URBAN SPRAWL

origins and environmental consequences

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1. INTRODUCTION

During the second half of the 20th century urban sprawl has become a mass phenomenon throughout the western world. Over time, it has developed to be one of the most popular subjects in the discourse about urban and regional development. Plenty of literature about urban sprawl in terms of specialised books, scientific studies, analyses, articles in journals etc., revealing ever new findings, has been published. On the one hand, this is due to the complexity of the phenomenon. Urban sprawl is a very multilayered process. It is shaped by various historical, political and socio-economic factors, as well as the process itself in turn influences all these dimensions. On the other hand, urban sprawl polarises the academic discourse. While its advocates conceive urban sprawl as a form of natural urban development, symbolising the individual's freedom of choice, its opponents allude to the multilayered problems urban sprawl supposedly entails.

The purpose of the present work is to provide a brief survey of the process of urban sprawl. What are its origins, how did it develop and why? Moreover, focus will be on environmental concerns in the framework of urban sprawl. The thesis concentrates on developments in Europe and North America, where cities can look back on a long history of sprawl, and where processes have become very sophisticated. Based on a detailed description of the origins and history of urban sprawl in Europe and the United States, potentially sprawl-induced effects on the environment will be presented and discussed. In a further step, urban sprawl in two case studies will be highlighted and discussed with special focus on environmental effects. The purpose in doing so is basically to provide a basis and a starting point for further discussions concerning potential and actual effects of sprawl on environment concerns.

The *following chapter* will examine the origins and basic historic stages of urban sprawl in Europe and the United States. Focus will be on the basic differences in the historic development, which have shaped the processes in unequal ways. In order to understand the complexity of urban sprawl, it is crucial to know some backgrounds about historic urban development.

A discussion about various attempts to define urban sprawl (*Chapter 3*) is followed by a short presentation of the drivers of sprawl (*Chapter 4*). What are the push- and pull factors that make people move from the inner city to the periphery?

Chapter 5 points out environmental consequences that are (and partly might) be caused by urban sprawl. Those reflect numerous arguments used by "anti-sprawl advocates" in the academic discussion to support the thesis that urban sprawl entails problems and therefore must be controlled. Against the background of this general overview of impacts, *Chapter 6* takes a closer look at two major German cities affected by urban sprawl: Leipzig and Stuttgart. Based on the development of sprawl and the examination of specific quantitative data, conclusions are drawn concerning urban sprawl and its contribution to the environmental situation in the particular urban area.

Chapter 7 presents potential approaches to counter urban sprawl, ranging from visionary concepts of the anti-sprawl movement in the United States to specific problem-related tools in urban planning. The chapter discusses whether such responses to sprawl

can be implemented and how effective they can be. The thesis will conclude (*Chapter 8*) with a summary of the basic findings and the derivation of appropriate planning goals for the future, under consideration of current and future development trends

Methodology

The content of the present work is based on various primary literature in German and English language. Besides monographs, use was made of several articles published in professional journals. This accounts for the most part of the thesis. Furthermore, the internet served as a source of information, e.g. in order to find current quantitative data. Concerning the case studies, information was basically gathered through scientific studies and statistical data on the respective city or region. Telephone interviews with Mr. Henning Nuissl (UFZ, Leipzig, 2007-03-14) and Mr. Jürgen Merks (BUND, Stuttgart, 2007-05-07) provided additional cognitions.

2. THE HISTORY OF SPRAWL

(*This chapter is in large part based on the monograph Sprawl – a compact history, written by Robert Bruegmann, professor in the School of Architecture and the Programme in Urban Planning in Chicago.*)

The term “Urban Sprawl” was presumably born in 1937. The American Earl Draper, employee of the Tennessee Valley Authority, used the adjective “sprawling” on a conference, in order to characterise what in his eyes were the unaesthetic and uneconomic changes of the settlement patterns of North American cities. It took just a few years until urban planners and economists showed growing interest in the phenomenon of sprawl, resulting in the first academic discourses about sprawl.[1]

In Europe sprawl partly started to become a subject of serious academic interest not before the 1960s, which is basically due to the serious consequences of World War II. In the 1950s, numerous European countries were concerned about reshaping their cities. Besides, a lot of countries had been decimated by the war and many cities saw their populations remain stable or even decline. Therefore, urban sprawl in Europe did not play a mentionable role in the discourse before the 1960s.[2]

2.1 THE ORIGINS OF SPRAWL

However, according to Bruegmann, the process of urban sprawl is much older than its discourse. He argues that sprawl has been “a persistent feature in cities since the beginning of urban history”[3]. Hence, even ancient Rome faced a certain pattern of sprawl, as wealthy Romans moved outwards from the high density settlements within the city walls, to live in elegant villas near the sea or in the hills east of Rome. The desire for low-density living outside the city was not only restricted to the western world, but also visible in China, e.g., as early as the Ming dynasty.

It seems that these processes of decentralisation throughout history have been closely linked to the economic conditions of a society. In other words, economic prosperity was the driving force behind decentralisation processes. This can be exemplified by modern London between the seventeenth and eighteenth century. By the end of the seventeenth century London had become the economically most dynamic and most important city of the world. The expanding urban job market attracted masses from the countryside to move to London. During the eighteenth century London expanded beyond its historical borders. As the economy continuously expanded and achieved a certain maturity, an increasing number of affluent Londoners could afford to escape the extremely dense residential areas in the city and were able to build or rent houses in the surroundings, or suburbs, of the city. Life outside

[1] Cp. Siedentop, S. (2005): *Urban Sprawl – verstehen, messen, steuern. Ansatzpunkte für ein empirisches Mess- und Evaluationskonzept der urbanen Siedlungsentwicklung*, in: DISP 160 (2005), Zürich, pp. 23-35.
[2] Cp. Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 42.
[3] Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 18.

here was supposed to be quiet and orderly compared to the chaotic conditions in the streets of the walled city of London.

Beyond suburban London there was a further settlement entity, which was even more dispersed and very thinly populated: so called exurbia. Even though exurban settlements mostly looked totally rural, their inhabitants were usually socially, cultural and economically bound to the city. Instead of farmers, exurban estates predominantly harboured the wealthiest families in society. Already in the eighteenth century, affluent countries like Britain were able to provide a highly developed transportation system which made it possible for a larger group of citizens to live in the countryside while having good access to the city.

For several reasons London is an outstanding example to demonstrate early sprawl processes in Europe. Since these processes started earlier in London than in other important European cities like Naples or Paris, It took over a leading role. This was not only due to its size[4] and booming economy, but also to the fact that England was an island and therefore relatively peaceful. This allowed the city of London to disperse its settlements beyond the protecting city walls much earlier than most continental cities. As a result, the London area soon had one of the lowest densities of any large cities in the world, a distinction it still maintains today.

In the second half of the nineteenth century, when the industrial revolution affected the rest of the western world, further cities followed the lead of London, both in terms of increasing population density at the centre and the move of people and activities away from it. By the end of the nineteenth century, commuter suburbs and exurban villages had become a common settlement pattern throughout most northern European cities.

In the beginning of the twentieth century a basically similar development could be found in US cities. Here, the process was even more rapid than in Europe. After 1900, more and more immigrants could afford to move from the centre of New York to settle down in less dense areas. Inexpensive public transport advantaged outward movement, as it allowed workers to live much farther away from their place of employment. After a few decades, when densities remarkably began to decrease in the centre, factories and retail establishments dispersed as well.

In opposition to others, Bruegmann argues that even the social patterns of the decentralisation trends have been similar in European and North American cities throughout these early days. He mentions the massive exodus of all kinds of families, whether poor or wealthy, the emergence of suburbs closely linked to the centre and the development of loose exurban estates for the wealthiest residents of the city. The main difference was merely a time offset, since the processes started earlier in Europe.

In short, decentralisation processes had already been a common phenomenon of spatial development in large cities throughout the developed world by the end of the nineteenth century.

[4] In the year 1700 the city of London already had a population of 575.000 inhabitants. This number grew constantly until the British involvement in World War II. In September 1939 there were 8.1 million people living in the city. Between 1825 and 1925 London was the most populous city in the world, until it was outstripped by New York City.

2.2 SPRAWL IN THE INTERWAR YEARS

The 1920s in Europe and North America were characterised by an unprecedented industrial boom and accelerated consumer demand, coupled with significant changes in society and lifestyle. Therefore, terms like “The Roaring Twenties” (in North American parlance) or “The Golden Twenties” (in European parlance) have gained popularity. The fact that the outward movement from the centre to the urban periphery had become a mass movement in Europe and North America by this time, can be construed as one attribute of a changing lifestyle.

In London thousands of families with modest income could afford to live in single-family detached or semi-detached houses in the periphery. Along with the residents, factories and industries of all kinds moved out of the congested centre. This mass movement resulted in a sheer explosion of land used for urban purposes. While the population in the urbanised area of London grew by about 10 percent between 1921 and 1931 (from about 7.3 million to 8.1 million), the area developed for urban uses grew by almost 200 percent[5]. Half of all commuting to work was suburb-to-suburb rather than suburb-to-centre.

Similar developments took place in other affluent European cities like Hamburg and Stockholm. Outward dispersal was also visible in southern European cities, but usually to a much less notable extent, because these cities had less economic power and, therefore, were less affluent. This in turn resulted in a relatively small middle-class. In every case, the poorest people concentrated in the oldest and densest parts of the centre and inner suburbs, since they could not afford to follow the masses and settle own in the periphery.

Outward dispersal in the United States was even more of a mass movement in the 1920s than in Europe. The rapid intensification of office and retail uses in the old downtowns led to a sharp decrease of people living in the city centres. Besides, even many workers could afford their own home, if they were willing to do much of the building work themselves. The most impressive examples of suburban growth could be found in cities on the North American west coast. In the Los Angeles area, most families lived in single-family homes and owned their own automobile by the end of the 1920s. A lot of urban characteristics tended to be classified as typical post-war American, such as a high rate of home and car ownership, had in fact been evident in several affluent urban areas in the 1920s and 1930s already.

Exurban growth also played a weightily role in North America between the wars. Because of lower land prices outside the regularly developed suburbs, the working-class was able to settle down in exurban areas for the first time in history. The decentralisation process did not only affect residents, on the contrary, it was “often the case that the jobs, particularly industrial jobs, went first and the people followed”[6], as Bruegmann mentions. Already in 1900 a third of all manufacturing jobs were located outside the city centres in the United States. By 1950, this number was close to 50 percent[7].

By the end of the 1920s large commercial districts outside the city centres had started to rival the retail sales of the traditional downtowns. These shopping districts had their own department stores, offices and theatres. They operated like miniature versions of the traditional downtowns. As a result, retail sales outside the city cores increased dramatically. In

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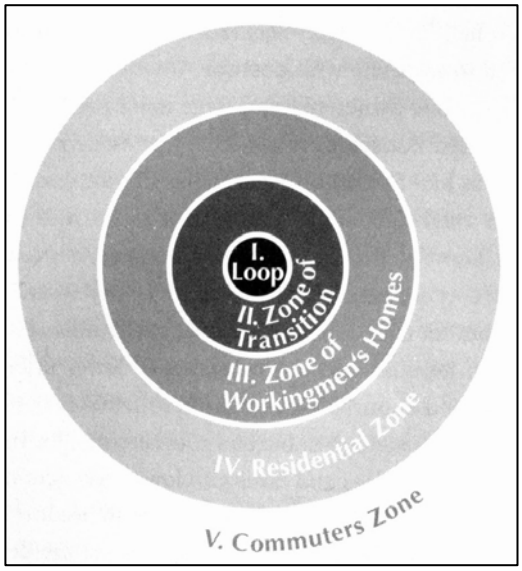
[5] Cp. Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 33.
[6] Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 37.
[7] Cp. Harris, R. and Lewis, L. (2001): *The Geography of North American Cities and Suburbs, 1900-1950: A New Synthesis*, in: Journal of Urban History 27, no.3 (March 2001), p. 265.

1935, three quarters of the retail sales in the Chicago area were obtained outside the city core[8]. One of the main driving forces behind the all-embracing sprawl process was the remarkable expansion of infrastructure. During the interwar years, America put notable effort in finishing the process of paving streets and expanding the highway system in many cities.

As mentioned before, decentralisation and sprawling processes have already been very vital and dynamic in the United States during the interwar years. The best evidence in favour are two internationally well known academic approaches which have their seeds in this period of time, and which try to visualise and explain urban growth processes. In the 1920s two sociologists at the University of Chicago, Robert Park and Ernest Burgess, put much work in analysing the modern city and its structure. Using Chicago as a case study, they tried to generate a model that could explain the form and growth of the city. Their so called "ecological" or "concentric" model (*Figure 1*) is characterised by concentric rings surrounding an inner core. The model illustrates how residents, as they become more affluent, would tend to move constantly outward in the urban area, replaced by other, less affluent residents. The inner circle (the "Loop") contains the central business district. The loop is surrounded by a first concentric ring, the "zone of transition". This area, which housed most of the city's poorest residents in districts like Chinatown or ghettos, was being invaded by business uses and light manufacturing. The third ring symbolises residential areas of the working class, who could afford to live further away from the congested districts close to the centre. This circle was followed by a fourth one containing single-family residential areas. The final stage represents the commuter zone: suburban and partly exurban settlements dispersed around the city, between thirty and sixty minutes away from the city centre.[9]

***Figure 1*: Concentric Model**



Source: *Bruegmann 2005, p.38.*

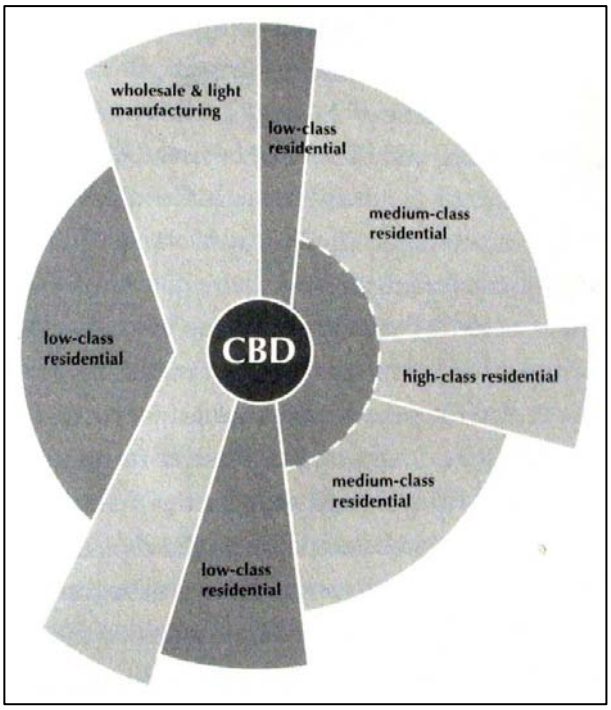
The Park-Burgess model soon became the standard way among urban experts and planners in the United States in order to analyse urban development. Its main advantage was the simplicity and abstraction, by which it demonstrated the complex dynamics of urban growth. On the other hand, the model faced some major limitations. It disregarded the fact that industry developed along railway transportation lines, often in zoned districts far from the centre rather than in concentric patterns. Already by the 1920s, numerous large North American cities no longer had only one single city core. Residential districts were not as homogeneous as the Park-Burgess model suggested, both, districts close to the centre and suburban areas were usually characterised by a greater social variety.

[8] Cp. Harris, R. and Lewis, L. (2001): *The Geography of North American Cities and Suburbs, 1900-1950: A New Synthesis*, in: Journal of Urban History 27, no.3 (March 2001), p. 271.
[9] Cp. Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 40.

An approach to resolve these problems and limitations was developed by Homer Hoyt in the 1930s. He created a variation of the old Park-Burgess model. In his "sectoral" model (*Figure 2*) people still tended to move further out as they were able to, but Hoyt replaced the concentric shape of the urban development by different, heterogeneous wedges. These modifications corrected some of the weaknesses of the original, but only at the expense of the graphic simplicity.

Still, there were important features of urban life in reality that were not taken into account neither in the concentric nor in the secotral model. Urban development in the interwar period was not strictly unidirectional, meaning that affluent people were constantly moving outward. Gentrification of the city centres already took place at this time, in North America as well as in Europe. However, both models remained to be the standard view of urban development among many planners in the United States.

***Figure 2*: Sectoral Model**



***Source**: Bruegmann 2005, p.39.*

2.3 POST-WAR SPRAWL

The consequences of World War II led to significant differences in post-war urban development between Europe and the United States. Immediately after the war, many European countries felt impelled to re-shape their cities, which had been destroyed to a partly low and partly higher extent. This tremendous challenge gave many urban planners the opportunity to implement ideas and concepts they were advocating for a long time. As mentioned in the beginning of *Chapter 2*, a lot of European countries were decimated by the war and many large cities such as Berlin, Vienna, Glasgow and Birmingham were stagnating, or even lost population.[10]

The post-war period in the United States, on the contrary, was characterised by economic prosperity and a vast population growth. Within less than twenty years, the American population increased by fifty million people from 150 million in 1950 to 200 million in 1968[11]. Some cities were even growing to a faster degree. In the same period the Los Angeles area more than doubled from under four to over eight million people. The Pheonix urbanised area grew almost fourfold, the San Jose area more than fivefold. These figures were accompanied by a significant decrease in the average size of households.[12] The unprecedented affluence

[10] Cp. Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p.42.
[11] Cp. U.S. Census Bureau Website: www.census.gov, complete URL [14], (called: 2007-03-24).
[12] Average household sizes in the United States had been nearly five people in the end of the nineteenth century, and were still over four people in 1930. In 1950, they fell to 3.37 persons and by the 1970s they had reached 3.14. The figure in 2000 stood at 2.62 persons.

allowed many people to occupy more living space. The result was a dramatic decline of densities at the core and rapidly growing, space absorbing low-density suburbs in many urban areas in Northern America.

From Bruegmann's perspective it was the combination of prosperity, vast population growth and decreasing sizes in households that made urban sprawl much more visible in the United States than in Europe for a brief period of time. Unlike other authors he argues that the process was not different in kind, but only different in its dimensions. He considers the common post-war suburban landscape in the United States as "more expansive as anything seen before"[13].

In fact, prosperity, population growth and a changing structure in households shaped urban development patterns after World War II, but can the complex issue of post-war urban sprawl in America adequately be reduced to these three aspects? Since a large amount of literature dealing with urban sprawl has been published and the discourse has been going on for decades, numerous different theories and perspectives about the development of sprawl have emerged.

According to R. Burchell[14] the explosion of post-war urban areas in the United States is due to laws and regulations that encouraged sprawling growth. For example, he mentions the federal mortgage loan programme established in 1949 guaranteeing new construction, and the floodplain insurance that made it easier to build in outlying areas. Furthermore, Burchell blames the federal interstate highway programme from 1956 to be partly responsible, providing local communities with ninety percent of the funds needed to build interstate highways.

