieval of archaeological surface data. Chapter 4 deals with methods that can be used to detect and counter such biases, both proactively by introducing procedural improvements in the design and execution of contemporary fieldwork, and retroactively by applying extensive source criticism on data sets formed in the past:

- Our ability to record surface archaeological material is not perfect; it is biased by visibility and research biases. Causing the former are factors such as current and historical land use / land cover (LULC); causes of the latter include the recording and classification methods used by the field archaeologist. The amount and type of bias varies strongly depending on the type of data and scale of analysis; no hard and fast rules can therefore be given, other than that a bias study should be a requisite part of any regional data collection exercise or analysis.
- Neither the intensive interest and study conducted in the early 1980s, nor the growing popularity of surveying and use of GIS since then, have so far led to anything resembling a successful approach to the recording and correction of biases which is valid across projects. We must follow up on Terrenato's (1996) urgent call to record bias factors if we are to attempt 'the correction, at least partially, of incomplete distributions', and conduct the 'series of methodological experiments dealing with the various aspects of how to document surface scatters', advocated by him.

The case studies presented here were conducted to demonstrate a) the relevance of bias factors to the interpretation of survey data and of landscape archaeological data in general; and b) methods by which bias factors can be included in geographic models of archaeological landscapes. At the regional scale, studies of the data collected by the Wroxeter Hinterland Project and the Agro Pontino Project (Voorrips *et al.* 1991) demonstrate this for systematically surveyed data and general archaeological records; at the scale of a 'local' survey such as the Ninfa and Fogliano surveys conducted 1998-9, case studies demonstrate this for specific visibility and research biases.

## CHANGES IN LAND USE AND LAND FORM

The geological history and the history of land use of the landscape have a great influence on the design and results of archaeological fieldwork. In the WHP surveys conducted in 1994-6, the choice of fields was limited by modern land use and land cover (LULC), in particular the availability of recently ploughed agricultural fields. Since such fields are not randomly distributed over the landscape – relief, distance to the river Severn, soil type, modern infrastructure and hydrology all play a role – the surveys result in the taking of a potentially biased sample which cannot be used to make straightforward extrapolations about the study area as a whole. In the surveys conducted by the Agro Pontino project during the 1980s, paleosurfaces dating to the Paleolithic period had been covered in most parts of the Pontine plain by more recent alluvial and colluvial deposits (Kamermans 1993), and similar though less clearly evident biases must have been present for material dating to later periods. In chapters 14 and 17 of my thesis I presented examples of bias modeling applications focusing on the recent and subrecent land use history of the Wroxeter hinterland and the Pontine plain. It was demonstrated that 20<sup>th</sup> century land use in the former region is correlated with the large-scale distribution patterns of several of the most numerous site types in the former area. Land form changes as a result of the fascist and later land improvement schemes

in the latter region were likewise shown to have a significant influence on the results of the RPC field surveys near Fogliano (chapter 10).

The study of LULC for regional archaeological research can be said to have both a methodological and a historical purpose. The former is perhaps best approached by the use of GIS to store and compare historical cartographic data about land use. Such data may be derived from archival records made for military, legal or taxation reasons; from studies of agricultural productivity; and, more recently, from historic aerial photography and satellite imagery. The resulting LULC maps can then be compared and correlated to the visibility and discovery mode aspects recorded in the archaeological archives. The case study presented in chapter 14 found that recorded discovery mode in the Shropshire SMR does indeed correlate with historic LULC. Examples are given of the positive correlation of aerial photographic data to arable land use, of chance finds to areas more likely to be frequented in recent times, and of earthworks to uncultivated land. Using the example of barrows and ring ditches, it was demonstrated that analysis of the archaeological record *within* a particular discovery mode can also flag up significant deviations. Whilst both feature groups represent a single underlying class of sites (ring ditches being the ploughed-out remains of burial mounds), barrows discovered by air are located mainly on poor soils while ring ditches discovered by air occur mainly on rich soils. When the two data sets are recombined the latter correlation becomes insignificant. The second, historical, use of LULC studies is demonstrated by reconstructing a regional pattern of arable vs. woodland for the late Roman period supported by archival studies of diocesan boundaries and literary topographic references. It is argued that such studies are needed if we are to distinguish between archaeological patterns relating to ancient LULC, and those relating to modern LULC.

