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# Sprawl, Squatters and Sustainable Cities: Can Archaeological Data Shed Light on Modern Urban Issues?

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*Ancient cities as documented by archaeologists and historians have considerable relevance for a broader understanding of modern cities and general processes of urbanization. This article reviews three themes that illustrate such relevance: sprawl, squatter settlements and urban sustainability. Archaeology's potential for illuminating these and other topics, however, remains largely unrealized because we have failed to develop the concepts and methods required to analyse such processes in the past. The following aspects are examined for each of the three themes: the modern situation, the potential insights that archaeology could contribute, and what archaeologists would need to do to produce those insights. The author then discusses some of the benefits that would accrue from increased communication between archaeologists and other scholars of urbanism.*

Do archaeological studies of ancient cities have any relevance for understanding the processes and problems of urbanization today? The media and popular press certainly imply that this is the case. *National Geographic News* tells us that 'Sprawling Angkor [was] brought down by overpopulation' (Brown 2007). The Environmental News Network reports that 'Researchers [at Tell Brak] rewrite the origins of ancient urban sprawl' (Environmental News Network 2007), whereas the Planetizen web site says of the same site, 'Ancient cities were clusters, not sprawl' (Berg 2007). *Scientific American*, on the other hand claims that 'Ancient squatters [at Tell Brak] may have been the world's first suburbanites' (Biello 2007). In his bestseller, *Collapse*, Jared Diamond (2004) warns us about the fates that awaited non-sustainable ancient cities. This kind of facile ancient-modern comparison is a staple of the media (and of university public relations offices), but does it signal any real significance for research on comparative urbanism? It is hard to answer this question because no one has attacked the issue with rigorous data and methods.

In this article I argue that archaeological research on ancient cities has considerable potential to increase our understanding of modern urban issues and problems, but it will require that archaeologists undertake conceptual and methodological work before this

potential can be realized. This work will not only allow better comparisons of ancient and modern urbanism, but it will also improve our understanding of some of the social dynamics at play in the cities of the past. In order to illustrate the reciprocal relationship between analyses of ancient and modern urbanism, I limit my focus to three topics — sprawl, squatters or informal settlements and urban sustainability. These are the targets of considerable bodies of research for modern cities, but archaeologists for the most part have yet to address them systematically. This is a programmatic article, and I present only limited amounts of data to support my assertion. Although I do briefly explore the analysis of these topics within one ancient urban tradition (Prehispanic central Mexico), that exposition is merely for illustrative purposes; it is not a fully worked-out case study. Archaeologists have not yet analysed our data or conceptualized our findings in ways that can inform research on modern urbanism in a convincing manner.<sup>1</sup>

The first question to consider is whether ancient and modern cities are actually comparable. After all, the modern world is quite different from the ancient world in countless ways, and one could easily argue that cities in the two settings are so radically different that serious comparisons are doomed to fail. But in fact we have surprisingly little empirical evidence for

the nature and extent of differences between modern and ancient cities because the two phenomena have rarely been studied together using common methods and concepts. This situation presents a stark contrast to comparative research on state-level economies, where comparisons between ancient and modern economic systems have been endlessly researched and debated with ample presentation of empirical data and theoretical perspectives (see the review in Smith 2004). In my opinion, considerable comparative research will be needed to evaluate the similarities and differences between ancient and modern cities (Smith 2009a). Urban scholars have suggested some of the factors that have produced transformations in cities and urban processes in the twentieth century, and these provide a starting point for comparative research.

Most urban scholars stress advances in transport and communications as major forces that shaped new urban forms and processes in the modern era (e.g. Vance 1990; Jackson 1985). Environmental historian John R. McNeill (2000, 281) notes that 'twentieth-century urbanization affected almost everything in human affairs and constituted a vast break with past centuries'. He cites the size of cities, the amount of garbage and pollution, and the extent of ecological footprints as the major differences between twentieth-century cities and their predecessors. Political economists Gordon McGranahan and David Satterthwaite (2003) emphasize changes brought by the end of colonialism in the third world (2003, 247) and by the expansion of global capitalism: 'The most important underpinning of urban change during the twentieth century was the large increase in the size of the global economy' (2003, 246). On a smaller scale than these grand forces, life in cities today is quite different from the past, in everything from expanded life expectancy, to the prevalence of planning and zoning, to the growth of surveillance practices.

On the other hand, some writers acknowledge these differences but still argue that ancient and modern cities can be considered within the same frame of reference for many issues. This view is expressed most frequently by scholars working on the urban built environment. Amos Rapoport, in particular, urges urban scholars of the built environment to draw on all historical periods, all cultural traditions, and all kinds of buildings (Rapoport 1983, 250). Rapoport (1973) and other scholars (e.g. Hakim 2007) suggest that traditional cities hold lessons that can help architects and planners achieve more satisfactory urban contexts today. Archaeologist Monica Smith states that,

Rather than seeing cities as fundamentally changed by the advent of the Industrial Revolution and the global connections of the modern world, new anthropological research suggests that both ancient and modern cities are the result of a limited range of configurations that structure human action in concentrated populations (M.L. Smith 2003, 2).

This is a reasonable hypothesis that forms the basis for the arguments that follow.

### **The problem of recentism**

Before proceeding to my analysis, it is useful to consider the issue of 'recentism', a scholarly trend that currently places limitations on comparisons between ancient and modern social phenomena such as cities and urbanism. Recentism describes the situation in which historical scholarship on social topics focuses increasingly on later and later periods, ignoring earlier epochs. This phenomenon was identified (and named) by historical geographers through the analysis of articles in the leading journals in their field. Whereas historical geography journals used to include a substantial number of papers on early time periods, scholarship today focuses almost overwhelmingly on the nineteenth and twentieth centuries (Sluyter 2005; 2010; Jones 2004). Similarly, a simple comparison of two benchmark 'global' works on historical and environmental geography (Thomas 1956; Turner *et al.* 1990) shows the preponderant concentration on recent periods in the 1990 book compared with the first volume in 1956.

This trend is not limited to historical geography; indeed my impression is that recentism may be even more rampant in other branches of historical social science. For example, a recent collection titled, *Comparative Historical Analysis in the Social Sciences* (Mahoney & Rueschemeyer 2003) includes almost exclusively analyses of political processes in the past two centuries by political scientists. The '*Big Structures, Large Processes, and Huge Comparisons*' in the title of a book by social historian Charles Tilly (1984) are evidently not big enough to extend much earlier than the industrial revolution. Tilly's consideration of the field of urban history (Tilly 1996) similarly does not extend very far beyond the past three centuries, and in this scope it matches most of the content of the two leading urban history journals, *Journal of Urban History* and *Urban History*. This kind of limited-perspective, recentistic, scholarship not only hinders comparisons between ancient and modern cities, but it can also preclude our discovery of cycles, trends, and other temporal patterns over long periods of history.

In a paper that tries to get beyond recentism in geographical analyses of imperialism and colonialism, Rhys Jones and Richard Phillips make the following argument. If one substitutes the word 'urbanism' for 'colonialism', this quotation nicely epitomizes the approach I advocate in this article:

We have shown that there are no *a priori* grounds for maintaining a binary distinction between modern and premodern forms of colonialism. The shift to modernity did not mark the emergence of a totally new type of colonialism. Adopting a broader temporal outlook would enrich our understanding of colonialism as a set of social and spatial practices, conceptually, by enabling us to examine the limits of colonialist practice, and empirically, but exploring the varied temporal and spatial contexts under which colonialism has been exercised (Jones & Phillips 2005, 155).<sup>2</sup>

## Sprawl

Urban sprawl is generally regarded as one of the major problems accompanying contemporary urbanization in less-developed countries. In spite of a vast amount of research on sprawl, many of its components remain poorly understood (and hotly debated). Analogous processes can be identified in the ancient world, leading to the notion that research on ancient sprawl could illuminate aspects of the contemporary situation.

### *The contemporary situation*

Urban sprawl, the extension of low-density settlement outwards from cities into the countryside, is an almost ubiquitous feature of contemporary settlement in the developed world. The scholarly and popular literatures on sprawl are enormous. Research themes include methodological studies of how to measure sprawl, analyses of its economic causes and consequences, studies of relevant laws and codes, searches for new approaches to non-sprawl regional planning, and aesthetic studies of the effects of sprawl. Major books include Bruegmann (2005), Duany *et al.* (2001), Soule (2006), Hayden (2004) and Jackson (1985); helpful recent review articles include Ewing (1994), Galster *et al.* (2001) and Garnett (2006) and Miller (2008).

Sprawl is a highly complex (and politically-charged) phenomenon and it has a very wide range of definitions and associations among scholars, popular writers, and politicians. Galster *et al.* (2001) analyse social science definitions of sprawl and conclude that they differ by their relative emphasis on eight distinct dimensions: density, continuity, concentration, clustering, centrality, nuclearity, mixed uses and proximity.

According to Ewing (1994), most people view sprawl in terms of one or more of four 'archetypes': low-density development, strip development, scattered development and leapfrog development.

As is the case with many social phenomena, some definitions of sprawl are sufficiently general to include settlement around ancient cities, whereas others limit consideration to the modern world, effectively precluding the study of premodern sprawl. Here is a sample of three succinct definitions of sprawl that range in their conception and applicability from restrictive and limited to more open and broad:

a process of large-scale real estate development resulting in low-density, scattered, discontinuous car-dependent construction, usually on the periphery of declining, older suburbs and shrinking city centers (Hayden 2004, 7–8).

Sprawl is usually defined as 'haphazard growth' of relative low density over an extended region, with residential units dominated by single family homes. It implies a lack of planning and often results in the duplication of public services, such as policing, fire fighting and elementary education (Gottdiener & Budd 2005, 145).

low-density, scattered, urban development without systematic large-scale or regional public land-use planning (Bruegmann 2005, 18).

Although there is a general agreement on a variety of factors that cause or favour sprawl, there are fierce debates over their relative importance. The major forces favouring sprawl include:

- rising incomes;
- highway construction and other factors favouring automobile use in and around cities;
- poor mass-transit systems;
- market forces affecting land values and job locations;
- the fragmented nature of laws, administration, and planning within metropolitan areas;
- political relationships between developers and local officials.

It is generally assumed that sprawl is a contemporary phenomenon brought on largely by the expansion of automobile use. Most writers emphasize its negative costs for society. Ewing (1994) summarizes the major costs identified in the literature as follows: psychic costs (e.g. deprivation of access to services or environments); excess travel and congestion; energy costs; environmental costs; inflated costs of infrastructure and services; loss of agricultural land and open spaces; and downtown decay. Because of these costs many discussions of sprawl take a strongly negative tone (e.g. Hayden 2004; Kunstler 1994).

In a controversial study, architectural historian Robert Bruegmann (2005) downplays many of the negative characterizations of sprawl. Bruegmann's major points may be summarized as follows:

- sprawl is not new; it accompanied virtually all cities from earliest times and it is what most people naturally desire in the absence of government coercion;
- sprawl results from the actions of the free market, not government policies or laws;
- the harmful side-effects of sprawl are overrated by its critics;
- any government regulation to limit sprawl will artificially restrict the housing supply and raise housing prices;
- the anti-sprawl movement consists of upper middle class elitists who want to tell working class people where and how to live.

Needless to say, Bruegmann has been attacked by anti-sprawl crusaders such as James Kunstler (2006). Lewyn (2007) and Garnett (2006) provide more reasoned evaluations of his book and ideas.

I do not wish to get involved in the debates about sprawl and Bruegmann's ideas, but his book is important because it contains one of the broadest historical perspectives in the sprawl literature (see also Jackson 1985, chap. 1). Bruegmann claims that urban sprawl existed 'in almost every era in urban history' (Bruegmann 2005, 21). His evidence for this situation prior to the nineteenth century, however, consists entirely of a brief consideration of villas outside of Imperial Rome. Bruegmann's claim is clearly open to empirical investigation; was sprawl indeed universal around ancient cities?

