

**Urban Form and Urban Land Use:
Some Contrasting Case Studies**

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INTRODUCTION

The World's urban areas are a testament to the impact of humans on the Earth's surface. Many owe their origins to the endeavours of ancient peoples and are synonymous with the advent of civilization. This of course depends on how cities and civilization are themselves defined but there is no doubt that the congregation of people in mutual living space has been a catalyst in cultural development. Many of these ancient cities have been abandoned, leaving behind structures that attest to the ingenuity and organization of past civilizations. Examples include the fabled cities of the Maya, Aztecs and Incas of Latin America, those of the Khmer empire in southeast Asia, the ancient cities of the Middle East and those of the Greek and Roman empires in the Mediterranean basin and beyond. Today, these often impressive remains provide opportunities for wealth generation through tourism. In contrast, many cities that were founded several millennia ago remain important centres today; they are characterized by ancient, historic and modern buildings, examples of which include Athens, Rome and London. There are also relatively modern cities which, especially in Europe, are mainly the product of the Industrial Revolution of the eighteenth century; one example is that of Birmingham in the UK. In the New World the colonial period beginning in the fifteenth century witnessed the foundation of many settlements that have become huge modern metropolises. Many such cities, examples of which are Toronto, San Francisco, Lima and Quito, reflect planning from their inception. In particular they reflect the importance of the gridiron system whereby streets are arranged in parallel with other streets constructed at right angles. Modern cities have also become established throughout the developing world, partly as a consequence of colonialism, partly because of efforts to centralize administration and provide services, and partly because of a degree of industrialization as well as inherent population growth. Some have ancient origins whilst others are relatively recent.

Cities are, paradoxically, similar yet different; the similarities reflect the overwhelming influence of humans and culture, especially the intense use of resources to create and sustain the built environment, whilst the differences reflect the varied ways in which local resources, notably building materials and their manipulation to suit the climatic conditions, have been used. No two cities are alike, even those which have been created from concrete blocks; people and place remain unique despite the globalizing efforts of multinational urban players such as McDonalds and Pizza Hut! Another common feature of cities in general is that most are growing rapidly. Urbanization is occurring in almost all countries but the highest rate of growth is in developing countries as people abandon the countryside in favour of what they perceive as improved employment and thus wealth-generating opportunities in urban areas. This movement of people is not only significant in China and India which are industrializing especially rapidly but it is also important in numerous African cities where the urban environment is perceived as a provider of opportunities for income even where a significant industrial base is absent.

As discussed in Mannion (2002), all cities are characterized by varied landuse: residential, industrial, retailing and public buildings are juxtaposed with parks, gardens and sometimes water bodies. Moreover, urban land use is dynamic; its continuous state of flux is the result, chiefly, of alterations in socioeconomic conditions and their accommodation. Cities also react to changes in their hinterlands,

especially changes in emphasis within agriculture and primary resource exploitation. They also exert a profound affect on their hinterlands; at the very least cities rely on their hinterlands to provide vital resources such as water, food and fuel energy and minerals and they produce waste materials which are generally disposed of outside the city boundaries. Hinterlands thus act as sinks for waste materials which are varied in nature, ranging from solid waste, such as sewage, to gaseous waste such as carbon dioxide from vehicular emissions and domestic fuel consumption. In consequence, cities have a large Ecological Footprint as defined by Rees (1992; see also Chambers *et al.*, 2000), ie. they are unsustainable insofar as they cannot generate sufficient food, fuel and other resources from within their geographical area to satisfy the requirements of their inhabitants or provide adequate means for the disposal of all types of waste. In contrast, however, cities provide a cultural archive in their archaeology, architecture, libraries, museums, art galleries, theatres and public buildings. All cities, and especially those with a long history, generate wealth, not only through their current functions as industrial and/or service centres but also through their attraction for tourism.

The following sections provide examples of the form and land use of several types of cities, notably ancient and now defunct cities, modern cities with origins that date back more than 2000 years, cities of the Americas which originated with the advent of European colonists c.1500 and later, and cities in the developing world which are currently experiencing substantial expansion.

ANCIENT CITIES: THE ARCHAEOLOGICAL CONTEXT

As the last ice age drew to a close c.12,000 years ago most humans lived in dispersed hunter-gatherer groups that occupied open, non-permanent sites often in caves or adjacent to water bodies. Indeed there is abundant evidence for this type of habitation from c.20,000 years to 10,000 years BP (see Gamble, 1999 and papers in De Laet, 1994). However, from c.10,000 years BP there is evidence for an increase in permanent settlements, many of which may have been associated with the advent of agriculture (see review in Mannion, 1999). Figure 1 gives the location of a number of these early settlements in the Middle East; others occur in Egypt, the Indus valley and China (see Maisels, 1999, for details). Early settlements have also been discovered in Latin America, the most well known of which were constructed by the Olmecs and the Mayans beginning c.3,500 years ago. However, recent discoveries at Caral in the Supe Valley, some 185 km north of Lima, have shown that permanent settlements in the Americas are older than this. The complex at Caral (see below) contains ropes made of reed, the age of which has been estimated by radiocarbon assay to be c.5000 years old. The archaeological remains of many other civilizations worldwide bear witness to the capacity of human societies to alter land cover by constructing built environments. Examples include Machu Picchu, an Inca citadel in Peru c.500 years old, Angkor, an urban complex constructed c. 1100AD in Cambodia as part of the

THE EPIPALAEOLITHIC

Abu Hureyra 1

PHASE 1 11,500 – 11,000 years bp

Characteristics: Interlinked pit dwellings c. 2 to 2.5m in diameter and up to 0.70m deep. Postholes are present around the edge and in the centre; these probably supported timber poles that held a thatched roof of reeds. The area of the village was c. 49m² and it was constructed by hunter-gatherers who exploited a wide range of resources from the nearby riverine, forest and plain environments. Querns, stone tools, animal bones and carbonized seeds were present plus storage pits of 1m diameter.

PHASE 2 11,000 – 10,400 bp

Characteristics: Houses are tightly grouped but are above rather than below ground as in phase 1. Hearths were present in the centre of the site and artefacts discovered include a range of stone and other tools.

PHASE 3 10,400 – 10,000 bp

Characteristics: The village opened up as suggested by more widely spaced floors and numerous hearths. Huts were similar to those of phase 1 i.e. wooden posts with cladding in between. Charcoal present shows that willow, poplar, maple and tamarisk were being exploited. Year round occupation is probable and a wide variety of resources were exploited, including gazelles and many different plant types.

HIATUS c. 10,000 – 9,500 village abandoned

Abu Hureyra 2

A new village came into existence. It was larger at 12 ha than Abu Hureyra 1 and located on a low mound. Initially gazelle hunting was the primary activity but by 9000 bp there was a shift to herding domesticated animals, such as sheep and goats, and cultivating a range of domesticated plants i.e. einkorn wheat, pulses and barley. The buildings were mid-brick houses located along narrow lanes and courtyards and many houses had polished floors. Occupation of the site continued until c. 7000 bp.

TABLE 1. The development of Abu Hureyra (based on Moore, 1991 quoted in Maisels, 1999)

