Missing persons? Models of Mediterranean regional survey and ancient populations

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1 Introduction

The critical importance of demography for studies of the ancient world is widely recognized; for example, both the size and structure of populations are central to understanding the scale and organization of economies. The three principal sources of information derive from historical texts (e.g. manpower figures), comparative data (e.g. early modern societies) and archaeological evidence (e.g. the number and type of settlement sites). This article approaches the issue of demography primarily through the archaeological evidence for rural settlement, but inevitably touches upon textual and comparative data. The aim is to explore the potential and the problems of Mediterranean regional survey for demographic modelling drawing on case studies from Italy, Greece and North Africa. Specifically, it addresses concerns about recovery rates, or the percentage of settlement sites and, indirectly, population identified by surface survey.

Discussion is structured into four main sections. The first reviews the general literature on recovery rates, particularly their variability, and leads to consideration of the situation in the ancient Mediterranean. The next section presents opposing models of recovery rates in the context of the early imperial population of Italy and explores the implications for economic organization. The third section tackles the issue of the Italian population from an alternative model-building approach using the results of the Liri valley survey. Finally, issues of recovery rates and demographic modelling in Greek and North African contexts are used to develop a comparative understanding of population and wider economic organization across the ancient Mediterranean.

2 Recovery rates

Sites

Survey archaeologists have generated an extensive critical literature on the theory and method of archaeological field survey (see Barker & Mattingly 1999-2000). One particular area of concern is the degree to which patterns mapped by survey accurately reflect past settlement. In different circumstances, survey may either *over*estimate or *under*estimate the number of sites with obvious implications for spatial analysis and the reconstruction of population. Archaeologists such as Dewar (1991) have drawn attention to the 'contemporaneity problem': that is, the mobility of individual sites within any single archaeologically-defined period may lead to 'double-counting' and thus overestimation of site numbers. In effect, the recovery rate may be more than 100%. In the context of classical Greece, Osborne (2001) notes that site mobility may lead to exaggeration of the

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density – and significance – of rural population. Similarly, the misidentification of barns, seasonal shelters, and even burials, as permanently-occupied settlement sites (e.g. Osborne 1992) may also effectively lead to recovery rates of more than 100%. A further complication is that a site may change function over time; for example, Bintliff and Howard (1999) suggest that sites may evolve from farm to barn and back to a farm again. Each of these problems can be partly addressed with methodological refinements. Hence, settlement mobility could be partially mitigated by defining shorter chronological phases, and the misidentification of non-settlement sites (or phases) could be addressed through closer analysis of assemblages (e.g. artefact function).

Second, theoretical and methodological studies have demonstrated that a large number of depositional, post-depositional and sampling processes can lead to the *under*estimation of site density; indeed, the literature on reduced recovery rates is rather more extensive than that on exaggerated recovery rates; see Banning 2002: 39-74 for a summary of the former). By and large, attention has focussed on: a) those post-depositional processes such as alluviation and intensive agriculture which have 'degraded' settlement patterns, and b) the inadequacies of sampling procedures, for example, issues of surface visibility and variable fieldwalker efficiency. In each case, the effect is to reduce recovery rates to less than 100%. Often these 'biases' have been subject to quantification in order to allow for the numerical correction of survey results and the reconstruction of the 'original' numbers of sites (e.g. Terrenato & Ammerman 1996).

Such work has been invaluable for demonstrating the significant influence of post-depositional and sampling processes on recovery rates, but there is a danger that attempting to account for every possible bias in a quest for the 'ideal' distribution map risks reducing survey to the mechanistic application of method, with inadequate consideration of what the resultant 'perfect' map might mean. Such an approach seeks to empower the archaeologist in the present to control and understand the archaeological record, whilst systematically denying the very thing it claims to seek – the variability of past human behaviour (Witcher 2006a). For example, Banning's (2002) highly useful manual of archaeological survey attends carefully to recovery rates, but focuses almost entirely on post-depositional and sampling processes. Such issues are both important and fully worthy of study, but only indirectly touch upon the fundamental question under consideration here: variability of recovery rates *as a result of past behavioural and depositional practices*. For example, for current purposes, I am not concerned with those sites missed because of geomorphological processes, but rather sites missed because they did not make use of finewares and are therefore more difficult to find and date.

A number of archaeologists have called attention to the critical importance of such behavioural and depositional processes in the past and their influence on survey recovery rates. Pettegrew (2001) has argued that the process of site abandonment in Classical Greece could have profound influence on recovery rates; if sites were systematically stripped of portable artefacts and even roof tiles, there may be little (durable) material culture to enter the archaeological record in the first place, making 100% recovery of Classical Greek farmsteads unlikely. Millett (1991) and Fentress *et al.* (2004) note significant variation in the supply and consumption of diagnostic finewares across time and space as a result of diverse social and economic processes. For example, reduction in the availability of African Red Slip pottery in Italy as a result of political or military disruption may have led to increased market price and hence reduced availability to some social groups. If African Red Slip is the only diagnostic material available with which to detect and date settlement sites, such social groups may become less archaeologically visible. Hence, variation in the consumption and deposition of diagnostic material culture

suggests that recovery rates are not only less than 100% but are also uneven across time and space (Witcher 2006b: 45-9).

Again, some of these issues can be partially mitigated through methodological refinement: for example, the collection of coarsewares may assist the recognition of groups living outwith the fineware market. However, the almost infinite variety of these behavioural and depositional processes means that they are intractable for those who seek to discipline the archaeological record and to recover the 'perfect' distribution map. However, these processes are not inconvenient 'biases', but rather the proper object of study. This article therefore steers a careful course. I am interested in the (in)completeness of the archaeological record; I seek to address the fundamental paradox of understanding what has been missed in order that I can understand what has been recovered. However, I approach this issue not in order to correct 'biases' in the archaeological record, but rather to reconceive (some of) these patterns as valid insights into past human behaviour which have implications for reconstructions of economy and demography. The aim is not to establish specific population densities, but rather to explore the significance of variable recovery rates for understanding ancient societies more generally.

Dimensions of variability

The normative assumption which underlies the analysis of settlement patterns is "What You See Is What You Get" (WYSIWYG). Even when archaeologists acknowledge that recovery rates are less than 100%, there is a widespread belief that mapped settlement patterns are reliable. However, recovery rates may vary in a number of ways which questions this assumption and which makes the expression of a single recovery rate meaningless. Figure 1 demonstrates three ways in which recovery rates might hypothetically vary; in each case, numbers of sites are deliberately excluded in order to focus attention on the percentage recovery rates. Sites successfully identified are indicated in solid grey; missed sites are indicated by hatching. Figure 1a illustrates the effects of variable rates for different types of site, and consequently the effects on the overall shape of the settlement hierarchy. Both theoretical studies and field observation suggest that sites of different size and status are recovered at different rates. Banning (2002: 48-54, 69-72) summarizes research on the effects of site size and 'obtrusiveness'[1] on site recovery. Generally speaking, larger sites are likely to be better represented. Despite the wide acceptance of this phenomenon (e.g. Cherry 1983: 392-3), relatively few surveys explore the implications for settlement and population reconstruction.[2] In Figure 1a, the sites successfully recovered indicate a rather steep settlement hierarchy. However, when a variable recovery rate declining from 100% to 15% is introduced, the settlement hierarchy changes shape dramatically; for example, the numerical relationship between farms and off-site scatters is reversed. Figure 1b illustrates the effects of variable recovery rates over time. The sites successfully recovered indicate that Periods A and B had the same number of sites. However, when variable recovery rates are factored in, it becomes clear that a genuine increase in site numbers is disguised by a decline in recovery rate during Period B. In Period C, a modest increase in site numbers is exaggerated by a sharp rise in recovery rate. Finally, Figure 1c illustrates the effects of variation in recovery rates

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[1] Some types of artefact and site are easier to detect than others (e.g. monumental architecture, denser concentrations of material); when combined with field method (e.g. transect spacing) and environment (e.g. background noise), measures of obtrusiveness can be used to determine variable recovery rates; see Schiffer (1987 236, 347).