Whilst the scope of this case study was limited both by the available time and by the relatively low quality of the data available from the Shropshire SMR, there is no reason to assume that other regions will have been much better documented. Our archaeological understanding of the Wroxeter hinterland should not be conditioned by the ‘accidental’ but systematic absence from the landscape of certain kinds of evidence as recorded under certain kinds of conditions. Such hiatuses can be managed efficiently in a GIS by mapping the type, coverage, and intensity of archaeological research events<sup>1</sup> across the landscape. With regard to the potential of land use mapping in Mediterranean studies, one may point to the many and sometimes very detailed topographic maps of the Pontine region, which contain land use data dating back as far as the 16<sup>th</sup> century. Attema (1993), for example, used military topographic maps of 1851 to derive a map of the typical transhumant settlement and land use practiced until the early part of the 20<sup>th</sup> century in the Pontine plain.

The case study presented in chapter 17 demonstrates the feasibility of employing GIS to extract and interpret recent and subrecent land form changes from historic elevation and land cover data. Although it is generally recognized that the interpretation of survey results requires knowledge of local geopedology and landscape history, workers have not yet gone very far with this approach. The case study shows that, provided certain requirements regarding data quality are met, historic elevation data can be used to track one of the most important factors biasing the results of field surveys in Europe today – changes in land form caused by agricultural and construction activity. By detailed comparison of historic and recent elevation data in the GIS environment, maps can be made of the location and approximate amount of soil deflation/inflation affecting the presence and visibility of the archaeological record. Such maps can be used both to target future surveys to areas that are likely to have survived undisturbed, and to re-interpret the results of older surveys.

Taken together, chapters 14 and 17 provide an especially clear demonstration of the strength of the correlation between most small-scale (wide area) patterns in regional archaeological data sets, and the combined factors of recent and subrecent land use and local research methods and interests. A more

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<sup>1</sup> The term ‘event’ is here used in accordance with accepted archaeological recording practise, where it indicates a single episode of relevant actions/observations affecting a monument.

extensive and detailed meta-analysis of Italian surveys is now needed in order to map in detail their correlation with contemporary land use.

### 3.2 MODELING SETTLEMENT PATTERNS

#### SITE LOCATION MODELS

In order to arrive at an assessment of the two main schools current in archaeological GIS studies of the last decade, chapters 5 and 6 presented a full analysis of the theory, methodology, and methods underlying ‘predictive’ models (location models mostly based on the extrapolation of correlations between the locations of archaeological remains and characteristics of the physical landscape) and ‘cognitive’ models (mostly models that relate the location of archaeological remains to the degree of visibility and accessibility of the surrounding landscape). Predictive models were developed internationally mainly in the context of heritage management and preservation, but in the form of location models have long been the object of academic research as well. In the latter case the aim is usually to explain existing settlement and land use patterns by relating them to landscape parameters. The potential of GIS software as a tool for this kind of study was quickly recognized and in Europe led to a steadily increasing flow of publications since the early 1990’s. During that same period, however, post-modern theory also gained an increasing number of proponents within European archaeology, giving rise to heavy criticism of the ‘ecological determinism’ inherent in predictive models, and proposals to replace it by ‘cognitive’ alternatives. This led to a lively but chaotic debate regarding both the theoretical underpinnings and the aims and methods of this type of geographical model. Based on an overview of the international literature on the subject, chapter 5 lists and evaluates all of the arguments employed in this debate, in which a series of dichotomies stemming from the polarized theoretical stances appear to predominate.