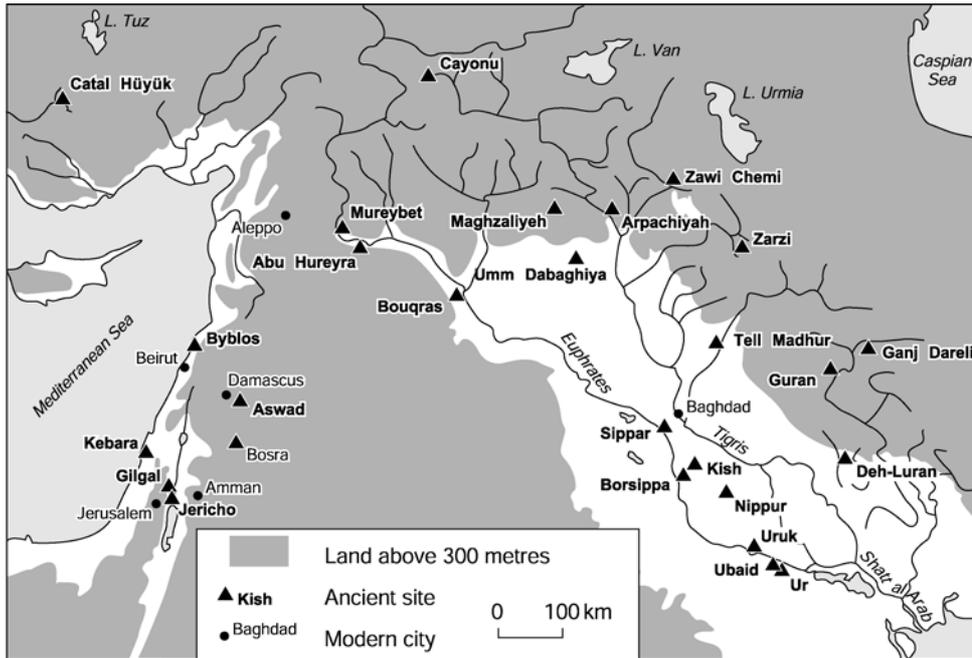


Figure 1 Ancient cities of the Middle East

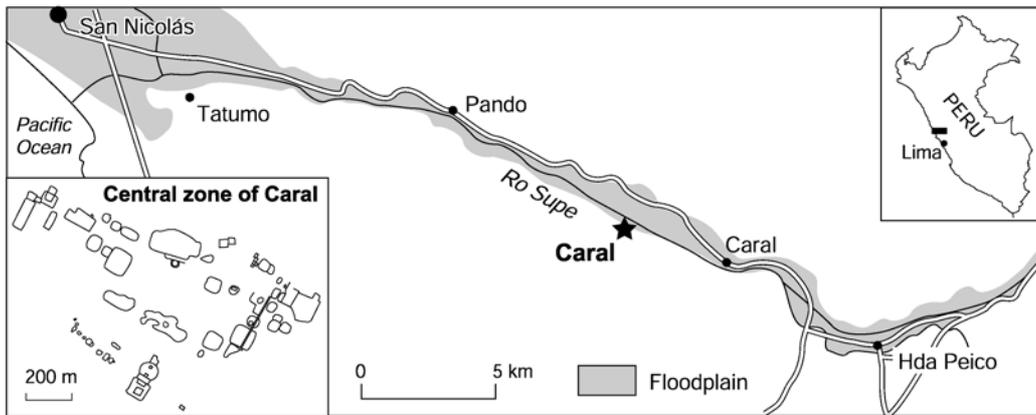


Figure 2 Location and detail of Caral, an ancient settlement in the Supe Valley of Peru (based on Solis *et al.*, 2001)

Khmer empire and the many settlements, between 4,500 and 4,000 years old, of the Harappan civilization in the Indus valley.

Some of the early settlements of the Middle East may not strictly be considered as cities; whilst it is clear that many contained numerous residences and communal structures most were only a few hectares in extent. But does size matter? These settlements represented a considerable departure from the form of earlier habitation sites and established a trend that was to culminate in the vast areas of urban land use that characterize today's world and in which almost half of the world's population currently lives. An example of one of these early settlements is that of Abu Hureyra, located in the Euphrates valley c.200 km west of Aleppo in what is modern Syria (see Figure 1). Not only is this an example of an early settlement associated with pre- and

post-agricultural activities but its archaeological record also reflects considerable change within the settlement over two millennia.

As shown in Table 1, three phases of occupation have been identified between 11,500 years ago when the settlement was founded and 10,000 years ago when it was abandoned. Hunting and gathering were the chief forms of food procurement but the site was not a temporary residence and, as Table 1 shows, there was a shift from underground to above ground dwellings by 11,000 years ago and an opening up of the settlement by c.10,400 years ago. Following a c.500 year hiatus a new, larger settlement was constructed comprising some 12 ha, the economy of which was associated with the production of domesticated crops and animals.

Caral, near Lima in Peru, is another early settlement associated with an economy based mainly on agriculture. Like Abu Hureyra it is pre-ceramic (or aceramic), ie. it was founded before the production of pottery, but its foundation was much later in time as Caral is c.5000 years old. According to Solis *et al.* (2001), Caral is but one of 18 pre-ceramic sites in the Supe valley. It is extensive; the central zone alone occupies 65 ha. As Figure 2 illustrates, there are communal or monumental (eg. pyramids associated with ancient religious practices, sunken circular plazas, terraces and enclosures) and various residential buildings; all were constructed from river cobbles and rubble and the outer walls were faced with several layers of plaster. The economy of the settlement was based on several components, notably irrigated agriculture involving the production of squash, beans and cotton, marine resources brought in from the coast, and a range of biomass resources from the Amazon basin. It is likely that other sites of a similar age, and possibly even earlier, await discovery in Peru's remarkable archaeological heritage.

Although not as old as the culture that established Caral, the Mayans had a major impact on the landscapes of Central America. They established numerous administrative and religious centres which supported relatively large populations and which controlled large and productive hinterlands. Figure 3 gives the locations of the remains of the most important sites and shows that they are located in present-day Mexico, Guatemala, Belize and Honduras where they make a substantial contribution to local and national economies as tourist attractions. Figure 4 is a schematic map of Tikal (Guatemala), a Mayan capital whose construction began some 2,500 years ago and which persisted until c. 900 AD. The city was built in a lowland tropical forest area, now a national park, which reclaimed the land when Tikal was abandoned and obscured the extensive buildings until their discovery in 1848. According to Coe (1967), major excavation work was conducted by the British archaeologist Alfred Maudslay in 1881 and 1882. As Figure 4 shows, the site is extensive; the national park itself is 222 square miles and whilst there are many outlying structures, the centre of Tikal occupies some 6 square miles and contains a considerable number of buildings reflecting a varied urban land use. Temples, pyramids, plazas, stelae, acropolises and altars predominate, many of which have detailed friezes depicting the religious and ritual practices of the elite that ruled this important city. Other structures attest to leisure activities of the time; for example, there are several ballcourts in which ceremonial games took place. In addition, there are various palaces which attest to the power and wealth of Tikal's rulers.

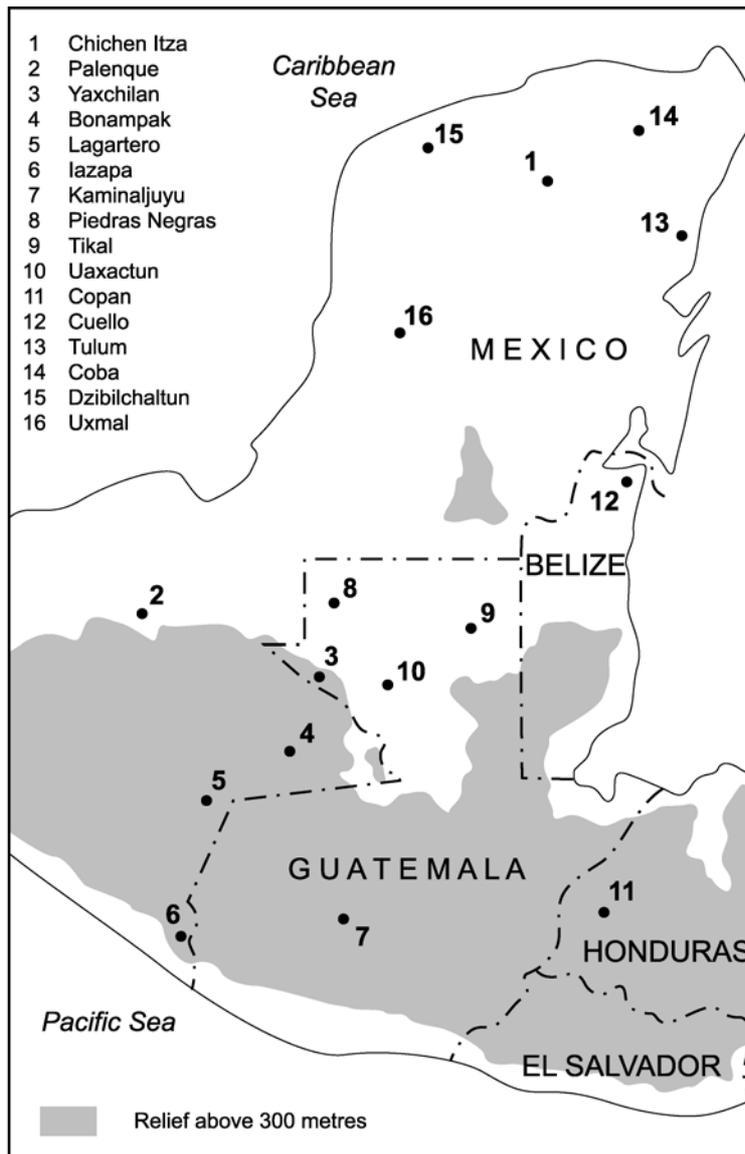


Figure 3 The distribution of Mayan Archaeological sites

While the Mayan empire flourished in Central America, the Roman empire came to dominate the Old World; beginning in what is modern day Italy, the Romans annexed lands throughout Europe, North Africa and western Asia. As Tikal was being founded so too was the city state of Rome. According to Fagan (1998), native Romans expelled foreign rulers in 509BC and thus set the seeds of what was to become a great, if not the greatest, empire, the extent of which is illustrated in Figure 5. Apart from Rome itself, which is discussed below, the Romans established numerous cities throughout their empire and moulded existing towns to their own design (see Figure 5). Many of these remain important urban centres today eg. Cologne, Autun, London (see below) and Norwich. Many others were abandoned and, like Tikal, they have been excavated, and today they are important outdoor museums and tourist attractions. Examples are Palmyra and Bosra in modern Syria; their locations are given in Figure 5 and details of their composition are