[2] E.g. Cambi's (1999) demographic model makes no distinction in the recovery of site types: House1 and House2. Wilson (2008: Tables 9-14) assumes the recovery of villages and villas to be 100% whilst assessing the effects of low farm recovery rates. For both of these models, see below.

over space (assuming each region to be equally sized). The sites successfully recovered indicate that Region D is much more densely occupied than Region C, but this is actually explained by a significantly lower recovery rate in the latter area.
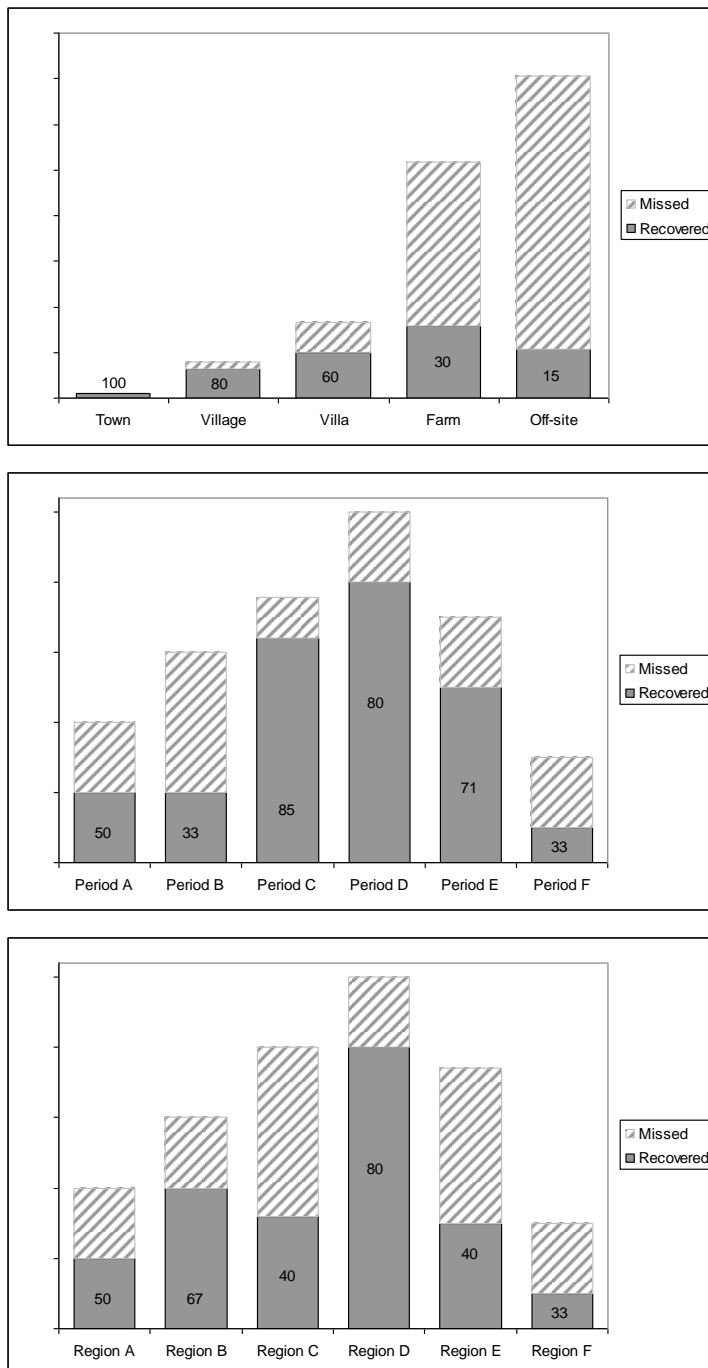
Figure 1: Hypothetical variation in recovery rates, a) across settlement hierarchy, b) over time, and c) across space.

In each case, relationships between site types, periods and regions are modified, even reversed, by the effects of variable recovery rates. This variation across settlement hierarchies, over time and across space presents potential difficulty for the use of survey data for spatial analysis and demographic modelling. It is difficult to estimate recovery rates even for a single area or chronological period; the problems rapidly multiply as we attempt to compare. Arguably, this situation lies behind the slow progress on comparative regional survey (generally, see Alcock & Cherry 2004; for examples of comparative

demographic studies, see Bintliff 1997a; Wilkinson 2004). This is not, however, a counsel of despair. It may be impossible to define precise figures, but the implications of variable recovery rates can be worked through in order to evaluate the implications for interpretation.

Insights from prehistoric and medieval landscapes

Above a simplistic distinction has been made between those processes leading to recovery rates of more than or less than 100% of sites. It is, of course, important to recognize that within any individual landscape, these processes may operate in tandem (Bintliff 1997b: 237-8; Chapman 1999): for example, a long period of high settlement mobility and socially-restricted ceramic consumption may lead to double counting of some sites and the failure to recognize others. However, in the context of the ancient Mediterranean world, it is arguably the underestimation of site numbers – or low recovery rates – which is the more significant. First, the intensity and duration of Mediterranean landscape use means that post-depositional processes are considerable (e.g. erosion, mechanized ploughing, urbanization, etc.); in turn, this can also make systematic archaeological sampling difficult. Second, Classical, Hellenistic and Roman pottery permit the definition of much shorter chronological phases in comparison to many prehistoric periods. As a result, the potential for over-counting is much reduced, though not necessarily removed altogether.

If site recovery is likely to be less than 100% and variable, what estimates are available? It is useful to compare briefly to the experience of other periods, for example, the late prehistoric or medieval. In both cases, there has been debate about the degree to which survey successfully recovers sites. In late antique and early medieval Italy, the sharp decline in settlement numbers has been taken to reflect historically-attested 'crises' such as plague, and political, military and economic instability (e.g. Hodges & Whitehouse 1983: 42); in other words, it is assumed that site recovery is high and that settlement patterns are reliable. Others have advanced less 'catastrophic' interpretations which argue that changing economic organization (e.g. production and exchange of pottery) and settlement location (e.g. hilltop nucleation) have depressed the number of sites located and exaggerated the impression of demographic decline; in other words, site recovery is comparatively low and unreliable (for summaries see Christie 2006: 412-28; Francovich & Hodges 2003).

In the context of prehistoric Greece, Bintliff *et al*. (2000) have argued that Neolithic and Bronze Age settlement in Boeotia may be 'hidden' for a variety of reasons including the disintegration of friable pottery when incorporated into the ploughzone and because scarce prehistoric artefacts are swamped by the abundant material of later periods. They argue that whole prehistoric landscapes have been systematically overlooked; in other words, site recovery rates are (extremely) low. A number of scholars have critiqued various aspects of this model and have asserted greater confidence in the reliability of prehistoric settlement distributions (e.g. Cavanagh 2004; Davis 2004). However, whilst the belief that 'What You See Is What You Get' does not presuppose that recovery rates are high in absolute terms, it does assume that different site types are recovered in broadly equal proportion.

Finally, in the Iron Age Salento (Italy), Burgers (1998) questions whether the sharp increase of sites during the eighth century BC was due to rapid demographic growth or due to increased accessibility of matt-painted wares to previously 'invisible' sections of the population. In other words, a large pre-eighth century BC population was already there, but is difficult to map because it did not use diagnostic pottery (i.e. low recovery rate), or survey has mapped a genuine increase in site numbers during the eighth century (i.e. high

recovery rate). On the basis of a consistent relationship between matt-painted wares and *impasto* in excavated contexts, Burgers (1998: 189) assumes the same situation holds universally and concludes that there was indeed a sharp increase in site numbers rather than an increase in access to matt-painted wares and therefore recovery rates; in turn, this decision shapes Burgers' model of social development in the immediately pre-colonial period.

These three examples demonstrate that there is little consensus about site recovery other than the belief that it is less than 100% and likely to have to varied widely across settlement hierarchy, time and space. Moreover, they demonstrate that recovery rates lie at the heart of profoundly different interpretations of the past (e.g. continuity vs. catastrophe, uniformity vs. variability). As survey has a virtual monopoly on the generation of long-term settlement and demographic data, it is incumbent upon archaeologists to pay close attention to recovery rates in order that their own and others' use of these data is more nuanced (Wilkinson 1999: 45).