The main conclusion arising from this review is that procedural transparency rather than theoretical purity should be the main characteristic of predictive models, a goal that can be reached only by formalizing all the stages in the modeling process as presented in the chapter, increasing the quality of the data and methods employed, and adequately testing the resulting models in the real world. Wide-area predictive modeling using GIS is poised to play a very important role in archaeological heritage management at the national level in the European Union because of the imminent implementation of the Valletta Treaty on the protection of the cultural heritage, but at the same time has remained an important tool for archaeological research as well. The ability to generate formal, rule-based, and testable hypotheses in the form of predictive maps is fundamental to both types of use, and requires a better understanding of the underlying theory, data and methods. Specific recommendations include the need to improve the spatial, functional, and temporal resolution of the models, to arrange for the *formal* inclusion of archaeological theory and expertise through the use of expert systems, and to incorporate *formal* stages of source criticism (bias correction) and quality testing. In both CRM-type and academic models there is sufficient scope for procedural improvement, including the proper and transparent use of statistical techniques and inclusion of bias models. It should be clear to students and end users alike to what extent models are supported by statistical inference, and what can and cannot be inferred from them. ‘Source criticism’ of both archaeological and environmental input data, including especially the absence of such data, should be an integral part of the modeling methodology. This can perhaps be implemented through the use of “taphonomical map layers” that assess the nature and extent of the distortions of the known material heritage, and suggests a link with the area of error propagation modeling in Geography.

#### COGNITIVE MODELS

A heightened attention to the landscape as perceived and conceived by humans both in the past and today is one of the more significant contributions of post-modern archaeology to the debate regarding the nature and goals of GIS applications (chapter 6). In contrast to the external and physical characteristics of the landscape, this approach targets its internal, cognitive, aspects. In everyday research practice it translates into archaeological applications and development of two GIS tools in particular: line-of-sight analysis (LOSA) and cost surface analysis (CSA). Leaving aside the fruitless theoretical debate accompanying this development, research efforts in this direction have allowed a more realistic

approach to predictive modeling that takes into account the human experience of being in the landscape. In chapter 6 I reviewed the international archaeological literature on these two techniques. It is concluded that, a decade after the first LOSA / CSA studies were conducted, an initial phase characterized by naïve applications and constrained by the capabilities of generic GIS has drawn to an end, and is being replaced by a phase in which specific procedures are being proposed in order to implement more realistic models of human perception of the landscape. Although research in this area is still characterized by the existence of ‘schools’ - the ‘environmental’ school continues to explore refinements to approaches current throughout the past decade while proponents of the ‘enrichment’ school advocate a landscape architectural approach – it is becoming increasingly clear that deterministic analysis in GIS can become more accurate by adopting a flexible approach to cognitive criteria. Early explorations of such a ‘cognitive processualist’ approach include Wheatley and Gillings’ (2000) investigations in the framework of Higuchi viewshed properties, Llobera’s (2000) implementation of ‘attractive’ and ‘repellent’ features in the landscape, and several of the case studies presented elsewhere in this thesis.

The apparent, and vocal, conflict between adherents of processualist and post-processualist approaches to archaeology was shown to be beside the point from a pragmatic point of view. A much more significant watershed exists between studies that fail to adduce proper supporting evidence to their interpretations, and those that do. A case in point is the general lack of supporting evidence given for claims of unusual (non-random) cost or viewshed properties for particular locations within a region. Yet the techniques to provide such evidence exist:

- To substantiate the significance of visibility and accessibility properties obtained for a sample of archaeologically meaningful locations, they can be compared with similar properties of either one large sample, or many similar-sized samples of randomly chosen locations. The former is typically done by first generating a cumulative visibility or accessibility index for all, or a representative subset of, locations within the study region. The result obtained for the sample of interest can then be formally compared to the population (one-sample tests) or to a representative sample of it (two-sample tests). As is shown by Fisher and others (1997) and Kvamme (1999), Monte Carlo tests can be employed in the latter approach to demonstrate that the results obtained are unlikely to have arisen by chance, now that computing power is no longer an issue.
- A different method by which LOSA- or CSA-based models may be supported is by comparison with independent archaeological evidence. For example, networks of least-cost paths may be compared to historically known networks such as the mule-paths that criss-crossed the Italian uplands until recently.
- Finally, two potential approaches have been suggested to make cognitive models more robust: firstly, since there are a large number of potential sources of error in the input parameters and algorithms involved in these models, Wheatley and Gillings (2000) suggest that we should instead study the trends emerging from an accumulation of models with a wide variety of such input parameters and algorithms. Secondly, rather than attempting to interpret the viewshed or accessibility properties of sites directly, we could study the *differences* among sites and between sites and ‘background’. Both methods avoid a lot of the uncertainty and errors usually associated with this type of analysis.