In his book *Crabgrass Frontier: The Suburbanization of the United States*[15]*,* which was published in 1985, Kenneth Jackson additionally mentions the suburban shopping centres and the creation of mass-produced suburbs to have encouraged sprawling growth.

However, it is most likely that all the mentioned aspects have in some way encouraged the process of urban sprawl in post-war America. In combination, they resulted in much more expansive dimensions of urbanised areas than it was the case before World War II.

Although suburbanisation took also place in Europe during the post-war period, its dimensions were by far less expansive than in the United States. First of all there was generally less growth in urban areas and therefore less pressure to develop the countryside. Besides, urban expansion was usually highly regulated. Planners and other government officials were able to intervene in city development more actively than their American counterparts. In Paris, for example, large parts of suburban settlements consisted of high-density houses directly built by governmental bodies or were at least highly subsidised. This procedure was not common in the United States, where the private-market single-family home was the norm.

While the masses moved outward in American cities, the older central cities struggled as never before. Many industrial jobs were relocated from the city centres to the suburbs or even further out, due to cheaper land prices and better facilities than in the old, congested

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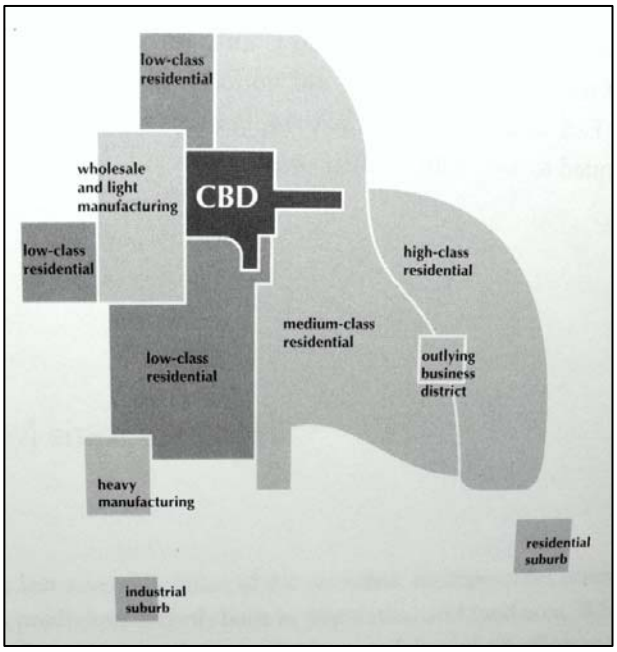
[13] Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 44.
[14] Cp. Burchell, R.W. et al. (2005): *Sprawl Costs – Economic Impacts of Unchecked Development*. Washington, p. 15-16.
[15] Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 23.

centres. Regarding the retail sector, the city core had already competed with shopping districts located in the suburbs in the interwar years. In the 1950s, these problems were intensified by the emergence of large-scale suburban shopping malls.

As more and more jobs and residents disappeared during the following years, numerous American city centres such as Newark, Detroit and San Louis faced serious urban decay. Old buildings were often abandoned or sometimes demolished and it became common to compare American city centres with “Dresden after the war”.

However, “a setback for one group often provides an opportunity for another”[16], as Bruegmann states. With this phrase in mind it is no surprise that the process of gentrification accelerated precisely during the worst years of many city centres. This process was characterised by the arrival of artists, gay people and other bohemians, who were later followed and replaced by single professionals and childless couples. Gentrification of the city centres typically resulted in lower population densities, as the gentrifiers tended to occupy more space.

***Figure 3*:** **Multiple Nuclei Model**



***Source**: Bruegmann 2005, p.49.*

Another scientific model of urban growth was created in the post-war period by geographers Chauncy D. Harris and Edward L. Ullman. The old diagrams by Park and Burgess (1925) and Homer Hoyt (1939) urgently needed a successor, since American cities had become multinucleated regions already before the outbreak of the war. The “Multiple Nuclei Model” (*Figure 3*) ought to demonstrate how cities establish similar industries with common land use and financial requirements near each other. These groupings are assumed to influence their immediate neighbourhood, like hotels and restaurants sprouting around airports, for example. The number and kinds of nuclei mark a city's growth.

In spite of its advantages the Multiple Nuclei Model was soon seen to be inadequate because it described the city, with all its peripheral development, as a separate entity. It did not take into account the tight clustering of cities forming a single urban region. To give examples for such regions, one can mention the industrial belt between Cleveland, Ohio and Pittsburgh or the coal mining region in the Ruhr area in Germany. The model was also unfit to represent the large peripheral and exurban settlements in the United States, which stretched out for miles into the countryside and often had connections to several cities. Furthermore, the model lacked of visual clarity. Eventually, the model has not been much used in recent years. To its credit, the urban system in the United States was distinguished by such a complexity already in the post-war period that it was hardly possible to abstract it in a diagram. Since the Multiple nuclei model there has not been an adequate alternative yet.

[16] Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p.47/48.

2.4 SPRAWL SINCE THE 1970s

Cities across the world have experienced vast growth both in population as well as in land area during the last decades of the twentieth century. Sprawl has led to the development of metropolitan areas, where boundaries between city centres, suburban and rural landscapes have disappeared and where different cities are intertwined with each other as never before. With more than twenty million people, New York is one of the largest metropolitan areas today. It is sprawling across vast territories and incorporates highways, airports, industrial parks, shopping centres and former separate urban entities. In terms of population and economic power, some areas like these can be compared to small countries.[17]

Since the 1970s many cites in the affluent western world have been turned inside out in a functional way. Commercial and industrial sites have moved out from the centres to the urban periphery or exurbia, while central city districts have become the preferred living space for a relatively small amount of better off people, and the predominant location for the high-end service sector.

Today most central cities in Europe contain only a small share of the population and jobs in the metropolitan area. In 2002, for example, 60 percent of the population in German metropolitan areas lived in suburbs, while only 40 percent lived in the cities.[18] During the 1990s the inner city of Paris lost 200.000 jobs, while the outer suburban ring gained 160.000.[19]

In the United States the situation has advanced even further. By the year 2000, most city centres provided less than 10 percent o the total amount of jobs in the respective metropolitan area. Furthermore, many city centres which functioned independently before are now competing with other centres in the same urban region. This can be exemplified by the San Francisco Bay area (San Francisco, Oakland and San Jose) and by the Dutch Randstad (Amsterdam, Utrecht, Rotterdam and the Hague).

However, the outflow of jobs and people from the centres implied a chance for new developments. As more and more businesses and people moved outward, the suburbs lost their exclusivity. Thus, the number of affluent individuals who wanted to buy a large house in the periphery decreased. At this point, central cities started to regain some of the shine they had lost in the post-war decades. Since 1998, for example, many city centres in the western part of Germany experience a continuous growth in population. The same is true for the development of jobs in the city centres, especially in the service sector.[20] Ironically, this revival of the inner city was primarily caused by the outward movement of facilities that once defined the traditional downtown.

During the last several decades some significant shifts could also be observed in suburbia in the United States. First of all, single-family houses have become much larger than they were in the post-war decades. The average size of a newly built house increased from 1.000 square feet (approx. 90 square metres) by the end of the war to almost 2.500 square feet (approx. 230 square metres) by the end of the century. In addition, an increasing number of residential suburbs have been gated, a neighbourhood pattern known as gated

[17] Cp. Sudjic, Dejan (1992): *The 100 Mile City*. San Diego, CA.
[18] Cp. Bundesamt für Bauwesen und Raumordnung (Ed.) (2005): *Raumordnungsbericht 2005*. Bonn.
[19] Cp. Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 52.
[20] Cp. Bundesamt für Bauwesen und Raumordnung (Ed.) (2005): *Raumordnungsbericht 2005*. Bonn.

communities. Trends like these have aggravated the animadversion on suburban development - implying that suburbs are out-of-scale residential areas in favour of segregation, housing self-absorbed people. Suburban development since the 1970s was additionally designated by new shopping centres and business parks with good access to freeways.

These characteristics indicate that the process of urban sprawl has accelerated during the last decades, at least in the United States. Since academics are still arguing about this point, the present work will not provide a final answer to that question. However, it can provide a differentiated overview, presenting opponent perspectives.

In the 1990s, various authors published figures which showed that the metropolitan area of Chicago grew about 4 percent in population between 1970 and 1990, but at the same time grew in land area by 46 percent. The original figure came from the Northeastern Illinois Planning Commission.[21] In the context, these figures usually suggested, that suburban decentralisation in these twenty years was greater than what happened between 1950 and 1970 and that this trend will continue in the future. From the authors' point of view, these numbers provided evidence for the acceleration of urban sprawl.

Other authors like Bruegmann, on the other hand, advance the opposite view and argue that "the rate of suburban sprawl has actually decreased in each of these successive periods"[22] He himself bases his statement on data collected by the U.S. Census Bureau. The sticking point in this confrontation is, that both sides did not just refer to different sources, they also present different indicators to support their perspectives. Therefore, none of their statements is really disprovable, or in other words, you can always find data usable to support either the first or the opposite opinion.

However, the U.S. Census Bureau's figures for "densities of selected American urbanized areas" between 1950 and 1990 come up with an interesting finding.[23] According to the data, older industrialised cities have declined sharply in density due to massive decentralisation after World War II. In contrast, a number of newer cities, although much less dense in the beginning, have experienced an increasing density within these 40 years. The result is a convergence between older and newer cities in terms of density. Almost every case shows that the decline in density has become less or has even stopped since the late 1970s. The development of the Los Angeles urban area, which was the early synonym for urban sprawl, is especially noteworthy. Its density increased from approx. 4.600 people per square mile in 1950 to virtually 6.000 in 1990. Consequently, the Los Angeles urban area is the densest in the United States and at least as dense as many urban areas in Europe.[24]

In the last few decades, suburbs in Europe have not developed in exactly the same way like in the United States, but partly similar. The inner suburbs of Paris, for example, started to decline in population and density in the early 1970s, while the outer suburbs registered a remarkable growth. Between 1960 and 1990, the outer suburbs and the exurban settlements around Paris were continuously growing and many Parisians moved from the city and the inner suburbs to the periphery further away. By 1999, the Île-de-France had almost

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[21] Cp. Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 59.
[22] Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 60.
[23] Cp. Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 62/63.
[24] London has a population density of 4.700 people/km². With 4.272, Munich is the densest city in Germany. Paris is a very special case. While the urban region has a density of only 797 people/km², the density in the municipal area is higher than 20.000.

10 million people, meaning that more than three quarters of all Parisians were not living in the city itself. Even though the French government tried to route urban growth into several development axes, the suburban and exurban landscape of Paris today looks pretty much the same like its American counterparts.

Parisian suburbs are responsible for the economic power of the region. A further similarity compared to the U.S. is the variety of suburbs that can be found in France, especially in regard to Paris. Besides high-class suburbs like Neuilly in the west, there are poor suburbs in the north and east of Paris with partly severe social problems. Latter have had particular international media presence in recent years, as they were the setting of escalating street riots. Moreover, Parisian suburbs are home to the vast majority of the middle-class population of the region.[25]

Decentralisation trends in Europe have not developed homogenously throughout history, one can rather draw an imaginary line between southern and northern Europe. Suburban development occurred much earlier in the more affluent northern and western parts than in southern and eastern Europe, and it has been highly regulated. In Munich and Hamburg, for example, one can see that suburban settlements have been clustered and separated from another, to create space for green ridges in between. These governmental interventions in urban development patterns intend to preserve green space and ease public transit functions. Nevertheless, these decentralisation trends have contributed to the vanishing of historic European urban patterns.[26] In his remarkable book *Zwischenstadt*[27], German architect and planner Thomas Sieverts describes a new urban pattern that spreads across the land between old city cores and the countryside. He calls this pattern Zwischenstadt, which can be translated by “intermediate” or “in-between” city and is characterised as an “urbanised landscape or landscaped city”[28].

Peripheral areas of large cities in southern and eastern Europe look very different from those in Hamburg and Munich. In Italy and Spain, for example, the decentralisation process occurred more rapid and less regulated.

As a result, suburban and peripheral settlements in southern Europe look much more like the periphery of American cities than those in northern Europe. Anyway, sprawling regions all over Europe have low densities and therefore it is not surprising that the private automobile has become the predominant means of transportation for suburbanites. Particularly over the past decades, the use of the private automobile has increased quickly throughout Europe. Even though many western European governments made a heavy effort in discouraging automobile use, financing public transportation and putting high taxes on automobiles and gasoline, this trend could not be stopped. As a result, the development of private car ownership in Europe looks very similar to the United States, even though there is a delay of a few decades. In 1990, there were 400 cars in Europe and 600 cars in the United States per 1000 inhabitants (*Figure 4*).

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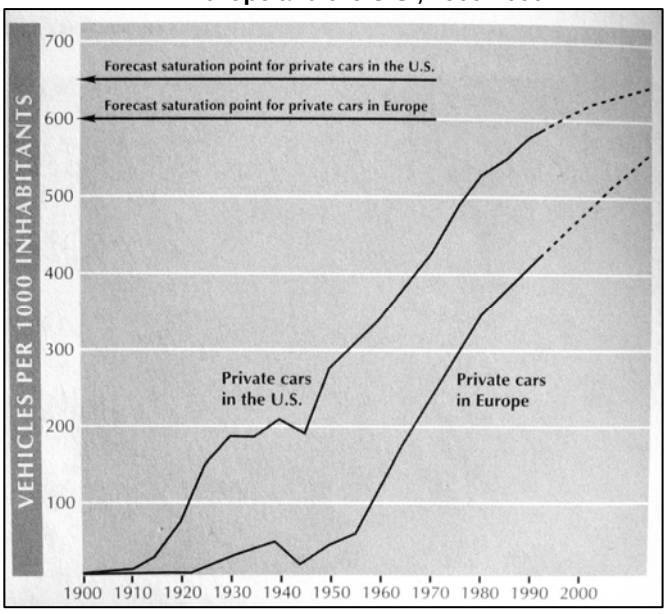
[25] Cp. Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 74.
[26] Ibidem.
[27] The first of this work, *Zwischenstadt: zwischen Ort und Welt, Raum und Zeit, Stadt und Land* (Braunschweig: Verlag Vieweg, 1997), attracted international attention and was republished several times before the English edition appeared in 2003. To date, Sieverts has published further works within the *Zwischenstadt* series.
[28] Sieverts, Thomas (1997): *Zwischenstadt: zwischen Ort und Welt, Raum und Zeit, Stadt und Land*. Braunschweig/Wiesbaden, p. 7.

While urban sprawl continued during the last few decades, more and more people depended on private cars to be able to commute to their place of work, for example. On the other hand, the rapid increase in private car ownership allowed people to move even further outside the city.

Figure 4: **Number of cars per 1000 inhabitants in Europe and the U.S., 1900-2000**



***Source**: Bruegmann 2005, p.78*

Today, urban planners all over Europe know about the miscellaneous problems that are linked to uncontrolled urban expansion at low densities. However, recent urban development demonstrates the vast disparities in public control and planning comprehension that still exist within Europe. In Germany, the trend of suburbanisation started to slow down in the late 1990s. Some numbers indicate this trend. Between 2000 and 2004, the amount of daily consumed undeveloped area for housing and transport-related purposes decreased by almost 40 hectares from 129 to 93 ha/day.[29] While critics state that this development is simply due to usual cyclical variations, the German government adopted a national strategy on sustainability in 2002, which formulates numerous objectives for a sustainable future. One of these aims is to step by step reduce the daily consumption of undeveloped area to 30 hectares by 2020.[30]

In Spain, on the contrary, recent developments show another scenario. Between 2005 and 2006, more new buildings were constructed in Spain than in Germany, France and Italy altogether.[31]

2.5 SUMMARY

What we can learn from the history of sprawl, is that decentralisation processes in cities of the western world did not just suddenly start after World War II. The outward movement of residents and industry from the city centres to suburban and exurban areas, and even the emergence of peripheral shopping centres, were already common aspects of urban life in the 1920s. After the war, the decentralisation trend simply continued in the United States, but in a much more expansive pattern than ever seen before.

Although urban sprawl cannot be considered to be exactly the same process in Europe and the United States, there are basic similarities. Most significant differences have

[29] Cp. Federal Environment Agency Website (Umweltbundesamt): http://umweltbundesamt.de/, complete URL [1]. (called 2007-05-14).
[30] Cp. Germany's Strategy for Sustainability, edited by the Federal Government: *Perspectives for Germany – Our Strategy for Sustainable Development*, p. 99. Retrieved from EWC Website: www.ewc2.org, complete URL [2] (called 2007-04-15)
[31] Cp. Ulrich, A, and Zuber, H.: *Schamlose Kaste*, in: Der Spiegel, Nr.9, February 2007, p. 134-135.

occurred regarding timeline, spatial dimensions and public control of the process. Furthermore, differences in the degree and pattern of urban sprawl are visible between different parts of Europe. Besides the degree of public control, these differences are basically due to disparate economic backgrounds, especially in the past.

History has shown that there is a direct correlation between prosperity and the degree of urban sprawl. As soon as people were affluent enough to be able to chose where they wanted to live, they tended to live further away from the city centres. Of course, population growth also led to expanding settlements. Residential preferences were later accompanied and favoured by general shifts in lifestyle and advanced mobility opportunities.

In recent years, the trend of moving outward has slowed down in parts of Europe, and many city centres are regaining population. In the United States, many cities are still declining in density, but the trend has slowed down during the past few decades. Several other cities, such as Miami, San Jose and Los Angeles are even increasing in density.

3. DEFINING SPRAWL

"Urban sprawl is like pornography. It is hard to define, but you know it when you see it."[32] This catchy phrase stems from Robert Cervero, professor of city and regional planning at the University of California at Berkeley. It expresses the difficulty of defining the complex process of urban sprawl, which can occur in numerous different shapes.

Reading through international literature, the terms "urban sprawl" and "suburbanisation" are often used synonymously. Both terms describe a basically similar process: "the development of new suburbs in undeveloped sites usually on the fringe of the city"[33], accompanied by an "increase of business activities and decrease of population in the centres"[34].

However, the term urban sprawl has won recognition over time, since urban development processes started to become more complex and existing definitions of suburbanisation began to be regarded as insufficient in describing the complexity of urban development. In particular regard to the U.S., H. Bodenschatz argues that the term 'Suburbia' is no longer adequate to characterise the existent spatial patterns in metropolitan areas that are by far more perforated and dispersed than traditional suburbs.[35] Bodenschatz believes that those structures are post-suburban developments, but fails to provide an adequate term to describe it. Thus, the term urban sprawl has "naturalised" and can be seen as an enhancement of former definitions of suburbanisation.