What are the lessons for recovery rates in Classical, Hellenistic and Roman landscapes? If it is accepted that prehistoric and medieval pottery is comparatively rare and friable (a variety of opinions hold and it may be difficult to generalize, e.g. Cavanagh 2004), then its reduced ability to survive in the ploughzone should make this material a good indicator of recently-disturbed archaeological deposits in the immediate vicinity. Conversely, the more abundant and durable ceramics of the Classical, Hellenistic and Roman periods may be rather less reliable for the detection of settlement sites as even sherds incorporated via manuring may survive. Ironically, the very abundance and durability of Classical, Hellenistic and Roman material culture may make it less useful for mapping settlement (as opposed to 'activity'). Indeed, Davis (2004: 22) explicitly questions the automatic assumption that prehistoric sites are harder to find than later sites.

One advantage over the prehistoric period, if not the medieval, is the existence of a number of independent 'checks' in the form of texts recounting numbers of colonists, military manpower and census data. These sources have been used to work 'backwards' from 'known' population to site recovery rates. For example, in central western Italy, Cambi (1999) has compared between historical texts concerning the numbers of colonists and archaeological settlement maps in order to estimate the recovery rate of dispersed rural settlement in the Albegna valley. For the second century BC, he calculates that *c.*20-33% of farms have been recovered. Similar calculations based on the Classical period settlement evidence from Boeotia (Greece) suggest *c.*57% of small sites have been recovered (Bintliff & Snodgrass 1985: Table 5).[3]

Such independent 'checks' are useful, but are not unproblematic. First, few of these independent 'checks' provide unambiguous population totals and usually require assumptions to be made: for example, records of military manpower require knowledge or estimates of family size and service liability. In the case of the Albegna valley, Cambi (1999: 121) is obliged to make a number of assumptions, some of which might be contested: for example, he assumes 20% of colonists were located in urban centres and thus 80% were in rural areas. Second, the vast majority of landscapes do not have any associated textual sources; the principal evidence available for most areas is archaeological. In short, the examples outlined so far, have used 'known' population to estimate recovery rates; however, recovery rates are a means to an ends. We are not interested in recovery rates *per se*, rather, we are interested in site and population totals.

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[3] More recently, Bintliff (1997b: 233-6) has increased the estimated population size of larger nucleated rural sites, calculating a recovery rate of *c.*77%, and removing the need to postulate a low recovery rate for small sites.

In other words, we really need to be able to work from recovery rates to *un*known population (see Section 4).

Population

So far discussion has focussed on the recovery of sites and the reconstruction of settlement patterns. What about the recovery and reconstruction of population? Wherever regional field survey is practised, demographic reconstruction is cited as one of its key aims (e.g. Mediterranean, Bintliff & Sbonias 1999; Levant/Near East, Wilkinson 2004; Mesoamerica, Feinman *et al.* 1985). One strategy used by Cambi (1999) is to equate the number of sites with the number of households; this method does not require him to define household composition. This approach usefully circumvents difficult questions concerning household size and the relationship of households to the extent of artefact scatters (see Osborne 2004; for alternative approaches to population using this particular dataset, see Fentress 2009; Perkins 1999). However, in demographic reconstruction, household size and composition become important when considering overall population figures, demographic structures, and economic organization.

There are several methodologies for converting numbers of sites into population figures. The most basic quantifies the number of site types (e.g. farms, villas) and multiplies these by standard site populations (e.g. five persons per farm). The process is repeated for each chronological period. Populations of nucleated settlements (e.g. villages) are often calculated by multiplying their area by standard densities (e.g. 100–250 persons/ha). Dispersed and nucleated populations are summed to calculate absolute populations and divided by survey area to calculate population density (e.g. Catling 1996a; Fentress 2009; Witcher 2005). (Other approaches include various assessments of carrying or productive capacity, e.g. Goodchild & Witcher in press; Sallares 1991; Wilkinson 2004, or labour requirements, Ørsted 2000a)

Although such models have not ignored the issue of site recovery rates, they have not placed great emphasis on them (e.g. Fentress 2009; Witcher 2005); discussion of confidence in site interpretation and site population has taken precedence. Scheidel (2008) has been critical of such models for their lack of attention to the issue (see Witcher 2008a for a response to Scheidel's comments on Witcher 2005). Undoubtedly, the explicit or implicit assumption of high site recovery can have important implications for the reconstruction of population figures and their interpretation. For example, in her discussion of the population the Albegna valley, Fentress (2009) suggests villas and large farms are 'very hard to miss', but accepts that smaller sites may have been less thoroughly identified (as a result of destruction rather than limited use of material culture). However, she notes that even if the number of small sites (Farm1) were tripled in response to Cambi's (1999) suggestion of a 33% recovery rate, the overall effect would be limited. The additional 8000 persons represent a *c.*26% increase in population (Fentress 2009). To take these calculations to their logical conclusion, if the recovery of small sites were as low as 20% (Cambi's lower figure), the additional 16,000 persons represent a *c.*51% increase. The point at which these additional individuals become sufficiently important to change interpretations is clearly a matter of judgement. Clearly, however, Fentress' assumption of high recovery rates in the Albegna valley becomes significant in the context of her interpretation of the long-term history of the city of Cosa and its environs. In particular, she places explanatory weight on the demographic weakness of the region, resulting from warfare, colonization and malaria (Fentress 2003: 143; also Sallares 2002: 192-200). If the Albegna valley survey achieved lower recovery rates, and rural population was rather higher than suggested, Fentress' explanation of Cosa's 'intermittent' occupation would need refining in order to explain the discrepancy between a healthier rural population and the repeated failure of the city's population.

The only attempt to explore Mediterranean survey recovery rates in a quantified manner is Wilson's (2008) exploration of the effects of hypothetical recovery rates in the Biferno valley survey (also briefly, Witcher 2008a). Wilson notes that rural site density is very low and that consequently a very high percentage of the population appear to live in urban centres, a pattern quite different from other parts of central Italy (e.g. *suburbium*, Witcher 2005; cf. Greek surveys below). In order to reduce the high level of urbanization and bring overall densities into line with those suggested elsewhere in Italy, he suggests that recovery rates as low as 10-20% are not implausible. Of course, the key problem of evaluating recovery rates is the issue of negative evidence. Are sites absent or simply invisible? Evidence of absence or absence of evidence? Correction factors can be applied to survey results. However, Davis (2004: 33) warns that "real differences in empirical results [from survey] may be 'massaged away' in order to make them conform to prior expectations"; Fentress (2009) makes the same point in direct relation to demographic modelling. Wilson (2008: 245) observes that "[t]he sceptic may… feel that the conjuring of thousands of inhabitants… out less than a hundred sites in each period is a dubious exercise", however, he rightly asserts that the potential implications of recovery rates are such that it is important to consider them further.

3 Demographic models of Roman Italy: high vs. low recovery

The models presented by Cambi (1999) and Bintliff (1997b) start from 'known' population figures and work 'backwards' to define recovery rates. It is possible to apply a similar approach to the population of early imperial Italy using census figures. However, the most appropriate interpretation of these historical figures has generated intense debate (for a recent and comprehensive collection of views, see de Ligt & Northwood 2008). The details of this debate cannot be reviewed here (see Scheidel 2008 for an overview); for current purposes, it is sufficient to note that population estimates have polarized into the 'low count', broadly the consensus position, which posits an Augustan population of *c.*6-7 million (e.g. Brunt 1971) and the revisionist 'high count' which argues for a population of *c.*12-14 million (Lo Cascio 1994).[4]

In this section, a pair of models will be defined which take as their starting points the two competing figures for the early imperial population of Roman Italy. The intention is not to resolve the 'high/low count' debate (see Witcher 2008a and comments by Mattingly this volume), but to evaluate what these population figures might mean in terms of field survey recovery rates. The two contrasting recovery rates thus revealed allow us to discern two very different visions of Roman Italy. The recasting of the 'high/low' population figures, via recovery rates, into a different vocabulary permits an alternative approach to the debate.

First, the 'low count' model. In order to reconcile a population of 6-7 million with the evidence of regional field survey, it is necessary to accept a relatively high rate of site recovery. The densities of sites directly attested by survey are already sufficient to reconstruct a population of several millions if extrapolated across Italy as a whole. As it would only be necessary to double roughly the number of known sites to approach a population figure of *c.*6-7 million (i.e. a recovery rate of 50% or higher), the 'low count' scenario requires us to believe that survey has identified a large percentage, perhaps the majority of sites. Settlement patterns should provide a reliable (if not complete) picture of settlement and population.