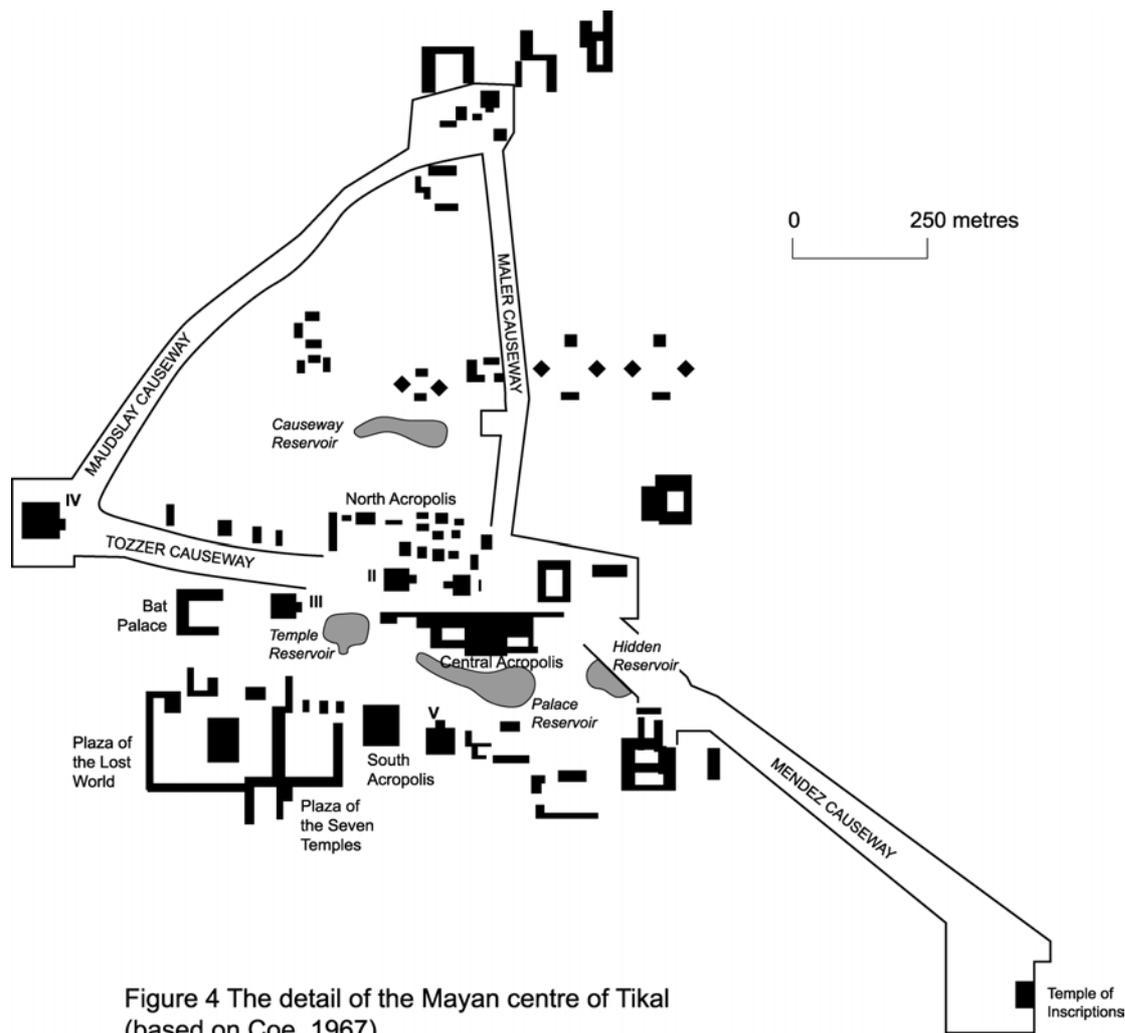


Figure 4 The detail of the Mayan centre of Tikal (based on Coe, 1967)

given in Figure 6. What is distinctive about Roman towns is the overall structure which comprises two main thoroughfares at ninety degrees to each other with a tetrapylon at the intersection and a wall around the periphery. Located within the walled area are commercial, residential, administrative and religious buildings. The plan of Palmyra, a remarkable oasis town in the Syrian desert is given in Figure 6 which shows that the main road is known as the Great Colonnade because it is flanked by huge pillars and that it is not straight, as is usual in Roman settlements. Beyond the tetrapylon, the eastern section of the Great Colonnade is several degrees askew, possibly because of a pre-existing structure which forced a deviation from the norm. In common with many other Roman towns, temples, military camps and market places are in evidence. In Bosra, which was annexed by the Romans in 106 AD, the most notable feature attesting to its Roman history is the fortified amphitheatre. This is one of the largest existing Roman amphitheatres; like the other Roman remains in the town the amphitheatre is built of local basalt and has the capacity to seat 15,000 people.

By the time the Mayan empire was crumbling (c. 900 AD) and some 500 years after the demise of the Roman empire, much of southeast Asia was under the control of the Khmer people. Like their counterparts in the Americas and Europe this Asian people have left their mark in present-day Cambodia, as shown in Figure 7. Under the

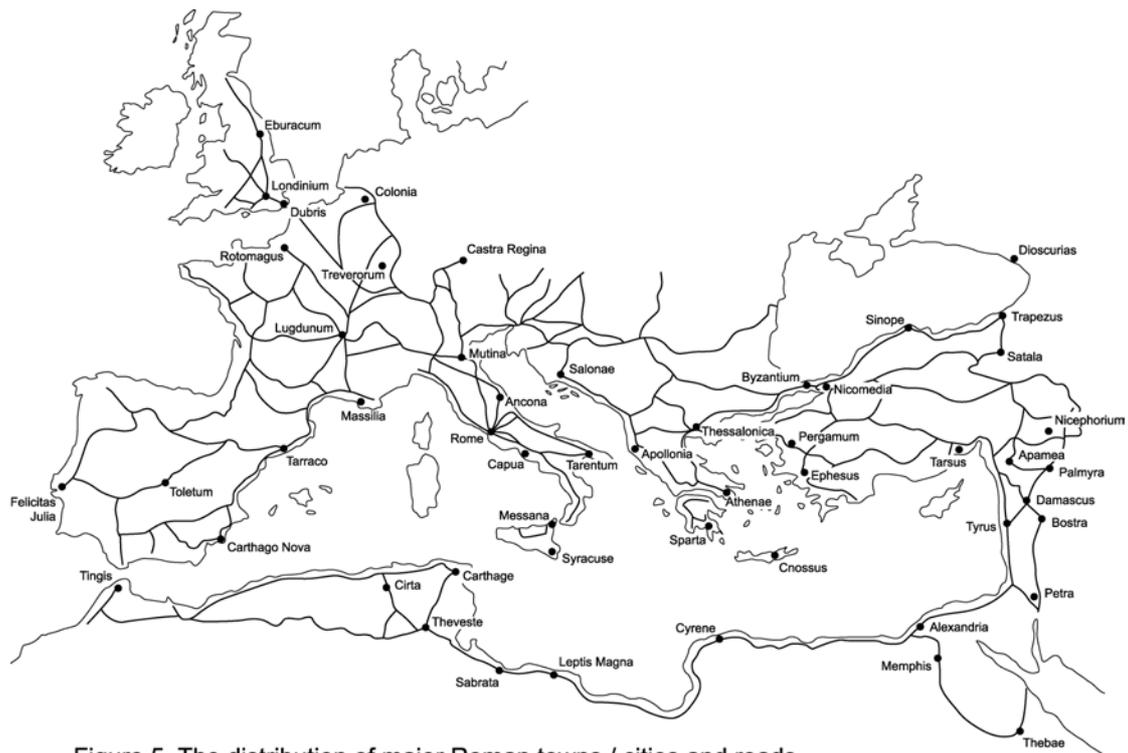


Figure 5 The distribution of major Roman towns / cities and roads (based on The Times History of the World, 1999)

jurisdiction of King Jayavarman II, who came to power in 802 AD, the Khmer empire was founded. It incorporated worship of the Hindu god Shiva and each successive emperor constructed a temple to commemorate his reign. According to Rooney (1994) it is the efforts of the various Khmer emperors to immortalize themselves that have given rise to the remarkable urban complex of Angkor in modern-day Cambodia. As Figure 7 shows, the dominant structures are Angkor Wat, a funerary temple complex, and Angkor Thom, a fortified city with buildings for priests, military and government officials as well administrative buildings and a royal residence. The city bears witness to the considerable architectural skills of the Khmer whilst the intricate bas-reliefs reflect artistic excellence. The splendour of the Angkor complex also reflects the wealth of the Khmer empire and the capacity of the land for food production.

All of the ancient cities referred to above, through their ability to attract visitors, continue to generate wealth for local people.