#### *What can archaeology contribute?*

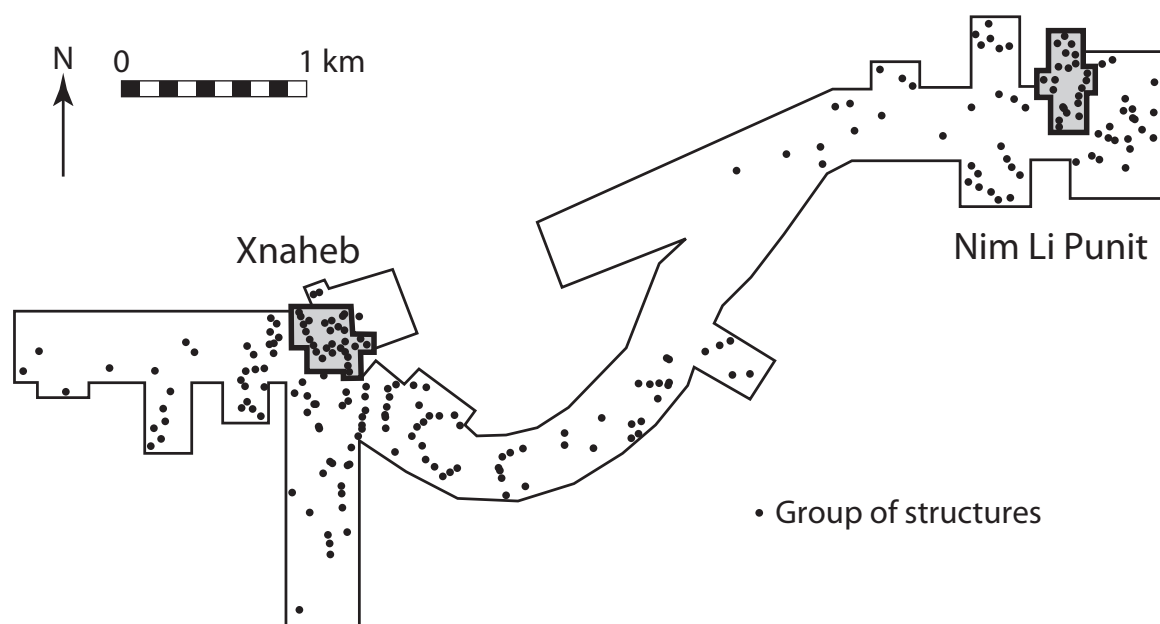
There can be little doubt that sprawl, following Bruegmann's definition ('low-density, scattered, urban development without systematic large-scale or regional public land-use planning': see above) existed around many ancient cities in various parts of the world. This is easiest to show for walled cities and towns. In nearly all known cases — from China to medieval Europe to Mesoamerica — walled cities and towns were accompanied by extra-mural or suburban development. Of the Mongol capital that would eventually become Beijing, Marco Polo (1903, vol. 1, 412) reported, 'There is a suburb outside each of the gates, which are twelve in number, and these suburbs are so great that they contain more people than the city itself' (for earlier Chinese examples see Steinhardt (1990)). A similar situation characterized many or most medieval walled towns in Europe,

where the roads outside the gates were typically lined with houses (Keene 1975). The best-studied walled city of ancient Mesoamerica, Mayapan, also had a substantial residential zone outside of the wall (Russell 2008), and extensive extra-mural suburban zones have been identified at Tell Taya and other Mesopotamian cities (Van De Mierop 1999, 68–73).<sup>3</sup>

Nevertheless, it is one thing to point out examples anecdotally like this and quite another to produce reliable systematic data. To fully evaluate Bruegmann's hypothesis would require a level of sampling and comparative analysis of ancient cities that has yet to be attempted. If archaeologists were to undertake such a study, the resulting documentation of the extent and nature of sprawl around ancient cities might provide some context for interpreting variations in sprawl in the modern world. More productive than the simple identification of ancient sprawl would be research on the causes of the variation identified in such a study. It would be interesting to learn, for example, whether cities with developed wheeled transport systems (e.g. in Roman or medieval times) had more sprawl than their counterparts in economies without wheeled transport (e.g. the Andes and Mesoamerica). This could help illuminate the debate over the role of automobiles in modern sprawl.

Any reliable connections that archaeologists could make between sprawl levels and contextual variables (city size, regional demography and settlement pattern, agricultural productivity, technology, political regime, etc.) would not only increase our understanding of ancient urbanism, but it would also improve our understanding of general processes of urban expansion and settlement. This in turn could both increase understanding of parallel factors in the modern world. Archaeologists need to keep in mind that it is one thing to identify similar spatial forms and quite another to infer similarities in the dynamics that produce the forms. In his classic study of suburbanization in the United States, Kenneth Jackson (1985, 13) makes a useful distinction between 'the suburb as a residential place' — an ancient pattern — and 'suburbanization as a process', a synonym for the modern process of sprawl.

These remarks illustrate the general approach to ancient–modern urban comparisons that I advocate. I do not claim that research on ancient processes of sprawl will produce knowledge that can be used by regional planners to reduce sprawl in specific instances. Rather, my argument is that there are probably general patterns and processes in urban settlement expansion that affected societies in the past just as they affect modern societies. If archaeological



**Figure 1.** *Sprawl-like settlement along transects at the Classic Maya towns of Xnaheb and Nim Li Punit in southern Belize. Each dot is a group of structures. Most groups consist of four to six buildings arranged around a patio; these probably correspond to one or more extended households. (Map redrawn from Jamison 1993, 237.)*

research can increase our understanding of some of these general processes, then such knowledge may in turn aid in the understanding of processes of sprawl in the modern world (beyond the obvious benefits of better understanding of ancient urbanism and sprawl).

#### *What do archaeologists need to do?*

In order to address the issue of ancient urban sprawl systematically, archaeologists will need to work on data, methods and concepts. The empirical work is alluded to above: we need a systematic comparison of ancient cities using a logical and problem-oriented sample. No one has come anywhere close to accomplishing such a task. One reason for this is the conceptual and methodological issues that have to be worked out first. Measuring sprawl is a difficult endeavour today (Huang *et al.* 2007; Galster *et al.* 2001), and as yet there is little work on how to measure such settlement in preindustrial systems using archaeological data.

The site-based surface survey methods common in many regions (e.g. Kowalewski & Fish 1990) may prevent the identification and analysis of sprawl settlement. Fieldworkers make judgments about site boundaries based on surface artefact densities. Even when different density classes are used (for example, the compact *vs* dispersed village types used in central Mexican surveys: Sanders *et al.* 1979), archaeologists

still make judgments about whether a given patch of ground is inside or outside of the site. In this approach, non-site or off-site settlement — by definition — does not exist, and lower-density suburban settlement could easily lie outside of the identified urban zone. The intensive non-site survey methods employed in the Mediterranean (Barker & Mattingly 1999–2000; Wilkinson 2003; Alcock & Cherry 2004) are far more appropriate for studying the gradations in settlement density that likely characterized ancient sprawl or suburban settlement.

‘New urbanist’ scholars of urban sprawl make use of transects running from city centres into the hinterlands to monitor density and land-use patterns (Talen 2002; Duany & Talen 2002), a method that resonates with the use of surface collection transects by archaeologists employing intensive survey to study urbanism in the Mediterranean Basin (e.g. Bintliff *et al.* 2008) and the Maya lowlands (e.g. Puleston 1983). For example, Figure 1 shows settlement within transects around two Classic period Maya towns — Xnaheb and Nim Li Punit (Jamison 1993). Residential groups seem to sprawl out from the former town to a greater extent than from the latter, although the reasons for this pattern are not clear. The use of such transects is a method whose adoption in other areas would contribute greatly to our ability to analyse urban settlement and sprawl in the past.

In contrast to the topics of informal settlements and sustainability discussed below, archaeologists already have a number of concepts and bodies of research appropriate for the study of ancient urban sprawl. This is an issue of settlement patterns, a topic with a long history of archaeological analysis. Roland Fletcher's (1986; 1995) comparative work on settlement densities is very pertinent here, as is research linking rural settlement density to the labour needs of intensive agriculture (Netting 1993; Drennan 1988). Processes of settlement aggregation and dispersal have been studied extensively in the US Southwest (Varien 1999; Adler *et al.* 1996). Although the non-urban character, and environmental particularities, of the Southwestern societies may limit the applicability of such concepts as analogues for the urban systems discussed here, some of the methods and concepts from this research can be adapted to the study of ancient cities and sprawl.

One conceptual and methodological problem for the study of ancient sprawl is how to deal with low-density urban centres. Nearly all of the literature on modern sprawl, and most of the literature on urban history, assumes that cities are high-density settlements. Thus the identification of areas of lower-density sprawl that may surround them is more of a methodological than a conceptual issue. But in a number of urban cultures in tropical areas around the world — e.g. the Classic-period Maya, the Khmer of Angkor, and many precolonial cities of Africa — ancient cities had low population densities. In many or most of these cities, the central civic-ceremonial zones were carefully planned but residential areas were not (Smith 2007; 2009b). Following Bruegmann's definition ('low-density, scattered, urban development without systematic large-scale or regional public land-use planning'), the entire residential areas of these cities could be considered sprawl.

Should we consider ancient low-density urban centres as nothing but sprawl? These cities must have had very different settlement dynamics from the high-density cities and towns more common in the western urban tradition, an observation explored in several works by Fletcher (1995; 1998; 2009). Perhaps we should call these settlements 'sprawl cities'. In any case, comparative research on ancient sprawl will have to deal with this diversity in urban form and population density, and such work will no doubt increase our understanding of these ancient cities, whether or not the ancient settlement dynamics turn out to be comparative to modern processes.

### Squatters (informal) settlements

Just as sprawl is a major issue facing cities in the developed world, squatters or informal settlements and their associated poverty are widely seen as one of the most serious problems facing cities in less-developed countries.<sup>4</sup> A number of commentators have pointed out continuities between ancient urban settlement and modern informal settlements and it is worth exploring these continuities in more detail.

#### *The contemporary situation*

The United Nations Centre for Human Settlements defines squatter settlements as follows:

Squatter settlements are mainly uncontrolled low-income residential areas with an ambiguous legal status regarding land occupation; they are to a large extent built by the inhabitants themselves ['self-help housing'] using their own means and are usually poorly equipped with public utilities and community services (UNCHS/Habitat 1982, 15).

Although some authors suggest that such settlements have existed from the time of the earliest cities (see below), urban informal settlements exploded throughout the less-developed world in the mid-twentieth century. At first, municipal authorities and development professionals deplored these crudely built shanty-towns and tried to destroy them and prevent their spread. A number of myths about them were promoted, most of which were subsequently disproven by research; these myths include the notions that the settlements are chaotic and unorganized and serve as places of social breakdown and centres of crime (Mangin 1967).

Tremendous surges in growth occurred in informal settlements around the world, quickly outpacing both attempts to destroy them and programs to provide services. Scholarly views of squatter settlements began to emphasize their positive features and some development experts started to promote self-help aid instead of clearance and destruction. The publications of John Turner (1972; 1991) were influential in this shift of emphasis (for historiographic analysis, see Harris 2003). Turner's basic ideas can be summarized as follows:

- self-help construction is valuable, both as a form of housing the poor and as a source of satisfaction and engagement of the builders;
- governments should assist owner-builders, not hinder them;
- the poor are rational and entrepreneurial, and squatter settlements are solutions, not problems (summarized in Harris 2003, 251).

The notion that people were building their own homes as they liked, rather than accepting government housing or control, is celebrated by Colin Ward:

The poor of Third World shanty-towns, acting anarchically, because no authority is powerful enough to prevent them from doing so, have three freedoms which the poor of the rich world have lost. As John Turner puts it, they have the freedom of community self-selection, the freedom to budget one's own resources and the freedom to shape one's own environment. In the rich world, every bit of land belongs to someone, who has the law and the agents of law-enforcement firmly on his side. (Ward 1973, 70; see also Ward 2002)

As with sprawl, the scholarly literature on informal settlements is enormous. In addition to the works cited above, a few of the major studies are: Mangin & Turner (1969), Caminos *et al.* (1969), Lloyd (1979), Hardoy & Satterthwaite (1989), Pugh (2000), UN-Habitat (2003) and Davis (2006).

A number of authors have noted that squatter settlements (i.e. informal unplanned residential zones on the edges of cities) have a long history. In his book, *Shadow Cities*, journalist Robert Neuwirth (2004, 179) states that 'the history of cities teaches that squatters have always been around, that squatting was the way the poor built homes, that it is a form of urban development'. Architectural historians Peter Kellett and Mark Napier put it this way:

The phenomenon of informal urban housing is not new. Throughout history, the poor have constructed their dwellings around the urban centers of the rich and powerful. For example, in Latin America, according to Jorge Hardoy, 'self-help was as characteristic of the past as of the present Latin American city. In both, the self-built shelter of the majority surrounded the small city core built for pre-Columbian, colonial or national elites'. (Kellett & Napier 1995, 8; the quoted portion is a citation to Hardoy 1982, 19)

As in the case of sprawl, such historical claims rest on rather scant cited evidence, but archaeologists have the data to investigate the issue on a much firmer empirical basis. Did the non-elite urbanites of the past indeed build and live in informal, self-built, squatter-like housing?

#### *What can archaeology contribute?*

As a starting point for the archaeological analysis of ancient informal or squatters settlements, consider a provisional classification of urban residential zones into two polar types: highly planned (regular and orthogonal layouts of houses of similar size and form) and informal (houses on apparently haphazard sites with variable orientations, sizes, and forms). While a

more accurate representation might be a continuum based on the extent of state control of planning (Briassoulis 1997), I use instead a dichotomous model for purposes of exposition.<sup>5</sup> This distinction — highly planned *vs* informal residential layouts — has been discussed by planners and anthropologists under a variety of labels, including formal *vs* informal planning (Briassoulis 1997), regulative *vs* generative planning (Rees & Murphy 1990; Uzzell 1990), and master planning *vs* generative programs (Hakim 2007). Following these and other models (e.g. Smith 2007), archaeologists can infer that the layout and construction of highly planned residential zones were directed in some manner by political authorities, whereas many aspects of informal housing were outside of the control of elites and authorities.

It is not appropriate, however, to call informally configured residential areas 'unplanned'. Research has shown that apparently haphazard modern squatters settlements do have social- and spatial-ordering principles. For example, Larissa Lomnitz describes an informal settlement in Mexico City as follows: 'The houses are apparently arranged at random, but in reality their distribution obeys social principles, especially that of kinship' (Lomnitz 1975, 39). On a more abstract level, Eda Schaur (1991) identifies a number of spatial principles at work in structuring apparently 'non-planned settlements' (see also Briassoulis 1997), and other works relating spatial organization to social organization (e.g. Gabrielopoulos *et al.* 2002) are also relevant. Thus while informal settlement areas exhibit structure and planning at some scale, they show little evidence for the hand of central planners in their design, layout or construction.

The most elementary contribution that archaeology can make to the analysis of informal settlements is the basic documentation of the extent of such informal housing in the cities of the past. Figure 2 shows what appear to be informally laid-out houses and compounds within a system of nearly orthogonal main walls at the site of Chan Chan in Peru (Moseley & Day 1982; Moseley & Mackey 1974). We can evaluate the suggestions of authors like Hardoy (1982), Kellett & Napier (1995) and Neuwirth (2004) to the effect that 'squatters have always been around' (Neuwirth 2004, 179). The term 'squatters' may be inappropriate for many past preindustrial societies, where private land ownership was much less extensive than in modern capitalist nations, a point emphasized by historically-minded scholars like Hardoy (1982, 22) and Ward (1973, 70). Archaeologists have the data to evaluate the relative frequencies of highly-planned housing and informal housing in different cities and urban



**Figure 2.** *Informal urban settlement outside the Laberinto compound at Chan Chan, Peru. Although the overall configuration of the main walls suggests central planning, the irregularity of individual compounds and houses suggests the bottom-up processes of informal settlement. Modified after Moseley and Mackey (1974, map 12).*

traditions. Although I am unaware of any systematic treatment of this issue, my impression is that informal settlement is far more common in most ancient urban settings (Smith 2007). Clearly, a focused comparative study based on some kind of systematic sample of ancient cities and urban traditions could evaluate the historical interpretations of the prevalence of informal urban housing.