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[4] Scope for an intermediate figure has been systematically rejected by both 'high' and 'low' counters on philological grounds, but there is increasing interest towards intermediate figures which are effectively modified versions of the 'high' or 'low count (e.g. Launaro 2008). Here, the figures of 6-7 million and 12-14 million are used to frame two models and to explore the implications. Section 4 goes on to address the archaeological evidence without the framework provided by the census figures.

The 'high count' model starts with an early imperial population in the order of 12–14 million. In this case, the settlement patterns mapped by archaeological survey can only be reconciled with such high population by assuming that site recovery rates are low, far below 50%, perhaps as low as 10%. This is because there are simply too few 'dots on the map' to accommodate such a large population. For 'high counters', it is necessary to believe that survey fails to recognize the majority of sites and population; such a small sample would provide an inadequate basis for demographic modelling and is unlikely to give a reliable overview of settlement in general. (For more detailed of discussion of these two models, see Witcher 2008a.)

Put simply, the 'low count' implies high recovery rates and the 'high count' implies low recovery rates. Starting with the 'known' (if disputed) census figures, it would be easy to allow this matter to descend into a critique of the efficacy of field survey and the search for methodological solutions (e.g. higher intensity, larger samples). This, however, falls into the trap of assuming that recovery rates are predominantly shaped by post-depositional processes which can be measured and corrected. In other words, it perceives recovery rates to be unrelated to the behaviour and organization of people in the past. Here, instead, the intention is to evaluate the social and economic conditions which may have led to these two very different recovery rates.

Why might recovery rates be high? The ability of survey to recover the majority of sites assumes that rural populations were well-integrated into urban and regional economies through the consumption of (diagnostic) material culture, especially (mass-produced) finewares and other manufactured and imported goods. Indeed, survey is dependent upon such goods in order to identify and date sites. These goods were presumably acquired in exchange at local markets for agricultural surpluses (including rural manufacturing such as textiles, e.g. Roth 2007). High recovery rates therefore suggest a rural socio-economic organization akin to Horden and Purcell's (2000: 270-7) Mediterranean peasantry: rather than independent and autarkic citizen-farmers, these rural populations were involved in agricultural production well beyond subsistence with regular exchange of surplus through regional economic networks in order to access a wide range of manufactured and imported goods (Witcher 2007).

Conversely, low recovery rates imply extremely densely-occupied landscapes but with very limited consumption of (diagnostic) material culture rendering settlement and population less visible. This situation points towards much lower surpluses and more limited contact with urban and regional markets. The alleged inability of survey to recognize the vast majority of the population actually indicates a fundamentally different socio-economic interpretation of Roman Italy.

Recovery rates and economic growth

The social implications of these two recovery rate models are discussed elsewhere; in particular, despite their differences, both reveal the marked regionality of early imperial Italy (Witcher 2008a). Here, the focus is upon the economic implications. Recently, scholars have considered the performance of the Roman economy and, more precisely, whether there is evidence for *real growth* (Jongman 2007: 185; Scheidel 2007). If population increases, but overall production remains stable, *per capita* income falls. If overall production increases in pace with population growth, then *per capita* income remains stable. It is only when production increases at a greater pace than population that *per capita* income rises. In other words, *real* growth requires both population and *per capita* income to increase simultaneously. Looking across the Roman Empire as a whole, both Jongman (2007) and Hitchner (2005) assume growing population during the late republican and early imperial period and seek to identify proxies through which to measure rising income, for example, numbers of shipwrecks and levels of meat consumption. Each

of these proxies contributes to an overall model of the Roman economy which emphasizes increasing scale and complexity. For example, Kron (2002) uses the archaeozoological evidence to document a substantial increase in average animal size; he argues that this reflects significant specialization of production within an integrated market economy. Improved nutrition, especially from meat consumption, is reflected in significant increases in mean human height (Kron 2005). Overall, Jongman (2007: 187, 191) concludes that "significant sections of the working population" shared in an improved standard of living.

The intepretations of Jongman and Hitchner do not necessarily require a commitment to either 'high' or 'low' population count[5] but the increased economic complexity and higher consumption proposed might be taken to suggest that it should be easier to see settlement and people in the archaeological record. For example, it is difficult to imagine that improved standards of living can be reconciled with the idea that table wares, cooking wares, amphorae and other portable material culture were entirely beyond the reach of the majority of the late republican and early imperial population (on pots as proxies, see Chapman 1999). In other words, the expanding economy as defined by Jongman and Hitchner would appear to imply high recovery rates. And in the terms of the two models outlined above, the implication of high recovery rates is a 'low count' population (this is, for example, the position of Fentress 2009 on the Albegna valley).

Is it therefore possible to reconcile the economic model outlined by Jongman and Hitchner with low recovery and a 'high count' population? Although post-depositional processes may account for a significant percentage of 'missed' sites, an equally – if not more important – consideration is that very low recovery rates are the result of the limited quantities of (diagnostic) material culture consumed by the majority of the rural population (see Rathbone 2008; Witcher 2008a). Rural sites are difficult to find because their inhabitants existed outwith regional and urban exchange networks. Such limited market engagement, perhaps indicative of small agricultural surplus, conflicts with the model of increased and integrated economic activity proposed by Jongman and Hitchner. Alternatively, it is possible that rural populations did produce agricultural surplus, but it was concentrated in monumental urban centres through rents and taxes. Again, however, this implies an exploitative relationship which leaves the rural majority substantially worse off than urban populations. Or perhaps rural wealth was invested in archaeologically-invisible ways, though this does not fit easily with Jongman's (2007: 186) assertions about that the quantity and diversity of Roman material culture in circulation.

Whichever way it is conceived, it seems improbable that very low recovery rates can be reconciled with an argument for real economic growth in Italy during the early imperial period. Low recovery rates are suggestive of a rural landscape densely-occupied by poor subsistence peasants. In contrast, the argument for real growth fits far better with the model of lower population and high recovery rates. The ability to identify more sites and more of the rural population is a function of their higher visibility as a result of greater participation in the market economy; specialization and agricultural surpluses permitted more opportunities for the acquisition of manufactured goods and imported foodstuffs. In this context, it is therefore interesting to note that Fentress' (2009) demographic models loosely correlate high recovery and low population with significant economic development (e.g. the export of murex purple and *passum* wine and the import of grain to Jerba).

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[5] Neither explicitly addresses the 'high/low count' debate. Both broadly argue for a growing population across the empire as a whole rather than Italy specifically, but both draw on much Italian evidence in the process. Growing late republican / early imperial population is widely seen as incompatible with the low count, but De Ligt 2004 has presented one method of reconciling the two.

However, it is important to consider issues of scale and regionality. Both Jongman (2007) and Hitchner (2005) work at highly generalized levels taking the Roman Empire as a whole. It is therefore possible, indeed likely, that not all areas experienced demographic and economic trends in the same way. For example, Hitchner (2005: 213) observes that the acquisition of thinly-occupied provincial areas allowed the *overall* economy to grow; in Italy, whether 'high' or 'low count', the population density was already high compared to other parts of the Empire and there was consequently less scope for such growth. Indeed, within Italy, it is possible to discern rather varied early imperial settlement trends. In the *suburbium*, the increase in settlement numbers during the early imperial period, combined with the abundance and diversity of material culture in circulation (Witcher 2005), make a good case for the coincidence of increasing population and higher *per capita* income, i.e. real growth. However, the declining numbers of settlements in areas such as inland Etruria and Samnium, and the relatively restricted material culture found on rural sites in these areas, is more problematic (for detailed regional comparisons, Witcher 2006a). Assuming high recovery, fewer sites suggests fewer people, but as Jongman (2007: 185) points out, even if *per capita* income rose as a result of this declining population, it would be perverse to see this as economic growth. Alternatively, settlement and population remained broadly stable, but recovery rates declined sharply; again, it is difficult to reconcile a reduction in the tangible evidence for wealth and market exchange with real economic growth.