The particular appearance of sprawl is being influenced by a large number of local variables, like demographic and social aspects, economic prosperity and the degree of public control in planning issues. Therefore, virtually every spatial entity affected by sprawl has its own specific dynamics, which shape the settlement pattern. On this account it has been found complicated to generate a sharp definition of the term "Urban Sprawl" that can be used categorically. The discourse has been going on for several decades, but experts have not yet been able to provide a generally accepted definition. During years and years of controversial discussion, various divergent attempts to define sprawl have appeared in the technical literature. In this chapter I will refer to some basic characteristics of sprawl and the different typologies of definitions that have developed over time.

Referring to the basic characteristics, one can define sprawl as "low-density, scattered, urban development without systematic large-scale or regional public land use planning."[36] The processes considered to be sprawl in *Chapter 2* are based on this definition.

The European Environmental Agency (EEA) offers a more detailed but basically similar attempt and describes urban sprawl as the "physical pattern of low-density expansion of

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[32] Cervero, R. (2000): *Shapeless, Spread Out, Skipped Over and Scattershot – Sprawl Sweeps the Globe*., in: The World Paper, March/April, 2000. p. 5-6.
[33] Australien Government, Department of the Environment and Heritage Website: www.environment.gov.au, complete URL [3], (called 2007-04-17).
[34] European Environmental Agency (EEA) Website: www.eea.europa.eu, complete URL [4], (2007-04-17).
[35] Bodenschatz, H. and Schönig, B. (2004): *Smart Growth – New Urbanism – Liveable Communities. Programm und Praxis der Anti-Sprawl Bewegung in den USA*. Wuppertal, p. 136.
[36] Bruegmann, R. (2005): *Sprawl – a compact history*. Chicago, p. 18.

large urban areas, under market conditions, mainly into the surrounding agricultural areas"[37]. As a further attribute to characterise urban sprawl, the EEA mentions "leapfrog development", a term that can be found in other definitions as well.[38] It means that development in sprawling regions is patchy and scattered, leaving agricultural enclaves in between and therefore is everything but compact.

I could continue quoting different single definitions of sprawl and listing all its attributes and characteristics, but that would not lead us anywhere and it might be rather confusing than adjuvant in understanding the problem. Moreover, I want to present different typological approaches in defining sprawl, which highlight the process from different perspectives. One can distinguish between five very different groups of definitions, which refer to

- density – therefore, sprawl is characterised by a dominance of low density settlement patterns combined with a general functional segregation of the settlement area;
- the degree of spatial concentration – therefore, sprawl means the decentralisation of urban functions accompanied by a spatial expansion of urban uses into rural areas.
- the structure and shape of the settlement area – in this case, sprawl is believed to be a specific process shaping the once mono-centric, compact cities into expanding, polycentric settlement structures;
- the socially relevant effects of land use patterns - here, sprawl is characterised by its specific effects on traffic and soil consumption, for example;
- the normative dimension of land use planning – therefore, sprawl is an unplanned development, that contradicts the objectives of spatial planning.

In recent years, an increasing number of people advanced the view that it is not reasonable to reduce the phenomenon of urban sprawl to just one of the five definition approaches. The very complex nature of sprawl is rather to be seen as a multidimensional phenomenon, which is only representable by a combination of different parameters.[39]

[37] European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 6.
[38] Cp. Burchell, R.W. et al. (2005): *Sprawl Costs – Economic Impacts of Unchecked Development*. Washington, p. 12.
[39] Cp. Siedentop, S. (2005): *Urban Sprawl – verstehen, messen, steuern – Ansatzpunkte für ein empirisches Mess- und Evaluationskonzept der urbanen Siedlungsentwicklung*, in: DISP 160, p. 23-35.

4. DRIVERS OF SPRAWL

Driving forces fostering urban sprawl are as diverse as the process itself. Without including excessive detail, I would like to highlight some of them. *Chapter 2* already indicated that sprawl provides a lifestyle desired by many people. In fact, urban sprawl neighbourhoods in the United States comprise numerous key features of what is used to be called the American Dream: owning a detached, single-family home with a large yard in a safe neighbourhood. In a nationwide Housing Survey in the US in 1997, 71 percent of those interviewed stated that a "single-family detached house with a yard on all sides" was the "ideal" form of dwelling.[40] The desire to own a single-family house is not predominantly an American characteristic, but rather a significant aspect of European lifestyle as well. Among an increasing number of people in Europe, new semi-detached or detached houses in suburban and rural environments are regarded to be the prime investment to be made in their lifetimes.[41]

Another important factor underlying urban sprawl is land prices. Land tends to become less expensive, the further it is away from the city centre. Land in built-up areas is more expensive, because it has easier access to many facilities that are established already. An empirical study produced in 1990 found that the costs for a home would be reduced by 6 percent per every mile further away from the central business district of Los Angeles.[42]

Table 1 gives an overview about the different drivers contributing to urban sprawl, subdivided into particular groups of influences. As a macro-economic factor, global economic growth plays an increasingly significant part in the development urbanised areas. The constantly growing economic sector of information and communication technologies (ICT) is beginning to have profound impacts on the spatial distribution of population and employment. The trend towards ubiquitous access to high-speed ICT loosens location-related dependencies for private people as well as companies and is likely to advance a more sprawled urban development in the future.

Increasing global competition has led to a more dispersed distribution of economies in general. In order to stay competitive, companies of all branches are moving from the city core to the periphery where they often benefit from better location factors such as more space, better road accessibility and lower taxation. Suburban municipalities, on the other hand, usually run a liberal economic policy in order to generate jobs and tax money and to stay competitive themselves. A prosperous local economy usually stands for attractiveness and a good reputation. Competition of this nature among municipalities fuels urban sprawl.

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[40] Burchell, R.W., et al. (2005): *Sprawl Costs – Economic Impacts of Unchecked Development*, Washington, p. 127.

[41] Cp. European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 20.

[42] Cp. Burchell, R.W., et al. (2005): *Sprawl Costs – Economic Impacts of Unchecked Development*. Washington, p. 128.

***Table 1*:** **Drivers of urban sprawl**

Macro-economic factors	**Inner city problems**
• Economic growth	• Poor air quality
• Globalisation	• Noise
• European integration	• Small apartments
Micro-economic factors	• Unsafe environments
• Rising living standards	• Social problems
• Price of land	• Lack of green open spaces
• Availability of cheap agricultural land	• Poor quality of schools
• Competition between municipalities	**Transportation**
Demographic factors	• Private car ownership
• Population growth	• Availability of roads
• Increase in household formation	• Low cost of fuel
Housing preferences	• Poor public transport
• More space per person	**Regulatory frameworks**
• Housing preferences	• Weak land use planning
	• Poor enforcement of existing plans
	• Lack of horizontal and vertical coordination and collaboration

***Source**: EEA 2006, p.17.*

EU Policies can either drive sprawl throughout Europe. Structural and Cohesion Funds, for instance, include investments in new motorways and other roads. Once constructed, those new or improved transport lines attract new development around. Furthermore, the proposed Trans-European Transport Networks (TEN-T), an EU project set up to facilitate improved accessibility and mobility, will influence the future spatial development of urban areas across Europe. In general, investments in transport can be powerful in stimulating new development and sprawl, including shopping centres and residential areas.[43]

Transportation is another significant aspect influencing sprawl. Private car ownership, which is closely related to affluence, allows a maximum in mobility for the individual. Long distances can be covered in relatively short time, at any time and with a high degree of convenience. Car ownership has been constantly rising in recent decades throughout the western world (see *2.4*), and the trend continues.

While population growth had been the predominant push-factor behind expanding cities in former days, this is no longer the case among many sprawling cities today. Throughout Europe, most sprawling cities are expanding to a greater extent than would be expected solely on the basis of population growth.[44] This can partly be explained by a change towards more space consuming, individual lifestyles. In Germany for instance, living space per capita almost doubled within 4 decades, from 22 m² in 1965 to 42 m² in 2006.[45] Coevally, a trend towards smaller households is visible for a long time. In 2005, 38 percent of all German households were single person households, while only 28% of the total number of house-

[43] Cp. European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 18.
[44] Cp. Ibidem, p. 15.
[45] Cp. Institut für Städtebau (ifs) Website: www.ifs-staedtebauinstitut.de, complete URL [5], (called 2007-04-18).

holds consisted of three and more persons.[46] A similar trend is underway in the United States since the 1950s (see *2.3*).

Moreover, there are a number of social circumstances that drive people from the inner cities to the urban fringe. Young families with little children are most likely to move to suburban and rural areas outside the city, because they don't consider the city to be the appropriate environment to raise children. Many people who prefer to live in suburban neighbourhoods perceive inner city cores as places of poor environmental qualities, social problems and higher safety risks. Suburbs are usually less polluted, less noisy and have a lower crime rate. Some people also consider the city unattractive, due to poor urban planning and the lack of open green spaces and sports facilities. Unemployment, poverty, drug abuse and minorities with integration problems are often associated with inner-city areas. One of the most crucial reasons for young families to search for a new place to live is the quality of schools. Many parents do not want their children to attend inner city schools, since local social problems are often reflected in everyday life at school. These so called "push factors" drive people out of the city.[47]

Recapitulating, it becomes apparent that urban sprawl is not just a pattern of urban development that has developed incidentally over time and was abetted by weak land use planning and the triumph of the private car. It is rather the result of the people's opportunity to choose their way of living. Little more than a century ago, this opportunity was reserved to a tiny fraction of society. In the meantime economic prosperity and modern technology have literally generated new roads. One of these roads is sprawling neighbourhoods as the preferred lifestyle of a large number of people. Whether this road is the silver bullet, is a different question.

[46] Cp. Statistisches Bundesamt Deutschland (Ed.) (2006): *Leben in Deutschland — Haushalte, Familien und Gesundheit, Ergebnisse des Mikrozensus 2005*. Wiesbaden, p. 14.

[47] Cp. European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 20.

5. ENVIRONMENTAL EFFECTS

Besides alleged improvements in the quality of life, urban sprawl furthermore entails enfolding effects on a large variety of subjects. A spatial entity concerned by sprawl is shaped in its entire structure - in social, economic and ecological terms. This chapter will focus on the ecological dimension. It will discuss the way urban sprawl is affecting the environment. In doing so, focus will be on effects that can in fact be related to urban sprawl and effects that are potentially caused by urban sprawl.

5.1 NATURAL RESOURCES AND ENERGY

Urban development consumes natural resources. The consumption of land and soil are of particular concern, as they are mostly non-renewable resources. The history of urban sprawl (see *Chapter 2*) has shown that expanding, low-density settlements at the urban fringes have become a common aspect of urban development in cities throughout the affluent, highly developed parts of the world. In many cases urban areas grow at a faster rate than their populations.[48] In other words, the consumption of land per capita is rising. It is important to state that the consumption of land is a major direct effect on the environment caused by urban sprawl. Without the consumption of land, sprawl would not exist. Anyhow, consumption of land is usually closely linked to a number of side effects. Therefore, these side effects can in particular cases be related to urban sprawl.

Burchell[49], for example, argues that the conversation of agricultural into urbanised land does not only mean a physical loss but also a loss of functions, as farming operations near residential areas involve certain difficulties and reduce agricultural productivity. Besides its specific effects on farmland, urban sprawl usually leads to the transformation of soils and the change of its essential functions. One of the most severe transformations is the sealing of land. In Germany, for example, it is estimated that 52 percent of the soil in built-up areas are sealed. The more sprawled a city becomes at low densities, the more ground is consumed and the more ground needs to be sealed to build roads, for example. Sealing vastly reduces a soil's water permeability. Once precipitation falls on sealed ground, artificial gutters and canals transfer the water to brooks or rivers. By flowing down roads, water gathers pollutants such as tire abrasion, oil and heavy metals, which degrade the hydrological system. Besides an increased risk of flooding, due to the dispossession of the soil's function to absorb and store water, the recharge of groundwater is heavily derogated. A decrease of the groundwater table might in addition have negative impacts on the hydrological dynamics of wetlands that surround sprawling areas.[50]

According to the type of land consumed by sprawl, the effects can be quite different. Especially when environmentally fragile lands, such as forests, meadows and wetlands, are

[48] Cp. Burchell, R.W., et al. (2005): *Sprawl Costs – Economic Impacts of Unchecked Development*. Washington, p. 38.
[49] Cp. Ibidem, p. 41.
[50] European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 29.

affected by development, there is a high risk of creating severe environmental problems: “The effects of disturbing aquifers, streams, and wetlands can range from flooding to drought to poor water quality”[51]. Very dry territories, such as parts of Andalusia and Extremadura in southern Spain, where desertification takes place, are particularly sensitive to certain land use changes. If essential ecological and human benefits like groundwater supplies diminish, the basic need for life cannot be maintained. These conditions affect humans as well and generate strong migratory flows of people looking for places offering a better quality of life.

In association with changes in lifestyle, urban sprawl also contributes to an increase in the use of further natural resources. As mentioned before, an increasing number of people tend to live in individual households. Therefore the number of households is growing, accompanied by an increase in land use and a further expansion of urban areas. This way of living is most likely to be less efficient, requiring more resources per capita than larger households. This becomes obvious by comparing the amount of water used, for instance. A two-person household uses 300 litres of water per day, two single households use 210 litres each.[52]

This example is advanced by the European Environmental Agency (EEA). It is valid as such, but in the context of environmental effects caused by urban sprawl, it is at least in parts arguable and needs clarification. The EEA bases its argument on the individualisation of households, which contributes to an expansion of used land. However, after all we know about the characteristics of sprawl, households in low-density neighbourhoods with a high rate of single-family homes tend to be larger in average compared to households in inner city areas. Specifically young families seeking for a better quality of life choose to live in sprawled settlements, while individuals prefer a more compact environment like closer-in suburbs and areas close to the city centre.[53] Thus, the example presented by the EEA is slightly misleading. In cases, where the increase in the consumption of resources can definitely be attributed to the size of households, it may not necessarily be related to sprawl.

Nevertheless, the size of households and urban sprawl are interrelated and sprawling areas themselves do contribute to a rising consumption of resources. Concerning the use of water, one can for example mention the sprinkling of large yards surrounding detached and semi-detached houses in sprawled neighbourhoods. In denser settlement structures, capacities like these are simply not available. Even though this appears to be a minor problem that might be solved by appealing to the people’s rationality, it adds further pressure to the fact that about “60 percent of large European cities are already overexploiting their groundwater resources and water availability”[54].

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[51] Burchell, R.W., et al. (2005): *Sprawl Costs – Economic Impacts of Unchecked Development*. Washington, p. 42.

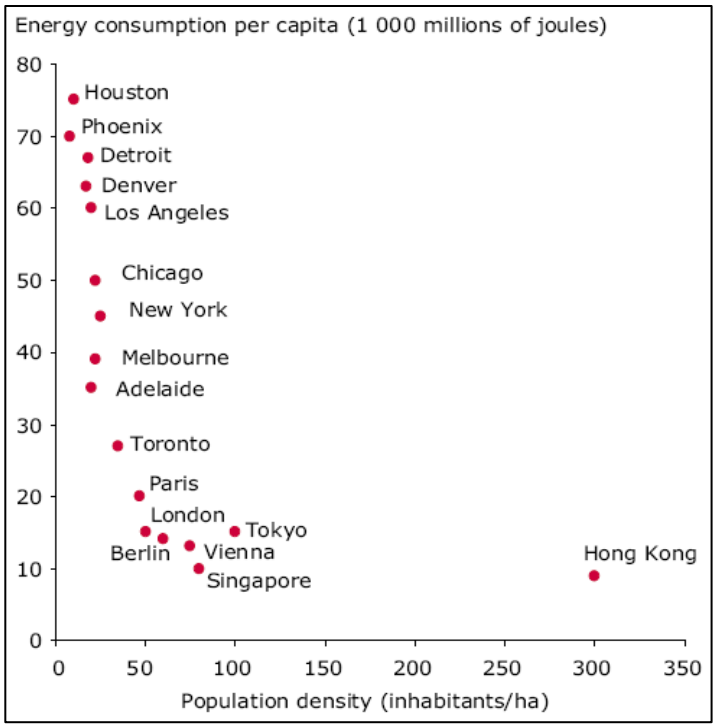
[52] Cp. European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 29.

[53] Cp. Statistisches Bundesamt Deutschland (Ed.) (2006): *Leben in Deutschland — Haushalte, Familien und Gesundheit, Ergebnisse des Mikrozensus 2005*. Wiesbaden, p. 15.

[54] European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 29.

Increasing consumption of land, expanding land uses and the reduction of population densities are closely linked to a growth in energy consumption. *Figure 5* assumes that compact urban development with high population densities is more energy efficient than areas with low densities. Particular high consumption rates are associated to low density areas, such as sprawling environments. First of all, these depend on lengthy distribution systems undermining efficient energy use. Moreover, a household in a detached or semi-detached house tends to consume more energy than a household in a block of flats.[55]

***Figure 5**:* **Population density and energy consumption, selected World cities (1998)**



***Source**: EEA 2006, p.30.*

Transport has always been a controversially discussed aspect in the context of urban sprawl. Discussing transport related energy consumption in cities, various factors have to be respected. Every city has its own dynamics in terms of rail- and road networks, public transport systems and the modal split between public and private transport. Additional social circumstances and ongoing trends further influence the situation. Due to a number of variables like these, it is usually difficult to prove causal relations between urban sprawl and transport related energy consumption.

Presumably, transport related energy consumption increases as density falls. The EEA report confirms this assumption by presenting accordant data (*Table 2*). Sprawl demands the covering of relatively long distances, as it is far from being a compact way of urban development. It favours the dominant use of private cars, which are relatively energy inefficient. The car is frequently the only practical alternative to more energy efficient, but typically inadequate and expensive public transport. In most cases the configuration of sprawling peripheral neighbourhoods with public transport systems is insufficient because of high construction costs, being at odds with relatively low demands.[56]

[55] Cp. Nuissl, H., Rink, D. and Steuer, P. (2005): *The consequences of urban sprawl in a context of decline: The case of Leipzig*. UFZ Centre for Environmental Research, Leipzig, p. 15.

[56] Cp. European Environmental Agency (EEA) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 29.

***Table 2*: Population density, energy consumption and cost of transport**

Density (population + jobs per hectare)	Annual energy consumption for travel (mega joules per inhabitant)	Cost of transport (% of GDP)
< 25	55 000	12.4
> 100	20 200	11.1
50 to 100	13 700	8.6
> 100	12 200	5.7

***Source**: EEA report 2006*

Case studies show that a large portion of people, once they have moved to the urban fringe, buy a further car (most of the already had one before). It is very easy to find and list numerous conditions and data that appear to draw a clear picture, indicating that urban sprawl creates more traffic, especially energy inefficient car traffic. In fact, car traffic has increased during recent decades. However, this point is actually more complicated than it seems at first glance, and it is worth discussing different perspectives.