HISTORIC WORLD CITIES

It is generally considered that the ‘modern’ city began with the emergence of Athens as a city-state c.500 BC. Originally founded c.7,000 years ago, its emergence as a city-state marked its heyday; its population grew to c.275,000 and it was described as a magalopolis, especially when compared to most other settlements in the Mediterranean world whose populations did not exceed 150,000 (see Hall, 1999 for details). However, the city’s greatest growth has occurred since the 1850s following its designation as the capital of Greece in 1833. Athens, as shown in Figure 8, lies in

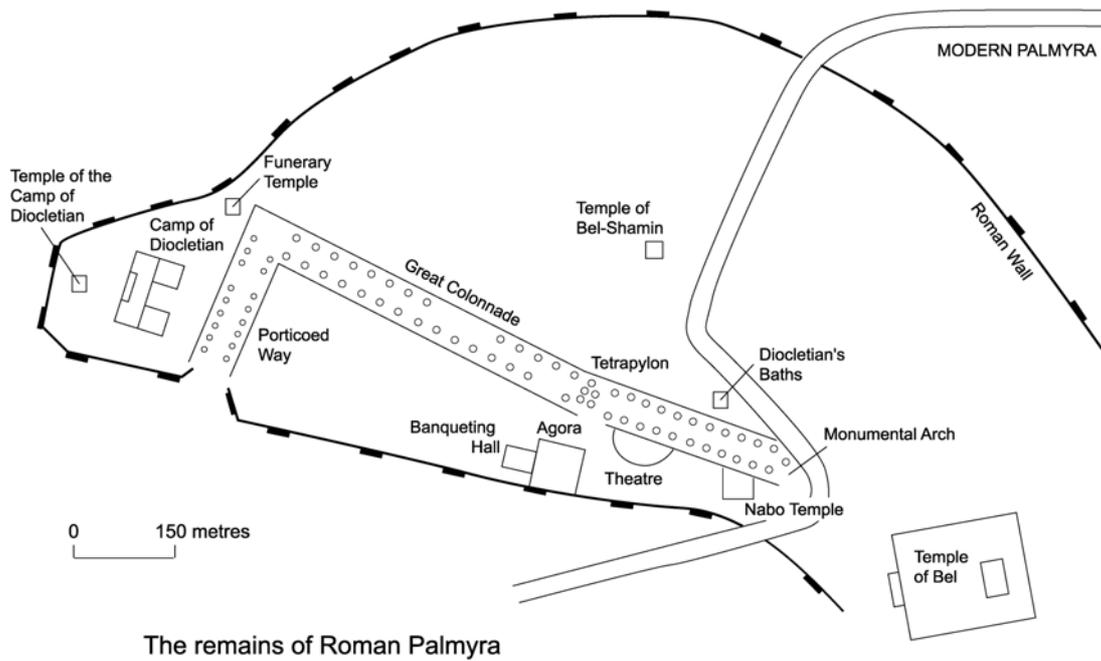
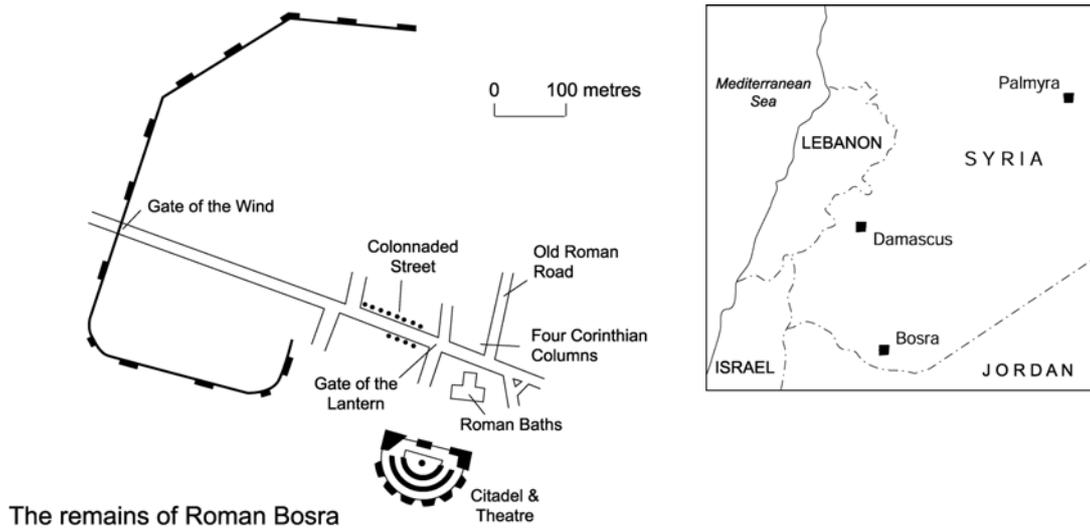


Figure 6 Examples of Roman towns: Bosra and Palmyra

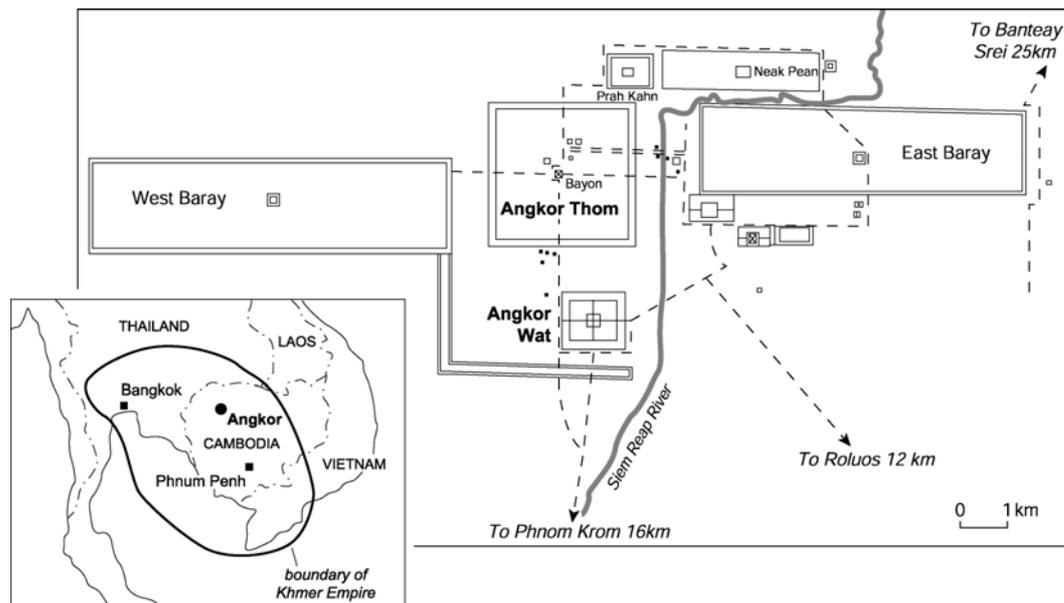


Figure 7 The Khmer Empire and the Angkor Complex (based on The Times History of the World, 1999, and Rooney, 1994)

HISTORIC WORLD CITIES

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Ancient Athens was a member of a *polis*, an economic and political unit. It occupied 2,756 km², representing a unified Attica and a fusion between urban and rural sectors. Hall (1999) states that two noteworthy citizens of Athens, Plato and Aristotle, considered a *polis* as a generally self-sufficient unit with some import of essential resources that were not available locally. In modern terms, a *polis* would not have a major ecological footprint because its biocapacity, ie. ability to support its population in terms of food and fuel production and waste disposal (see above), would not greatly exceed its needs. It is possible that some *polis* were indeed self-sufficient but this was not the case for Athens as it was necessary to import significant amounts of grain and wine. According to Morris (1994), many Greek cities of this period, eg. Miletus and Priene, were subject to planning based on the gridiron system but this was not the case for Athens which experienced a more organic form of growth. This was particularly true in its heyday (5th century BC), when the city grew rapidly and new residential