Interpretations of the early imperial economy of Italy vary enormously; it has been argued to range from the moribund to the vibrant; in large part, this situation is the result of generalization of the archaeological and textual evidence (see Patterson 2006; Witcher 2006b). By linking population to recovery rates, it is possible to explore the socio-economic organization of Roman Italy. At a general level it is difficult to connect high population, low recovery and real economic growth. At a regional scale, it is possible to identify distinct demographic and economic regimes: some areas undergoing demographic expansion, economic growth and opportunity, others experiencing population decline, reduced economic activity and greater inequality. Some regions of Italy developed in quite different ways to the wider imperial economy. If there were real growth, there was important geographical variation in the distribution of "the advantages of wealth and luxury" (Hitchner 2005).

4 From sites to population in the early imperial Liri valley

The models in the previous section have used 'known', if disputed, population figures to establish recovery rates and their implications. However, this relies on documentary sources for population figures to estimate recovery rates; is it possible to work from recovery rates to population? This section reverses the approach, applying estimates of recovery rates to specific survey results in order to reconstruct population totals. Rather than establish precise figures for specific ancient populations, the aim is to develop a method of assessing the implications of variable recovery rates on the recognition of site types and population distribution. The following figures are excerpted from a dynamic spreadsheet which allows the impact of change to any individual parameter on the wider model to be assessed; in printed form, there is a danger that this particular set of variables takes on greater certainty than should be the case. It is clearly important to stress: this model is intended as an iterative device.

The model utilizes a simplified rural hierarchy of three site types: nucleated, large and small. In effect, these categories map on to village, villa and farm. However, these are contentious terms; for example, Rathbone (2008) has effectively critiqued the widely-used dichotomy of farm and villa. Yet, in practice, most surveys have collected and interpreted artefact scatters with these categories in mind (see comments in Witcher 2008a). 'Farms'

and 'villas' are extremely difficult if not impossible to eradicate from existing datasets (on use of legacy data, Witcher 2008b).

The model is populated by the numbers of nucleated, large and small sites of specific date recovered by survey. In this example, Table 1 uses early imperial period (AD1-100) settlement figures from the Liri valley survey (Hayes & Martini 1994).[6] To calculate the number of sites which the survey has failed to identify ('missing sites'), and therefore the total number of sites, it is necessary to define recovery rate. It is, of course, impossible to know the recovery rate without knowing the total number of sites. However, the aim of the model is not to establish *the* recovery rate, but to assess the implications of different recovery rates on population size and distribution.

	Survey area (km^2)	No. of sites recovered	Site recovery rate	No. of sites recovered per 100km^2	No. of sites missed per 100km^2	Total number of sites per 100km^2
Nucleated (village)	-	2	80%	2	<1	2
Large (villa)	-	12	60%	10	7	17
Small (farm)	-	93	30%	81	189	270
Totals	115	107	-	93	196	289
Percentages	-	-	-	32%	68%	100%

Table 1. Early imperial settlement sites (AD1-100) recovered and missed by the Liri valley survey based on hypothetical recovery rates.

The model permits the definition of different recovery rates for each site type (see Section 2). For small sites (farms), Cambi's (1999) figure of *c.*20-33% is widely-cited; Witcher (2008a: 291) argues that recovery rates for the early imperial *suburbium* are likely to be higher than this because of the greater abundance of datable material culture, but does not provide a figure. The Liri valley is at the limit of Rome's immediate territory, though settlement was more established than that in the fragile colonial landscape of the Albegna valley during the second century BC; an initial figure of 30% will be used. Next, large sites (villas). The larger size and greater consumption/deposition of obtrusive material culture (e.g. stone blocks, marble veneers, high densities of pottery) suggests that recovery rates should be set substantially higher than 30%. However, the rate is still likely to be less than 100%. The resurvey of previously reconnoitred areas suggests that although newly-detected sites tend to be small, it is also possible to identify a few comparatively large sites previously unrecognized by earlier survey (e.g. Di Giuseppe *et al.* 2002). Similarly, the comparison of results from parallel surveys of the same territory indicates that even large and high status sites can be missed (e.g. Fentress 1993; Witcher 2008b; also Mattingly this volume). Given the medium intensity of the Liri valley survey, an initial figure of 60% will be used. Finally, nucleated sites (villages). In the context of Roman Italy, this is a comparatively poorly-understood settlement category. Although many villages lack the monumental architecture and wealthy assemblages which increase the obtrusiveness of villa sites, the substantial size and dense surface scatters associated with villages should render them still easier to find; an initial figure of 80% will be used.

Populated with the numbers of each site type identified by the survey, and the estimated recovery rates, the model can calculate the hypothetical number of sites missed, and therefore, the total number of sites. For convenience, the model uses the survey area to

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[6] Alessandro Launaro provided a summary of the Liri valley survey figures drawn from his doctoral thesis.

standardize settlement figures per 100km². In this case, the Liri valley survey identified the equivalent of 81 small rural sites and missed 189 similar sites, for a grand total of 270. Overall, *c.*32% of sites were recovered and *c.*68% missed.

The effects of these variable recovery rates can be assessed by comparing the proportions of types of site recovered with the restored proportions, i.e. including those sites missed by survey (Figure 2a). In both cases, the settlement hierarchy remains 'bottom-heavy', but whilst the dominance of small sites increases only marginally, the significance of nucleated and large sites is halved. Figure 2b presents the same data, but expressed as numbers of sites rather than percentages. This demonstrates the dramatic increase in the numbers of small sites and the substantial re-shaping of the settlement hierarchy.
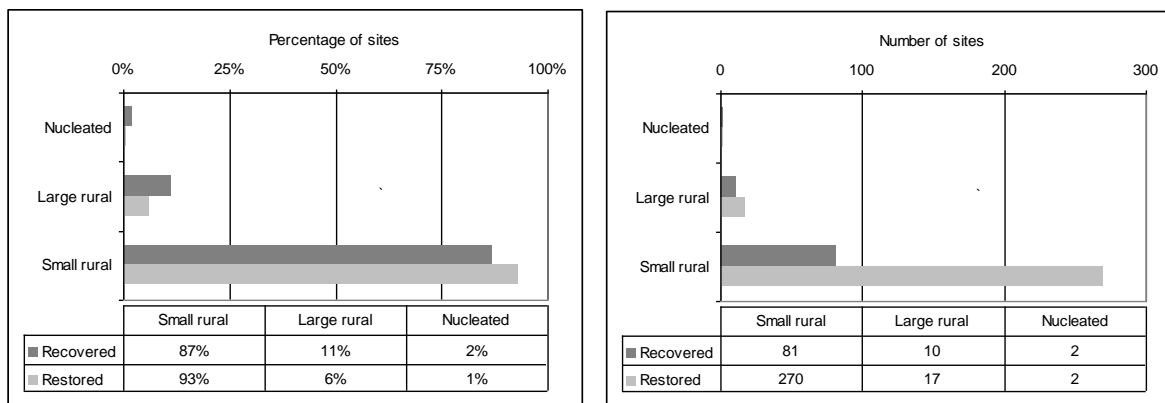

Figure 2. a) Recovered and restored proportions of sites by type; b) recovered and restored numbers of sites by type. NB all figures are rounded.
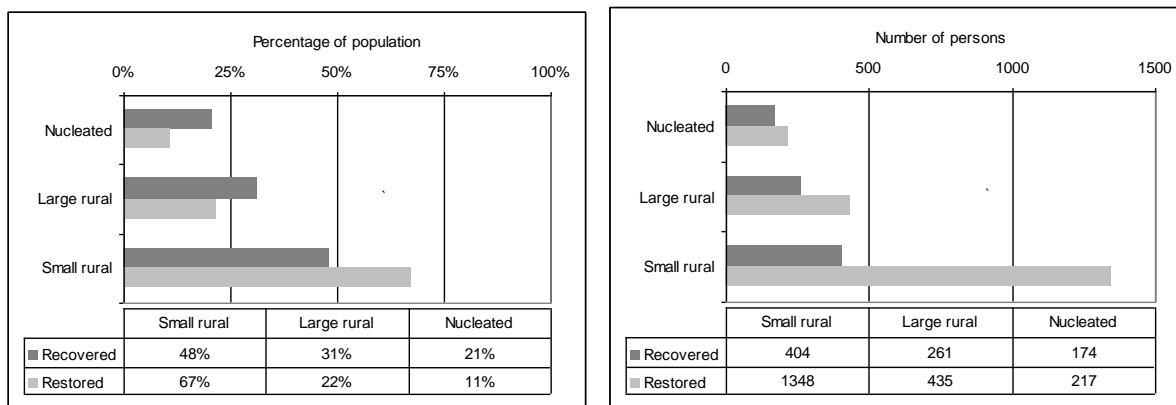
At this point, it is important to emphasize that the recovery rate of settlement sites is not necessarily the same as the recovery rate of population. This is because most settlement patterns, at least for the Classical, Hellenistic and Roman periods, are hierarchical. If survey recovers a higher percentage of larger sites with larger populations, then the population recovery rate will be higher than the site recovery rate. It is therefore useful to consider both site and population recovery rates.