A more powerful contribution that archaeology could make to this issue would be an exploration of the spatial and social dynamics responsible for the layout and formation of urban informal settlement in the past. Relatively little attention has been given to this question for contemporary cities, and beyond a few rather broad generalizations there seem to be few explanations for variations in the forms of modern squatters settlements. Most comparative analyses of modern informal settlement distinguish slow, gradual growth from rapid, planned invasions (e.g. UNCHS/Habitat 1982, 17; Peattie & Aldrete-Haas 1981), and some authors link these alternative growth trajectories to the spatial layout of houses.

David Cymet, for example, identifies two types of carefully planned informal settlements around Mexico City ('colonias paracaídas', literally 'parachutist neighbourhoods' and 'irregular developer subdivisions') and one type of settlement formed by gradual, accretional growth ('ciudades perdidas', or lost cities). He shows that, 'the ciudades perdidas, the other variant of squatter settlements, would not display the strict geometric pattern of the colonias paracaídas but would instead present a disorderly agglomeration pattern without any dividing property boundary lines' (Cymet 1992, 47).

Beyond this kind of generalization, is it possible to identify the factors that influence the construction of planned *vs* informal housing in ancient cities? Can archaeologists begin to identify the spatial dynamics that structured ancient informal settlement layouts? It is always difficult to identify generative forces on the basis of city plans alone. In an instructive comparison of urban plans over the centuries, planner Jill Grant (2001) shows that orthogonal urban grid planning has been generated by a variety of political and



social processes. Nevertheless, archaeologists have produced a rich assemblage of ancient urban plans, including residential zones, the analysis of which might shed light on some of the conditions and processes responsible for generating the forms of urban housing in the past. Whether or not such research will shed light on modern settlement dynamics, it will certainly improve our understanding of ancient urbanism.

#### *What do archaeologists need to do?*

Although the use of archaeological house plans to infer the social characteristics of their ancient builders and residents is an area of active research (e.g. Blanton 1994; Cutting 2006; Kent 1990; Wallace-Hadrill 1994), there is still much that we do not understand about ancient housing, particularly in urban settings. Most studies focus on individual structures and ignore their larger spatial context (such as neighbourhoods or urban districts). Admittedly, much of the reason for this lies in the expense and difficulty (and therefore the rarity) of excavating urban sites on a scale of hectares rather than metres squared. But my impression is that there are enough ancient cities with good plans of extensive residential zones to make some headway in exploring settlement dynamics as discussed above. The most basic step in addressing this issue is empirical — the assembly of urban plans and their comparative analysis (e.g. Fig. 2).

For this kind of comparative analysis, archaeologists need to be able to measure degrees of central planning in residential areas, and identify the other social determinants of urban form in these zones. Although archaeologists have yet to develop the methods and concepts needed to make much sense out of a comparative study of ancient urban housing, several promising starts can be mentioned. One approach would be to adapt relevant features of my urban-planning model (Smith 2007) to the examination of housing. That model addresses civic architecture and planning at two scales: the epicentre (the central district with the bulk of the public architecture) and the entire city. The measures proposed in that paper, however — coordination of buildings and standardization of layout — can be adapted to the study of residential zones, perhaps permitting a rough estimate of the degree of central planning.

A second promising approach to the development of methods and concepts for analysing ancient housing patterns is the extension of the principles of space-syntax analysis (Hillier & Hanson 1984) to analyse the layouts of residential neighbourhoods. This process has already begun in studies of modern

cities (e.g. Duarte *et al.* 2006; Sobreira 2003), and it may be possible to extend the approach to historical and archaeological cases with good maps. The almost complete reliance of Hillier's approach on street layouts (Hillier & Vaughan 2007), however, will require considerable modification before it can be applied to low-density cities without street networks. Schaur's (1991) study of non-planned settlements from a generalized space-syntax approach holds great promise in this respect, and some writers have drawn on Schaur's work in their analyses of modern squatters settlements (e.g. Duyar-Kienast 2005). As in the case of sprawl, the pursuit of these and other avenues of analysis of ancient informal urban housing by archaeologists can pay dividends for both our understanding of ancient urbanism and for useful comparisons between ancient and modern cities.

#### **Urban sustainability**

The phrase 'sustainability' has recently become an extremely popular concept in both scholarly and popular discourse, but research on urban sustainability has lagged behind. In the words of Gordon McGranahan and David Satterthwaite (2003, 249),

Although there is a large and diverse literature about sustainable development that goes back 30 years, much of it ignores urban centres or sees urban centres as the problem, with little or no discussion of the role of urban policies and urban management in meeting sustainable development goals.

Perhaps not surprisingly, urban sustainability has also been neglected by archaeologists, although I think this topic holds great potential for using ancient cities to illuminate modern urban processes.

#### *The contemporary situation*

The sustainability literature is huge, including many treatments of the definition and usefulness of the concept. Most writers focus on the notion of 'sustainable development' and cite the definition of Gro Harlem Brundtland: 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (quoted in Allen *et al.* 2003, 25). There are extensive debates and discussions about this definition and its usefulness (e.g. Costanza *et al.* 2007; Kates *et al.* 2001; Tainter 2006b; Worster 1993; Bodley 2004), but the dual components of current practices and potential future outcomes are fundamental for most writers.

Turning to the notion of urban sustainability, we not surprisingly find a range of definitions, from those

restricted to modern societies to those applicable to the past:

a sustainable city is one in which the community has agreed on a set of sustainability principles and has further agreed to pursue their development (Munier 2007, 17).

For cities, I have defined sustainability as reducing Ecological Footprint (energy, water, land materials, waste) while simultaneously improving quality of life (health, housing, employment, community) within the capacity constraints of the city (Newman 2006).

when we talk about urban sustainability, we should consider several issues: survival of the settlement through time, environmental impacts on landscapes, and quality of life for inhabitants (Grant 2004, 24).

One of the major concepts used to try to measure urban sustainability is the ecological footprint. In the words of Peter Newman ecological footprint refers to:

how a city extracts foods, water, energy and land from a bioregion (and beyond) and requires ecosystem services to absorb its wastes. The total resource use of a city is figured relative to its population, and the resulting calculation allows a per capita footprint of land to be compared to that of other cities (Newman 2006, 280).

There is a considerable body of research on ecological footprints (Chambers *et al.* 2001; Rees 1992), as well as critiques of the concept (Fiala 2008). Ecological-footprint analysis has been applied to historical data on medieval Europe (Hoffmann 2007) and to archaeological data on non-urban settlements (Nelson & Schollmeyer 2003), but archaeologists have yet to use this concept for the analysis of ancient cities. As discussed below, however, the archaeological concept of site catchment is similar to ecological footprint.

Beyond ecological-footprint research, several themes can be identified in current work on urban sustainability. Within architecture and planning there are emphases on devising and promoting 'green' techniques and materials that are more sustainable (Girardet 2004), and on promoting urban forms (such as green areas) that contribute to the sustainability of cities and neighbourhoods (Al-Hagla 2008; Jabareen 2006). McGranahan & Satterthwaite (2003) review the literature on urban sustainability but enlarge the context to consider cities within their wider settings:

The key ecological issue for urban centres is not sustainable cities but cities and smaller urban centres that have production systems and inhabitants with patterns of consumption that are compatible with sustainable development within their region (encompassing both rural and urban areas) and globally (McGranahan & Satterthwaite 2003, 244–5).

In other words, heavy resource use may occur within cities, but it is less the concentration of demand in cities *per se* that is environmentally destructive than the fact of the overall levels of consumption and waste generation within a region or society (see also Satterthwaite 1997). Recent reviews of (modern) urban sustainability can be found in Newman & Jennings (2008) and Grimm *et al.* (2008).

#### *What can archaeology contribute?*

The archaeological record contains innumerable cases of urban settlements that survived for varying lengths of time, from a few years to many millennia. If we classify those cities that survived for long periods as 'sustainable' and those that were abandoned or destroyed after a short time as 'unsustainable', then we would have an extraordinarily rich data set for studying the factors that affected longevity and sustainability in the past. But this is not how students of modern cities tend to conceive of sustainable cities (the only definition of urban sustainability that is sufficiently broad here is that quoted above by Grant 2004). For modern cities, we know something of the mechanisms of sustainability but not the outcomes, largely because insufficient time has elapsed. For ancient cities, on the other hand, archaeologists typically know the outcomes but far less about the mechanisms. This disjunction must be addressed before archaeological data can be used to illuminate modern urban sustainability.

As noted above, the study of modern urban sustainability does not ask whether cities will fail or not, but whether a given quality of urban life can continue into the future. One reason for this neglect of what seems an obvious question to an archaeologist is the fact that, in the words of Thomas Campanella (2006, 142), 'the modern city is virtually indestructible'. Research on the effects of natural disasters on contemporary and recent cities (Campanella & Vale 2005; Körner 1999) shows that modern cities (from Beirut to New Orleans) nearly always survive just about anything that nature or people can throw at them.

The reasons for the resiliency of modern cities in the face of physical disaster are listed by Campanella (2006, 142):

- modern nation states have a vested interest in the well-being of their cities;
- private property laws ensure the continuing organization of urban space, even after physical destruction;
- the modern insurance industry lessens economic impacts of disasters;
- urban infrastructure is complex and multi-layered, and is rarely destroyed totally.

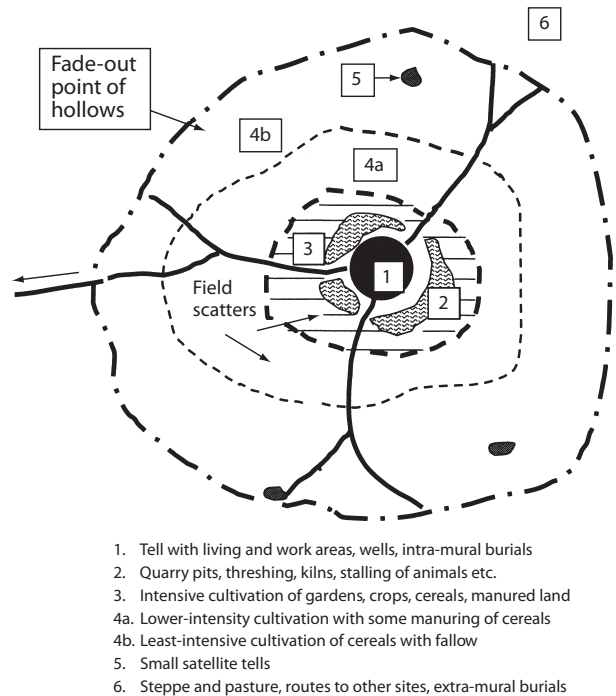
These conditions do not hold for most preindustrial cities, making it difficult to compare ancient urban sustainability (how long did cities survive?) with modern sustainability (can present lifestyles continue into the future?). In his paper on the indestructibility of modern cities, Campanella (2006, 141) suggests that the situation was only slightly different in the past. He asserts that after AD 1100 very few cities were destroyed or abandoned. Now any archaeologist who has undertaken a survey knows this is not the case; landscapes all over the world are littered with destroyed and abandoned urban sites.

#### *What do archaeologists need to do?*

Although archaeologists now contribute to the general literature on sustainability and sustainable development (e.g. Costanza *et al.* 2007; Redman *et al.* 2004; Kirch 2005; Tainter 2006b), archaeological research has had virtually no impact at all in the area of urban sustainability. This is a topic that archaeologists have simply not addressed, perhaps because archaeology lacks the conceptual tools to adequately analyse the sustainability of ancient cities. We require models for the expansion and decline of cities as settlements or institutions in and of themselves, but all we have are models for societal collapse. Some archaeologists are exploring the concept of resilience, which will be of great importance in this endeavour, but nearly all applications to date concern resilience in non-urban agrarian societies (Peeples *et al.* 2006; Redman 2005; Nelson *et al.* 2006); for exceptions see Scarborough (2000), or the papers in McAnany & Yoffee (2010).

Societal collapse is one of the few concepts available for examining the longevity and decline of cities (Diamond 2004; Tainter 2006a; 2008). But this is surely too crude a notion for understanding the rise and fall of individual cities (or polities, economic systems or religious cults, for that matter). These phenomena have growth trajectories of their own, irrespective of the fate of the overall society. Cities expand and contract and are abandoned without a total societal collapse, and in many cases cities survive episodes of societal collapse (M.L. Smith 2003; Schwartz & Nichols 2006). Some archaeological writers on sustainability, however, explicitly advocate an analytical focus on 'the continuing existence of a historically identifiable society' (Redman *et al.* 2007, 119) rather than on the 'survival or collapse' of individual institutions or social systems such as cities. The total collapse of society sounds good in a best-seller title, but progress in scientific research requires work on a smaller analytical scale.

Where might archaeologists find concepts to model the rise and fall of ancient cities? The field of



**Figure 3.** Site-catchment model ('ecological footprint' in the current sustainability literature). This is an idealized spatial model of zones of agricultural exploitation around a Near Eastern Tell (town). (From Wilkinson 2003, 119; reproduced with permission.)

economic urban history (e.g. Bairoch 1988) has numerous concepts and case studies, but these are most relevant to cities whose primary functions were in the realm of exchange and production. For many ancient cities that served as political capitals with more limited economic functions, research on long-term political dynamics may be more relevant (Dark 1998; Ferguson & Mansbach 1996; A.T. Smith 2003). A rich source of concepts and data for understanding ancient urban trajectories is the study of the 'decline of towns' in the early medieval period (Slater 2000; Ward-Perkins 2006; Madgearu 2001). Although this is a data-heavy area of historical and archaeological research, without much concern for comparison or theory, some of the identified patterns have good potential for cross-cultural analysis and theory-building.