The easy it is to call urban sprawl a “car-oriented suburban way of life”, the hard it is to provide evidence, that people would own and use fewer cars if they stayed in the inner city. As soon as individuals achieve a certain degree of affluence, cars are willingly used as a symbol for lifestyle and social standing. To possess a car is therefore a question of lifestyle and prestige rather than a question of mobility. Besides, individuals tend to prefer travelling in cars, because it is normally the most private and comfortable way to travel – no matter if living in the countryside, the suburbs or close to the city centre. In other words, “in highly developed societies it seems almost impossible to prevent people from getting around by car, regardless of the spatial structure they inhabit”[57]. The use of cars is very much a question of individual awareness and especially convenience. The particular spatial pattern merely influences personal behaviour. If a suburbanite is determined to cover everyday travelling without a private car, there will most likely be ways and means – although probably on cost of convenience. Furthermore, it must be taken into account that due to suburbanisation and urban sprawl, public transport in the periphery has gained new passengers, too. Anyhow, its increase by no means compensates for the growth in car traffic.[58]

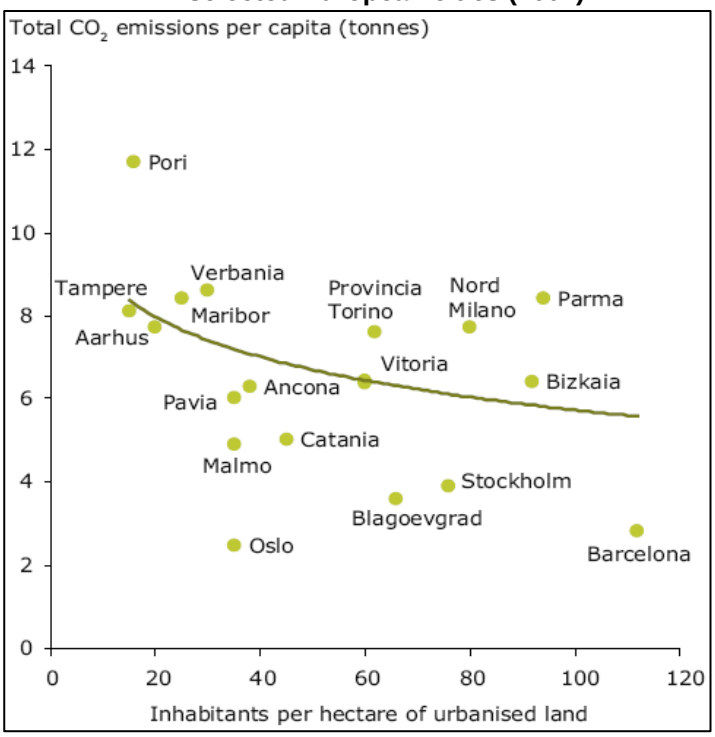
Intense discussions have been carried out about this point among geographers and planners. The perspective of those who refuse that urban sprawl causes a growth in individual traffic is presented in the paragraph above. This view is based on the assumption that a change in mobility patterns cannot simply be referred to a certain kind of urban development, but is rather a societal phenomenon. On the other hand, opponents of this perspective believe that the expansion and dispersion of urban functions are a byword for an increasing need for mobility and changes in mobility patterns. Thus, growing numbers of private cars are just a logical consequence. However, as mentioned before, an increase specifically induced by urban sprawl is very difficult to prove, and academics have not agreed on this point, yet.

[57] Nuissl, H., Rink, D. and Steuer, P. (2005): *The consequences of urban sprawl in a context of decline: The case of Leipzig*. UFZ Centre for Environmental Research, Leipzig, p. 14.
[58] Cp. Ibidem.

5.2 POLLUTION

Urban sprawl causes air pollution. This can be traced back to the fact that expansive, dispersed settlement structures need more energy and traffic, which in turn result in the consumption of fuels in cars and the domestic heating system. Again, as seen before in the context of energy consumption, it proves to be very difficult to determine the extent of pollution that can be attributed to urban sprawl.

***Figure 6**:* **Population density and CO2 emissions, selected European cities (2002)**



***Source**: EEA 2006, p.30.*

According to findings of the EEA, increasing CO_2 emissions are of special concern. Based on data from cities across Europe, *Figure 6* presumes that an increase in CO_2 emissions is basically connected to a decrease in population density. The information given may be scrutinised carefully, because the amount of CO_2 emissions does not solely depend on the number of cars, but on a great number of factors, including the level of industrial activity and local climatic conditions. Furthermore, it seems quite obvious that the cities presented in the graph have not been selected arbitrarily, but by purpose to amplify the favoured statement.

However, aside from *Figure 6*, the predominance of car transportation in sprawling urban structures is clearly a factor contributing to the growth of urban green house gas emissions. These do not only threaten the local air quality, but are also responsible for climatic change on a global scale. Thus, critics argue that urban sprawl undermines the commitments agreed on in the Kyoto protocol to reduce greenhouse gas emissions by 2012. *Chapter 5.4* will discuss the issue “climate change” in further detail.

Besides concerns about CO_2, scientific sprawl discussions mention further severe consequences for the environment and human health, which are potentially caused by changed mobility patterns in sprawled areas: traffic, emitting pollutants such as benzene, soot, nitrogen oxide and ozone, leading to a steady increase in pollution, allergies, eczema and so on. Due to improvements in transport technologies, carbon dioxide emissions have dramatically decreased in recent years. However, carbon dioxide emissions would have increased due to a growth in traffic, if cars had not become cleaner at the same time. In addition, traffic also means noise pollution, while sprawled settlement structures lead to light pollution.[59]

[59] Cp. Nuissl, H., Rink, D. and Steuer, D. (2005): *The consequences of urban sprawl in a context of decline: The case of Leipzig*. UFZ Centre for Environmental Research, Leipzig, p.17.

5.3 NATURAL AND PROTECTED AREAS

Urban sprawl causes significant impacts on natural areas. As adumbrated in section 5.1 *Natural resources and energy*, land sustains a wide variety of functions, leading from food production and habitat for natural species to water retention and recreation. All of these functions are inevitably influenced by contiguous land uses. The expansion of urban activities into natural areas results in stress on ecosystems and the disturbance of species, mainly through noise and air pollution. In the United States more than a million acres of forestland were converted to developed uses each year between 1997 and 2001. Losses like this often result in fragmented habitats and a loss of ecological functions. The barrier effect forces animals to live in smaller territories, sometimes separated from their own species. The disruption of wildlife corridors can reduce natural habitats to such an extent that the viability of species populations is severely threatened. The U.S. Environmental Protection Agency found out that the destruction of habitats is "the main factor threatening 80 percent or more of the species listed under the endangered Species Act"[60] The fragmentation of forests, wetlands and other habitats are irreversible impacts on natural areas.

The ongoing degradation of habitats is also threatening to undermine the ecological network *Natura 2000* in Europe. This network was established by the member states of the European Union in order to protect the most seriously threatened habitats and species throughout Europe.

Urban sprawl is particularly vital in coastal regions across Europe. In parts it also affects ecologically sensitive areas. Figures show that the population density in European coastal regions is in average 10 percent higher than in the inland. Between 1991 and 2001, most of the European countries with coastlines denoted an increase in their coastal population. In the majority of cases, this increase was also higher than the population growth in the inland in the same period of time.[61] Moreover, this trend seems to continue in the future, as prospects predict an increase of population of around 35 million people within the next two decades in European coastal regions.[62]

Consequently, the transformation of coastal land into artificial areas has remarkably increased between 1990 and 2000, as *Figure 7* shows. 56.5 percent of the artificialisation is due to housing, services and recreational uses. 41.6 percent of this was due to residential urban sprawl, appearing as diffused housing along the coast. Agriculture, natural and semi-natural landscapes were mainly affected by this transformation process.[63]

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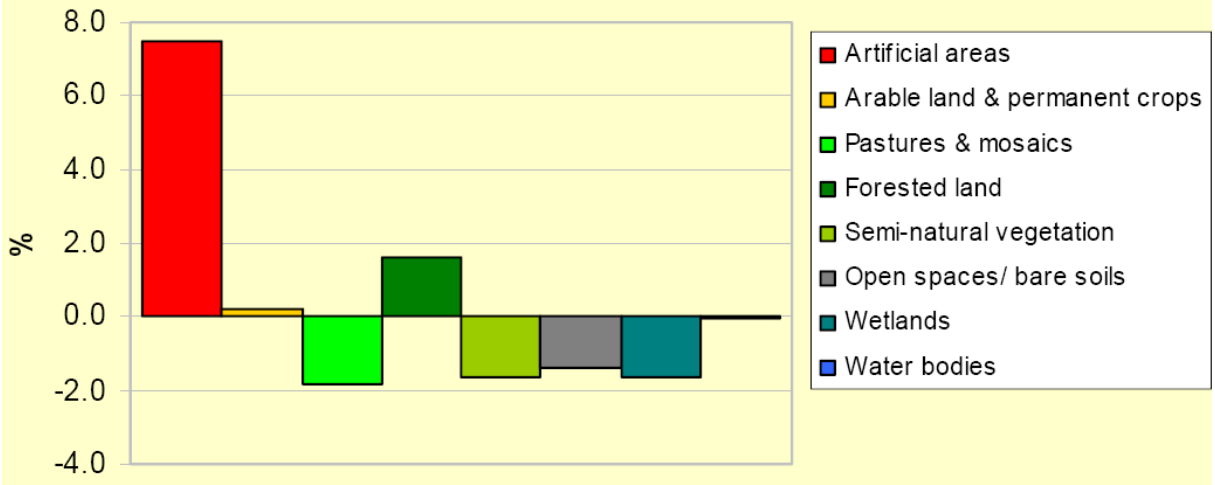
[60] Burchell, R.W., et al. (2005): *Sprawl Costs – Economic Impacts of Unchecked Development*. Washington, p. 43.

[61] Cp. Uhel, Ronan: Lecture on *Urban Sprawl in Europe*, presented at BTH, Karlskrona, 2006-11-27. Retrieved from BTH Website: www.bth.se, complete URL [15], (called 2007-05-14).

[62] Cp. European Environmental Agency (EEA) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 30.

[63] Cp. Uhel, Ronan: Lecture on *Urban Sprawl in Europe*, presented at BTH, Karlskrona, 2006-11-27. Retrieved from BTH Website: www.bth.se, complete URL [15], (called 2007-05-14).

***Figure 7*: Net change in coastal land cover 1990-2000 (% of initial year)**



***Source**: Uhel 2006(see footnote 63)*

The transformation of coastal land has already led to ecological consequences in coastal zones. The vulnerability has increased, because significant ecological functions have been traded in for urban development. Therefore, usual thunderstorms have become a danger in some coastal regions. Unsustainable urban design, consisting of a mixture of large hotels, small summer residences and beach boulevards, has led to the fragmentation of landscapes. The degradation of sensitive soils has in part resulted in coastal erosion, a severe problem besides eutrophication and water shortages. There is an increased demand for water related to urban uses, which more and more competes with needs for irrigation water for agricultural land. In Spain, the development of golf courses has further aggravated the problem, since the over-extraction of groundwater caused the infiltration of saltwater into the groundwater.

Regarding environmental impacts caused by urban development and sprawl in particular, Spain is a particularly profound example. Due to population growth and recent affluence, the building industry is booming. The number of new houses has proverbially exploded in recent years. Moreover, tourism is a huge business in Spain. The Balearic Islands, for example, are being congested with countless newly built hotels all over the coastal zones. In some cases, investors don't even shrink away from degrading protected areas to capitalise it. This is due to the fact, that corruption still is a problem in Spain, especially concerning the building industry.[64]

Another natural landscape that is lately threatened by expanding urban uses is mountain ranges across Europe. The increasing development of transport infrastructure facilitates commuting through mountainous areas. Improvements especially focus on connections between mountainous areas and large cities close-by. This development encourages new urbanisation in naturally coined mountain zones. Besides, an increase in transit and tourist traffic burdens the sensitive ecosystems of mountain ranges, which can only be conserved in their uniqueness, when the balance is maintained between urban and mountain regions.[65]

These developments raise the question, whether economic development, based on tourism that boosts urban sprawl and threatens sensitive environmental areas, can be sus-

[64] Cp. Ulrich, A. and Zuber, H.: *Schamlose Kaste*, in: Der Spiegel, Nr.9, February 2007, p. 134-135.
[65] Cp. European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 30.

tainable. This formulation implies that urban sprawl has indeed negative effects on the environment. On the other hand it also implies that urban sprawl is not the root, but just one element in a chain of factors degrading ecological functions. The examples provided above describe environmental impacts that can surely be related to urban sprawl. However, there is no evidence to prove the extent of sprawl-induced impacts, because there are further factors affecting the environment, such as the development of transport infrastructure. Even without adjacent urban development, roads normally cause barrier effects, fragment habitats and degrade ecosystems - especially large scale transport infrastructure such as highways and main roads, which are primarily built for economic reasons rather than to develop new land for urban development, although history has shown that such infrastructures encourage urban sprawl. Examples are transport corridors between Dresden (Germany) and Prague (Czech Republic), as well as between Paris (France) and Brussels (Belgium). [66] By spending large amounts of money on the construction of international transport networks in the framework of the Trans-European-Network (TEN) projects, the cohesion policy of the European Union indirectly supports this development.

However, the point is that from a certain outlook, many of the environmental problems mentioned before appear anyway, whether urban sprawl exists or not. In fact, sprawl clearly intensifies and accretes negative environmental effects, even though it was only occurring in areas that already faced environmental problems before, which is not the case.

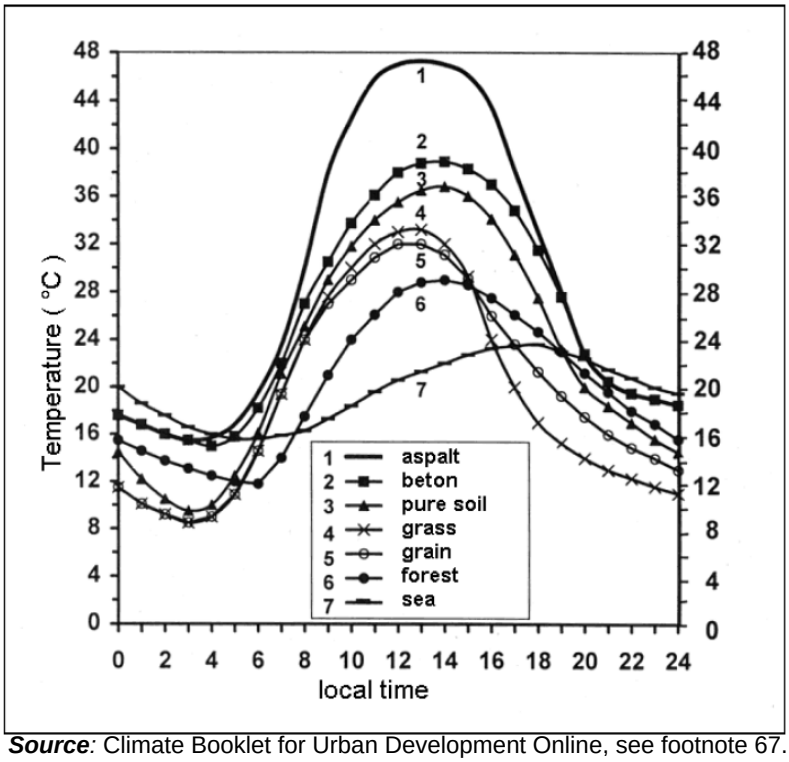
5.4 URBAN SPRAWL IN THE CONTEXT OF CLIMATE CHANGE

A further environmental element affected by urban sprawl is climate. The development of land influences local climatic conditions. Whereas climate in rural areas is basically dependent on natural features, it is rather produced by the composition of artificially built up structures in urban areas and is thus called “urban climate”. Any form of built up environment in some way influences local climatic elements. The basic causes leading to the development of a separate urban climate are changes in the heat budget and the local wind field. Additionally, air pollution caused by industry, power plants, traffic and fires is a factor. Soil sealing is accompanied by a decrease in open spaces and a reduction in evaporation, causing a rise in temperatures in the city. Of course, these characteristics also apply for sprawling settlements in the urban fringes, since a relatively high share of ground needs be sealed for transport related demands. A further factor causing rising temperatures in urbanised areas are pollutant gases (e.g. carbon dioxide), which will be discussed beneath.

[66] Cp. Uhel, Ronan: Lecture on *Urban Sprawl in Europe*, presented at BTH, Karlskrona, 2006-11-27. Retrieved from BTH Website: www.bth.se, complete URL [15], (called 2007-05-14).

Critics might argue that all these climatic effects are even more distinctive in compact city structures, where sealing and air pollution are much more concentrated. To a certain extent this is right. One should also notice that local effects of warming are not necessarily negative characteristics of the city climate. The generally higher temperature level in cities (in annual average 1-2 degrees Celsius warmer than surrounding landscape) has positive effects on inner city vegetation. The vegetation period is extended and the need for heating energy is reduced. *Figure 8* gives an overview about daily temperature differences of various surface materials.

***Figure 8**:* **Temperatures of various surface materials on a midsummer day**



***Source**:* Climate Booklet for Urban Development Online, see footnote 67.

However, the point at issue is that urban sprawl entails climatic changes in a much more dispersed and expansive spatial dimension, influencing the naturally coined climate of large adjacent rural environments. Besides, the expansive land consumption caused by sprawling structures is associated with a constant loss of vegetation and forest land. Particularly forests carry out significant filtering functions on the air. As such, air in forests has between 200 and 1000 times less dust and soot particles than air in cities.

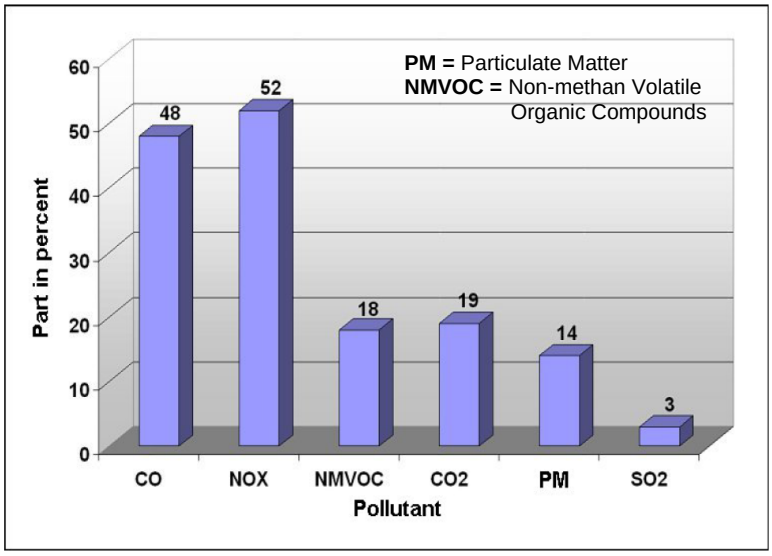
Currently, worldwide efforts to protect the earth's atmosphere demonstrate that the protection of particularly air and climate must not be restricted to the local level, but have to be conceived as a global challenge. In 2001, the German state of Baden-Württemberg generated 80 million tonnes of the greenhouse gas carbon dioxide (CO_2). The biggest share (31%) originated from households, followed by traffic (30%), power plants (25%) and industry (14%).[67] Household heating systems produce further pollutants besides CO_2. Therefore, the conservation of energy must be a significant measure in planning activities. Energy-inefficient sprawling structures dominated by large detached houses contradict this goal.