Table 2 defines standard population sizes for the three site types. Such population estimates are contentious (Fentress 2009; Osborne 2004; Witcher 2008a) but again the aim of the model is to provide a means of assessing the effects of different figures (e.g. doubling the population of small sites). Using these figures, the model calculates the population recovered, missed and the overall total. Per 100km², the Liri valley survey identified 839 persons from a total of 2001. In other words, the survey identified 32% of sites, but 42% of the population. In this case, the 'bottom-heavy' nature of the settlement hierarchy means that the recovery of population is not substantially greater than the recovery of sites.

	Site population	*Population recovered per 100km²*	*Population missed per 100km²*	*Total population per 100km²*
Nucleated rural (village)	100	174	44	218
Large rural (villa)	25	261	174	435
Small rural (farm)	5	404	944	1348
Totals	-	839	1162	2001
Percentages	-	42%	58%	-

Table 2. Early imperial site populations recovered and missed by the Liri valley survey based on standard site population estimates. See Table 1 for associated site data and estimated recovery rates.

The effects of converting site recovery into population recovery can be assessed by comparing the proportions of recovered population by site type with restored proportions of population by site type (Figure 3a). The percentage of population living on small rural sites increases from 48% to 67%; Figure 3b demonstrates the dramatic implications in terms of actual population figures. If the estimated recovery rates are even approximately correct, then not only is it necessary to revise population densities upwards (from *c*.880 to 2001/100km^2), it may also be necessary to rethink the associated socio-economic organization: how integrated or otherwise was this rural population if well over half is invisible to survey?

	Small rural	Large rural	Nucleated
Recovered	48%	31%	21%
Restored	67%	22%	11%

	Small rural	Large rural	Nucleated
Recovered	404	261	174
Restored	1348	435	217

Figure 3. a) Recovered and restored proportions of population by site type; b) recovered and restored numbers of persons by site type. NB all figures are rounded.

The population of Italy

Although it is not the focus of this paper, at this point it is worth reflecting on the implications of the figures laid out in Tables 1 and 2 for the wider debate about the total population of Roman Italy discussed in Section 3. To extrapolate these figures to Italy as a whole requires two other variables. First, the percentage of Italy under cultivation; this can be set at 50% (for discussion, see Witcher 2008a: 291-2). Second, the rate of urbanization; this can be set at 15% excluding Rome. On the assumption that the Liri valley data are representative, population figures are projected across the 50% of Italy under cultivation (*c*.125,000km^2); Table 3 lists a total rural population of 2,500,000. This figure comprises 85% of the Italian total population to which an urban population of 441,176 (i.e. 15% of total) is added. The city of Rome adds another 1,000,000, for a grand total of 3,941,176. Clearly, this figure is some way short of the 'low count' population of 6-7,000,000.

	Population
Nucleated rural (village)	271,739
Large rural (villa)	543,478
Small rural (farm)	1,684,783
Rural total	2,500,000
Urbanization @ 15% of total population	441,176
Rome	1,000,000
Italian total	3,941,176

Table 3. Extrapolation of Liri valley population figures across Italy. See Table 1 for associated site data and estimated recovery rates, and Table 2 for associated population figures.

At this point, it is important to re-emphasize that the model is intended to be iterative not definitive. All of the individual variables input so far are subject to debate; the aim of the model is to explore the implications of different variables. For example, is the rate of urbanization too low? A total urban population of 441,176 (excluding Rome) equals *c.*1000 persons in each of *c.*430 towns. All else being equal, the current model would require a rate of urbanization of over 50%, averaging *c.*6000 persons per town, in order to achieve an Italian total population of 7,000,000. However, this may be rather too high for the majority of towns. At 150 persons/ha, towns would need to average 40ha at 100% occupancy to achieve populations of *c.*6000; most were smaller. For comparison, Morley (1996: Table 1) estimates 430 cities totalling 325,000 persons, or fewer than 1000 persons per town.

Another way to increase both urban population and total population is to raise the rural base. This could be achieved by lowering recovery rates and/or increasing site populations. Finally, a critical consideration is that the Liri valley figures may not be representative of the general Italian situation. Indeed, if the model is rerun with the same variables, but populated with the early imperial period results of the Biferno valley survey (5 villages, 16 villas and 68 farms/domestic sites across *c.*400km^2, Witcher 2008a: table 3), the result is an Italian rural population of 757,813, an Italian urban population of 133,732 (plus a further 1,000,000 at Rome) for a grand Italian total of just 1,891,544. Clearly, any attempt to reconstruct the population of Roman Italy as a whole needs to allow for significant regional variability in survey results, recovery rates, urbanization and site populations.

5 Comparative survey

Greek world

Inter-regional comparative survey has become a central theme of recent Mediterranean archaeological studies (e.g. Alcock & Cherry 2004). However, there has been limited consideration of recovery rates in this context. This final section demonstrates that by comparing assumptions about recovery rates in different regions, it is possible to raise significant questions. Examples are drawn from Greece and North Africa.

As in Italy, the reconstruction of the population of the ancient Greek world has been the subject of long debate. Recently, M. Hansen (2006) has developed the 'shotgun method' to approximate the population of the Greek world during the fourth century BC. Starting with the number and size of urban centres, he uses average population densities[7] to calculate a total urban population of *c.*3.3 million (encompassing both the Greek mainland and colonial areas). He observes that if the urbanization rate were 10%, overall population would be more than 30 million (*ibid.*: 29). He suggests that a total population of such a size is unacceptably high and argues for an urbanization rate of up to *c.*50% for a total population of *c.*7.5 million. However, Hansen does not clearly define how he establishes the upper limit on total population (e.g. comparison to nineteenth century population or carrying capacity; for the latter, see Sallares 1991). In other words, Hansen 'squeezes' the rural population between his calculated urban population and an expected but undefined total. Turning to the rural survey data, Hansen (2006: 71-4) reviews some of the problems

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[7] 150 persons/ha assuming 67% occupancy of small *poleis*, 50% of medium *poleis* and 33% of large *poleis* (Hansen 2006: 61).

of reconstructing population, but concludes they either do not affect the urban:rural ratio, or serve only to shift it in favour of urban population. He observes that the number of sites identified by survey indicate sufficient population to bridge the 'gap' between his estimates of urban population and the overall but unstated total. In other words, he more or less accepts the results of regional field survey at face-value; for Hansen, site recovery rates are high.

It is informative to compare this population distribution with the situation in Italy. In the fourth century BC Greek world, Hansen (2006: 23-4) adjusts his average figure rate so that small *poleis* have urbanization rates of 67%, medium-sized *poleis* 50% and large *poleis* 33%. These figures contrast sharply with those widely-assumed for Roman Italy, i.e. 10-20% (Wilson 2008: 245 notes the limited basis of this assumption). The Salento peninsula in southern Italy provides an intermediary area in which to discern the differences of Greek and Roman traditions. Yntema's (2008) brief consideration of the third century BC population of Messapia demonstrates an extremely high urbanization rate. Yntema explicitly assumes 50% rural site recovery and hence doubles the number of sites identified by survey. He also assumes rather higher site populations than other demographic reconstructions (8-12 persons per farm). He calculates urban population by assuming *c.*50% of walled areas were occupied at *c.*80-120 persons/ha. In other words, Yntema makes generous allowances to boost rural population in comparison to Hansen, but still reaches an urbanization rate of *c.*90%.[8]

In Hansen's approach to the broader Greek world, much depends on starting assumptions. For example, Price (??this volume??) questions frequently assumed urban population densities; fewer persons per hectare would lower overall urban populations and allow for a larger rural base – in effect, a low recovery rate. However, Bintliff (1997b: 237) suggests that even if recovery were low, it would make minimal difference for the overall distribution and total population of Classical Greece; similarly, Osborne (2001) notes that even if the site recovery rate of the Southern Argolid survey were reduced to just 10%, then rural population would only rise from *c.*26% to *c.*48% of the total. However, whilst the effect of low recovery is certainly less dramatic in Greece than in Italy, such an interpretation underplays the significance of the near doubling of rural population and, more importantly, neglects consideration of the possible reasons for such low visibility in terms of socio-economic integration.