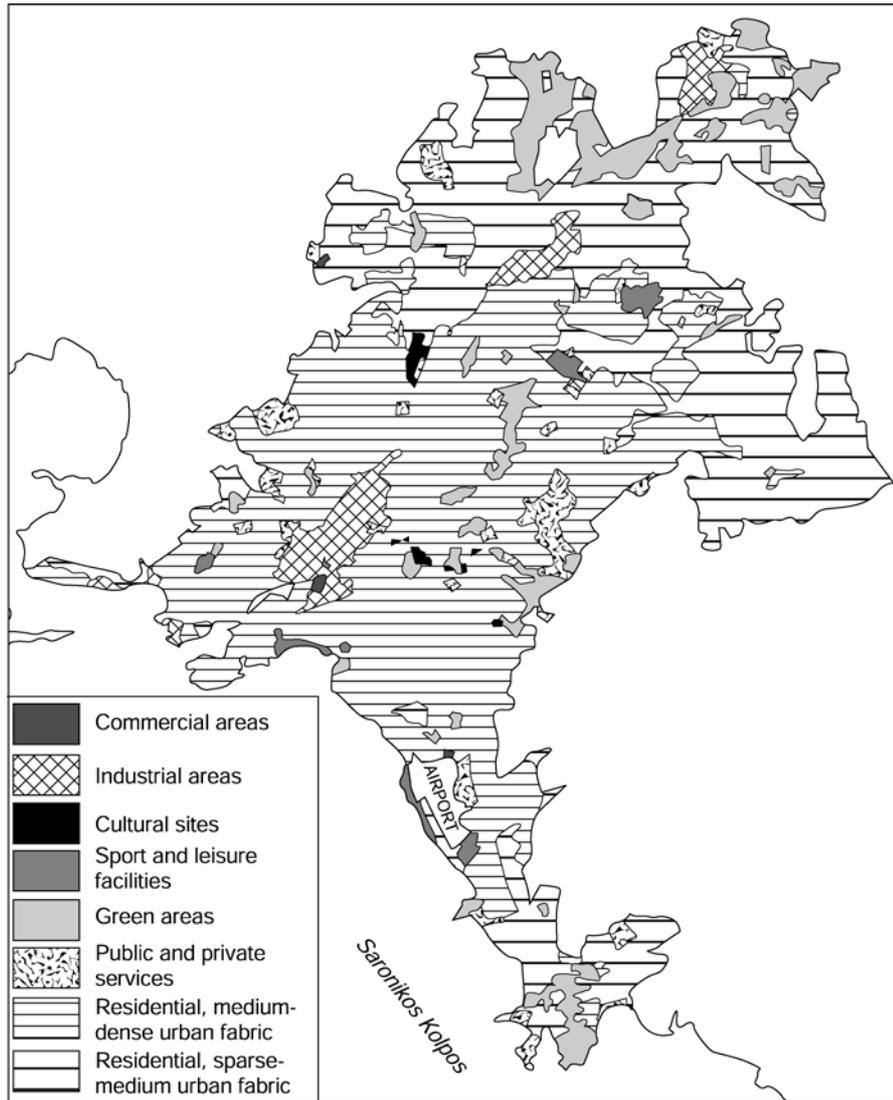


Figure 8 A simplified land-use map of the Attica basin, Greece, 1999 (based on Geoapikonisis, 2001)

areas spread irregularly from the centre into the plain of Attica. The defeat of Athens by Philip II of Macedon in 338 BC began the city's decline although it was subsequently influenced by Roman architecture. The Goths destroyed a large part of the city in 267 AD and a new but smaller city was constructed. Morris (1994) points out that this rebuilt city occupied only c.16 ha within a new wall. Between 1461 and 1830, Athens came under the influence of Turkey and experienced an Islamic influence on its art and architecture and by the time Greek rule was re-established in 1830 there were a mere 4000 inhabitants; Athens was a village once again.

DATE	POPULATION
1830	c.4000
1862	c.42,000
1871	c.68,000
1922	c.108,000
2000 Greater Athens	c.3,098,775
Municipality of Athens	784,110

Table 2. Data on population change reflecting the growth of Athens, Greece (Envibase Project, 2001).

The data given in Table 2 show the rapidity with which Athens grew once it received the status of capital; within 30 years the population had increased by a factor of ten and although this rate of growth subsequently slowed the population of modern Athens is substantial; more than three million people live in Greater Athens (Envibase Project, 2001). The city has experienced rapid growth in the post World War II era resulting in the land use of present-day Athens as given in Figure 8. This shows that residential areas predominate with the greatest density of green areas in the northeast and three major industrial areas along a northeast axis. According to Envibase (2001), a regional plan to effect decentralization was inaugurated in 1985; it involves the creation of a number of ‘centres’ at community and neighbourhood levels with linking road networks and open spaces as well as plans to improve air quality and general modernization. Another impetus for change within Athens is the reprisal of its role as host of the Olympic Games in 2004.

Like many other major European cities, London also has ancient origins; there is, for example, archaeological evidence of palaeolithic, mesolithic, neolithic and Bronze age and Iron age occupation, as well as Roman and later settlement, points to continuous occupation for the last 8,000 years. However, Inwood (1998) states that ‘enough evidence has been discovered,....., to establish that London was a Roman new town, not a Romanized version of an ancient British settlement’. The Romans established *Londinium* (see Clout, 1999) in 50 AD, just a few years after their successful invasion of Britain in 43AD in what they considered was a good place for bridge construction across the Thames but which could receive sea-going ships. To quote Inwood: ‘Although the chosen site had other advantages, including a good water supply, its ability to command the land, river and sea communications of southern Britain from the lowest bridgeable point on the Thames has been the key to London’s commercial and administrative predominance for almost 2,000 years’. He goes on to point out that, because of its bridge(s), *Londinium* became the centre of road links with other parts of Britain to the north and south; it is this strategic position (see Figure 9) which has continued to contribute to London’s role as Britain’s vibrant capital and helped to turn it into an international centre through modern rail, road and air facilities. From Roman times London’s population has increased from c. 100,000 (as estimated by Morris, 1982, quoted in Inwood, 1998) to c. 6.5×10^6 , which is the population of Greater London today. As a consequence of this long period of occupation, the city has undergone many changes in residence types, architecture, industrialization, transport networks and retail facilities.

Hall (1999) has highlighted three specific periods of this long history as being of prime importance both at home and abroad. These are given in Table 3. The Elizabethan era of London as a cultural mecca witnessed an increase in population from c.200,000 in 1600 AD to c.500,000 in 1660 AD. Moreover the Great Fire of 1666 brought change of a different kind as much rebuilding was necessary. Entrepreneurial activities focused not only on the theatre world but also on commercial enterprise and so London became a capital of capitalism, a characteristic that reasserted its importance in the 1980s. In between, in the 1800s, the city expanded as an industrial base became established. London also experienced major structural change during and after World War II; bomb damage was extensive, especially in the City of London (the present business district) as detailed in Clout (1999), and some 29,890 people died (Inwood, 1998). Rebuilding was necessary. This plus the fact that new homes were desperately needed for a growing population meant that London's land use altered substantially by 1950. By the 1970s the beginning of a shift away from manufacturing to service industries was underway generating further change through the 1980s and 1990s. This period also witnessed a revival of London's Docklands not as providers of port facilities but of expensive apartment blocks and specialist shopping facilities in renovated warehouses. Other, important assets of London are its royal connections in the form of buildings and parks, its historic government buildings and its world-renowned museums and galleries. These, and its theatres, attract tourists from all over the world, an industry that contributes considerably to wealth generation and which attests to London's status as an historic world city.

ERA	CHARACTERISTIC
1570-1620	Innovation in the theatre: significant developments in the performing arts occurred with the emergence of world-class playwrights
1825-1900	The utilitarian city: a time of major growth and innovation to improve the quality of urban life, including prison reform, sewerage provision and housing improvement
1979-1993	The capital of capitalism: manufacturing industries declined as did London's role as a major port while the financial and service sectors led the way as the city became a centre of global capitalism

Table 3. Three significant eras in London's history as defined by Hall, 1999.

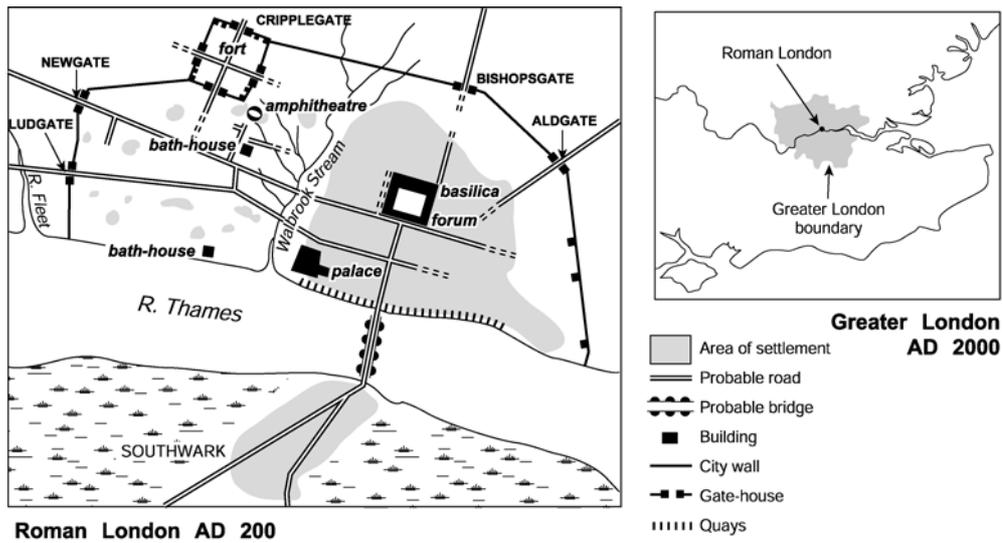


Figure 9 The area of Greater London today compared with that of Roman London (based on Clout, 1999)