Furthermore, sprawl clearly favours an increase in traffic, although a causal connection between sprawl and an increase in traffic is difficult to prove. Traffic is one of the main contributors to air pollution and climate change. Pollutant gases like CO_2 can absorb longwave heat radiation and thus reduce its effective dispersal, leading to a warming of the local and, moreover, global atmosphere – the greenhouse effect. *Figure 9* shows the proportion of pollutant emissions attributed to road traffic in Germany in the year 2001. The amount of pol-

[67] Cp. "Climate Booklet for Urban Development Online" Website: www.staedtebauliche-klimafibel.de/, complete URL [6], (called 2007-05-01).

lutants produced by traffic was 48% of carbon monoxide (CO), 52% of nitrogen oxide (NOX), 19% of particulate matter (PM), and 19% of the greenhouse gas carbon dioxide (CO_2).

Figure 9: **Proportion of pollutant emissions attributable to traffic in Germany (2001)**



***Source**:* Climate Booklet for Urban Development Online, see footnote 67.

Climatic developments in recent years show an obvious trend towards rising temperatures in a global scale. These do not just result in mild winters and hot springs, but also in increasingly severe weather events. In this context, there are severe risks in continuing the development of environmentally vulnerable areas like river shores and coast lines. Recent major floods in Europe have affected large urban populations, causing casualties and extensive evacuations. Although projections expect an increase in similar events in the near future, sprawling urban development is still very dynamic in such fragile zones. This situation poses a major challenge for future land use planning in Europe.

Another even more considerable risk in a long-term perspective is the rising sea levels, caused by melting polar caps through global warming. The concentration of population along coastal zones depends on sophisticated planning solutions to cope with this challenge.

Of course, these developments are no specifically sprawl-generated problems. However, according to the EEA, "the management of these risks and planning for adaptation will be made more complicated if urban sprawl is not controlled."[68]

5.5 SUMMARY

Urban sprawl is harmful to the environment. There are direct impacts like the consumption and sealing of different types of land, which decrease agricultural productivity, disturb significant ecological functions and downsize wildlife habitats. Furthermore, there are many factors causing environmental problems, which can in part be related to sprawl, but also to other forms of urban development and societal phenomena. The best example therefore is the discussion concerning urban sprawl and its contribution to air pollution. Sprawl presumably fosters the use of private cars and increases traffic, thereby increasing CO_2 emissions. However, it has not yet been feasible to prove, that there were fewer cars without sprawling settlements.

Examples show that ecologically sensitive areas are particularly vulnerable to urban development. Especially coastal and mountainous regions are increasingly exposed to urban

[68] European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 35.

and economic land use, and fragile ecosystems are threatened to be degraded and destroyed. Besides impacts on local ecosystems, urban sprawl moreover contributes to global climate change by “needing” relatively more transport and energy logistics than compact built up structures.

Even though negative impacts of urban sprawl might selectively be reduced, the process itself is virtually impossible to avoid. Too many external factors contribute in boosting dispersed urban development. Its multidimensional character makes it extremely difficult to control.

Sometimes preconditions for urban sprawl are set up “by accident”, through developments like large scale transport infrastructure. The prime intention of constructing highways, modern train lines and main roads is usually to improve the connection between certain places. Besides the fragmentation of habitats and the disruption of ecosystems, these transportation links entail further side effects such as the attraction of various new developments in the close-by surroundings.

Cases like this influence the emergence of urban sprawl and demonstrate that sprawl does not necessarily initiate environmental degradation, albeit it definitely intensifies it. Against this backdrop it is also crucial to critically examine the cohesion policy of the European Union, since it indirectly assists urban sprawl by financing infrastructure projects across Europe.

6. URBAN SPRAWL IN LEIPZIG AND STUTTGART

Based on the overview about sprawl-related environmental effects in general (see *Chapter 5*), *Chapter 6* will focus on the situation in two concrete case studies: Leipzig and Stuttgart. Both are major German cities of comparable size, and both are affected by urban sprawl. However, it is rather the fundamental differences between Leipzig and Stuttgart, which render a comparison interesting. Stuttgart is an economically booming city in a booming region, growing in population. On the other hand, Leipzig is sprawling, even though it loses population. Since it was part of the former GDR, which broke down in 1990, its urban development in the second half of the twentieth century was coined by overall different framework conditions.

	Leipzig	Stuttgart
State	Saxony	Baden-Württemberg
Area	297,60 km²	207,36 km²
Population	506.372 (2006)	593.639 (2006)

***Sources**:Statistical State Bureaus.*

6.1 LEIPZIG

Like many other cities across the world, the urban region of Leipzig has experienced remarkable urban sprawl in the 1990s. However, Leipzig is a special case. Sprawl processes have taken place against the background of post-socialist transformation and therefore in a context of declining industry and shrinking population. These two aspects need further explanation.

First of all, there was a strong trend towards modernisation and catching up across post-socialist Europe in the early 1990s. In eastern Germany, this trend became visible by heavy urban sprawl, which was in part advanced by the building industry and investors, who scented big business in the new “Länder”, and in part by governmental start-up programmes steered by money and laws. The spatial development of many cities was characterised by oversized expansion, with Leipzig in the vanguard of these dynamics.

Even though urban sprawl in a context of decline is also well known from several “old industrialised” regions in the western part of Germany, the speed and intensity of urban

transformation in Leipzig reached a new scale. Since urban sprawl did not exist in Leipzig before the unification, experts describe the processes that took place as a development in a "time lapse"[69].

The process of urban sprawl in Leipzig can be divided into four different phases, which will be characterised later on in this chapter. Doing so is crucial to understand the basic dynamics of the development Leipzig has experienced, but first of all it is important to know the origins of the process.

6.1.1 The development of urban sprawl

The point of departure

By 1990, the time of the German unification, Leipzig was a compact and functionally mixed city. It had already declined in population before, basically since 1933, when more than 700.000 people were living in Leipzig. From 1966 on, the city faced a continuous decline in population and became the only major city in the former GDR with this attribute. This was basically due to internal migratory flows to Berlin and northern regions in the former GDR until the early 1980s. By the end of the 1980s, migration to the western part of Germany started to become a mass movement. In 1989 and 1990, Leipzig lost approximately 16.000 people to the west each year.

One reason for these losses was the rapid decay of Wilhelminian-style districts, a process that outnumbered the construction of new dwellings. A large amount of people faced bad living conditions. Dwellings were very poky and only partly equipped with indoor-WC and modern heating systems. After the unification, immediate improvement was not conceivable.[70]

(1) The initiation of sprawl (1990-1992)

Even though urban sprawl was moderate in the beginning, this phase was of prime importance for the later development. As soon as the German-German border was opened, developers and investors "invaded" the still existing GDR. They regarded suburbanisation as kind of a natural process, being backed up by political concepts that aimed at the modernisation and the catching-up process of the new 'Länder'. First of all, large shopping malls emerged in the periphery of Leipzig. They were symbolising the affluent, capitalist west and first signs of beginning urban sprawl. The shopping centres were followed by large commercial and residential parks.

The simultaneous decline in population resulted in a matchless deindustrialisation. Between 1990 and 1993, more than 80% of the 100.000 industrial jobs were abolished only in Leipzig. Old industrial districts outside and smaller industrial areas inside the city were left

[69] Nuissl, H. and Rink, D. (2003): *Urban sprawl and post-socialist transformation. The case of Leipzig (Germany)*, UFZ-Bericht 4/2003, UFZ Centre for Environmental Research, Leipzig, p. 7.
[70] Cp. Nuissl, H. and Rink, D. (2004): *Schrumpfung und Urban Sprawl. Analytische und Planerische Problemstellungen.* UFZ Centre for Environmental Research, Leipzig, p. 27.

stranded. Consequently, many quarters were functionally “de-mixed” and developed towards pure residential areas.

Outward migration remained strong, even though it decreased after 1990. At the same time, the local birth rate vastly decreased. Consequently, the city continued to decline in population rapidly. Leipzig tried to compensate these losses and initiated some major projects, based on a city marketing concept and in order to prevent further negative growth. Some of these projects were part of urban sprawl processes themselves – such as the extension of the airport, the construction of an exhibition centre and the development of a centre for goods traffic.

Table 3: **Population density in the Leipzig region (1990 and 2001)**

	Area (km²)	Pop/km²	
		1990	2001
Municipalities adjacent to Leipzig (“suburbia”)	743.69	187.67	217.28
Towns and villages incorporated into the city of Leipzig since 1990* (Leipzig – “New Fringe”)	145.12	318.59	476.24
Leipzig (1990 borders)	146.50	3,578.90	2,954.29

excluding Podelwitz Süd & Radefeld* ***Source:* *Nuissl et al, 2003*[71]

(2) Increasing suburbanisation (1992-1996)

While the first phase of urban sprawl was dominated by commercial developments in the urban periphery, in both the retail and industrial sector, from 1992 on Leipzig also experienced heavy residential suburbanisation, reaching its peak in 1996. Living in the hinterland of the city was popular, as the quality of living was poor in the city and newly built dwellings close to the centre were expensive.

The development of large “residential parks” outside the city was advanced by the political goal to increase the rate of proprietary. The post-socialist transformation policy of the 1990s offered many incentives for urban sprawl and resulted in a vast migration from the city to the urban periphery accompanied by a further shrinkage of the core city. At the same time, Leipzig tried to improve its image, particularly by aid of the marketing campaign *Leipzig kommt* (English: *Leipzig is coming*) and presented itself as a ”boomtown”.

(3) The resurgence of the core city (1996-2000)

The year 1997 was a watershed. The number of people who migrated from the city to the hinterland decreased for the first time since 1989. At the same time the character of residential suburbanisation changed. Whereas semi-detached houses were the predominant form of

[71] Cp. Nuissl, H., Rink, D. (2003): *Urban sprawl and post-socialist transformation. The case of Leipzig (Germany)*, UFZ-Bericht 4/2003, UFZ Centre for Environmental Research, Leipzig, p. 34.

suburban dwellings until 1996, single-family houses became the standard in the second half of the 1990s. Moreover, the restoration of old buildings in the city made considerable progress. By the end of the 1990s, the housing market in the inner city eased and the differences between city and hinterland began to flatten.

The inner city restoration also led to the building of inner city shopping centres and revitalised the urban retail sector. Further factors that reduced the decline in population were the slowdown of "west-migration" and a slight but steady increase in the birth rate.

(4) Consolidation (since 2000)

Since the year 2000 there is a balance in migratory activities between Leipzig and its hinterland. Partly, migration back to the city can be observed, but this is mainly a statistical effect due to the incorporation of numerous surrounding municipalities in 1999. The situation in Leipzig has eased, but the immense vacancy of dwellings, offices and commercial areas is still an alarming economic and urbanistic problem. Vacancy is not restricted to the inner city, but is also present in sprawling parts of the urban region.

In its struggle for population growth, Leipzig keeps on adhering to major projects, like the settling of BMW in 2005 (start of production) or DHL (2008). Still, this modernisation strategy is being flanked by image campaigns and, not least, the (abortive) candidature for Olympia 2012.

Finally, it is crucial to state that the development of urban sprawl in Leipzig was heavily advanced by "governance decisions". All actors, including private households, investors and commercial actors, reacted to the financial incentives provided by the government. Surveys from the 1990s show that the decisive motive for people to move to the urban fringes was the improvement of living quality rather than push- and pull-factors like location, image, environment and inner city dilapidation. Furthermore, regional competition is not to be sneezed at, especially in the context of decline and a socialist past. Thus, globalisation has led to struggles for inhabitants and economy, contradicting a controlled spatial development.

6.1.2 Environmental effects

Chapter 5 has delineated the difficulty of determining explicit sprawl-induced effects on the environment aside from further influential factors. The following section will discuss environmental consequences of urban sprawl in Leipzig. This will be done by the aid of several types of quantitative data that indicate relations between urban sprawl and certain environmental conditions. The focus will be on data concerning land consumption, surface sealing, mobility and traffic, energy consumption and pollution. The discussion is based on findings by the UFZ Centre for Environmental Research in Leipzig.[72]

(a) Land consumption

[72] Cp. Nuissl, H., Rink, D. and Steuer, D. (2005): *The consequences of urban sprawl in a context of decline: The case of Leipzig*. UFZ Centre for Environmental Research, Leipzig.

The urban region of Leipzig has experienced an enormous consumption of formerly undeveloped land since the early 1990s. This emanates from looking at various sources of data. The official German land use statistics (collected under the federal agricultural legislation and provided by the national, regional and local departments of statistics) clearly reflect recent urban land use changes. *Table 4* shows that the urban region of Leipzig (which consists of the city of Leipzig and 16 adjacent municipalities) has grown in size by more than 14% in just eight years between 1993 and 2001. Unfortunately, there are no adequate data from before 1993 to make a long-term comparison, because the statistical system was basically changed after German unification.

***Table 4*: Urban land ("land for settlement and transport purposes") in the Leipzig region**

	1993	1997	2001
	Urban land (ha/% of total area)	Urban land (ha/% of total area)	Urban land (ha/% of total area)
Outer fringe / new fringe	ca. 8.281	9.441	9.903
Inner fringe	ca. 3.333	ca. 3.800	12.729
'Old' Leipzig	8.208	8.693	

***Source**: Nuissl et al, 2005*

In order to determine the patterns of land consumption in Leipzig, GIS analyses based on satellite pictures have been carried out. These analyses have revealed that urban sprawl occurred mainly at the expense of agricultural land (as it is usually the case in Germany). A more striking specificity of recent urban development in Leipzig is that green spaces have remarkably increased by 370 ha since 1990. This development is due to the heavy deindustrialisation that took place in Leipzig after unification, which led the renaturation and re-use of numerous brownfield sites for recreation. In particular a vast open-cast mining field south of Leipzig has been closed down and converted into a lake surrounded by parkland.

These circumstances exacerbate the expressiveness of statistical data, when it comes to analysing sprawl-induced impacts on land consumption. However, *Table 5* reflects a vast increase in urban land between 1940 and 2003, too. One should bear in mind the decrease in population in the same period of time.[73]

***Table 5*: Land use change in Leipzig (in ha)**

	1940 – 2003 (ha)
Urban land (residential, industrial, traffic)	+ 5.501
Urban green spaces (parks)	+ 5.064
Non-urban land (agricultural, woods, water)	- 5.956

***Source**: Nuissl at al, 2005*

[73] Whereas Leipzig had a population of 709.000 people in December 1940, it lost more than 200.000 people until 2003 (December 2003: 497.531). ***Source***: Leipzig-Sachsen Website: www.leipzig-sachsen.de, complete URL [7], (called 2007-05-14).

(b) Surface sealing

Together with the growth of urban land, the amount of sealed land has increased tremendously in and around Leipzig. The sealing of ground has been exceedingly intense in areas, where huge enterprise zones have been developed. Unfortunately, concrete data on surfacing is only available for the city of Leipzig in its current limits, excluding surrounding municipalities which make up large parts of the urban region and particularly areas mostly affected by urban sprawl. However, according to the data, about 80 percent of the urban area developed in Leipzig after World War II are sealed to a degree of at least 20 percent. The remaining 20 percent of urban land represent green spaces of all kinds.

Urban land use changes are not tantamount to surface sealing. For instance, Leipzig has many currently unused inner city plots of which more and more are being converted into "micro parks" lately. Due to the fact that Leipzig is a slowly shrinking city, these plots might provide further potential for unsealing activities in the future.

Nuissl, Rink and Steuer (2005) annotate that "an overall assessment of the effects and impacts of surface sealing in Leipzig and the Leipzig region has not been undertaken yet." They further add, that "such an assessment would require additional monitoring and modelling work at the city and regional scales."[74]

(c) Transport-related effects

Based on the findings concerning transport-related effects on the environment *(in Chapter 5*) it is crucial to examine the mobility patterns and its interrelation to urban sprawl in the urban region of Leipzig.

***Table 6*: Car density in selected districts of Leipzig: private passenger cars per 1.000 inhabitants in 2004**

Inner-city districts		Inner-city districts	
District (location)	**Car density**	**District (location)**	**Car density**
Zentrum (centre) (A)	233	Paußig-Portitz (B/C)	575
Zentrum-West (A)	292	Mölkau (C)	504
Zentrum-Süd (A)	314	Baalsdorf (C)	490
Südvorstadt (A)	301	Althen-Kleinpösna (C)	497
Connewitz (B)	294	Holzhausen (C)	549
Anger-Crottendorf (B)	320	Hartmannsdorf-Kn. (C)	573
Plagwitz (B)	295	Burghausen-Rückm. (C)	560
Altlindenau (B)	276	Seehausen (C)	548
Gohlis-Süd (B)	329	Wiederitzsch (C)	476
A = inner-city districts; B = districts incorporated in c. 1900; C = districts incorporated in the 1990s			

***Source**: Nuissl et al, 2005*

[74] Nuissl, H., Rink, D., Steuer, D. (2005): The consequences of urban sprawl in a context of decline: The case of Leipzig, UFZ Centre for Environmental Research, Leipzig.

Comparing data on car ownership in the inner city and the outer fringe districts indicates significant differences in the mobility patterns of “urbanites” and “suburbanites”. *Table 6* shows that the number of cars per 1000 inhabitants is significantly higher in peripheral settlements compared to inner city districts.

However, these numbers are still indicators, which cannot provide any evidence for a change in mobility patterns that is causally linked urban development patterns. There are further factors like income and lifestyle influencing car ownership. Unfortunately, there is no further adequate data available – for example, on shares of commuters in the inner city and outer fringes - to distinguish the mobility patterns between different districts in Leipzig.

Thus, other indicators have to be analysed in order to derive findings for the interrelation between urban sprawl and mobility patterns. Car ownership heavily increased in Leipzig between 1991 and 2003 (see *Table 7*). Again, these numbers can be explained by various conditions. The development might partly be due to expanding urban sprawl, but it might as well be due to a strong pent-up demand after German unification.

***Table 7*: Development of car-ownership since 1990**

	‘91	‘92	‘93	‘94	‘95	‘96	‘97	‘98	‘99	‘00	‘01	‘02	‘03
Passenger cars per 1000 inhabit.	143	274	375	393	393	383	372	362	378	381	385	386	387
…of which private cars	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	326	342	343	348	350	353

***Source**: Nuissl et al, 2005*

Figures on commuting show, that the urban region of Leipzig has also experienced increased traffic flows since the mid-nineties. Even though employment was decreasing, the total number of incoming commuters was steadily rising between 1994 and 2002. Besides a noticeable amount of inward commuting, there is also a remarkable number of people commuting from the city of Leipzig to the new industrial and commercial areas in the periphery, as these suburban developments have created numerous new jobs.