Once archaeologists develop concepts appropriate to monitor the rise, fall and longevity of ancient cities, we can address the data generated by countless surveys and excavations. I can suggest three potentially productive lines of research. First, a sample of large, well-studied urban sites (i.e. sites with considerable excavation, good chronologies, and extensive analyses of growth, decline and social contextual issues) could

be compared to search for factors that may correlate with longevity. Are there regularities in the trajectories of growth and decline of these cities? Standardized growth curves of the sort plotted for empire size by Taagepera (1978) could be informative. What social and environmental factors may correlate with variations in longevity or growth pattern? Second, regionally based samples of urban sites from full-coverage surveys could be examined in a similar fashion to search for regional-specific factors. This would employ more complete samples of cities, but ones with lower levels of archaeological data (see example below).

A third line of potentially productive research would be to extend and further develop the method of site-catchment analysis. Nelson & Schollmeyer (2003, 76–8) point out the similarity between ecological footprint in sustainability research and the archaeological concept of site catchment. First formulated in the 1960s by Claudio Vita-Finzi and Eric S. Higgs (1970), site-catchment analysis was used extensively and refined in the 1960s and 1970s (e.g. Flannery 1976; Roper 1979). In the past decade, site catchment has been revitalized by GIS methods (Wheatley & Gillings 2002, 159–62), but most archaeological applications continue to focus on agrarian villages and nomadic campsites rather than urban centres. One exception is the work of T.J. Wilkinson (2003) on the agricultural territories of early Near Eastern towns (Fig. 3). Site-catchment analysis is clearly applicable to ancient cities and could provide a bridge between research on modern and ancient urban sustainability.

### **Sprawl, squatters and sustainability in Prehispanic central Mexican cities**

In this section I use the example of Prehispanic central Mexican urbanism to illustrate some of the kinds of data, methods, and concepts implicated in the above discussion.<sup>6</sup> Because issues like sprawl, informal settlements and sustainability have not been the subjects of targetted research in this area, my discussion should not be considered a case study. Rather, my goal is to indicate some of the relevant research that has been carried out already, what kinds of things could be done in the future, and how such work can potentially illuminate both urbanism in central Mexico and comparative urban processes across the globe.

There has not been a comprehensive synthesis of central Mexican urbanism. Most discussions that move beyond a single site or time period focus almost exclusively on the 'big three' cities — Teotihuacan, Tula, and Tenochtitlan (e.g. Sanders & Santley 1983). I take a broader, functional perspective that defines

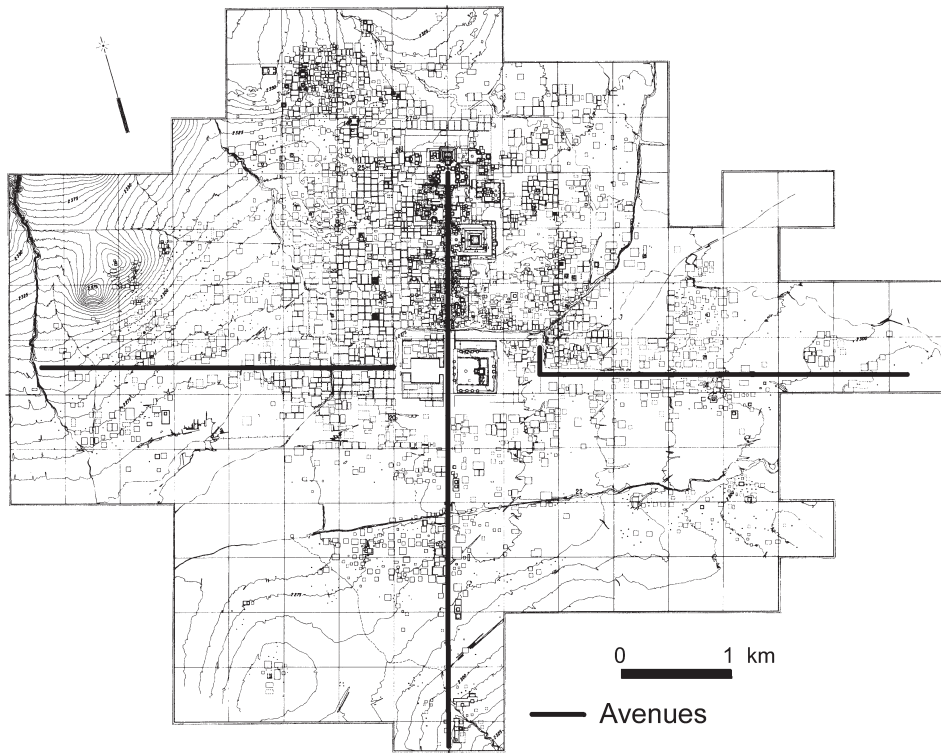
urban centres as places whose activities and institutions (urban functions) affect a broader hinterland (Smith 2007; 2008). Thus the head settlements of chiefdoms and other small polities can be considered urban settlements on the basis of their political and religious roles within a regional landscape; urbanism from this functional perspective is not limited to large, densely-populated settlements.

Urbanism in central Mexico began with the town of Chalcatzingo and a few other chiefdom centres during the Middle Formative period, 1100–500 BC (for a broad outline, see Sanders *et al.* 1979). The following Late Formative and Terminal Formative periods (500 BC–AD 200) witnessed considerable population growth and the expansion of towns across central Mexico. During the Classic period (AD 200–600), the huge metropolis Teotihuacan dominated central Mexico politically and economically, with few other urban settlements. The Epiclassic period (AD 600–900) saw the decline of Teotihuacan and the rise of a number of powerful hilltop cities, particularly Xochicalco, Cacaxtla, Cantona and Teotenango. In the Early Postclassic period (AD 900–1100), the Toltec capital Tula grew into a metropolis whose domination of central Mexico was second only to the earlier Teotihuacan. The Middle Postclassic period (AD 1100–1300) was dominated by small city-state capitals, whose importance continued even under the political domination of Tenochtitlan during the Late Postclassic period (AD 1300–c. 1520).

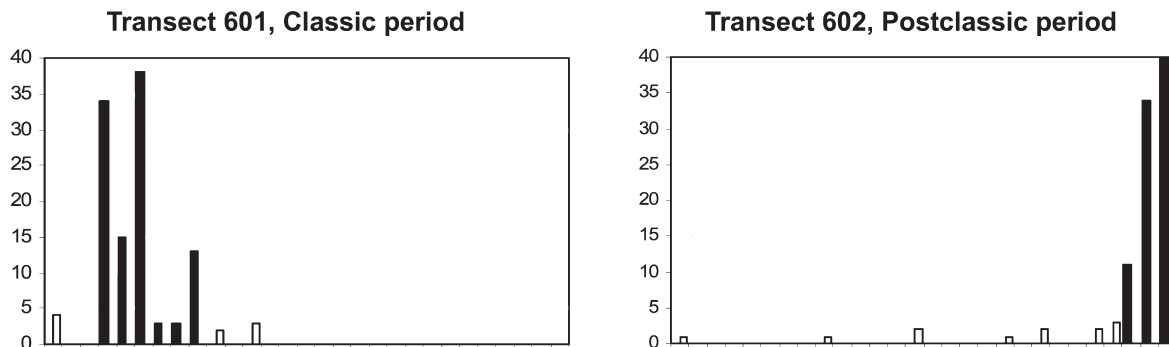
#### *Urban sprawl*

Most Prehispanic central Mexican cities had relatively low population densities; the median density for Aztec city-state capitals is 50 persons per hectare (Smith 2008, 152). Because these were dispersed cities, typically without perimeter walls, archaeologists have not made distinctions between urban and suburban contexts. As noted above, the site-based survey methods used in central Mexico make it difficult to identify low-density settlement surrounding cities. Nevertheless, there has been some discussion of sprawl-related issues (although not using that term) for Aztec cities and Teotihuacan.

Mapping and intensive surface collection at Teotihuacan, a site whose population was probably over 100,000, has revealed marked gradations in population density. Apartment compounds were closely spaced with little open area in the central zone, whereas most of the land on the outskirts of the city (but within the city limits on most maps) was open and presumably farmed (Millon *et al.* 1973; see Fig. 4.) Beyond one paper by George Cowgill (1974), there has been little explicit discussion of variations in density



**Figure 4.** Plan of Teotihuacan, Mexico. (Modified after a base map provided by George L. Cowgill. Map courtesy of the Teotihuacan Mapping Project, René Millon, Director.)



**Figure 5.** Ceramic sherd densities in surface-collection transects around urban centres in the Yautepec Valley, central Mexico. The vertical axis is the number of sherds of a given time period per 25 square metre collection. Black bars are collections taken within urban sites (as identified in an earlier stage of survey), and white bars are off-site collections. (Graphs by Angela Huster 2009, based on data from Smith 2006).

at the site. Cowgill examines changes in settlement location and density through time at Teotihuacan. Although the control of chronology in the outer areas is not as fine as one might like, there was clearly some kind of ‘sprawl’ process in effect. The earliest settlement was nucleated in the ‘Old City’ area northwest of the Pyramid of the Moon, and the expansion of

dense occupation around the Street of the Dead was accompanied by the spread of low-density occupation surrounding the central core zone. The inhabitants of the periurban areas of Teotihuacan were farmers and artisans, quite a different situation from the elite villas surrounding Rome discussed by Bruegmann (2005) as an example of ancient sprawl.

Cowgill's 1974 paper on variations in density within Teotihuacan has not been followed up by other researchers at Teotihuacan, and there is still much to be learned about the topic (see discussion of informal housing below). Most researchers seem to assume that factors of transport efficiency (for both economic and administrative reasons) explain the dense clustering in the centre of Teotihuacan, while the food needs for the large urban population explain the open cultivated fields on the periphery. Beyond Teotihuacan, there are only a few large cities sufficiently well mapped to consider processes of sprawl in central Mexico. Comparative analysis of these cases (e.g. Tula, Xochicalco, Cantona) could potentially illuminate urban settlement dynamics and the applicability of the concept of sprawl in the region.

The Aztec period (Middle and Late Postclassic periods) witnessed a dramatic population surge, making it the demographic apex of the Prehispanic epoch (Sanders *et al.* 1979). As rural population expanded in the Late Postclassic period, small settlements spread across the gentle slopes and foothills that dominate the inhabitable topography of central Mexico. Archaeologists have found that Late Postclassic pottery has a distribution roughly analogous to Roman pottery in many regions of the Mediterranean Basin — it is literally everywhere. It appears that population was widely dispersed across the landscape. Discussions of this phenomenon have focused on rural, agrarian dynamics (e.g. the labour requirements of intensive terrace agriculture: Drennan 1988; Sanders *et al.* 1979) rather than urban processes such as sprawl. Given the lack of data on density gradients around cities, however, the analytical focus on rural processes seems natural.

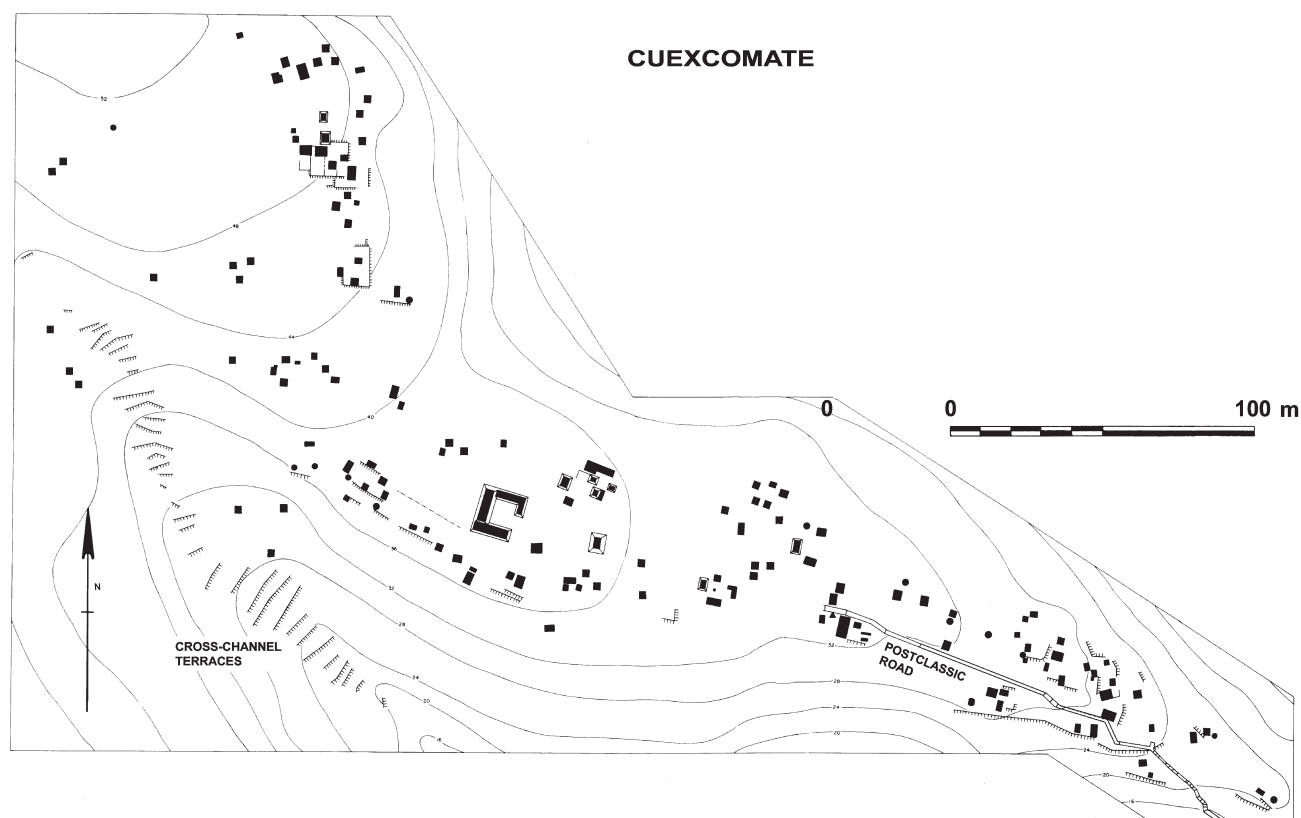
Whereas prior survey projects in central Mexico had addressed the ubiquitous distribution of Late Postclassic pottery by categorizing it as background scatter (Sanders *et al.* 1979), in 1994 my colleagues and I applied a limited version of Mediterranean style off-site survey methods to the problem (Bintliff & Snodgrass 1988; Cherry *et al.* 1991). While carrying out a traditional central Mexican style regional survey of the Yautepec Valley in Morelos (due south of the Basin of Mexico), we examined off-site artefact distributions along seven transects (Hare *et al.* n.d.; Smith 2006). We took controlled surface collections (complete artefact recovery within squares of 5 × 5 metres) at 100 metre intervals along transects that cut across major environmental zones. Each of our seven transects was placed to cross at least one urban centre of the Classic or Late Postclassic periods, as defined in an earlier stage of the survey (Huster 2009).