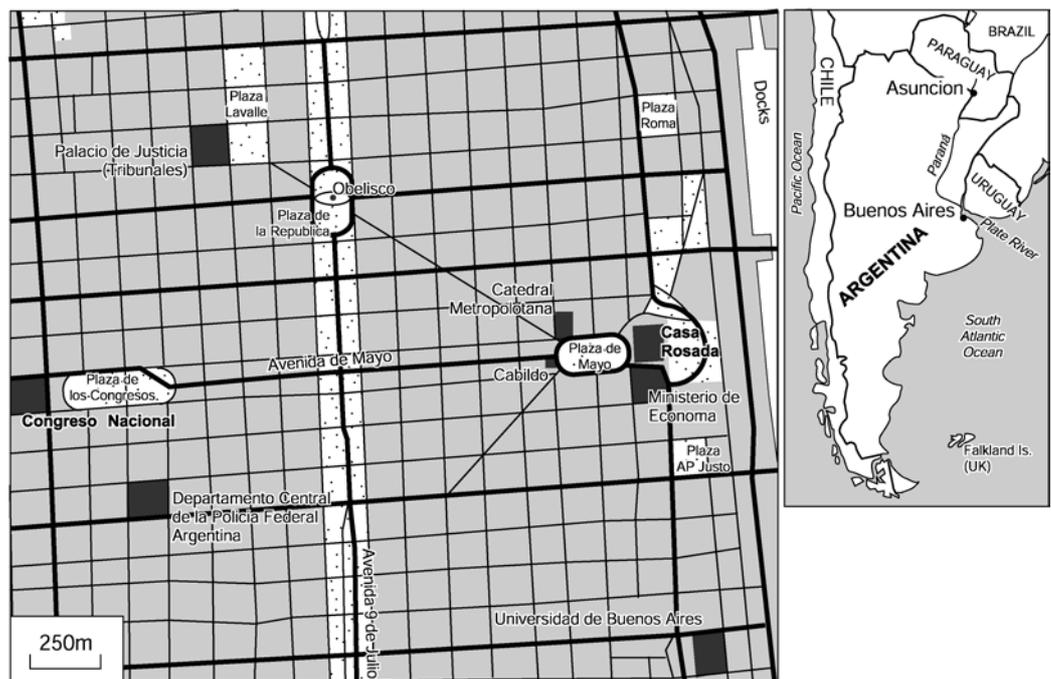


Figure 10 The structure of the centre of Buenos Aires, Argentina (based on Lonely Planet Map Series, 2001)

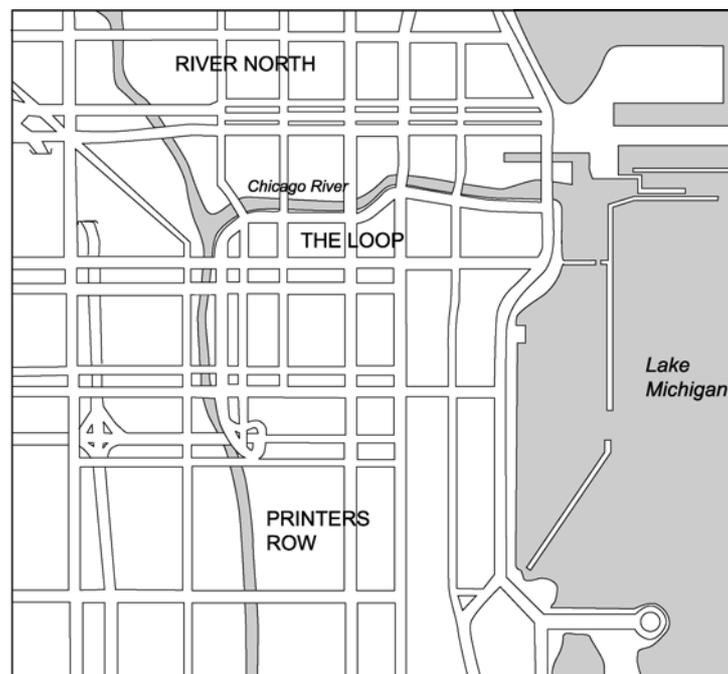
RECENT WORLD CITIES

Many of today's cities have relatively short histories when compared with those discussed above. The 'expansion of Europe', for example, into the Americas, which began in the fifteenth century, and later into Australasia, led to the foundation of new settlements that eventually became cities. Some were constructed on the sites of pre-existing indigenous settlements whilst others were founded in pristine locations which were considered strategic for trade and exploration. Most of the cities of North America and Latin America originated under these circumstances and most were planned cities from their inception. According to Morris (1994) Spain's King Phillip II issued a royal ordinance which established guidelines for the structure of settlements throughout Spain's empire which thus have many features in common. For example, the cities and towns of Latin America in particular have a central rectangular plaza, essentially a small park, around which a church or cathedral and administrative buildings were constructed. Moreover, the gridiron system of street construction was generally used so that, where topographically feasible, streets were arranged at right angles to each other. Amongst the earliest cities to be established were Havana, Cuba, in 1514, Buenos Aires, Argentina, in 1580 and Mendoza, Argentina, in 1561 (Morris, 1994).

Buenos Aires was initially founded in 1536 as the settlement of Nuestra Senora Santa Maria del Buen Aire on the banks of the River Plate. However, this settlement did not prosper and a second settlement was founded nearby in 1580. As discussed by Morris (1994), the city was designated as a royal governorship in 1618 and then it became Spain's vice-regal capital in 1776. It flourished and by 1900 emigration from Spain had increased its population to more than a million making Buenos Aires the largest city of Latin America. Its population today is $c.3 \times 10^6$ with a population of 11×10^6 in Greater Buenos Aires, ie. c.33 per cent of Argentina's total population. The area of land occupied by the city is $7,729 \text{ km}^2$ of what was rolling pampa.

The detail of modern Buenos Aires is given in Figure 10. It shows that the city centre comprises a compact rectilinear arrangement of avenues which has produced a number of squares. At the eastern end of the main *Avenida de Mayo* is the presidential palace known as the *Casa Rosada* and the cathedral whilst the congress building is at the western end. Recent work by Morello *et al.* (2000) has shown that since 1869 urbanization has been extensive, exerting a substantial 'landscape footprint' on the natural environment of rolling pampa which is one of Argentina's richest agricultural areas. The 'landscape footprint', not to be confused with the 'Ecological Footprint' referred to above, is a measure of the productive land, water, and natural and semi-natural landscapes consumed by the city. This 'landscape footprint' is most important in the peri-urban zone, the ecotonal area between the urban and rural environments where neither zone operates at its optimum. The rural sector is characterized by poor ecosystem services, including impaired carbon storage due to below-optimum photosynthesis as land is used for purposes such as rubbish disposal (which may be illegal), and soil removal for urban gardens and brick manufacturing; land parcelling in anticipation of price rises as the city expands may also have a detrimental impact. In the urban zone there is often a lack of services such as water availability and sanitation provision. Morello *et al.* also show that land parcelling is itself a measure of urban expansion on a temporal basis. For example,

land parcelling was at a height during the 1947 to 1970 period when it involved c. 61 km² per year; subsequently it declined to 16 km² per year.



**Figure 11 Gridiron structure of Chicago's centre
(based on the Times Concise Atlas of the World, 1995)**

In North America Chicago is an example of a city planned on the gridiron system (see Figure 11). According to Chicago Public Library (1997), the city's origins, at the mouth of the Chicago River as it enters Lake Michigan (see Figure 12), lie in the foundation of two Indian villages which were established in the late 1600s and the Mission of the Guardian Angel established by Father Francois Pinet in 1696. This was abandoned in 1700 and it was another century before Fort Dearborn was constructed in 1803; following its destruction in 1812 by hostile Indians, the fort was rebuilt in 1816. The first major growth stage occurred in the 1830s as the construction of the Illinois and Michigan canal began. The Cambridge Gazetteer of the United States and Canada (1995) states that by the time the canal was opened in 1848 Chicago had been granted a city charter (in 1837) and the all-important railways had been established. Chicago was rapidly becoming a centre of communications based on rail and water and a major depot for the grain and beef produced in the Mid-West. Growth was also stimulated by the Civil War and by 1871 there were 300,000 inhabitants. 1871 was a momentous year insofar as a fire destroyed a large part of the city. Rapid rebuilding followed as did rapid expansion; population increased from c. 1×10^6 in 1890 to c. 2×10^6 in 1910.