Case studies from the Wroxeter hinterland, illustrating the application of line-of-sight and cost surface analysis techniques in models of the Late Iron Age and Roman cognitive landscape, were presented in chapter 16. Developed originally in 1996-7, these case studies no longer represent the ‘state of the art’ in GIS modeling of visibility and accessibility, as the modeling of ‘energy and resource landscapes’ with the help of cost surface techniques has become increasingly sophisticated in the last few years. Cost is now measured in real terms as energy expenditure in Watt or kcal; cost surfaces have become anisotropic to reflect the importance of the effect of direction of movement on costs; the interpretation of visibility and accessibility models is now informed by a better understanding of statistical complexities; and, last but not least, the limitations of the underlying theory are now beginning to be understood. Keeping these limitations in mind, line-of-sight analysis is used to model and visualize the potential degree of control exercised from Iron Age hillforts and the later Roman legionary fortress at Wroxeter over parts of

the central Severn valley. Cost surface analysis is used to model, first, the accessibility of the region in the Roman period, and then, on the basis of that accessibility, the locations of potential routes and nodes in the local infrastructure.

An exploration of the properties of ‘background’ visibility and accessibility indices is also included in chapter 16. Although the simulations presented there do not constitute definite proof, it would appear that simply by increasing the viewshed range used, the higher visibility values will concentrate on areas of higher ground, ridges and peaks. Any sufficiently large sample of archaeological viewpoints will tend to generate a cumulative viewshed similar to these simulated ones, depending on the viewshed radius used. Furthermore, any such viewshed based on points located on or near ridges and peaks will further emphasize the visibility of other ridges and peaks. It is argued that the properties of cumulative ‘background’ indices should become more widely known and used by practitioners. Of equal importance is the testing of GIS-generated visibility and accessibility models, firstly by a comparison with extant historic, archaeological, and cartographic data, and thereafter by targeted fieldwork.

#### CENTRAL PLACES AND TERRITORIAL DIVISIONS

In chapter 15, spatial models deriving from the theoretical models of centralization, urbanization, and colonization presented in chapter 2 were investigated, using examples from the Pontine region and the Sibaritide. These examples concerned centralization, urbanization, and the formation of territories during protohistory, and early and middle Republican colonization of the Lepine margin.

Protohistoric settlement dynamics in widely separated regions of central and southern Italy, as presented in the literature, demonstrate a remarkable similarity, so that it is quite possible to draw comparisons between the regions on this basis. The development of indigenous central places and territories in the late Bronze Age and early Iron Age is one such dynamic. The process by which archaeological sites of that period are identified, the criteria by which they are classified, and the arguments and methods used to segment the surrounding landscape into territories, are investigated and weaknesses in the process are exposed. In general it emerges that current economic and cognitive models of the ordering of settlements and the landscape in protohistory (and, for indigenous societies, even for many centuries afterwards) are of a very non-specific and intuitive nature. Bias modeling (chapter 6) and corrective fieldwork (chapter 8) will be needed to test the many assumptions on which these models are based. For the early (4<sup>th</sup> century BC) Roman colonization of the Lepine margin, a viewshed study is conducted to test the hypothesis that these colonies were established as strategic strongpoints, as much for the purpose of controlling the Lepine uplands from which direction attacks by mountain tribes could be expected as for protecting the agricultural resources and infrastructure of the Pontine plain. A brief review of literary historical sources regarding Rome's early colonies in south Lazio is given to substantiate the need for such strategic decision making in a landscape which remained contested between Latins, Volscans, and Romans for a century and a half. The results of the study show that the colonial viewsheds cover the whole of the western Lepine mountains in a complementary fashion, and support the hypothesis.