These transects were not designed to address questions of urbanism or sprawl, and our methods were far from appropriate for those topics; a research design to study urban sprawl with transects would require spacing collections closer than the 100 metre interval we employed, and it would require that individual sites be crossed by more than one transect. Nevertheless, these transects (Fig. 5) do suggest that urban centres of the Classic and Postclassic periods were not surrounded by extensive areas of low-density settlement of the type found at Teotihuacan (Fig. 4). Both Site 1 in the Classic period and Site 160 (the city of Yautepec) in the Postclassic period were associated with limited levels of nearby 'off-site' artefacts, while other urban centres (in both periods) had no off-site materials in their transect collections. As expected from initial observations, there was more off-site material in the Postclassic period than during the Classic period. But these data, crude as they are, suggest a lack of sprawl-type settlement around urban sites in the Yautepec Valley.

#### *Informal urban housing*

Although few Prehispanic central Mexican cities have extensively mapped urban neighbourhoods, informal urban housing has been documented at both low-density and high-density settlements. The housing at some central Mexican urban settlements covers rather steep slopes, and not surprisingly plans of sites such as Xochicalco (Hirth 2000), Cihuateopan (Evans 1988) and Calixtlahuaca (Smith *et al.* 2007) show little evidence for formal planning of residential areas. Aztec urban sites on flat and gently sloping terrain, such as Ixtapaluca Viejo (Blanton 1972, 256) and Cuexcomate (Smith 1992), also have informally laid out residential areas. At Cuexcomate (Fig. 6), for example, individual houses and patio groups show divergent cardinal orientations, and their locations show little apparent spatial structure on a large scale beyond preference for the top of the ridge and a vague clustering. On a smaller scale, many houses are arranged into patio groups, the spatial signature of a basic Aztec-period social group called the *cemithualli* (Smith 1993). Unfortunately there are few other low-density sites, of any Prehispanic period in central Mexico where significant areas of housing have been mapped. Nevertheless, residential excavations at other Aztec sites suggest the presence of informal housing with spatial patterns similar to those observed at Cuexcomate (Smith *et al.* 1999; Brumfiel 2005).

Classic-period Teotihuacan, with its high population density, extensive use of orthogonal planning covering the entire city, and relatively standard-



**Figure 6.** Plan of Cuexcomate, Mexico, a small town of the Aztec period, illustrating informal settlement. (Illustration by the author.)

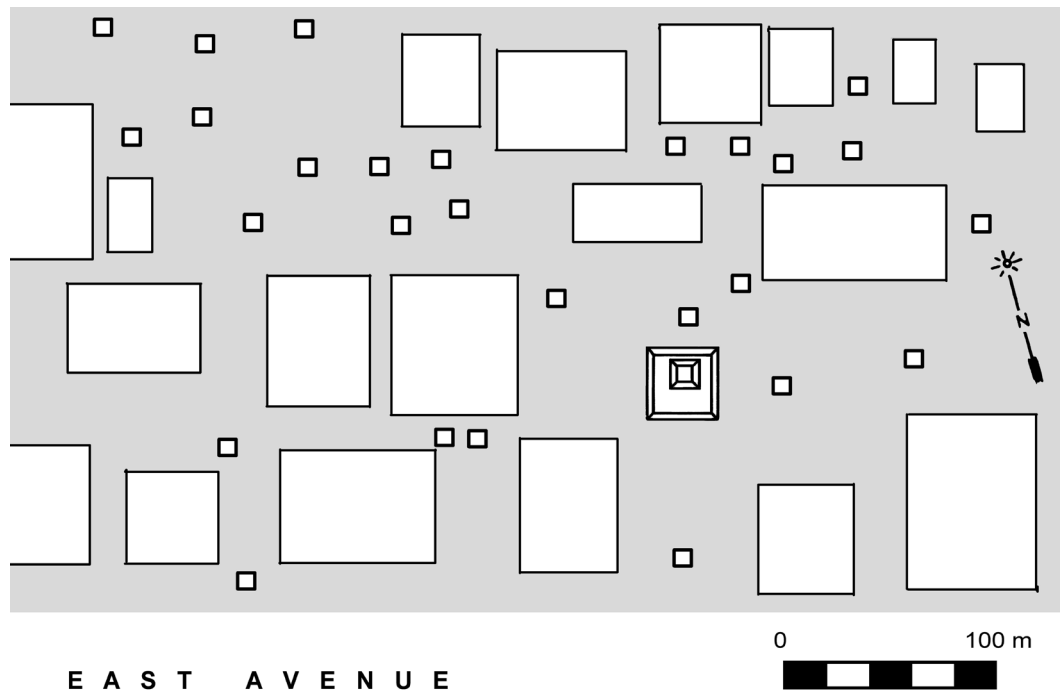
ized housing in the form of apartment compounds (Cowgill 2008), presents a scheme of highly planned housing very different from nearly all other Mesoamerican cities (Fig. 4). Nevertheless, the Teotihuacan Mapping Project identified a significant amount of informal housing interspersed with the apartment compounds. Surface traces of residential occupation lacking the size, form, and stone architecture of apartment compounds were coded on the city's map with tiny squares (Millon *et al.* 1973). These are generally assumed to have been small houses built of material more insubstantial than stone (e.g. adobe brick or wattle and daub) whose design and construction were outside of the planning arm of the central administrative organization of the Teotihuacan authorities (Cowgill *et al.* 1984). Some of these structures are found in high-density parts of the city, interspersed with apartment compounds (Fig. 7), whereas others are located in lower-density areas on the edge of the city. Only one such area of informal housing has been tested archaeologically (Cabrera Cortés 2006), revealing poorly preserved irregular stone wall foundations quite distinct from the city's apartment compounds.

This location was the setting for ceramic production activities.

It is difficult to draw conclusions about formal and informal housing given the lack of attention to the mapping and excavation of residential neighbourhoods in central Mexican cities. But even this brief survey of some of the relevant work done to date suggests that the historical generalization discussed above — namely, that informal urban housing was widespread at ancient cities — holds true for cities in this area. Whether archaeologists are able to move from this simple observation to the realm of interpretation and explanation of variable spatial patterns of housing will depend on advances in both fieldwork and conceptualization.

#### *Urban sustainability*

I am aware of only a few studies that address the longevity of urban settlements in central Mexico from a comparative or analytical perspective beyond the individual site. In a comparison between Teotihuacan and Classic Mayan cities, Cowgill (1979) identifies contrasting developmental trajectories that relate to



**Figure 7.** Plan of a residential area on the north edge of the eastern avenue at Teotihuacan (grid square N1E5), showing informal residences — depicted as small squares — interspersed with apartment compounds (large rectangles). (Redrawn from the plan of square N1E5 in Millon *et al.* 1973.)

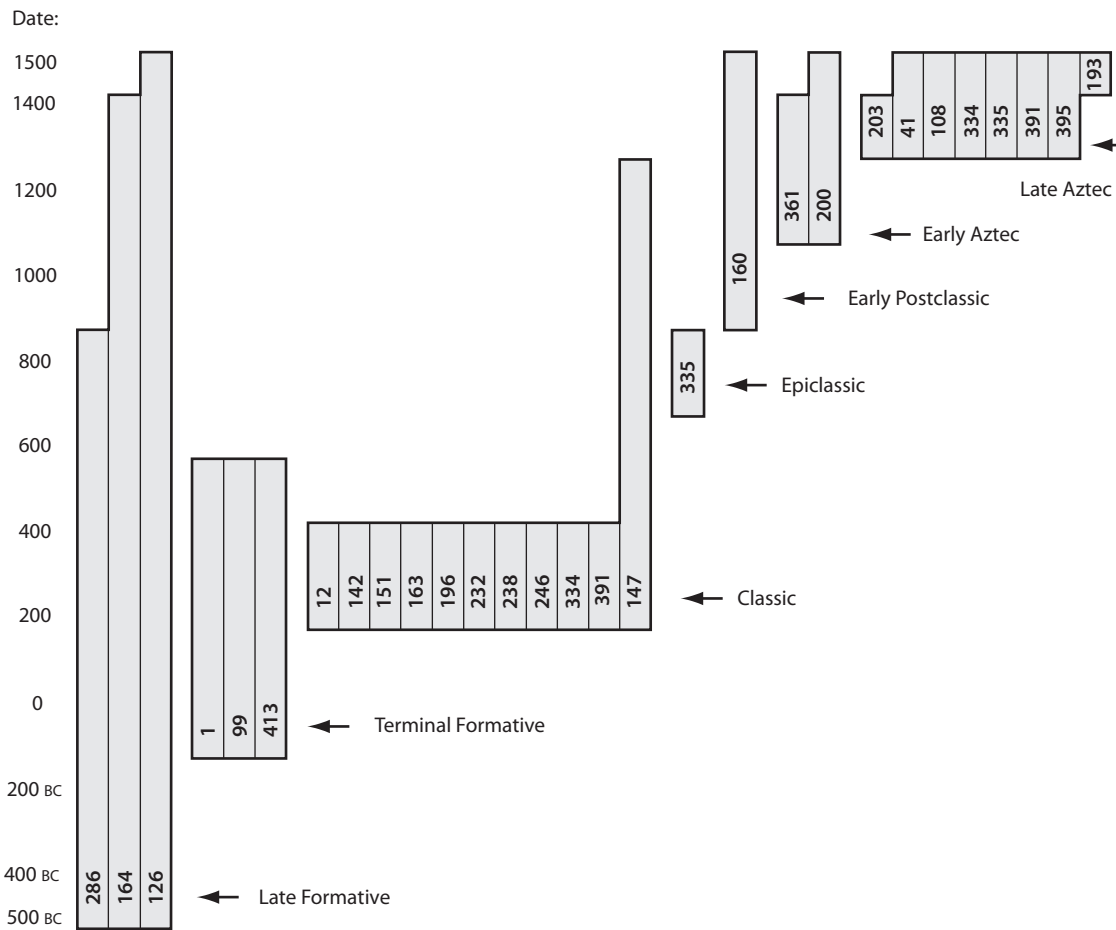
questions of urban sustainability. Whereas Teotihuacan grew rapidly at first and then maintained its size and organization for several centuries, the Mayan cities followed a more exponential trajectory, with slow initial growth changing to much more rapid growth, leading to collapse and abandonment. Cowgill relates this difference to contrasting forms of political organization and environmental context, a good start for comparative analysis of urban sustainability.

There are some studies of urban food needs, resource use and environmental impact for individual cities in central Mexico. Teotihuacan has seen the bulk of the work along these lines (e.g. McClung de Tapia *et al.* 2003; Barba P. & Franz 1999), with less-intensive research at urban sites such as Xochicalco (Hirth 2000) and Tula (Mastache *et al.* 2002). The food supply of Aztec Tenochtitlan is the subject of an extensive literature, mostly concerned with energetics, demography and exchange systems (e.g. Parsons 1976; Rojas 2001). The relatively short life of the Aztec capital prior to its conquest by Hernando Cortés, however, limits the usefulness of this research for considerations of urban sustainability. Most work on food supply and environmental impact in central Mexico, however, has proceeded on the scale of regions, not individual urban centres (e.g. Sanders *et al.* 1979; Williams 1989).

One line of analysis suggested above is the systematic comparison of urban longevity within a region. In Figure 8, I have assembled data on the lengths of occupation of urban sites from the Yautepec Valley survey. 'Urban' sites are here defined as sites larger than 13.3 ha. This is the size of the smallest historically documented city-state capital during the Aztec period (Hare 2004), and it provides a convenient standard for present purposes. I have not carried out any systematic analyses of these data; I portray the information in Figure 8 merely to illustrate the variation in site longevity.

The earliest urban centres, founded in Late Formative times, lasted considerably longer than any others (Fig. 8). A major part of the explanation for this probably lies in their location; all three sites were founded in areas of the richest and deepest soils along the floodplain of the Yautepec River. The short lives of most Classic period urban foundations almost certainly derive from political considerations; this region was part of an empire based at Teotihuacan (Smith & Montiel 2001) and when Teotihuacan withdrew from the area, these sites were abandoned. But why did site 147 survive the end of Teotihuacan rule and continue on for nearly another millennium? Why did the sole Epiclassic urban foundation have a relatively short





**Figure 8.** Longevity of urban sites in the Yauhtepec Valley. See discussion in the text. (Illustration by the author, based on data from Smith 2006.)

life in comparison to the sole new Early Postclassic city? The answers to these and other questions will require a systematic quantitative analysis of the settlement data, including contextual variables related to the environment, regional demography, political dynamics, and economic organization.

Although I have not seen settlement data from the numerous other central Mexican regional surveys portrayed or analysed in this fashion, it should not be difficult to assemble comparative information from a number of regional survey projects. Such a comparative data set would have considerable potential for illuminating questions of ancient urban sustainability. A comprehensive analysis would certainly shed much light on central Mexican urban dynamics, and it could potentially illuminate more general issue of urban sustainability with wider implications. In this case the data are available; someone just has to do the analysis.