This and subsequent growth is reflected in Figure 12 which shows that major expansion occurred in the 1950 to 1998 period. According to data quoted in SustainUSA (2002) the population of the Chicago region increased by 4 percent between 1970 and 1990 but the extent of urban land increased by 35 per cent; another

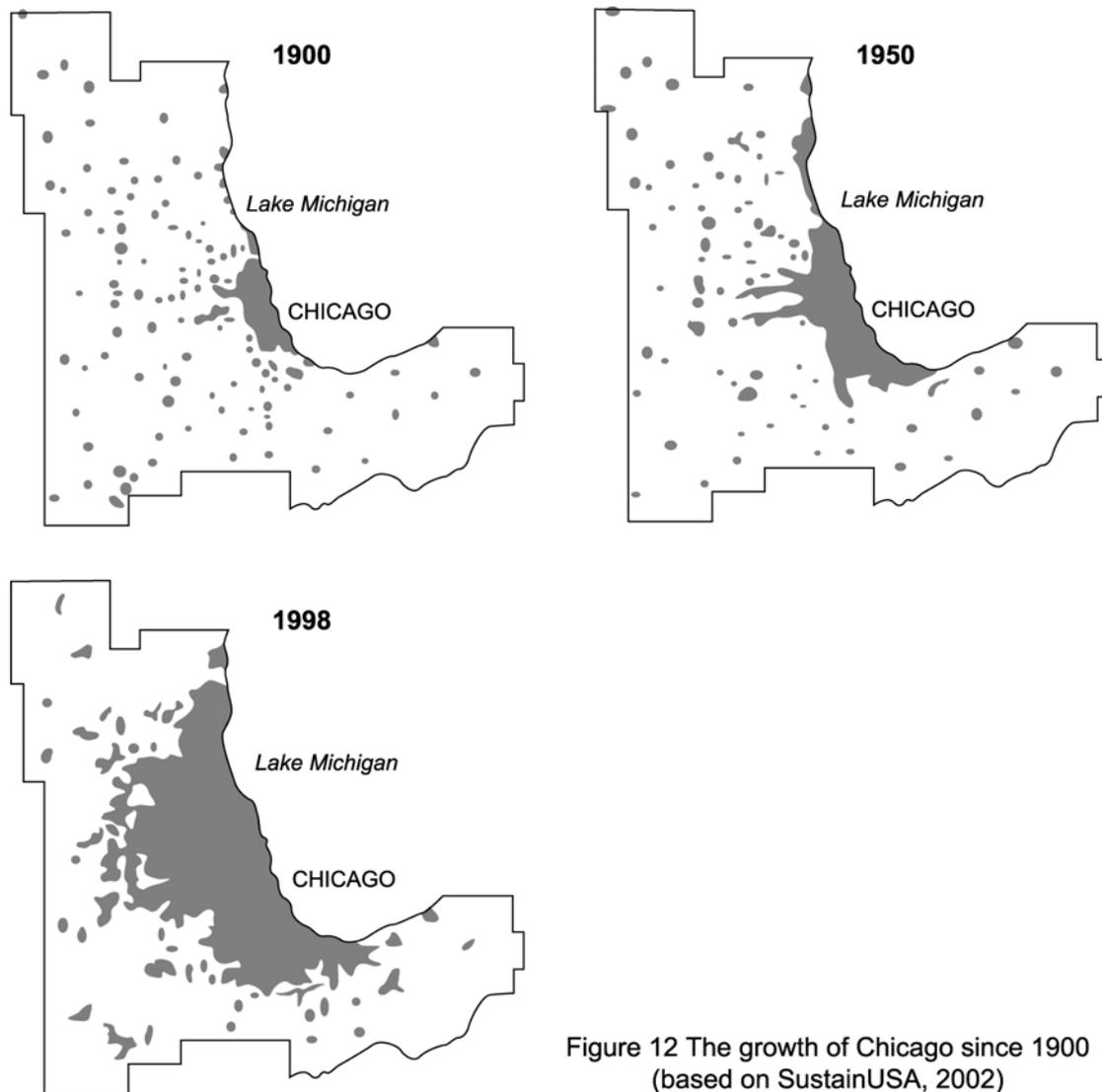
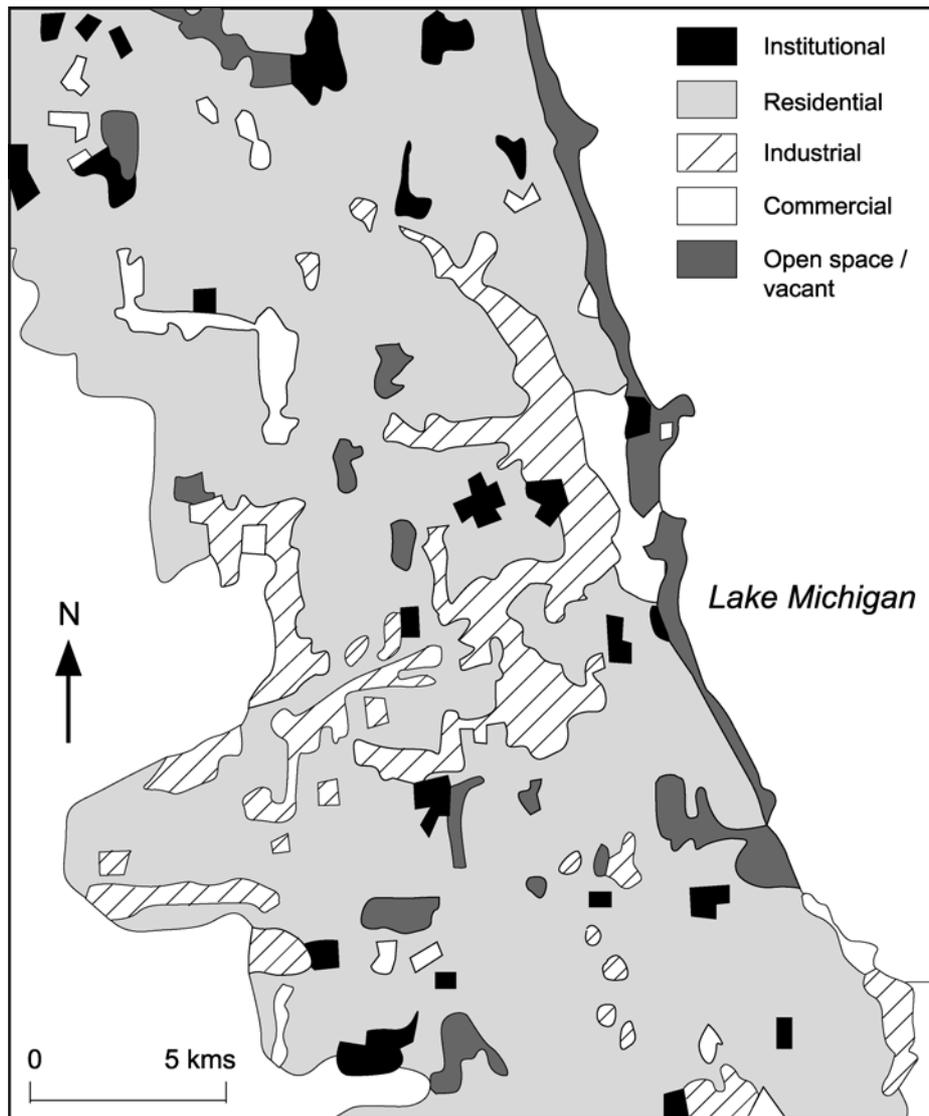


Figure 12 The growth of Chicago since 1900 (based on SustainUSA, 2002)

large increase occurred between 1990 and 1996 when population increased by 9 per cent and the urban area expanded by a massive 40 per cent; the latter has occurred because of increasing demand for properties with extensive gardens/grounds and so the amount of land consumed by urban growth is out of proportion with the actual population growth. Chicago now extends well beyond its original six counties to thirteen counties in three states. This expansion has been fuelled by *in situ* population growth, immigration and a shift of people from the central area of the city and inner-ring suburbs to outlying towns and villages facilitated to a large extent by the construction of interstate highways. Moreover, the sources quoted by SustainUSA indicate that Chicago's population growth is likely to increase a further 25 per cent in the next 25 years though this will not be uniformly distributed. Inevitably, a city of such vast proportions and rapid growth is characterized by a wide range of land uses which are in a continual state of flux. Figure 13 provides a snap shot of the distribution of the major land uses in 1990. The use of land for residential purposes predominates whilst commercial and industrial uses are next in importance. This rapid growth has resulted in environmental degradation due to pollution, especially air pollution caused by vehicular traffic, as well as loss of loss of agricultural land and



**Figure 13 A simplified land-use map of Chicago, USA
(based on Northeastern Illinois Planning Commission (NIPC), 1998)**

natural ecosystems. Similar developments have taken place in many of the metropolitan areas of the USA another example of which is Atlanta, Georgia, as has been reported by Yang and Lo (2002). Using remote sensing techniques and GIS Yang and Lo have shown that the extent of forest in Atlanta's metropolitan area declined by c.13 per cent between 1973 and 1998 as high-density and low-density urban land use increased in parallel with a population increase of c.30 per cent.

Even more recent cities have been constructed on the basis of approved plans and designs on sites with no history of settlement. The major examples are Brasilia in Brazil, Islamabad in Pakistan and Canberra in Australia. Canberra is the oldest as construction began in 1913, Brasilia was constructed between 1956 and 1960, and Islamabad emerged in the northern part of the Pothowar Plateau in the early 1960s; all are national capitals. The basic layout of Canberra is shown in Figure 14; at the centre lies lake Burley Griffin, so named because it was the plan of Walter Burley Griffin, an



Figure 14 The basic layout of Canberra, Australia
(based on National Capital Authority, 2001)

American landscape architect, that won an international competition to find an appropriate design for Australia's proposed capital. Although work on the site was disrupted by the Depression as well as World Wars I and II, parliament was first convened there in 1927 but only in the 1950s was substantial progress made in building work. According to the national capital Authority (2001) the state of New South Wales designated 911 square miles of land for Canberra in 1913 and today there is a city of some 300,000 people most of whom live in satellite towns each with a designated centre. As Figure 14 shows Canberra's centre also has a number of foci, e.g. the City and Capital Hill, around which roads have been constructed in concentric circles; there is also an abundance of green spaces in a city dominated by a land use comprising government/administrative buildings and service industries. This city structure is in marked contrast with the gridiron structure of North American cities (see above).