Moreover, many daily traffic flows nowadays don’t even touch the city’s territory at all. Industrial and commercial sprawl has generated a lot of jobs outside the city centre. Data on changes in employment indicates that the urban fringe of Leipzig provides more jobs in the than the city itself, at least in the second half of the 1990s.

Besides commuting, it is also important to observe traffic flows induced by shopping malls situated in sprawling locations. Case studies on car traffic related to new, large malls have been carried out in the urban region of Leipzig. The findings are that malls increase the traffic on surrounding roads by between 23 – 50 percent. Beyond, calculations show that malls cause an increase in pollution (CO_2, benzene and others). Affected are particularly those parts of the urban region, which are mostly crossed by mall shoppers. However, it is very difficult to definitely prove that malls create additional traffic. If shopping facilities were more concentrated in the city and customers would still use their cars for shopping, an increase in traffic would as well be most likely, since an additional amount of people would have to drive from the fringe to the city. On the contrary, if retail was more dispersed in various suburban sub-centres, shopping-related car traffic would probably decrease.

These various approaches demonstrate that is virtually impossible to prove a causal relationship between urban sprawl and particular patterns of mobility in the urban region of Leipzig. Besides general, external influences, this is partly due to a lack of data. Consequently, there is no evidence that sprawl causes an increase in traffic and therefore, it cannot be proved that sprawl causes an increase in transport-related pollution, harming the environment. However, most of the data presented can be interpreted insofar as sprawl creates an increase in traffic. These complicated circumstances have led to countless academic discussions, which are reflected in the case of Leipzig.

(d) Changes in energy consumption

Potential effects of urban sprawl on energy consumption have been presented in *Chapter 5*. In short, changes in housing and transport patterns may lead to a change in the amount of energy consumed, and therefore might affect the environment.

In the case of Leipzig, data are only available on the different energy resources used in total numbers and the particular share of domestic households. *Table 8* shows that energy consumption decreased in the 1990s (in total numbers). This positive trend mainly results from the decrease in population and the intense deindustrialisation. The "counterweight" effect of urban sprawl cannot be measured, because no data are available on specific changes in energy consumption (e.g. figures recording increases due to changed housing preferences in sprawling settlements with less energy-efficient detached houses).

***Table 8*: Energy consumption by energy source in Leipzig (GWh/year)**

	1990	1997	1998	1999	2000	2001
Electricity	1.494	1.455	1.390	1.382	1.799	1.980
Of which: domestic households	568	527	478	464	485	574
Heating (remote and home)	2.179	1.904	1.760	1.596	1.669	1.779
Of which: domestic households	1.090	1.008	950	862	834	784
Natural gas	1.733	1.578	1.710	1.685	2.190	2.396
Of which: domestic households	1.125	1.089	1.158	1.112	1.457	1.607
Coal	1.292	585	471	410	353	315
Of which: domestic households	1.037	457	401	350	316	295
Oil/gas	1.188	898	876	847	1.339	1.330
Of which: domestic households	201	183	196	197	306	304
Total energy consumption	7.886	6.420	6.207	5.920	7.350	6.800
" by domestic households	4.021	3.264	3.183	2.985	3.398	3.564
Total domestic enegery consumption per capita (in MWh/year)	**7.9**	**7.3**	**7.3**	**6.1**	**6.9**	**7.2**

***Source**: Nuissl et al, 2005*

Due to the incorporation of several adjacent municipalities, the total amount of energy used in Leipzig increased after 1999. Unfortunately, total numbers are not very informative in this context. Data on the domestic consumption of energy per capita would be much more useful,

since they might indicate a relation between a growing number of detached houses in sprawling settlements and an increasing use of energy per capita.

Table 8 also shows changes in the mix of fuels used in Leipzig. “Dirty” fossil fuels like brown coal have been largely replaced. This development is mainly attributable to intensive modernisation activities, including the installation of new heating systems in many of the old residential buildings in Leipzig. Besides the general pent-up demand, these activities were further boosted by the government, which offered grants and tax cuts for energy-saving measures.

The presented data on energy consumption in Leipzig is yet another example for the difficulties that emerge when it comes to prove sprawl-induced effects based on empirical data. What remains to state is that large detached houses normally consume more energy per capita than compact housing entities which usually can be found in city centres. Most likely, it is the same in Leipzig.

(e) Pollution

Pollution in the Leipzig region has a special history. During the lifetime of the GDR, air pollution was tremendous due to regional industries in the chemical and energy sector, especially. Leipzig was one of the most badly polluted regions throughout Europe. Maximum pollution-limits for almost all relevant chemicals were regularly exceeded. In recent years the situation has completely changed. While the city was heavily sprawling during the 1990s, air pollution decreased significantly. The improvement of air quality is admittedly due to deindustrialisation processes rather than to settlement structures.

Attributing air pollution to urban sprawl is hardly possible. In case of pollution caused by car traffic, some assumptions can at least be made on the basis of data on air quality in Leipzig. Traffic emits pollutants such as nitrogen oxide, benzene and ozone. Not surprisingly, these substances still merit critical attention, since German unification was followed by an exploding motorisation in eastern Germany. Consequently, car traffic has more than doubled.

***Table 9*: Impact of pollution in central Leipzig (Leipzig Central Station) (µg/m³)**

	‘92	‘93	‘94	‘95	‘96	‘97	‘98	‘99	‘00	Critical threshold
SO2	103	79	41	34	23	15	9	6	5	140.0 (TA-Luft)
NO2	33	36	36	48	48	53	50	46	48	80.0 (TA-Luft)
Particulate	65	62	58	53	75	52	46	42	41	150.0 (TA-Luft)

***Source**: Nuissl et al, 2005*

As mentioned before, studies have shown that single large shopping malls in the periphery of Leipzig have caused increased air pollution in particular areas, due to a “mall-induced” increase in traffic flows. This proves that urban sprawl causes increasing air pollution. Nevertheless, *table 10* points out that recent improvements in air pollution have by far outweighed simultaneous negative effects of sprawl.

***Table 10*: CO_2 emissions in Leipzig (tons/year/inhabitant)**
(incorporation of suburban townships and resulting population increase taken into account)

CO_2 (t/y/inh.)	1990	1998	1999	2000	2001
Due to energy consumption	13.32	7.89	7.18	6.46	5.94
Due to traffic	1.09	1.39	1.99	1.80	1.81
Total	14.41	9.82	9.17	8.26	7.75

***Source**: Nuissl et al, 2005*

There is no discussion about the effects of urban sprawl without experts stating that sprawl entails heavy air pollution. After all considered, the finding remains that sprawling settlements 'need' more energy and traffic than compact urban structures. In its current appearance, with a spatial concentration and segregation of particular functions, urban sprawl in Leipzig "entails a high level of car traffic, although admittedly it is not possible to provide evidence that traffic would decrease if spatial structures were different."[75]

6.1.3 Summary

Leipzig has experienced an eventful history and extensive changes in the context of post-socialist transformation. These changes are also reflected in its urban structure. German unification was followed by intense and concentrated urban sprawl, boosted by a number of different actors, including investors, retail and governments.

The drastic and overarching transformation that took place in Leipzig throughout the 1990s also affected environmental issues. Land consumption and car traffic have vastly increased in the urban region of Leipzig since the early 1990s. Whereas land consumption in a context of decline is likely due to sprawl, it is difficult to prove that sprawl is also the driver behind an increase in private cars. On the other hand, intense modernisation activities and deindustrialisation led to a significant decrease in energy consumption and air pollution, as well as an increase in green spaces. These environmental improvements stand in contrast to the expected negative effects caused by sprawl.

The problem in the Leipzig case is a lack in appropriate data to relate environmental trends to urban sprawl. The data presented is not detailed enough. It is just adequate to give a general overview about recent environmental changes in Leipzig. Therefore it is no surprise that extensive positive environmental effects caused by deindustrialisation and modernisation by far outweigh potential negative sprawl-induced effects.

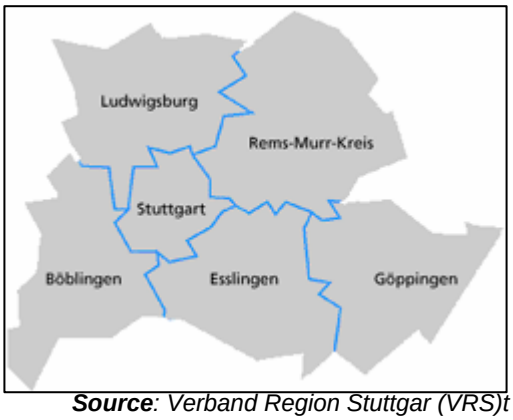
Lately, several factors such as the abolition of certain state grants and the resurgence of the city have reduced outward migration to the periphery. Still, many remaining factors like regional competition stand against efforts to control spatial development in a more effective way.

[75] Nuissl, H., Rink, D. and Steuer, D. (2005): *The consequences of urban sprawl in a context of decline: The case of Leipzig*. UFZ Centre for Environmental Research, Leipzig, p. 18.

6.2 STUTTGART

Examining the effects of urban development in Stuttgart, it is crucial to observe the city in the context of its large surrounding urban region. The Stuttgart region is the geographical, political and economic heart of Baden-Württemberg and consists of the urban district of Stuttgart and five surrounding administrative districts (Ludwigsburg, Böblingen, Esslingen, Göppingen and the Rems-Murr-district), covering a total of 179 municipalities. Almost 2.6 million people live in an area of 3.654 km². With a population density of more than 700 people/km², the Stuttgart region is one of the most densely populated conurbations in Germany. Besides, the area currently has Germany's highest density of scientific, academic and research organisations, and tops the national league for patent applications. The Stuttgart region is one of Europe's most successful economic centres. This is due not only to the influence of leading international Tcompanies, such as DaimlerChrysler, Porsche, Bosch, Hewlett-Packard and IBM, but also to the influence of world-renowned medium-sized enterprises such as Kärcher, Märklin, Stihl and Trumpf. In total, approximately 150,000 companies are located in the Stuttgart Region.

Figure 10: **The Stuttgart Region**



***Source**: Verband Region Stuttgar (VRS)t*

6.2.1 The development of urban sprawl

Regional characteristics and historical development

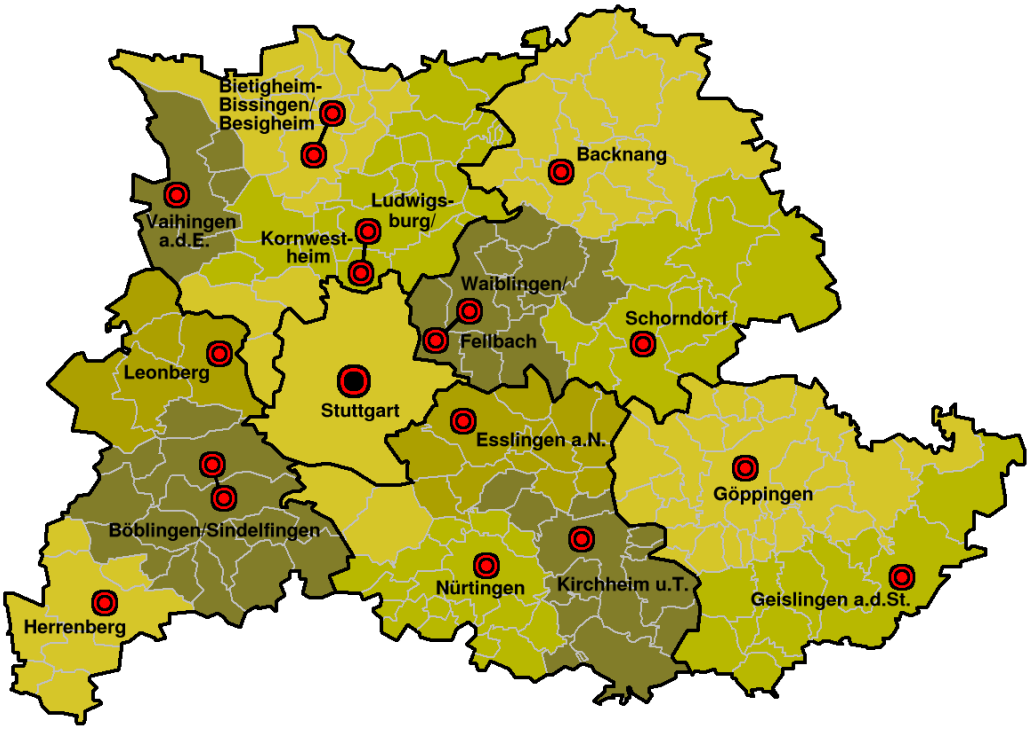
The main difference in regard to other urban regions is its polycentric character. The relatively small centre Stuttgart (2006: 593.000 people / 207.000 km²) is surrounded by several "little tigers"[76]: Esslingen (89.000), Ludwigsburg (86.000), Sindelfingen (60.000), Waiblingen (51.000), Böblingen (46.000), Leonberg (43.000), Fellbach (42.000) and Filderstadt (41.000). All together, the region accommodates 14 high-capacity mid-sized towns (see *Figure 11*). The polycentricity of the regional settlement structure traces back to historical traditions and is partly due to the remarkably diversified landscape and the moved topography of the region. Latter is particularly responsible for the perforated urban structure of the region. Even the city of Stuttgart itself is polycentric, reflecting region's structure in a smaller scale.

By the end of the 19th century, Stuttgart more and more became a business location, housing various industries such as electrics (Bosch), fine mechanics, photo (Kodak, Zeiss-Ikon) and the automotive industry (Daimler, Porsche). Due to a lack of land in the city, some industries already moved out to surrounding mid-sized centres at this time. After World War II, the region experienced further economic impulses through US-American funds (IBM, Hew-

[76] Harlander, T. and Jessen, J. (2001): *Stuttgart – polyzentrale Region im Strukturwandel*; in: Herfert, G., Brake, K., Dangschat, J. (Ed.) (2001): *Suburbanisierung in Deutschland. Aktuelle Tendenzen*. Opladen, p. 187.

lettPackard) and the settling of further German companies. The result was a rapid growth of commercial areas outside the city of Stuttgart and also outside the smaller surrounding cities.

***Figure 11*: Stuttgart and the "little tigers" in the Stuttgart Region**



Source: *Wikipedia*[77]

Population and urban development 1945 - 1970

The city of Stuttgart experienced a turbulent population development since the middle of the 20th century. After a decline in population by almost 50 percent, from 500.000 in 1939 to 260.000 in 1945, it took only 5 years until 500.000 people were living in Stuttgart again in 1950. This rapid population growth was not common in post-war Germany. Moreover, population growth continued until the peak was reached in 1962, when 644.000 people were living in the city of Stuttgart. The growth process was increasingly limited by the outward movement of affluent citizens into surrounding municipalities. On the other hand, population growth in the urban region of Stuttgart was above average in Baden-Württemberg between 1950 and 1970. In the mid-60s, suburbanisation processes became more dynamic in the Stuttgart area, forced by the motorisation of the masses.[78]

Population and urban development in the 70s and 80s

[77] Wikipedia Website: http://de.wikipedia.org/wiki/Region_Stuttgart (called 2007-05-05).
[78] Cp. Harlander, T. and Jessen, J. (2001): *Stuttgart – polyzentrale Region im Strukturwandel*; in: Herfert, G., Brake, K., Dangschat, J. (2001): *Suburbanisierung in Deutschland. Aktuelle Tendenzen*. Opladen, p. 187-199.

During the 1970s and 80s, the city of Stuttgart lost about 50.000 people. While the region was moderately growing in population until 1987, settlement structures virtually started to explode. Increasing demands for land could no longer be realised in already densely populated settlements along transport axes. Thus, building activities more and more concentrated on rural areas. Increasing costs for inner city land and better public transport connections to the hinterland fostered this trend. At the same time, societal changes led to an increasing decoupling of the development of living space from population development. Between 1968 and 1984, household sizes declined from 2.53 to 2.3 persons/household and more and more people tended to require more living space. The population density decreased from 7.900 to 6.100 people/km². The city continued to lose population, whereas surrounding settlements sprawled further away from the city into the hinterland, like a shifting sand dune. Thus, the 70s and 80s in the Stuttgart region were characterised by classical urban sprawl processes.

At the same time, a similar development could be observed in the employment sector. Between 1974 and 1985, Stuttgart (- 8.3 percent) and the high-density settlements along transport axes (-2.5 percent) lost jobs, while the number of employees in the rest of the region increased between 4.5 and 7.7 percent. Thus, urban sprawl was also visible in the spatial distribution of companies.[79]

Population and urban development since 1989

Like in other regions in western Germany as well, German unification led to an economic boom and a growth in population in the Stuttgart region. After a long period of decline, even the city of Stuttgart itself could record a growth in population. However, the outward movement of particularly middle-class citizens into the hinterland remained strong. Furthermore, the hinterland itself had started to attract newcomers from everywhere and therefore stepped into a competitive relation with the city core.

The distribution of the averaged regional population growth of 8.9 percent (between 1986 and 1992) was unbalanced. The population in the city of Stuttgart grew by only 3.5 percent. Above average growth rates particularly appeared in smaller municipalities beyond development axes and major and middle-sized towns. Highest growth rates occurred in areas, which are at least 25 km away from the core area of the region. On the other hand, most ‘little tigers’ such as Esslingen, Nürtingen, Sindelfingen, Leonberg, Fellbach, Schorndorf and Geislingen recorded minor growth rates. These trends basically remain until today and indicate a recent settlement development in the Stuttgart region, which contradicts general planning goals.[80] Due to its tight interlocking of settlements and landscape, Sieverts uses the Stuttgart region as an example for a new form of intensively networked regional cities in his well known book *Zwischenstadt*.[81]

[79] Cp. Sperle, T. (2002): *Boomtown Stuttgart? Siedlungsentwicklung und Strukturwandel in der Region Stuttgart. Unter besonderer Betrachtung des Büroflächenmarktes*, Diplomarbeit, Universität Stuttgart, p. 24.
[80] Cp. Ibidem, p. 31.
[81] Cp. Sieverts, Thomas (1997): *Zwischenstadt: zwischen Ort und Welt, Raum und Zeit, Stadt und Land*. Braunschweig/Wiebaden, p. 148.