## Discussion and conclusions

*What can be learned from ancient–modern urban comparisons?*

In terms of the broad comparative historical study of cities and urbanism, the single greatest contribution of archaeological studies of ancient cities is probably the enlargement of the sample of cities and urban systems. The archaeological record documents a far wider range of non-Western urban traditions than are normally studied by urban historians and comparative urbanists (e.g. Morris 1994; Mumford 1961; Reader 2005). Any attempt to achieve a systematic or comprehensive understanding of urbanism, historically and comparatively, must include ancient cities (Smith 2009a). If archaeologists start paying attention to the literature on urban issues such as sprawl, informal housing and urban sustainability, this will pay dividends in at least two ways. First, these bodies

of literature have numerous case studies, models and methods that can help us understand ancient cities and urbanism. Second, if we improve our own methods and generate our own data on these and other urban topics, we can contribute to broader currents of research on urban issues.

Is sprawl really just a modern phenomenon, limited to processes of sub-urbanization triggered by automobiles, zoning and capitalist land development? Definitions of sprawl such as that of Bruegmann clearly pertain to some ancient settlement systems, and the archaeological record suggests that Bruegmann's claim for the near-universality of sprawl is most likely correct. But are Mesopotamian or medieval suburbs appropriate analogues of modern suburban sprawl? We really cannot answer such questions yet, and archaeological research on urban-density gradients may tell us something about whether ancient suburbs and low-density cities can be usefully compared to modern urban sprawl.

Most writers on modern squatters and informal settlements ignore evidence prior to the twentieth century, leading them to claim, for example, that the dominant force generating such settlement is global capitalism (AlSayyad 1993; Portes & Johns 1986). While it would be foolish to deny a role for capitalism in modern third-world urban housing systems, the clear presence of informal settlements long before the Industrial Revolution suggests that there must be other forces generating this kind of housing pattern. Jorge Hardoy and other writers who have suggested that informal urban settlement was the norm in ancient cities (see above) are clearly on the right track, but the failure of archaeologists to take up their challenge limits the inferences that can be made about ancient urban housing dynamics. Just what are the relative proportions of centrally planned versus locally generated informal housing? What factors can explain this variation, across time and across space? Again, archaeological work on this topic will help us understand ancient cities and will also provide a firmer empirical foundation for research on more global and comparative processes of housing and settlement dynamics.

Of the three themes emphasized in this article, that of urban sustainability may prove the most intractable for rigorous ancient-modern comparisons. Few studies of the modern situation consider the possibility that cities will fail and be abandoned; urban-sustainability research focuses on goals and practices, not long-term outcomes. Yet research on variations in the longevity of ancient cities may be one of the most useful contributions archaeology can make to the

general understanding of urban sustainability. Can we produce credible models of this variation? And if so, will such results help illuminate the modern world? Even if the answer to the latter question turns out to be negative, the effort of answering it will undoubtedly contribute to our knowledge of ancient urban trajectories around the world.

*The need for improved communication between disciplines*

Sprawl, squatter settlements, and urban sustainability are not by any means the only topics for which archaeological data on ancient cities can potentially contribute to broader understandings of contemporary urbanism. A number of features of urban design and form — from gated communities to the nature and role of open spaces — cry out for analyses similar to those proposed above. Many aspects of urban society and life — e.g. neighbourhoods, urban demography, health in cities — could benefit from combined analyses of ancient and modern cities. The broader spatial and social contexts of cities can also be compared for topics such as the roles of cities in imperial and colonial expansion, or the significance of rank-size scaling of city sizes. I have selected sprawl, squatters and sustainability because they are issues of current interest that resonate in urban research throughout the world, but they are only illustrative of a wider realm of urban research.

The suggestions on urban research outlined above will require increased interaction between archaeologists and other scholars of urbanism, both contemporary and historical. To achieve this kind of improved interaction I suggest three courses of action. First, the pursuit of research on ancient cities using concepts from modern urban studies (as suggested in this article) will go a long way toward promoting an interest in our findings by other scholars. Second, archaeologists should take advantage of opportunities to participate in transdisciplinary research projects with other scholars. Transdisciplinary research can help break down the artificial barriers created by current disciplinary structures (Wallerstein 2003), and it is important because 'many, if not all, of the traditional approaches, as well as many heterodox tactics, fail to answer the most pressing issues plaguing the world' (Polimeni 2006, 2).<sup>7</sup> Van der Leeuw & Redman (2002) have argued strongly for positioning archaeology at the forefront of such transdisciplinary research on social and environmental issues. Third, archaeologists should publish in journals outside of archaeology. If we think our scholarship is of interest to scholars in other disciplines, then we need to present it in venues

where it will be seen and where it can become part of the wider realm of scholarship on human issues such as cities and urbanism.

An increased engagement of archaeologists with other scholars of urbanism can have a number of benefits for archaeology. First, if our data do indeed have relevance for improving the general scholarly understanding of aspects of urbanism, then the experience of communicating with and working with urban historians, geographers, sociologists, planners and other urban scholars will facilitate the generation and wider dissemination of archaeological knowledge. Second, the intellectual homework required to address issues of this sort will pay benefits in our analyses of the past. I have found that my reading on these topics over the past year or two has enriched my understanding of Mesoamerican urbanism and given me ideas about new and productive research directions in the future.

The current lack of archaeological concepts and theories noted above for sustainability and informal settlements is part of a broader conceptual difficulty in the archaeological study of social issues in complex societies. Anthropological archaeologists have long relied on cultural anthropology and ethnography as sources of ideas and analogies for interpreting the past, but these fields have relatively little to say about the kinds of complex societies studied by archaeologists. To counter this problem Jeremy Sabloff has argued that

archaeologists will have to turn more and more to the historic record. What ethnoarchaeology has been in recent years to the study of hunter-gatherer groups [i.e., a source of analogy and insight], history will be, I predict, to research on complex societies (Sabloff 1986, 116).

I would extend this perspective even further and argue for the relevance of modern urban studies, in addition to the discipline of history, to help archaeologists interpret ancient cities and urban processes. A third benefit of increased interaction between archaeologists and other urban scholars would be to make our discipline more widely understood in the social and historical sciences, a development that could pay a variety of intellectual and professional dividends in the future.

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### Notes

1. Several readers of earlier versions of this article have suggested that it would be much improved by the addition of a detailed case study. Unfortunately, no such case study currently exists. Indeed, if I had access to a rigorous example of how archaeological analysis of ancient sprawl, for example, illuminated the modern process, I would publish it in an urban studies journal, not an archaeological journal.
2. It is perhaps ironic that this research by Rhys Jones, who initiated the critique of 'recentism' in historical geography, does not include citations to the rather substantial literature on imperialism and colonialism in the ancient world (e.g. Alcock *et al.* 2001; Stein 2005; Sinopoli 1994).
3. I should point out a recent prominent use of the term 'sprawl' by archaeologist Robin Osborne (2005). He uses the term metaphorically rather than analytically; his paper is about varying definitions of urbanism, not 'urban sprawl' as discussed here.
4. I am following much of the literature in using the terms squatter settlements and informal settlements as synonyms. Some writers, however, distinguish the terms: Serageldin (1990), for example, distinguishes 'squatter settlements' as quickly-built shantytowns from 'informal housing' as a type of self-help construction

often associated with more secure land tenure and more durable housing. My usage does *not* extend to the re-occupation of abandoned housing in city centres; such ‘squatting’ is a very different kind of social and spatial process that requires its own separate analysis.

5. I acknowledge that this provisional dichotomy appears to replicate the ‘planned/unplanned’ dichotomy that I argue strongly against in another work (Smith 2007). That paper dealt primarily with public architecture in cities, with only passing attention to residential zones. The issue of planning in ancient housing, on the other hand, has seen almost no comparative or theoretical discussion. At this stage of our knowledge, an analytical dichotomy may be useful for heuristic purposes. Ultimately, however, it should be replaced by more precise and subtle concepts and measures.
6. I choose this area because it is the setting for my own fieldwork and therefore I know the literature best. I must admit that relatively little progress has been made in central Mexico toward the goals advocated in this article. The area with the strongest empirical and methodological foundation for research on sprawl, squatters and sustainability is probably the Mediterranean Basin, where work in several regions is far more advanced on these and related themes of ancient urbanism.
7. I am currently participating in a transdisciplinary research project funded by Arizona State University called ‘Urban Organization Through the Ages: Neighborhoods, Open Spaces, and Urban Life’ (see <http://latelessons.asu.edu/urban>). This multi-year project is in its initial stages, and it is too early to determine what the outcomes will be.

## References

- Adler, M.A., T. van Pool & R.D. Leonard, 1996. Ancestral pueblo population aggregation and abandonment in the North American Southwest. *Journal of World Prehistory* 10, 375–438.
- Al-Hagla, K., 2008. Towards a sustainable neighborhood: the role of open spaces. *International Journal of Architectural Research* 2(2), 162–77.
- Alcock, S.E. & J.F. Cherry (eds.), 2004. *Side-by-Side Survey: Comparative Regional Studies in the Mediterranean World*. Oxford: Oxbow Books.
- Alcock, S.E., T.N. D’Altroy, K.D. Morrison & C.M. Sinopoli (eds.), 2001. *Empires: Perspectives from Archaeology and History*. New York (NY): Cambridge University Press.
- Allen, T.F.H., J.A. Tainter & T.W. Hoekstra, 2003. *Supply-Side Sustainability*. New York (NY): Columbia University Press.
- AlSayyad, N., 1993. Informal housing in a comparative perspective: on squatting, culture, and development in a Latin American and a Middle Eastern perspective. *Review of Urban and Regional Development Studies* 5, 3–18.
- Bairoch, P., 1988. *Cities and Economic Development: From the Dawn of History to the Present*. Chicago (IL): University of Chicago Press.
- Barba P., L.A. & J.L.C. Franz, 1999. Estudios energéticos de la producción de cal en tiempos teotihuacanos y sus implicaciones. *Latin American Antiquity* 10, 168–79.
- Barker, G. & D. Mattingly (eds.), 1999–2000. *The Archaeology of Mediterranean Landscapes*. Oxford: Oxbow Books.
- Berg, N., 2007. Ancient cities were clusters, not sprawl. *Planetizen* August 31, 2007 (<http://www.planetizen.com/node/26668>).
- Biello, D., 2007. Ancient squatters may have been the world’s first suburbanites. *Scientific American News* August 30, 2007 (<http://www.scientificamerican.com>).
- Bintliff, J. & A. Snodgrass, 1988. Off-site pottery distributions: a regional and interregional perspective. *Current Anthropology* 29, 506–13.
- Bintliff, J., P. Howard & A. Snodgrass (eds.), 2008. *Testing the Hinterland: the Work of the Boeotia Survey (1989–1991) in the Southern Approaches to the City of Thespiiai*. (McDonald Institute Monographs.) Cambridge: McDonald Institute for Archaeological Research.
- Blanton, R.E., 1972. *Prehistoric Settlement Patterns of the Ixtapalapa Region, Mexico*. (Occasional Papers in Anthropology 6.) University Park (PA): Department of Anthropology, Pennsylvania State University.
- Blanton, R.E., 1994. *Houses and Households: a Comparative Study*. New York (NY): Plenum.
- Bodley, J.H., 2004. Growth, sustainability, and the power of scale, in *Dimensions of Sustainable Development*, eds. R. Seidler & K.S. Bawa. (Encyclopedia of Life Support Systems UNESCO - <http://www.eolss.net/>).
- Briassoulis, H., 1997. How the others plan: exploring the shape and forms of informal planning. *Journal of Planning Education and Research* 17, 105–17.
- Brown, S., 2007. Sprawling Angkor brought down by overpopulation, study suggests. *National Geographic News* 13 August 13 2007 (<http://news.nationalgeographic.com/news/2007/08/070813-angkor-wat.html>).
- Brueggemann, R., 2005. *Sprawl: a Compact History*. Chicago (IL): University of Chicago Press.
- Brumfiel, E.M., 2005. *La producción local y el poder en el Xaltocan Posclásico [Production and Power at Postclassic Xaltocan]*. Mexico City/Pittsburgh (PA): Instituto Nacional de Antropología e Historia/University of Pittsburgh.
- Cabrera Cortés, M.O., 2006. *Craft Production and Socio-economic Marginality: Living on the Periphery of Teotihuacán, México*. Report to the Foundation for the Advancement of Mesoamerican Studies, Inc. (<http://www.famsi.org/reports/03090/>).
- Caminos, H., J.F.C. Turner & J.A. Steffian, 1969. *Urban Dwelling Environments: an Elementary Survey of Settlements for the Study of Design Determinants*. (MIT Reports 16.) Cambridge (MA): MIT Press.
- Campanella, T.J., 2006. Urban resilience and the recovery of New Orleans. *Journal of the American Planning Association* 72, 141–6.
- Campanella, T.J. & L.J. Vale (eds.), 2005. *The Resilient City: How Modern Cities Recover from Disaster*. Oxford: Oxford University Press.
- Chambers, N., C. Simmons & M. Wackernagel, 2001. *Sharing*