RECENT GROWTH IN CITIES OF THE DEVELOPING WORLD

Throughout the world there is a trend towards urbanization, (see United Nations Centre for Human Settlements (Habitat), 2001) as some of the examples given above illustrate. However, the most marked trend is in the developing world where rates of rural depopulation are greatest as people move to the cities in search of employment and opportunities to improve their standards of living. In many cases existing cities are overwhelmed by new settlements in their peripheral regions; here, service provision is nil and housing quality as well as transport facilities are poor. The land-use changes and resulting social and health problems associated with this urban sprawl are illustrated by the case of Lima, Peru. Here, informal settlements are especially obvious in the city's periphery along the Panamerican highway where they contrast with the surrounding desert. The people of entire villages from the Andean mountains have relocated, producing 'informal' or shanty-town dwellings at Lima's edges to create so-called *pueblos jóvenes* or young towns. Individual houses of reed mats are constructed initially, but with time and the generation of income for the inhabitants who find employment in Lima, the houses are reconstructed with bricks, general improvements to the local environment occur and services improve. Such suburbs eventually become subsumed into Lima's infrastructure though there are ongoing problems of waste and sewage disposal which impair beach quality. As in the case of the growth of metropolitan areas in the USA (see above), the growth of many cities in the developing world has been recorded using remote-sensing techniques. For example, Prol-Ledesma *et al.* (2002) have monitored urban growth in the Chalco Basin to the southeast of Mexico City. Their data show that between 1975 and 1993 the annual growth of the urban area was a huge c.14 percent; this occurred mainly at the expense of agricultural land.

In another study of urbanization in Mexico Lopez *et al.* (2001) have shown that Morelia, in the State of Michoacan, had grown by 375 per cent between 1960, when it occupied c. 709ha, and 1990 by which time it had expanded to 3368ha. Much of this growth was due to the coalescence of a number of smaller settlements as well as through the consumption of agricultural land. This widespread process of urban expansion in which rural communities are subsumed into the periurban environment has resulted in the term *desakota* (derived from the Indonesian words for country and town ie. *desa* and *kota*) to signify the conjunction of town and country in terms of land use and employment. The term was coined by McGee (1989) and is now widely used to describe many periurban zones in developing countries.

The process of urbanization has been especially rapid in China where startling changes have occurred in the last three decades in the wake of liberalization policies since the end of the Maoist era. The rate of urban expansion has been particularly notable in the coastal provinces and cities which have benefited from new economic links in the Asia - Pacific rim. Using remote-sensing techniques Ji *et al.* (2001) have determined rates of urban change throughout China. Their results are given in Figure 15 which highlights the rapid annual growth experienced in the coastal provinces of the southeast. Rates as high as 30 per cent per year have been experienced in the cities of the Pearl River delta; in Guangdong Province, for example, the average rate of urban growth was c.27 per cent between 1989 and 1996/1997. Much of this expansion has been stimulated by the creation of 14 special economic zones in 1980 in this area by the Chinese government which attracted migrants from rural areas and

foreign investment; moreover, rural industrialization has also played a major role in this region (Lin, 2001). In another study based on remote-sensing techniques, Seto *et al.* (2002) suggest that between 1988 and 1996 the urban area in the Pearl River delta has increased by more than 300 per cent whilst in China overall Ji *et al.* (2001) state that urban areas have grown by c. 1.2×10^2 ha mostly at the expense of much-needed agricultural land, the arable component of which has declined by c. 0.867×10^6 ha. Additional studies have been undertaken on individual cities in China's southeast. For example, the case of Shenzhen, which is one of the special economic zones (see Figure 14), has been discussed by Ji *et al.* (2001) and Sui and Zeng (2001). In terms of population there was a 10-fold increase between 1980 and 1994 during which time population expanded from 0.333×10^6 to 3.35×10^6 ; in terms of urban area there was an increase of c.144 per cent between 1989 and 1996 as the city expanded from 149km^2 to 363km^2 . A similarly large expansion of Fuqing City occurred between 1991, when the urban area occupied 4.495km^2 , and 1996, by which time it had grown to 7.864km^2 (Xu *et al.*, 2000). In view of China's continued economic prosperity, it is likely that urbanization will continue apace into the twenty-first century'.

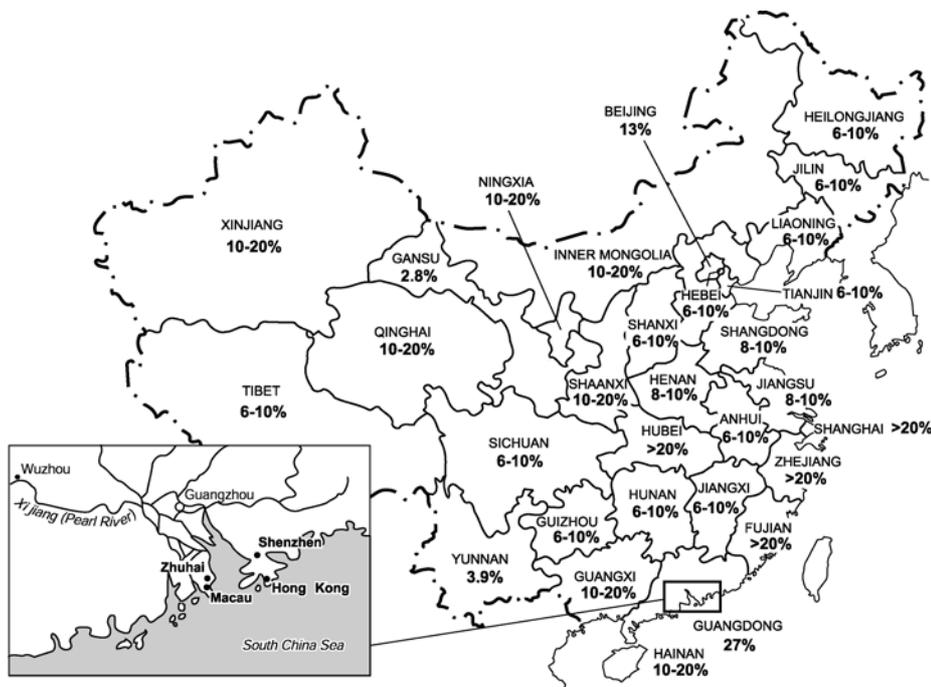


Figure 15 Rates of urban expansion in China (based on Ji *et al.*, 2001)

CONCLUSION

Urban form and urban land use represent a wide variety of land cover types which bear little, if any, resemblance to the natural environment which preceded them. Many cities have ancient origins, the remains of which are often juxtaposed with modern buildings; such remains attest to the power, wealth and cultural achievements of former empires and civilizations. In contrast many cities of ancient cultures were abandoned as empires declined and only vestiges bear witness to once great art and architecture. They do, however, continue to generate wealth for their host countries as significant tourist attractions. The expansion of Europe which began in the sixteenth century encouraged the growth of existing settlements and the construction of new ones based on European traditions. In the Americas new cities based on the gridiron system emerged, with streets and avenues intersecting at right angles and so imparting a high degree of regularity to the settlement pattern. Later, in the eighteenth century, European traditions spread to the Antipodes.

Industrialization in the eighteenth century also had a profound affect on European and American cities; not only did cities expand but their use altered to accommodate the changing economy, the shift of people from the countryside and high internal population increase.

In the last century several 'new' cities have been created, usually as capital cities. Such cities, the example of which that is discussed herein is Canberra, Australia, are entirely planned and accommodate a plethora of buildings linked with administrative functions as well as green open spaces and heritage collections in purpose-built museums. Moreover, during the last century, and especially in the last 40 years, the entire world has experienced a massive shift of people from rural areas into towns and cities; this trend is especially significant in the developing world and is particularly marked in those nations experiencing rapid industrialization. For example, exceptionally rapid growth has occurred in the southeast regions of China's Pacific coast; changing political and related economic policies have fostered urban change and development in a rapidly industrializing part of the world.

All indications, as voiced by national and international agencies such as the United Nations, the Food and Agriculture Organisation (FAO) and Population Reference Bureau (PRB), are that urbanization is set to continue. By c.2025 more of the world's population will live in urban areas rather than in rural areas; humankind is on the threshold of another major transition in its *modus operandi* as the emphasis shifts from the rural to the urban for the first time in history. Thus the ecological footprint of developed and developing nations will broaden and deepen, and alteration of the biosphere will continue apace.

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