Reasons for urban sprawl in the Stuttgart area

Most of the reasons for urban sprawl in the Stuttgart region reflect the findings of *Chapter 4*: increasing affluence, increasing demands for living space with simultaneous average decline in people/household, increasing prices in core areas etc. Besides, there are a number of more specific factors that have fostered urban sprawl throughout the years. Several kinds of state grants, in particular the mileage allowance and the home owner allowance, have encouraged people all over Germany to build large detached houses far outside of congested centres. In 2001, almost 90 percent of newly built living space in Baden-Württemberg was proprietary. Almost half of all newly built dwellings accrued in detached houses. Of course, the same grants contributed to the process in Leipzig after unification. Since 2006, the home owner allowance does no longer exist.

On the other hand, a census carried out by the city of Stuttgart found out that about 85 percent of the outward migrants can fancy moving back to the city after a while. Thus, a loss of inner city attractiveness does not seem to be a reason for outward migration.

Summary

Regarding the mentioned developments in the Stuttgart region, it stands out that there have always been interrelations between regional economic conditions and its settlement structure. The processes have reciprocally influenced and intensified each other. Urban sprawl has not been dominated to such a vast extent by the core city, as it is the case in numerous other urban regions in Germany. Migration to the hinterland was moreover additionally induced by a number of relatively strong mid-sized towns. Not least, a notable share in setting preconditions for settlement in a topographically challenging landscape like the Stuttgart region is due to a sophisticated transportation system.

6.2.2 Environmental effects

The discussion about environmental effects of sprawl in the Stuttgart region is essentially based on empirical data collected by the Verband Region Stuttgart (VRS). The VRS is the political, decision-taking body for the region and is responsible for regional planning policies - regional, infrastructure, landscape, traffic and transport – as well as business promotion, local public transport, waste management, trade fairs, exhibitions and tourist marketing.[82]

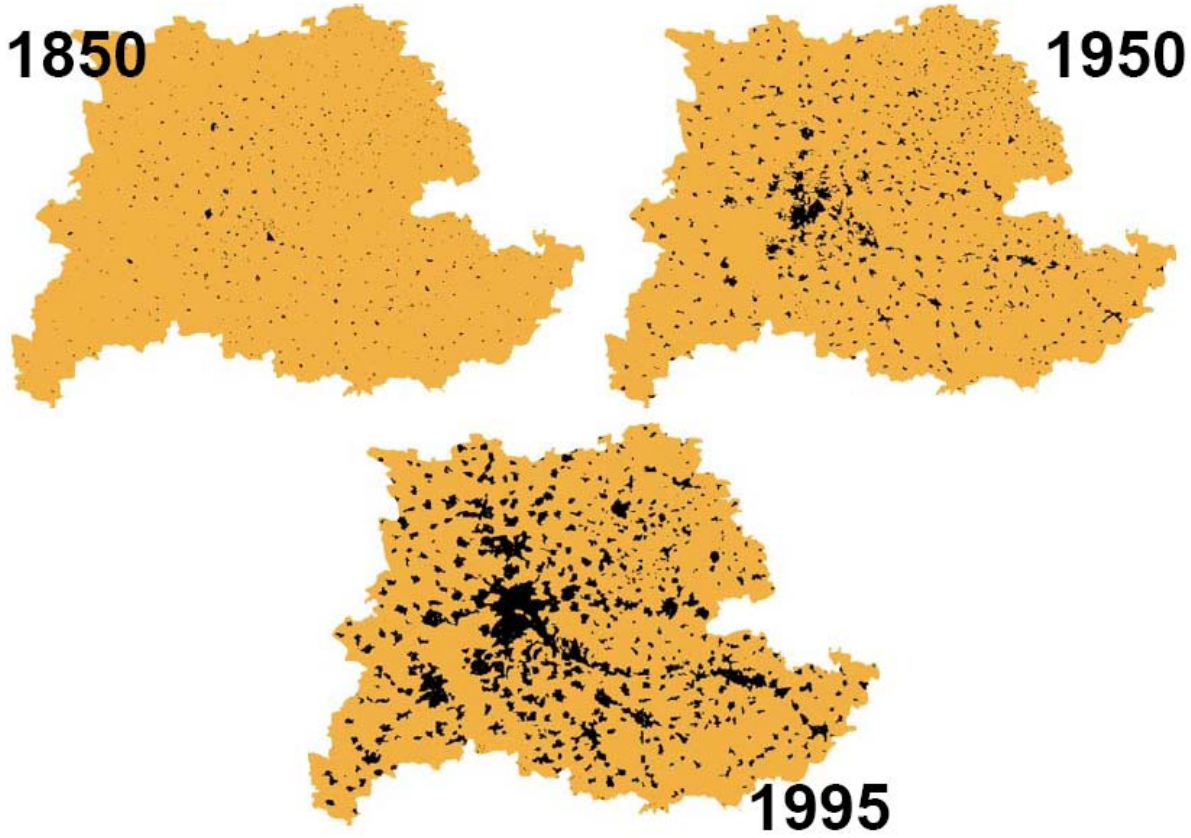
(a) Land consumption

Figure 12 visualises the development of the settlement structure in the Stuttgart region in three stages. Since early industrialisation in the 19th century, the settlement area has grown by more than 1.000 percent, excluding land use for transport purposes. Early settlement concentrations along first development axes were followed by a step-by-step expansion of settlement structures throughout the entire region. From 1950 to 1995, land consumption has

[82] Cp. Verband Region Stuttgart Website: www.region-stuttgart.org, complete URL [8], (date: 2007-05-05)

increased by 150 percent, whereas population has increased by roughly 25 percent at the same time. In Comparison to the state of Baden-Württemberg, the Stuttgart region has an above average share of developed land, exposing local environments to higher risks.[83]

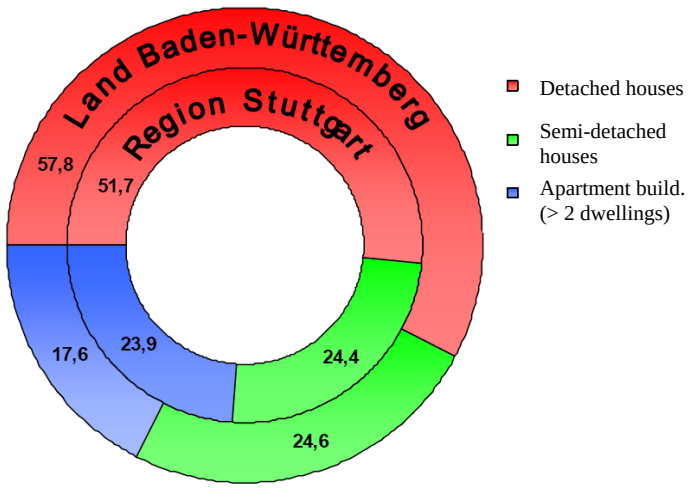
***Figure 12*: Settlement structures in the Stuttgart region, 1850-1995**



***Source**: Verband Region Stuttgart 2006*

Between 1990 and 2005, the consumption of land for settlement purposes in the Stuttgart region increased by 6.200 ha, or 14 percent. In other words, the daily rededication of undeveloped land for settlement purposes was 1 ha. At the same time, regional population increased by only 9.1 percent, which in combination means a growth in living space per capita. Particularly rural areas with relatively high shares of undeveloped land have experienced high growth rates in urban land use, with up to +35 percent (Herren-

***Figure 13*: Types of Residential Buildings in %**



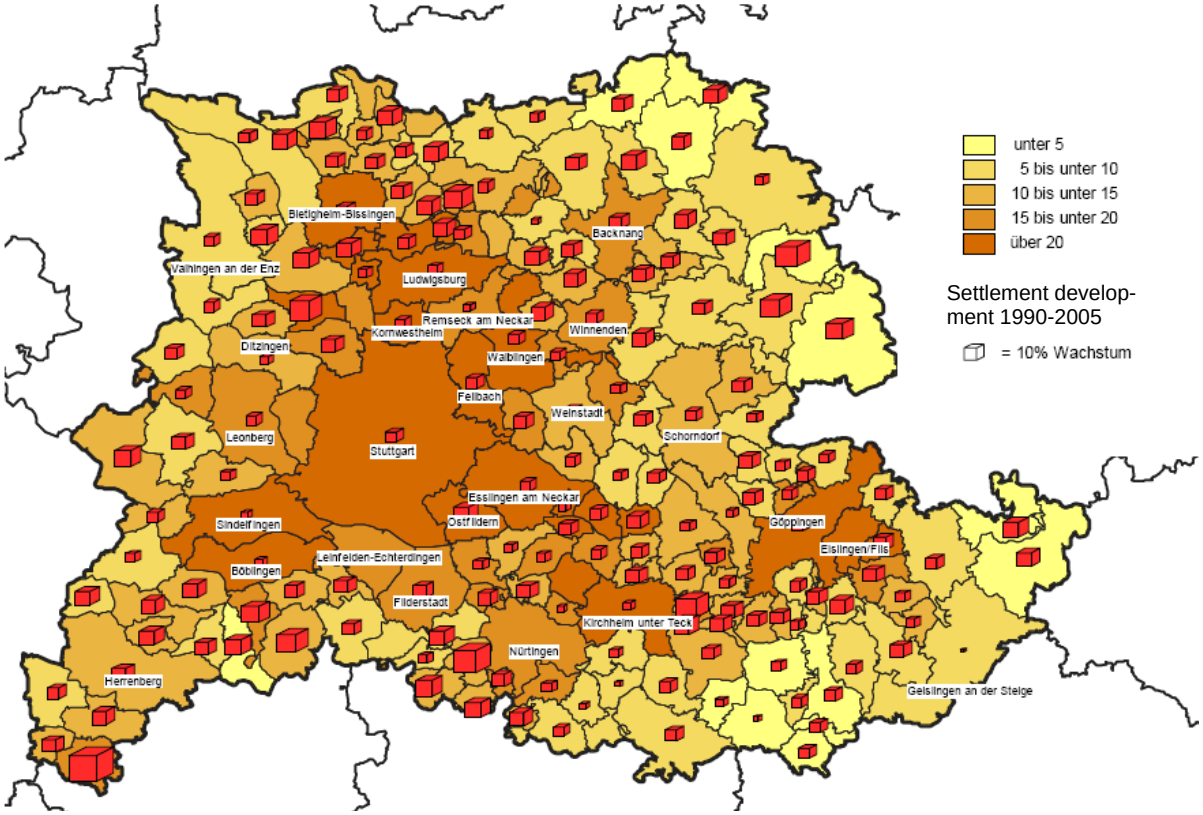
***Source**: VRS 2006*

[83] Cp. Verband Region Stuttgart (Ed.) (2006): *Regional-Monitor Region Stuttgart. Strukturen und Entwicklungen in der Region Stuttgart (Kurzfassung).* Stuttgart, p. 1.

berg).[84]

At the same time, the number of residential buildings has increased by 15 percent throughout the region, although this does not reflect the actual building activity, since losses are included in the growth rate. With 27 percent, the district of Herrenberg in the very southwest of the region has experienced another highest growth rate. On the other end, the city of Stuttgart accounted for the lowest growth rate in residential buildings between 1990 and 2005. Data clearly indicate a general trend towards higher growth rates in the periphery, in both settlement area and new residential buildings. More than half of all residential buildings in the region are single-family detached houses (52%). *Figure 13* shows an even higher share on the state's level.

***Figure 14*: Share of settlement area in 2005 and settlement development 1990 – 2005**



***Source**: Verband Region Stuttgart 2006*

Considering the fact that the Stuttgart region is characterised by a particularly multifaceted landscape, the continuous consumption of land ever further away from the centre has become a serious problem. Besides a relatively large share of fertile grounds, the region has a maximum difference in elevation of 665 metres. Sophisticated topographical conditions result in numerous irreclaimable areas, which in turn increase the pressure to develop fertile land. Unfortunately, no data were available on the types of land being converted into developed land. Therefore, a current example that has led to emotional discussions throughout the region shall be highlighted briefly.

[84] Verband Region Stuttgart (Ed.) (2006): *Regional-Monitor Region Stuttgart. Strukturen und Entwicklungen in der Region Stuttgart,* Stuttgart, p. 19.

Since 2004, a new prestigious project is under construction in the Stuttgart region: a new exhibition centre with an area of 100.000 m². The project is literally being realised "on the green field", in the immediate vicinity of the Stuttgart airport. The bone of contention is the fact that the affected land is part of one of the most fertile grounds (the "Filderebene") in the entire region. The construction, which will be completed in 2008, results in a remarkable loss of agriculturally precious loess soils. Additionally, it has far-reaching impacts for the local fauna, which loses (resp. already has lost) a great fraction of habitat. This example might be a special case in the context of urban sprawl, but it definitely contributes to the process as such. Furthermore, it is not the only project causing lasting impacts on environmental goods worthy of protection. Agricultural land in the Stuttgart region has increasingly been displaced by transport related projects (railroad, highways, airport), commercial and housing developments.[85] Lately, a concept to conserve remaining parts of the "Filderebene" from further development has been presented. However, the idea of creating the „Filderpark" very much appears to be a product of guilty conscience, since it came to life after heavy public protests against the exhibition centre had been going on for a long time.

Urban and regional planners across the region are aware of the problem of intensive region-wide land consumption. In order to reduce sprawl, the current regional plan comprises particular focal points for certain kinds of development like housing or business. New development shall therefore be concentrated along existing development axes. The plan further allots the reactivation of urban waste lands for new uses. However, since regional plans are not legally binding, reality often shows a different picture. According to Jürgen Merks from the *BUND*[86] office in Stuttgart, two particular aspects conflict the goals formulated by the regional plan: municipalities aggressively bid for inhabitants and companies, and the rapid growth of regional road infrastructure continues to develop peripheral areas.[87]

The discussion about land consumption in the Stuttgart region is further fuelled by a study on development potentials in the Stuttgart region, carried out by the University of Karlsruhe in 2003. Based on recent and prospected future demands for new developments (housing, business, retail), it comes to the conclusion that existing built-up structures provide enough space to satisfy the entire demand for new developments – without the necessity for new developments on the "green field".[88]

(b) Transport-related effects

Commuter flows in the Stuttgart region have increased during recent decades. In 1970, 30 percent of the people working in the city of Stuttgart commuted to work. By 1987, this number had increased to 40 percent. In 1993, more than half of the workforce employed in Stuttgart commuted every day. Traffic flows also exist in the opposite direction. By 1993, about 25 percent of the people living in Stuttgart were daily crossing the city limits to get to work.

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[85] Cp. Filderpark Website: www.filderpark.de (called 2007-05-05).

[86] The BUND (in German: Bund für Umwelt und Naturschutz Deutschland; in English: League for the environment and nature conservation, Germany) is the German Branch of Friends of the Earth (FOE).

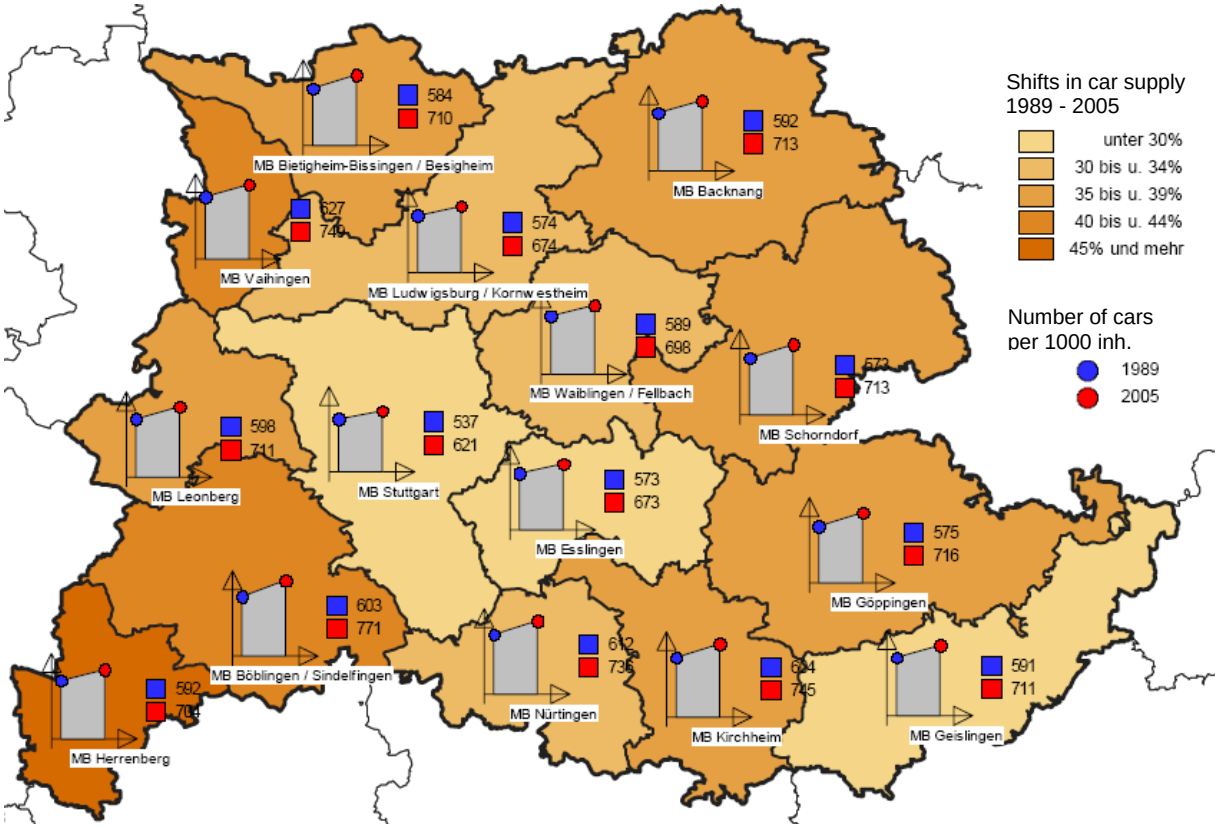
[87] Information collected within an interview with Jürgen Merks (2007-05-07).

[88] Cp. Wilske, S. (2003): *Innenentwicklung vor Aussenentwicklung - Innere Reserven in der Region Stuttgart*. Institut für Städtebau und Landesplanung, Karlsruhe, p. 92.

The particular regional structure is partly responsible for the relatively high volume of traffic, especially on the roads. Since traffic flows are not directed towards one single centre, conditions for public transport are difficult. Therefore, individual car traffic dominates the regional traffic system. Apparently, the emergence of urban sprawl, both housing and commerce, considerably boosted this development.[89] Complex interdependencies and interactions within the region have led to considerable consequences on the roads and traffic congestions have become part of everyday life in the Stuttgart region. In the year 2000, a traffic census counted 759.000 cars and 54.000 freight vehicles heading towards Stuttgart in one day. The share of commuters was 330.000.

The expansion of the public transport network was not able to keep up with rapidly growing settlement structures throughout the entire region. This is essentially due to financial reasons, whereas topographical obstructions in the region further increase construction costs. Currently, the interurban railway system is being expanded in order to compensate road related deficits.