- Nature's Interest: Ecological Footprints as an Indicator of Sustainability*. London: Earthscan.
- Cherry, J.F., J.L. Davis & E. Mantzourani, 1991. *Landscape Archaeology as Long-Term History: Northern Keos in the Cycladic Islands*. Los Angeles (CA): UCLA Institute of Archaeology.
- Costanza, R., L.J. Graumlich & W. Steffen (eds.), 2007. *Sustainability or Collapse? An Integrated History and Future of People on Earth*. Cambridge (MA): MIT Press.
- Cowgill, G.L., 1974. Quantitative studies of urbanization at Teotihuacan, in *Mesoamerican Archaeology: New Approaches*, ed. N. Hammond. Austin (TX): University of Texas Press, 363–96.
- Cowgill, G.L., 1979. Teotihuacan, internal militaristic competition, and the fall of the Classic Maya, in *Maya Archaeology and Ethnohistory*, eds. N. Hammond & G.R. Willey. Austin (TX): University of Texas Press, 51–62.
- Cowgill, G.L., 2008. An update on Teotihuacan. *Antiquity* 82, 962–75.
- Cowgill, G.L., J.H. Altshul & R.S. Slaod, 1984. Spatial analysis of Teotihuacan, a Mesoamerican metropolis, in *Intrasite Spatial Analysis in Archaeology*, ed. H.J. Hietala. New York (NY): Cambridge University Press, 154–95.
- Cutting, M., 2006. More than one way to study a building: approaches to prehistoric household and settlement space. *Oxford Journal of Archaeology* 25, 225–46.
- Cymet, D., 1992. *From Ejido to Metropolis, Another Path: an Evaluation on Ejido Property Rights and Informal Land Development in Mexico City*. New York (NY): Peter Lang.
- Dark, K.R., 1998. *The Waves of Time: Long-Term Change and International Relations*. New York (NY): Continuum.
- Davis, M., 2006. *Planet of Slums*. New York (NY): Verso.
- Diamond, J., 2004. *Collapse: How Societies Choose to Fail or Succeed*. New York (NY): Viking.
- Drennan, R.D., 1988. Household location and compact versus dispersed settlement in Prehispanic Mesoamerica, in *Household and Community in the Mesoamerican Past*, eds. R.R. Wilk & W. Ashmore. Albuquerque (NM): University of New Mexico Press, 273–93.
- Duany, A., E. Plater-Zyberk & J. Speck, 2001. *Suburban Nation: the Rise of Sprawl and the Decline of the American Dream*. New York (NY): North Point Press.
- Duany, A. & E. Talen, 2002. Transect planning. *Journal of the American Planning Association* 68(3), 245–66.
- Duarte, J. P., G. Ducla-Soares, L.G. Caldas & J. Rocha, 2006. An urban grammar for the Medina of Marrakech: toward a tool for urban design in Islamic countries, in *Design, Computing and Cognition*, '06, ed. J.S. Gero. New York (NY): Springer, 483–502.
- Duyar-Kienast, U., 2005. *The Formation of Gecekondu Settlements in Turkey: the Case of Ankara*. Berlin: Habitat International.
- Environmental News Network, 2007. Researchers rewrite origins of ancient urban sprawl. *Environmental News Network* 7 September 7 2007 (<http://www.enn.com/sci-tech/article/38052>).
- Evans, S.T., 1988. *Excavations at Cihuatecpán, an Aztec Village in the Teotihuacan Valley*. (Vanderbilt University Publications in Anthropology 36.) Nashville (TN): Department of Anthropology, Vanderbilt University.
- Ewing, R.H., 1994. Characteristics, causes, and effects of sprawl: a literature review. *Urban Ecology* 21, 1–15.
- Ferguson, Y.H. & R.W. Mansbach, 1996. *Politics: Authority, Identities, and Change*. Columbia (DC): University of South Carolina Press.
- Fiala, N., 2008. Measuring sustainability: why the ecological footprint is bad economics and bad environmental science. *Ecological Economics* 67, 519–25.
- Flannery, K.V., 1976. Empirical determination of site catchments in Oaxaca, in *The Early Mesoamerican Village*, ed. K.V. Flannery. New York (NY): Academic Press, 103–16.
- Fletcher, R., 1986. Settlement archaeology: worldwide comparisons. *World Archaeology* 18, 59–83.
- Fletcher, R., 1995. *The Limits of Settlement Growth: a Theoretical Outline*. New York (NY): Cambridge University Press.
- Fletcher, R., 1998. African urbanism: scale, mobility and transformations, in *Transformations in Africa: Essays on Africa's Later Past*, ed. G. Connah. London: Leicester University Press, 104–38.
- Fletcher, R., 2009. Low-density, agrarian-based urbanism: a comparative view. *Insights (University of Durham)* 2, article 4.
- Gabrilopoulos, N., C. Mather & C.R. Apentiik, 2002. Lineage organization of the Tallensi compound: the social logic of domestic space in northern Ghana. *Africa* 72, 221–4.
- Galster, G., R. Hanson, M.R. Ratcliffe, H. Wolman, S. Coleman & J. Freihage, 2001. Wrestling sprawl to the ground: defining and measuring an elusive concept. *Housing Policy Debate* 12, 681–717.
- Garnett, N.S., 2006. Save the cities, stop the suburbs? Review essay on *Sprawl: a Compact History* and *The City: a Global History*. *Yale Law Journal* 116, 598–630.
- Girardet, H., 2004. *Cities, People, Planet: Liveable Cities for a Sustainable World*. New York (NY): Wiley-Academy.
- Gottdiener, M. & L. Budd, 2005. *Key Concepts in Urban Studies*. London: Sage Publications.
- Grant, J., 2001. The dark side of the grid: power and urban design. *Planning Perspectives* 16, 219–41.
- Grant, J., 2004. Sustainable urbanism in historical perspective, in *Towards Sustainable Cities: East Asian, North American and European Perspectives on Managing Urban Regions*, eds. A. Sorensen, P. J. Marcutullo & J. Grant. Burlington (VT): Ashgate, 24–37.
- Grimm, N.B., S.H. Faeth, N.E. Golubiewski *et al.*, 2008. Global change and the ecology of cities. *Science* 319, 756–60.
- Hakim, B.S., 2007. Generative processes for revitalizing historic towns or heritage districts. *Urban Design International* 12, 87–99.
- Hardoy, J.E., 1982. The building of Latin American cities, in *Urbanisation in Contemporary Latin America: Critical Approaches to the Analysis of Urban Issues*, ed. A.G. Gilbert. London: Wiley, 19–34.
- Hardoy, J.E. & D. Satterthwaite, 1989. *Squatter Citizen: Life in the Urban Third World*. London: Earthscan Publications.
- Hare, T.S., 2004. Using measures of cost distance in the

- estimation of polity boundaries in the Postclassic Yau-tepec Valley, Mexico. *Journal of Archaeological Science* 31, 799–814.
- Hare, T.S., L. Montiel & M.E. Smith, n.d. Prehispanic Settlement Patterns in the Yau-tepec Valley, Morelos, Mexico. Manuscript in preparation.
- Harris, R., 2003. A double irony: the originality and influence of John F.C. Turner. *Habitat International* 27, 245–69.
- Hayden, D., 2004. *Field Guide to Sprawl*. New York (NY): Pantheon.
- Hillier, B. & J. Hanson, 1984. *The Social Logic of Space*. New York (NY): Cambridge University Press.
- Hillier, B. & L. Vaughan, 2007. The city as one thing (part 1 of 'The space syntax of urban segregation'). *Progress in Planning* 67, 205–30.
- Hirth, K.G. (ed.), 2000. *Archaeological Research at Xochicalco*, vol. 1: *Ancient Urbanism at Xochicalco. The Evolution and Organization of a Pre-Hispanic Society*, vol. 2: *The Xochicalco Mapping Project*. Salt Lake City (UT): University of Utah Press.
- Hoffmann, R.C., 2007. Footprint metaphor and metabolic realities: environmental impacts of medieval European cities, in *Natures Past: the Environment and Human History*, ed. P. Squatriti. Ann Arbor (MI): University of Michigan Press, 288–325.
- Huang, J., X.X. Lu & J.M. Sellers, 2007. A global comparative analysis of urban form: applying spatial metrics and remote sensing. *Landscape and Urban Planning* 82, 184–97.
- Huster, A., 2009. Mesoamerican Manuring: a Test Case from the Yau-tepec Valley, Morelos, Mexico. Unpublished manuscript, Arizona State University.
- Jabareen, Y.R., 2006. Sustainable urban forms: their typologies, models, and concepts. *Journal of Planning Education and Research* 26, 38–52.
- Jackson, K.T., 1985. *Crabgrass Frontier: the Suburbanization of the United States*. New York (NY): Oxford University Press.
- Jamison, T.R., 1993. Symbolic Affiliation, Architecture and Settlement Patterns in Southern Belize: Nim Li Punit and Xnaheb during the Late Classic. Unpublished PhD dissertation, Department of Anthropology, University at Albany, SUNY.
- Jones, R., 2004. What time historical geography? *Progress in Human Geography* 28, 287–304.
- Jones, R. & R. Phillips, 2005. Unsettling geographical horizons: exploring premodern and non-European imperialism. *Annals of the Association of American Geographers* 95, 141–61.
- Kates, R.W., W.C. Clark, R. Corell *et al.*, 2001. Sustainability science. *Science* 292, 641–2.
- Keene, D., 1975. Suburban growth, in *The Plans and Topography of Medieval Towns in England and Wales*, ed. M.W. Barley. (Research Report 14.) London: Council for British Archaeology, 71–82.
- Kellett, P. & M. Napier, 1995. Squatter architecture? A critical examination of vernacular theory and spontaneous settlement with reference to South America and South Africa. *Traditional Dwellings and Settlements Review* 6(2), 7–24.
- Kent, S. (ed.), 1990. *Domestic Architecture and the Use of Space: an Interdisciplinary Cross-Cultural Study*. Cambridge: Cambridge University Press.
- Kirch, P.V., 2005. Archaeology and global change: the Holocene record. *Annual Review of Environment and Resources* 30, 409–40.
- Körner, M. (ed.), 1999. *Destruction and Reconstruction of Towns: Destruction by Earthquakes, Fire and Water*. Bern: Haupt.
- Kowalewski, S.A. & S.K. Fish (eds.), 1990. *The Archaeology of Regions: the Case of Full-Coverage Survey*. Washington (DC): Smithsonian Institution Press.
- Kunstler, J.H., 1994. *The Geography of Nowhere: the Rise and Decline of America's Man-Made Landscape*. New York (NY): The Free Press.
- Kunstler, J.H., 2006. Review of *Sprawl* by Robert Bruegmann. *Salmagundi (Skidmore College)* 152, 175–83.
- Lewyn, M.E., 2007. Book review: Five myths about sprawl (review of Bruegmann, *Sprawl: a Compact History*). *Harvard Blackletter Law Journal* 23, 81–106.
- Lloyd, P., 1979. *Slums of No Hope? Shanty Towns of the Third World*. New York (NY): St Martin's Press.
- Lomnitz, L., 1975. *Cómo sobreviven los marginados*. Mexico City: Siglo Veintiuno.
- Madgearu, A., 2001. The end of town-life in Scythia Minor. *Oxford Journal of Archaeology* 20, 207–17.
- Mahoney, J. & D. Rueschemeyer (eds.), 2003. *Comparative Historical Analysis in the Social Sciences*. Cambridge: Cambridge University Press.
- Mangin, W., 1967. Latin American squatter settlements: a problem and a solution. *Latin American Research Review* 2(3), 65–98.
- Mangin, W.P. & J.F.C. Turner, 1969. Benavides and the Barriada movement, in *Shelter and Society*, ed. P. Oliver. New York (NY): Praeger, 127–36.
- Mastache, A.G., R.H. Cobean & D.M. Healan, 2002. *Ancient Tollan: Tula and the Toltec Heartland*. Boulder (CO): University Press of Colorado.
- McAnany, P.A. & N. Yoffee (eds.), 2010. *Questioning Collapse: Human Resilience, Ecological Vulnerability, and the Aftermath of Collapse*. New York (NY): Cambridge University Press.
- McClung de Tapia, E., E. Solleiro-Rebolledo, J. Gama-Castro, J.L. Villalpando & S. Sedov, 2003. Paleosols in the Teotihuacan Valley, México: evidence for paleoenvironment and human impact. *Revista Mexicana de Ciencias Geológicas* 20, 270–82.
- McGranahan, G. & D. Satterthwaite, 2003. Urban centers: an assessment of sustainability. *Annual Review of Environment and Resources* 28, 243–74.
- McNeill, J.R., 2000. *Something New Under the Sun: an Environmental History of the Twentieth-Century World*. New York (NY): Norton.
- Miller, D.A., 2008. *Urban Sprawl: Current Controversies*. Detroit (MI): Gale.
- Millon, R., R.B. Drewitt & G.L. Cowgill, 1973. *Urbanization at Teotihuacan, Mexico*, vol. 1: *The Teotihuacan Map*, part 2: *Maps*. Austin (TX): University of Texas Press.