Specific conclusions regarding settlement patterns in the three study regions, drawn in chapter 13, include:

- The developed Iron Age settlement pattern in the Sibaritide and Salento Murge displays remarkable similarities in the geomorphological location and spacing of the settlements, located some 10-12 km apart in defensible hilltop positions. It must be doubted that regular access to sea-borne trade had a major role to play in this, because the pattern continues into the Murge upland, and may in fact be more strictly related to control over high quality agricultural and pastoral resources. This hypothesis can be tested by targeted fieldwork in the Lepine uplands and the inland reaches of the Sibaritide.
- The ‘colonial’ settlement pattern in southern Italy was centered on the coast rather than on the hill country, and combined accessibility by sea with the presence of a substantial agricultural hinterland. In contrast, Rome’s early colonies were as much or more intended to fulfill strategic functions, so their locations meet other criteria of dominance – namely that of control over routes of attack

and advance. The fact that the viewsheds of the Roman colonies on the Lepine margin are both complementary and fall within the Higuchi 'middle range' distance creates support for the idea that these towns were located as much to control movement across the Lepine up- and highlands, as to control and protect communications and agricultural resources in the Pontine plain.

- As a tool for archaeological spatial analysis of territories, Thiessen polygons have been used extensively. The case study presented in section 2 of chapter 13 demonstrates the weaknesses of the technique in specific archaeological situations. The use of GIS and cost surface analysis allows the technique to be refined by replacing the simple gravity model of space with one in which each center can have its own 'weight' determining the relative size of its polygon, and in which characteristics influencing the accessibility of the terrain are used to determine the location of territorial boundaries instead of horizontal distance. Rank-size studies such as the one by Guidi (1985), although based on unreliable settlement sizes, when combined with X-Tent modeling techniques provide a more credible alternative to Thiessen polygons; another advantage is that they can be used to implement central place models as well as peer polity models of society.

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#### 4 CONCLUSION: REGIONAL ARCHAEOLOGICAL DATA ANALYSIS

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My research has shown that the type of regional archaeological data analysis required by landscape archaeological approaches is an area where both theory and method are still in their infancy. High-level theories about the occurrence, scope, and effects of processes such as centralization, urbanization, and Hellenization/Romanization cannot yet be supported by middle range theory, which itself cannot be developed until the basic business of generating information of sufficient quality about the archaeological record has been tackled. Currently, archaeological data can be made to fit almost any interpretation generated, ultimately, on the basis of the ancient written sources. If we are to escape from this self-reinforcing cycle, research should perhaps no longer be focused on the classical themes generated by culture-historical approaches, but should seek its own proper field of operation.

In the area of methods and methodology, I have demonstrated the pervasive influence of systematic research and visibility biases on the patterns that are present in the archaeological data generated over the past 50 years or so. There are mechanisms at work, both in the traditional archaeological interpretation of limited numbers of excavated sites and historical sources, and in the landscape archaeological approach, that cause the systematic undervaluation of unobtrusive remains. The significance of systematic biases in both the coarse site-based data sets resulting from desktop and 'topographic' studies and the more detailed site-based or 'continuous' data resulting from intensive field surveys has become much clearer as a result of the studies reported here. This should have practical consequences for the ways in which we study the existing archaeological record, plan future landscape archaeological research, and conduct field surveys. Site databases, the traditional starting point for regional archaeological studies, can no longer be taken at face value; rather, they require careful source criticism before being used to support specific arguments and hypotheses about settlement and land use dynamics. My studies have also shown that future data collection, whether through field survey, excavation or other methods, has to take place in a much more methodical manner if we are to produce data that are sufficiently standardized to be successfully exchanged, compared, and interpreted by others – guidelines for which should become embodied in an international standard defining 'best practice in landscape archaeology'.