In order to investigate the apparently high recovery rates in Greece, it is useful to approach the issue from a number of angles. Using the results of the Laconia survey, Table 4 summarizes the number of sites and calculated population distribution of the Archaic/early Classical and the Classical periods by site type. The figures demonstrate a modest reduction in population with a relative shift towards larger sites; much of this is the result of the abandonment of small farms.

	Archaic/early Classical (c.550-450 BC)			*Classical (c.450-300BC)*		
	No. of sites	*Population*	*% of population*	*No. of sites*	*Population*	*% of population*
Farmsteads	63	315	31%	27	135	16%
Villas	17	225	25%	10	150	17%
Hamlets	4	155	15%	7	270	32%
Villages	1	300	29%	1	300	35%
Totals	85	1025	100%	45	855	100%
Persons / km^2		14.6			12.2	

Table 4. Laconia Survey. Sites numbers and population estimates (based on Catling 1996a: Table 5.5)

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[8] Ranging from 10,000/145,000 to 15,000/117,000 (Yntema 2008: Table 1).

With due caution, the surveyors project these figures across Laconia as a whole. When Sparta and other large centres are included, this indicates an urbanization rate of *c.*50-60% during the Archaic/early Classical period, rising to *c.*57-64% in the Classical period. In other words, very similar to Hansen's urbanization rate in Greece as a whole.[9] However, even assuming 100% site recovery (which the surveyors do not, Catling 1996: 161), these population figures are almost double those of the nineteenth century; further, the surveyors note that this is relatively marginal agricultural land. If Hansen's 'acceptable' total is influenced in any way by nineteenth century population figures, his method might need revision.

The Laconia surveyors explicitly note a series of post-depositional processes which may have eroded or destroyed sites, as well as other visibility issues, which may have reduced the ability of survey to identify sites. The effects are likely to be biased towards the smallest sites which contribute the least population, but the correction will be upwards. Further still, there is a heavy reliance on finewares for site dating. "A generous selection of the most diagnostic [artefacts]" were collected from sites (Cavanagh *et al.* 1996: 43); 79% of these sherds are table wares (Catling 1996b: 87). Sites which did not make use of such tablewares are therefore likely to be under-represented. This does not mean that such sites existed, but there is an implicit assumption within the methodology of a certain level of economic integration and social status before a site is recognized.

Finally, both surface scatters and excavated sites demonstrate a clear shift in the quantity and quality of material culture in circulation during the fifth century BC; a reduction in ceramic imports to Sparta makes dating of locally-produced wares more difficult (Catling 1996b: 35). Hence, even if settlement numbers remained stable, a sharp reduction in recovery rates would be expected at this time (i.e. fewer sites identified; Pettegrew 2007 notes a similarly dramatic *in*crease in site visibility due to a surge in diagnostic material culture during the Late Roman period in Greece). Again, this does not rule out a nucleation of population – indeed, the foundation of several large hamlets clearly attests the importance of this category of site (Table 4). However, the disappearance of the smallest sites could be a result of reduced visibility, that is, not abandonment but poverty. In summary, the results of the Laconia survey offer a number of reasons to suspect that recovery may be neither as complete nor uniform as Greek demographers have assumed. These issues do not disprove Hansen's argument, but they should encourage greater attention to recovery rates in the interpretation of Greek survey.

Carter (1990: 406) uses a similar technique to Hansen to address the rural population around Metapontion. Using the estimated capacity of the *ekklesiasterion* at *c.*8000 citizens, he calculates a total population *c.*40,000. The fourth century BC city provided space for *c.*12,500, leaving *c.*27,500 in the surrounding *chora*. However, if the known settlement numbers for the period *c.*350-300BC are extrapolated across the whole *chora*, this indicates *c.*870 farms totalling only *c.*4500-9000 persons (*c.*22-44ppkm^2). Carter does not comment on the reasons that this figure should be so different to his expected figure of *c.*27,500, but this low rural total helps to maintain the high urbanization rate (*c.*58-74%) found in other Greek landscapes. Carter assumes 100% recovery; dividing the *chora* between these sites, he calculates overall agricultural production and notes that the scale of surplus is indicative of substantial profit. He notes that despite their small size, black-glazed wares and amphorae were collected from all farm sites, with the former comprising the main pottery classes recovered (*ibid.*: 408). This forms a coherent argument in favour

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[9] Hansen (2006: 70-1) stresses the issue of 'boundary effects' – i.e. urban:rural ratio is dependent on where the boundaries of the *polis* are drawn. He argues that the Laconia data cannot be used to address the issue because it is impossible to define where the political boundaries were. However, the surveyors' address this by extrapolating their results to the whole of Laconia.

of a "well-to do but also remarkably egalitarian society" (*ibid.*: 430). However, a lower recovery rate would not only reduce the size of these large hypothetical estates, but also depress overall surplus, shift the urban:rural ratio and create a rather less benevolent impression of rural society. In effect, we may only see the wealthy 'middle class' peasants and miss the poorest. This rather less egalitarian vision of rural society might also explain the discrepancy with Carter's calculated rural population.[10] Again, these are possibilities not proofs, but they put clear onus on surveyors to acknowledge and consider the issues of recovery rates for their interpretations.

In general, it appears that there are very different approaches to recovery rates in Greece and Italy. In Greece, there is an assumption of high recovery rates, perhaps because lowering rates is perceived to have limited impact, perhaps due to the powerful historical tradition of the *polis*. (In the Greek context, it is noticeable that there has been more debate about possible *over*counting, e.g. counting barns as farms, rather than low recovery.) Conversely, in Italy, there is a widespread if not universal belief that that survey recovers less than 100%, may be as low as 10-20%. In part, this difference may be related to the independent 'checks' which are used to frame understanding. Hence, in Greece, Hansen squeezes rural population between calculated urban population and an 'acceptable' total, possibly informed by nineteenth century figures or carrying capacity; as Greek survey has identified sufficient sites to bridge this 'gap', consideration of low recovery is deemed less important. In contrast, to achieve even the 'low count' Italian population of 7 million, it is necessary to assume *c.*50% recovery and probably considerably lower (see Table 3).

However, the implications of these very different recovery regimes for understanding of social and economic organization have been neglected. High recovery rates in Archaic/Classical Greece should be indicative of the close integration of rural populations into regional and urban exchange networks; the suggestion that Laconian farmsteads were subsistence-based and produced limited surplus for exchange (Catling 1996a: 197) seems difficult to sustain when survey collected finewares from all of these sites. In comparison, the farmers of Roman Italy appear to have struggled to acquire sufficient material culture to make themselves visible to survey. If more people shared in more wealth than ever before, becoming more specialized producers and more powerful consumers (Jongman 2007), it is difficult to explain why survey struggles to find them. Thus, inter-regional comparison promotes consideration of potential similarities and differences: did a more 'cellular' Greek economy promote greater local urban-rural integration? Did the more 'global' economy of the early imperial period expose Italian farmers to greater economic pressures?

North Africa

Finally, it is instructive to consider an example from North Africa. Discussing the results of the Segermes survey in northern Tunisia, the surveyors note that the sites recovered by the survey are affected by processes such as alluviation (Carlsen 2000:108; C. Hansen 2000: 58-9). Hence, when considering the farms of the period *c.*AD 200-450, they estimate an additional eight sites should be added to the 37 identified (i.e. *c.*82% recovery rate). This brings the figures broadly into line with those of the French colonial era, which are used more or less as an independent 'check'. Ørsted (2000a: 135-6) concludes a "virtually complete and at any rate representative picture of the ancient settlement pattern".