- Morris, A.E.J., 1994. *History of Urban Form: Before the Industrial Revolution*. New York (NY): Longman.
- Moseley, M.E. & K.C. Day (eds.), 1982. *Chan Chan: Andean Desert City*. Albuquerque (NM): University of New Mexico Press.
- Moseley, M.E. & C.J. Mackey, 1974. *Twenty-four Architectural Plans of Chan Chan, Peru: Structure and Form at the Capital of Chimor*. Cambridge (MA): Peabody Museum Press.
- Mumford, L., 1961. *The City in History: its Origins, its Transformations, and its Prospects*. New York (NY): Harcourt, Brace, Jovanovich.
- Munier, N., 2007. Introduction, in *Handbook on Urban Sustainability*, ed. N. Munier. Dordrecht: Springer, 17–88.
- Nelson, M.C., M. Hegmon, S. Kulow & K.G. Schollmeyer, 2006. Archaeological and ecological perspectives on reorganization: a case study from the Mimbres region of the U.S. Southwest. *American Antiquity* 71, 403–32.
- Nelson, M.C. & K.G. Schollmeyer, 2003. Game resources, social interaction, and the ecological footprint in southwest New Mexico. *Journal of Archaeological Method and Theory* 10, 69–110.
- Netting, R.M., 1993. *Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture*. Stanford (CA): Stanford University Press.
- Neuwirth, R., 2004. *Shadow Cities: a Billion Squatters, a New Urban World*. New York (NY): Routledge.
- Newman, P., 2006. The environmental impact of cities. *Environment and Urbanization* 18, 275–95.
- Newman, P. & I. Jennings, 2008. *Cities as Sustainable Ecosystems: Principles and Practices*. Washington (DC): Island Press.
- Osborne, R., 2005. Urban sprawl: what is urbanization and why does it matter?, in *Mediterranean Urbanization 800–699 BC*, eds. R. Osborne & B. Cunliffe. (Proceedings of the British Academy 126.) Oxford: Oxford University Press, 1–16.
- Parsons, J.R., 1976. The role of Chinampa agriculture in the food supply of Aztec Tenochtitlan, in *Cultural Change and Continuity: Essays in Honor of James B. Griffin*, ed. C. Cleland. New York (NY): Academic Press, 233–57.
- Peattie, L. & J.A. Aldrete-Haas, 1981. 'Marginal' settlements in developing countries: research, advocacy of policy, and evolution of programs. *Annual Review of Sociology* 7, 157–75.
- Peoples, M.A., C.M. Barton & S. Schmich, 2006. Resilience lost: intersecting land use and landscape dynamics in the prehistoric southwestern United States. *Ecology and Society* 11(2), article 22. <http://www.ecologyandsociety.org/vol11/iss2/art22/>.
- Polimeni, J.M., 2006. Transdisciplinary research: moving forward. *International Journal of Transdisciplinary Research* 1(1), 1–3.
- Polo, M., 1903. *The Book of Ser Marco Polo the Venetian Concerning the Kingdoms and Marvels of the East*, translated and edited, with notes, by Colonel Sir Henry Yule, R.E., C.B., K.C.S.I., Corr. Inst. France. London: John Murray.
- Portes, A. & M. Johns, 1986. Class structure and spatial polarization: an assessment of recent urban trends in Latin America. *Tijdschrift voor Economische en Sociale Geografie* 77, 378–88.
- Pugh, C., 2000. Squatter settlements: their sustainability, architectural contributions, and socio-economic roles. *Cities* 17, 325–37.
- Puleston, D.E., 1983. *The Settlement Survey of Tikal*. (Tikal Report 13.) Pennsylvania (PA): University of Pennsylvania, University Museum.
- Rapoport, A., 1973. The city of tomorrow, the problems of today and the lessons of the past. *DMG-DRS Journal* 7(3), 256–9.
- Rapoport, A., 1983. Development, culture change and supportive design. *Habitat International* 7(5/6), 249–68.
- Reader, J., 2005. *Cities*. New York (NY): Vintage.
- Redman, C.L., 2005. Resilience theory in archaeology. *American Anthropologist* 107, 70–77.
- Redman, C.L., C.L. Crumley, F.A. Hassan *et al.*, 2007. Group report: millennial perspectives on the dynamic interaction of climate, people, and resources, in *Sustainability or Collapse? An Integrated History and Future of People on Earth*, eds. R. Costanza, L.J. Graumlich & W. Steffen. Cambridge (MA): MIT Press, 115–48.
- Redman, C.L., S.R. James, P.R. Fish & J.D. Rogers (eds.), 2004. *The Archaeology of Global Change: the Impact of Humans on their Environment*. Washington (DC): Smithsonian Institution Press.
- Rees, M.W. & A.D. Murphy, 1990. Generative and regulative issues in urbanization: to plan or not to plan. *City and Society* 4(2), 107–13.
- Rees, W.E., 1992. Ecological footprints and appropriated carrying capacity: what urban economics leaves out. *Environment and Urbanization* 4, 121–30.
- Rojas, J.L. d., 2001. El abastecimiento de Tenochtitlan: un modelo probablemente poco modélico, in *Reconstruyendo la ciudad maya: el urbanismo en las sociedades antiguas*, eds. A. Ciudad Ruiz, M.J. Iglesias Ponce de León & M. d. C. Martínez Martínez. Madrid: Sociedad Española de Estudios Mayas, 491–502.
- Roper, D.C., 1979. The method and theory of site catchment analysis: a review. *Advances in Archaeological Method and Theory* 2, 1–40.
- Russell, B.W., 2008. Postclassic Maya Settlement on the Rural–Urban Fringe of Mayapán, Yucatán, Mexico: Results of the Mayapán Periphery Project. Unpublished PhD Dissertation, Department of Anthropology, University at Albany, SUNY.
- Sabloff, J.A., 1986. Interaction among classic Maya polities: a preliminary examination, in *Peer Polity Interaction and Socio-Political Change*, eds. C. Renfrew & J.F. Cherry. New York (NY): Cambridge University Press, 109–16.
- Sanders, W.T., J.R. Parsons & R.S. Santley, 1979. *The Basin of Mexico: Ecological Processes in the Evolution of a Civilization*. New York (NY): Academic Press.
- Sanders, W.T. & R.S. Santley, 1983. A tale of three cities: energetics and urbanization in pre-Hispanic central Mexico, in *Prehistoric Settlement Patterns: Essays in Honor of Gordon R. Willey*, eds. E.Z. Vogt & R. Leventhal. Albuquerque (NM): University of New Mexico Press, 243–91.

- Satterthwaite, D., 1997. Sustainable cities or cities that contribute to sustainable development. *Urban Studies* 34, 1667–91.
- Scarborough, V.L., 2000. Resilience, resource use, and socioeconomic organization: a Mesoamerican pathway, in *Environmental Disaster and the Archaeology of Human Response*, eds. G. Bawden & R.M. Reycraft. (Anthropological Papers 7.) Albuquerque (NM): Maxwell Museum of Anthropology, University of New Mexico, 195–212.
- Schaur, E., 1991. *Ungeplante Siedlungen: charakteristische Merkmale—Wegesystem, Flächenteilung/Non-planned Settlements: Characteristic Features—Path System, Surface Subdivision (bilingual text)*. (IL 39.) Stuttgart: Institut für Leichte Flächentragwerke.
- Schwartz, G.M. & J.J. Nichols (eds.), 2006. *After Collapse: the Regeneration of Complex Societies*. Tucson (AZ): University of Arizona Press.
- Serageldin, M.A., 1990. The development and morphology of informal housing, in *The Architecture of Housing*, ed. R. Powell. Singapore: Concept Media, 50–73.
- Sinopoli, C.M., 1994. The archaeology of empires. *Annual Review of Anthropology* 23, 159–80.
- Slater, T.R. (ed.), 2000. *Towns in Decline, AD 100–1600*. Aldershot: Ashgate.
- Sluyter, A., 2005. Recentism in environmental history on Latin America. *Environmental History* 10(1). <http://www.historycooperative.org/journals/eh/10.1/sluyter.html>.
- Sluyter, A., 2010. *The Geographical Review's* historical dimensions and recentism. *The Geographical Review* 100, 6–11.
- Smith, A.T., 2003. *The Political Landscape: Constellations of Authority in Early Complex Polities*. Berkeley (CA): University of California Press.
- Smith, M.E., 1992. *Archaeological Research at Aztec-Period Rural Sites in Morelos, Mexico*, vol. 1: *Excavations and Architecture [Investigaciones Arqueológicas en Sitios Rurales de la Época Azteca en Morelos, tomo 1: Excavaciones y Arquitectura]*. (Memoirs in Latin American Archaeology 4.) Pittsburgh (PA): University of Pittsburgh.
- Smith, M.E., 1993. Houses and the settlement hierarchy in Late Postclassic Morelos: a comparison of archaeology and ethnohistory, in *Prehispanic Domestic Units in Western Mesoamerica: Studies of the Household, Compound, and Residence*, eds. R.S. Santley & K.G. Hirth. Boca Raton (FL): CRC Press, 191–206.
- Smith, M.E., 2004. The archaeology of ancient state economies. *Annual Review of Anthropology* 33, 73–102.
- Smith, M.E. (ed.) 2006. Reconocimiento superficial del Valle de Yautepec, Morelos: informe final. Unpublished report submitted to the Instituto Nacional de Antropología e Historia.
- Smith, M.E., 2007. Form and meaning in the earliest cities: a new approach to ancient urban planning. *Journal of Planning History* 6(1), 3–47.
- Smith, M.E., 2008. *Aztec City-state Capitals*. Gainesville (FL): University Press of Florida.
- Smith, M.E., 2009a. Editorial: Just how comparative is comparative urban geography?: A perspective from archaeology. *Urban Geography* 30, 113–17.
- Smith, M.E., 2009b. V. Gordon Childe and the urban revolution: an historical perspective on a revolution in urban studies. *Town Planning Review* 80, 3–29.
- Smith, M.E. & L. Montiel, 2001. The archaeological study of empires and imperialism in Prehispanic central Mexico. *Journal of Anthropological Archaeology* 20, 245–84.
- Smith, M.E., C. Heath-Smith & L. Montiel, 1999. Excavations of Aztec urban houses at Yautepec, Mexico. *Latin American Antiquity* 10, 133–50.
- Smith, M.E., J. Novic, P.C. Kroefges & A. Huster, 2007. A new map of the Aztec-period city of Calixtlahuaca in central Mexico. *Antiquity* 81, 'Project Gallery' (<http://www.antiquity.ac.uk/ProjGall/smith1/index.html>).
- Smith, M.L., 2003. Introduction: the social construction of ancient cities, in *The Social Construction of Ancient Cities*, ed. M.L. Smith. Washington (DC): Smithsonian Institution Press, 1–36.
- Sobreira, F., 2003. Squatter settlements consolidation: spatial analysis in an agent-based environment, in *Proceedings, 4th International Space Syntax Symposium, London*. ([www.spacesyntax.org/symposia/SSS4/abstracts/16\\_Sobreira\\_abstract.pdf](http://www.spacesyntax.org/symposia/SSS4/abstracts/16_Sobreira_abstract.pdf)).
- Soule, D.C. (ed.), 2006. *Urban Sprawl: a Comprehensive Reference Guide*. Westport (CT): Greenwood Press.
- Stein, G.J. (ed.), 2005. *The Archaeology of Colonial Encounters*. Santa Fe (NM): SAR Press.
- Steinhardt, N.S., 1990. *Chinese Imperial City Planning*. Honolulu (HI): University of Hawaii Press.
- Taagepera, R., 1978. Size and duration of empires: growth–decline curves. *Social Science Research* 7, 180–96.
- Tainter, J.A., 2006a. Archaeology of overshoot and collapse. *Annual Review of Anthropology* 35, 59–74.
- Tainter, J.A., 2006b. Social complexity and sustainability. *Ecological Complexity* 3, 91–103.
- Tainter, J.A., 2008. Collapse, sustainability, and the environment: how authors choose to fail or succeed (review essay on Caldararo, Diamond, Gill, and Webster). *Reviews in Anthropology* 37, 342–71.
- Talen, E., 2002. Help for urban planning: the transect strategy. *Journal of Urban Design* 7(3), 293–312.
- Thomas, W.L.J. (ed.), 1956. *Man's Role in Changing the Face of the Earth*. Chicago (IL): University of Chicago Press.
- Tilly, C., 1984. *Big Structures, Large Processes, and Huge Comparisons*. New York (NY): Russell Sage Foundation.
- Tilly, C., 1996. What good is urban history? *Journal of Urban History* 22, 702–19.
- Turner, B.L., II, W.C. Clark, R.W. Kates, J.F. Richards, J.T. Mathews & W.B. Meyer (eds.), 1990. *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years*. New York (NY): Cambridge University Press.
- Turner, J.F.C., 1972. Housing as a verb, in *Freedom to Build*, eds. J.F.C. Turner & R. Fichter. New York (NY): Macmillan, 148–75.
- Turner, J.F.C., 1991. *Housing by People: Towards Autonomy in Building Environments*. London: Marion Boyars.



- UN-Habitat (United Nations Centre for Human Settlements), 2003. *The Challenge of Slums: Global Report on Human Settlements, 2003*. London: Earthscan.
- UNCHS/Habitat, 1982. *Survey of Slum and Squatter Settlements*. (United Nations Centre for Human Settlements, Development Studies Series 1.) Dublin: Tycooly International.
- Uzzell, D., 1990. Dissonance of formal and informal planning styles, or Can formal planners do bricolage? *City and Society* 4(2), 114–30.
- Van De Mierop, M., 1999. *The Ancient Mesopotamian City*. Oxford: Oxford University Press.
- van der Leeuw, S.E. & C.L. Redman, 2002. Placing archaeology at the center of socio-natural studies. *American Antiquity* 67, 597–606.
- Vance, J.E.J., 1990. *The Continuing City: Urban Morphology in Western Civilization*. Baltimore (MD): Johns Hopkins University Press.
- Varién, M.D., 1999. *Sedentism and Mobility in a Social Landscape: Mesa Verde and Beyond*. Tucson (AZ): University of Arizona Press.
- Vita-Finzi, C. & E.S. Higgs, 1970. Prehistoric economies in the Mt. Carmel area Palestine: site catchment analysis. *Proceedings of the Prehistoric Society* 36, 1–37.
- Wallace-Hadrill, A., 1994. *Houses and Society at Pompeii and Herculaneum*. Princeton (NJ): Princeton University Press.
- Wallerstein, I., 2003. Anthropology, sociology, and other dubious disciplines. *Current Anthropology* 44, 453–65.
- Ward-Perkins, B., 2006. *The Fall of Rome and the End of Civilization*. New York (NY): Oxford University Press.
- Ward, C., 1973. We house, you are housed, they are homeless (chapter 6), in *Anarchy in Action*. London: George Allen and Unwin, 67–73.
- Ward, C., 2002. *Cotters and Squatters: the Hidden History of Housing*. Nottingham: Five Leaves Press.
- Wheatley, D. & M. Gillings, 2002. *Spatial Technology and Archaeology: the Archaeological Application of GIS*. New York (NY): Taylor and Francis.
- Wilkinson, T.J., 2003. *Archaeological Landscapes of the Near East*. Tucson (AZ): University of Arizona Press.
- Williams, B.J., 1989. Contact period rural overpopulation in the Basin of Mexico: carrying-capacity models tested with documentary data. *American Antiquity* 54, 715–32.
- Worster, D., 1993. The shaky ground of sustainable development, in *The Wealth of Nature: Environmental History and the Ecological Imagination*, ed. D. Worster. New York (NY): Oxford University Press, 142–55.

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