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[10] More recently, Carter (2006: 204-10, n.45) has reduced his estimate of the urban population to a maximum of 2000 households (i.e. 10,000 persons) with 1000 households (i.e. 5000 persons) in the countryside. This is an urbanization rate of 67%. New thinking about the so-called *ekklesiasterion*, and its unusual size in particular, may also reduce overall estimates for population.

However, despite brief mention of the invisibility of shepherds' huts (Ørsted 2000b: 174), there is no consideration of low recovery resulting from past behaviour.

As with Laconia, it is possible to identify potential variability in recovery rates. Settlement from the period AD200-450 (see Hansen 2000: 65-7) illustrates two relevant issues. First, the prominence of architectural remains amongst sites identified: *c.*90% have structural features, including over 50% with cisterns; just six sites comprise scatters of artefacts only. This situation may be related to Tunisia's different climatic and land use history compared to the northern Mediterranean. However, the prominence of architectural remains is extremely high compared to Greek and Italian survey results (on this issue, see Mattingly this volume). Second, there is a large number of undated artefact scatters (i.e. 30 scatters of generic Roman date); if added to the 62 sites dated to AD200-450, they would be sufficient to reconfigure settlement hierarchies and population totals.

Despite the surveyors' confidence that post-depositional disturbance is low, a number of factors question the assumption that recovery rates are high. The Segermes survey was primarily an architectural survey which collected samples of surface artefacts; it was clearly capable of identifying scatters, but did not necessarily prioritize them. As noted in Section 2, the more 'obtrusive' a site, the easier it is to find. Indeed, the surveyors note the particularly strong continuity of occupation at individual sites and the difficulty of relating artefactual and architectural evidence (Hansen 2000: 61). An alternative interpretation is that surveyors mapped sites with architectural remains and collected artefacts from each; within these assemblages it was then possible to identify artefacts from a number of other periods (cf. Bintliff *et al.* 1999 on discovery of prehistoric material on classical sites in Boeotia). Other sites, for example, single-phase sites from periods which are not characterized by stone architecture are likely to be under-represented.

Secondly, the surveyors explicitly note that the artefactual evidence is insufficient to reconstruct the occupational history of many individual sites (Hansen 2000: 59). Just 15% of the highly selective sample of material collected is diagnostic. If there are insufficient sherds available from many 'obtrusive' architectural sites, the ability to recognize more modest sites may be significantly lower. Indeed, the existence of 30 undated artefact scatters may be significant in this context; many sites are dated by structures not artefacts. Of course, none of this proves the existence of other sites, but it does stress that it is important to consider the possible effects of methodology on interpretation. Targeted resurvey work is one way forward.

Here attention has focussed on site recovery rates in the Segermes valley; Ørsted (2000a) goes on to develop a rather different approach to population reconstruction based on calculations of the labour necessary to work farm estates. The details will not be discussed here; it is sufficient to note that, in comparison to the methods outlined in Section 2, this approach may generate rather higher population estimates. This is clearly of relevance if attempting to compare regional population densities. Further, there is an important question surrounding the 'urban' status of the municipium of Segermes. Despite its unambiguous legal status and architectural form, a population of just *c.*200 persons would not clearly qualify as 'urban' in Greece or Italy.

In sum, what are the implications of inter-regional comparison? Quite different assumptions underlie the treatment of survey results in these case study areas. In the Segermes valley, surveyors have assumed a high rate of site recovery. Population was highly dispersed and density was low; the overall urbanization rate was *c.*12.5%.[11] Reducing the site recovery rate would increase rural population, but densities would

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[11] i.e. 200 at Segermes and 1400 in the surrounding municipal territory (or 2400 in the whole survey region). (Ørsted 2000b: 174). Urbanization rate: 200/1600 = 12.5%.

always remain low in comparison to much of Italy and Greece. However, low recovery rates would have a disproportional impact on the urban:rural ratio. With a population of just *c.*200, Segermes was a small centre; even modest reductions in rural site recovery would therefore impact dramatically on interpretations of the town's significance. Ørsted (2000a: 137) concludes a "very superficial Romanization of the countryside" in the Segermes valley, but it is worth noting the contrast between the architectural wealth of rural sites such as baths and cisterns, and the comparative lack of (diagnostic) portable material culture. If recovery rates were high as Ørsted believes, the rural population of Segermes appears to have been rather wealthier and more 'Roman' in its adoption of cultural practices (e.g. bathing and specialized agricultural production) than the populations of areas such as the Liri and Biferno valleys in Italy.

In contrast, in Greece, it is widely assumed that survey recovers the vast majority of rural sites, with population evenly divided between town and countryside. As a result of large urban size, rural site recovery rates would have to be significantly lower in order to diminish the relative importance of towns. Although the population of North Africa was dispersed and the population of Greece was nucleated, both areas share the assumption of high recovery rates and, by implication, closely integrated urban and rural populations. Italy presents greater difficulties. In areas such as the Biferno valley, recovery rates would need to be extremely low in order to populate the countryside to the levels identified in the *suburbium* or Laconia, or to reduce the high urbanization rates to 'expected' levels. But in Italy, both historical texts and comparative agricultural evidence explicitly allow the possibility of much lower recovery rates – and hence larger rural population – than is credible for Greece or Africa. Yet, if recovery rates are this low, then consensus interpretations will need to be radically rethought. If the small sample of Greek, North African and Italian surveys discussed here are representative, then the issue of recovery rates is more pressing in Italy because there is more at stake in terms of current understanding.

6 Conclusions

The aim of this discussion has not been to prove that the Greek rural population has been underestimated or that the Italian population cannot possibly have reached 14 million. Rather, it has sought to address the effects of recovery rates on understanding of Greek and Roman societies. Recovery rates have often been reduced to the identification and correction of post-depositional distortion or a convenient means of squaring the archaeological evidence with 'known' population figures or prior beliefs. Here, it is suggested that post-depositional processes must be taken into account, but of no less importance is the variability of past human behaviour. Sites, periods, and regions are rendered visible to survey in different ways because of different social and economic behaviour in the past; the result is variability in recovery rates. By reconceiving of this variability as the object of study, recovery rates become a creative means through which to investigate social and economic organization. By their very nature, it is impossible to define recovery rates with any precision or accuracy. Historical texts provide some independent 'checks', but their interpretation is no less problematical than the interpretation of the archaeological data. Neither source provides superior insight into demography; neither source provides conclusive evidence. However, their critical juxtaposition can improve overall understanding of the strengths and weaknesses of both.

Two different modelling approaches have been presented to explore the implications of variable recovery rates with particular attention to Roman Italy. Neither resolves the key demographic dispute about the size of the Italian population *per se*; but by shifting the debate towards the implications for interpretation of the archaeological record, these models take the subject forward in a new direction. Finally, inter-regional comparison has

made it clear that very different beliefs about recovery rates prevail in different regions. Recovery rates in Greece and North Africa are usually assumed to be high; conversely, recovery rates in Italy are often assumed to be comparatively low. There is likely to have been variability by period and by sub-region, but if these general trends are valid, then it is worth considering their significance. Hansen's 'shotgun method' can be critiqued in detail, but the Greek population remains relatively highly urbanized; similarly, the population of Segermes valley will remain highly dispersed. In Italy, it is possible to see marked differences between areas such as the *suburbium*, the Biferno valley and Messapia. For example, urbanization levels and rural settlement density vary enormously: either we accept that this is a reliable picture (uniform recovery), or use variable recovery rates to even out the differences. Either way, we are compelled to explain significant regional variability. Likewise, on the basis of his own demographic models for arid environments, Mattingly (this volume) raises a fundamental question about the relative intensity of agriculture in the Mediterranean heartlands and on the arid margins.

Evidence of absence is always intangible but the implications of recovery rates are sufficiently important that more sustained consideration is warranted (Wilson 2008: 252). We must consider recovery rates or we risk allowing methods to determine interpretations. One of the most important successes of regional survey has been to populate ancient landscapes 'beyond the acropolis' (e.g. Snodgrass 2002: 188). But there is still much we do not understand about the significance of what we map; and potentially, there are many more people still to be found.

Acknowledgements

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