***Figure 15*: Development of car supply in the Stuttgart region 1989 - 2005**



Source*: *VRS 2006

In 2005, 1.828 million cars were registered in the Stuttgart region, which accounts for 2/3 of the regional population. *Figure 15* clearly indicates a correlation concerning distance from the centre and increase in the supply of cars per 1000 inhabitants. Between 1989 and 2005, the

[89] Cp. Sperle, T. (2002): *Boomtown Stuttgart? Siedlungsentwicklung und Strukturwandel in der Region Stuttgart. Unter besonderer Betrachtung des Büroflächenmarktes*, Diplomarbeit, Universität Stuttgart, p. 22.

city of Stuttgart accounted for the lowest relative increase with less than 30 percent, whereas the supply of cars in Herrenberg increased by over 45 percent.

These data lead to the assumption that urban sprawl is closely related to an increasing number of cars, although it is important to bear in mind there is no evidence that the situation would be different, if less people lived in sprawled settlements. However, heavy car traffic causes environmental impacts in the Stuttgart region. Besides general derogations due to the construction of roads, air pollution and climatic effects are of particular interest.

(c) Air pollution

Due to its topographical situation in a narrow valley-like location, air-hygienic conditions in Stuttgart have always been an important aspect in the context of urban planning. Recent measurements show that the city of Stuttgart is particularly burdened by transport-related air pollution (e.g. NOx, PM10, ozone). In many inner city roads, pollutant values of NO2 and PM10 exceed existing limit values.[90] Admittedly, the city of Stuttgart is an extreme example in the Stuttgart region and one cannot draw a direct connection between air pollution in the city and urban sprawl in the hinterland. However, traffic-related air pollution also affects large parts of the conurbation.

In 1996, a cumulated total of 110.468 tonnes of emissions caused by traffic, industry/business and household heating systems was calculated for the conurbation of Stuttgart. 80 percent of this amount were generated by traffic, followed by industry (11%) and households (9%). Analysing traffic emissions solely, 97 percent are related to road traffic.[91] Unfortunately, no data are available on a long term development of emissions. Thus it is impossible to interpret changes that might have occurred over time, and it is difficult to draw parallels between the development of emissions and urban development. In fact, however, as long as housing, industry and business settlements continue to sprawl, traffic flows will remain on a very high level. As explained in *Chapter 6.2.1 (b),* regional peculiarities make cars the most adequate alternative for travelling within the region.

Technical improvements, on the other hand, have led to a reduction in emissions caused by traffic. Between 1990 and 2002, absolute numbers of traffic-related NOx emissions have decreased by 42 percent in the Stuttgart region, even though the number of cars has increased by about 30% in the same time. This positive development is narrowed by the fact that total traffic-related CO_2 emissions in 2002 stagnated on a similar level as in 1990.[92]

There is one major problem in using absolute numbers of regional traffic-emissions in this context. The data include emissions generated on highways, which partly lead through the region. These highway-sections account for a big share in figures about regional emissions, even though most of it is no regional traffic. Therefore, presented data on emissions caused by traffic are basically inadequate to derive a concrete relation to urban sprawl. It just

[90] Cp. Stadtklima Stuttgart Website: www.stadtklima-stuttgart.de, complete URL [9], (called 2007-05-06).
[91] Cp. Stadtklima Stuttgart Website: www.stadtklima-stuttgart.de, complete URL [10], (called 2007-05-06).
[92] Statistisches Landesamt Baden-Württemberg Website: www.statistik.baden-wuerttemberg.de, complete URL [11], (2007-05-14).

confirms the fact that road traffic is one of the strongest contributors to air pollution. Unfortunately, no further useful data on traffic were available.

(d) Energy consumption

The Stuttgart region requires a relatively large amount of energy. In numbers, the region consumed 19.300 million kilowatt hours (kWh) in 2002. That accounts for 28 percent of the state's energy demand in that year. The total regional amount can be subdivided into four groups: traffic, industry, households, others (business, retail, public services and agriculture). Trying to derive information concerning sprawl-induced effects on energy consumption, the share of households is basically interesting (although business and retail are part of urban sprawl as well, but to a relatively a lower extent). In 2002, households accounted for 24 percent of the total regional energy consumption. This rate is remarkably lower than the state's average of 28 percent. Considering the assumption that sprawled settlements are accompanied by an increase in energy consumption due to lengthy distribution systems and large, energy-consuming dwellings, this is surprising. Of course, settlement structures in other regions of Baden-Württemberg are also sprawling, maybe to an even higher extent, as some data might presume. But this is speculation, there might be various other reasons. Since data were only available for 2002, it is not possible to study the development of energy consumption in households, thus a conclusion regarding the influence of urban sprawl is not possible.

6.2.3 Summary

Urban sprawl was present in Stuttgart long before the process started in Leipzig. Sprawl was never induced by one single centre, but by several strong mid-sized towns as well. Therefore it is significant to see Stuttgart and its surrounding region as a whole, characterised by numerous interdependencies. In contrast to Leipzig, Stuttgart was mostly growing in the 20th century, as well as its surrounding region. This has led to an enormous settlement pressure in the past.

Describing concrete sprawl-induced environmental effects in the Stuttgart region has proved very difficult. Even though large amounts of statistical data are available, they were mostly inadequate to relate environmental conditions to urban sprawl.

In fact, urban sprawl contributes to rapid land consumption in the region. Even though no data were available on the concrete type of land consumed by sprawling settlements (with exception of the exhibition centre), several indicators provided by the VRS clearly demonstrate vastly growing settlement structures in peripheral areas. Most likely, urban sprawl contributes to the remarkably high amount of cars and daily traffic in the region. No evidence could be provided. No adequate data were available to confirm the assumption that sprawled structures consume more energy.

6.3 CONCLUSION

The case studies of Leipzig and Stuttgart show that urban sprawl can develop under extremely different framework conditions – particularly with regard to the cities' urban history, regional structure, population development and economic development. On the other hand,

sprawl has in both cases been influenced in a similar way by public grants. The analysis of environmental effects caused by sprawl demonstrates that both cities basically face the same problems, even though it could only in part provide evidence for the assumption that urban sprawl causes negative environmental effects. It is crucial to bear in mind that adequate data to clearly relate environmental conditions to urban sprawl were very limited. However, virtually every indicator used led to the assumption that the emergence of sprawl negatively affects the accordant natural subject of protection.

Additionally to current problems, both cities/regions will have to meet future challenges of demographic changes. The urban region of Leipzig is shrinking in population for a long time and already has to deal with vacancies all over the region. Still, settlements are sprawling. According to (positive) prospects, the urban region will lose 70.000 people from 1999 to 2015.[93] Regional and urban planning will have to find answers to such developments. The situation in the Stuttgart region looks less dramatic, as population will continue to increase in the near future. However, in a long-term perspective, demographic changes will also affect the Stuttgart region to the full extent. To prevent the region from a similar development as in Leipzig, the region has to use its regional instruments at an early stage to prepare for future structural changes. In Stuttgart as well as in Leipzig, inner-city wastelands could play an interesting part in this context. The revitalisation of such currently unused lands within existing settlements has lately been of special interest in discussions about measures to reduce urban sprawl.

[93] Cp. Shrinking Cities Website: www.shrinkingcities.com, complete URL [12], (called 2007-05-14).

7. ALTERNATIVES TO SPRAWL?

For a long time, critics are discussing all kinds of sprawl-related problems, and different ways how to deal with it. Attempts range from measurements to alleviate sprawl-related problems, over the feasibility to control the process, to whole new visionary concepts for alternative forms of urban development. Urban sprawl in Europe and the US are basically similar processes, but different in shape and dimension. Therefore, attempts to deal with it also differ from each other. In the United States, an anti-sprawl movement has emerged over time, fighting against the unplanned expansion of cities. This chapter will give a brief overview regarding the movement's characteristics, goals and strategies. Besides, focus will be on selected European approaches to deal with urban sprawl.

7.1 THE ANTI-SPRAWL MOVEMENT IN THE U.S.

The anti-sprawl movement is very heterogeneous, without any formal organisation or defined agenda. It can be described as a large, interacting network of various actors with different political, social and professional backgrounds. The movement is borne by actors like environmentalists, agriculture unions, planners, architects, politicians, jurists and local initiatives, who share a common animosity against sprawl. With the support of institutions and agencies on the state level, the movement is interested in developing a regional lobby in order to constitute regional cooperation. Since public regional planning in the U.S. is relatively limited, this way of "visionary" regional planning is a chance to compensate planning deficits. The movement's work is based on the connection between policy, civil society, profession (architects, planners, investors, jurists), research and education with specific focus on the public. Surprisingly, the anti-sprawl movement does not deal with subjects that are present in the European discourse, although these might be of particular interest.

The anti-sprawl movement faces criticism from various directions. Particularly concepts aiming at the political control of development processes are criticised on the part of politically conservatives. Other sceptics denominate integrated strategies and conceptions of the anti-sprawl movement (such as New Urbanism and Smart Growth) as reformist, and aesthetically and politically unprogressive.

The anti-sprawl movement has a large stake in lifting the subject to the public level, which has led to numerous planning reforms and state grants, e.g. for local traffic projects. Since urban development in the U.S. is predominantly privately organised, it remains questionable whether concepts of the anti-sprawl movement lead to a limitation of urban sprawl. This will only happen, if urban development projects are closer coupled to regional planning reforms.[94]

[94] Cp. Bodenschatz, H. and Schönig, B. (2004): *Smart Growth – New Urbanism – Liveable Communities. Programm und Praxis der Anti-Sprawl Bewegung in den USA*. Wuppertal, p. 144.

Concepts of the anti-sprawl-movement

All concepts of the anti-sprawl-movem ent are based on the belief, that ecological, socio-economic and political problems can only be solved by an integrated strategy containing the core city, suburbs and exurbs. Another basic assumption is the individuality of the region: every single region requires an individual approach, considering its specific conditions. Instruments for regional development are supposed to be established through the institutionalisation and strengthening of regional planning, or by new public subsidy- and tax-policies.

New Urbanism stands for the development of a *Regional Design*: a creative concept for the entire region, containing political, social, ecological and economic strategies. The region is conceived as a highly networked system of hierarchically different centres, located along traffic corridors. To protect natural areas, regional plans shall contain growth limits along discernible natural borders such as rivers or mountains. Patchwork-like, fragmented sprawling areas are supposed to be networked by urban development and architecture. Isolated settlement fragments shall be connected by public transport, and a combination of a variety of housing typologies and uses mixes different social groups. Regional centres are meant to create a regional identity and develop along transport corridors (rivers, roads, railroads), which bundle traffic flows.

Existing projects based on concepts of the anti-sprawl movement (Civano, Arizona; King Farm, Maryland) demonstrate that their effectiveness regarding the reduction of urban sprawl is arguable. The restriction of growth often simply leads to a redirection of sprawl to another place. Furthermore, single existing settlement projects of New Urbanism and Smart Growth fail to be integrated into the claimed overall strategy of the region. Even worse, they are inadequately realised, missing important infrastructure. These projects do not have much in common with the visionary character of the concepts.[95]

Contribution to the European discourse?

To derive recommendations from the discourse in the U.S. for European regions is not easy. The American discourse is adapted to the accordant conditions, e.g. stronger decentralisation and concentration on private cars, as well as a strong segregation. Besides, planning laws are usually more influential in Europe than in the U.S. Nevertheless, it is essential to develop regional identities in Europe as well. Especially complex urban systems like the European metropolitan regions have to be perceived as planning- and political entities - not only by experts and decision makers, but also by the public – in order to secure sustainable development and social balance. Currently, the transferability of concepts of the anti-sprawl movement does not enter the equation. Besides too little knowledge about the impacts of realised projects, the situation is hardly comparable, e.g. in terms of the transportation system. Therefore, from a European perspective, some of the concepts appear to be relatively banal.

On the other hand, the anti-sprawl movement shows that it is possible to activate discussions about the handling of urban sprawl in the public. The discourse in the U.S. might

[95] Bodenschatz, H. and Schönig, B. (2004): *Smart Growth – New Urbanism – Liveable Communities. Programm und Praxis der Anti-Sprawl Bewegung in den USA*. Wuppertal, p. 147.

help to find strategies to generate a new awareness for urban regions in Europe. Networks like the *European Land And Soil Alliance* (ELSA)[96], *Futuregio*[97], and the *Council For European Urbanism* (CEU)[98] have already been established. Yet, the topic remains to be observed by only a small group of experts. According to Bodenschatz, a public movement for new ways of regional development can only be achieved by programmatic networks of competencies and projects. These networks are supposed to be implemented on different levels. Actors from different fields of civil society shall develop visions on a regional level. Moreover, science and planning professions are supposed to establish and organise those networks. This also means to allow interdisciplinary cooperation and to communicate with politicians, private investors and the public. Due to numerous structural, socio-economic, political and planning differences, a common strategy for all European urban regions won't be adequate – even on a national level. This way would not lead to appropriate results. [99]

7.2 EUROPEAN RESPONSES TO SPRAWL

Integrated regional attempts to control urban sprawl by creating public awareness and interdisciplinary, regional networks and cooperation are one way of addressing the problem. Experientially, the establishment and consolidation of such essential social and institutional structures are a long-term process.

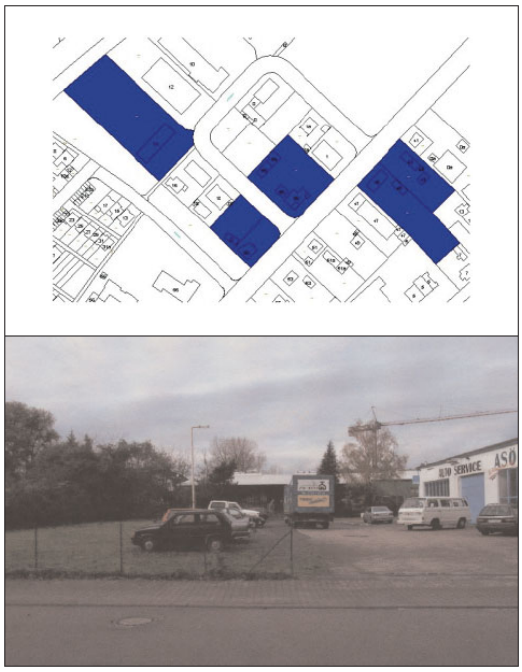
In recent years, an instrument in the field of land use planning which has increasingly attracted attention among planners is "infill" [100] Infill can be classified as a flexible instrument, which is immediately applicable and less dependent on regional networks etc. Such instruments are no integrated programmatic concepts, but rather approach single, specific problems. Chapters *5* and *6* have demonstrated that land consumption is the most serious and evident environmental problem caused by sprawl. Infill is a tool to revitalise and reuse undeveloped or unused areas in all kinds of existing settlement structures. These areas range from large, former freight depots within cities to small unused plots between buildings in suburban or exurban neighbourhoods. The activation of these potentials for urban uses entails numerous positive effects. Planners perceive it as an effective tool to reduce new developments in the periphery. It is used to counteract a further dispersal of urban development and surface sealing, and thereby indi-

Potential Infill Plots ***Source****: LfU 2003*

[96] Soil Alliance Website: www.soil-alliance.org (called 2007-05-09)
[97] Futuregio Website: www.regina-nm.de/futuregio.htm (called 2007-05-09)
[98] CEU Website: www.ceunet.de (called 2007-05-09)
[99] Cp. Bodenschatz, H. and Schönig, B. (2004): *Smart Growth – New Urbanism – Liveable Communities. Programm und Praxis der Anti-Sprawl Bewegung in den USA*. Wuppertal, p. 147-151.
[100] Since different languages use different terms for this planning instrument, the term "infill" might not be absolutely adequate. This chapter refers to the German term „Flächenmanagement".

rectly contributes to the preservation of soils.

Potential “infill plots” usually can be developed with little planning- and opening complexity. Therefore construction activities can begin immediately and public expenditures are lower. Further infrastructure like public transport, sanitation and institutions are used more efficiently. Not least, the overall spatial cohesion and urbanity of the affected neighbourhood is being improved.[101]



***Source**: LfU 2003*

In Germany, for instance, virtually every form of settlement, ranging from historic urban to new exurban structures, possesses potential infill plots, which partly make up to 30 percent of the settlement area. Thus, infill potential is relatively high. The tool is not limited to the local level, it can as well be used on a regional level, e.g. in metropolitan regions to densify dispersed settlement structures.

A study about inner development and infill potentials in the Stuttgart region has found out that the entire regional demand for housing, business and commerce could be realised on plots already surrounded by developments, without the need of further outward expansion.

Due to its experimental character, the tool has not been exercised so much yet. However, planners increasingly conceive it as a significant approach in future urban development, especially against the background of demographic change and population decline. With increasing settlement expansion come increasingly dispersed future vacancies and infrastructure inefficiencies. Densification of dispersed structures, on the other hand, helps to keep existent infrastructures efficient.

Even though expectations are optimistic, the tool’s effectiveness will have to be awaited. At least in regard to inner cities, many of the “push factors” that drive people outside the city will remain, even if some quarters can be structurally graded up. Thus, it is more reasonable to implement the concept of “infill” by looking at

***Source**: LfU 2003*

[101] Cp. Landesanstalt für Umweltschutz Baden-Württemberg (LfU) (Ed.) (2003): *Kommunales Flächenmanagement. Arbeitshilfe*, LfU, Karlsruhe, p. 5.

the region as a whole. Thereby, new developments can be redirected from peripheral areas into built-up structures.

However, according to Downs, it is “impossible and undesirable”[102] to avoid all further outward expansion, since metropolitan populations are still growing. Nowadays, 75 percent of the European population are living in urban areas. In the following decade, the number will prospectively increase by further 5 percent.[103] Of course, the instrument of “infill” alone cannot be regarded as the panacea. In order to prevent competitive municipalities from developing “green fields”, it probably requires stronger regional authorities to influence land-use patterns. Thus, an effective strategy for a more sustainable urban/regional development can be a combination of different attempts. Actors should be inspired to use specific problem-oriented instruments, backed by interdisciplinary regional networks and public participation. Therefore it is essential to keep in mind that the sensitisation of the public crucially influences the effectiveness of planning.

According to previous chapters, a further problem that is most likely aggravated by urban sprawl is an increase in traffic, resulting in an increase in air pollution. Urban and regional planning bodies can contribute to a reduction of traffic-related air pollution by limiting new road developments to a minimum and instead emphasising public transport. Of course, there is no single planning instrument to achieve this. Moreover, it requires an integrated urban development strategy. In this context, Munich can be regarded as a role model.

Regional cooperation in Munich

Munich is one of the few European cities that managed to stay relatively compact while growing in population. Between 1955 and 1990, the urban population increased by 49 percent. In the early 1960s, planners in Munich decided to move from traditional town planning to integrated urban development planning. This new strategy contained guidelines for all municipal activities including economy, social issues, education, culture and town planning. In the late 1960s, a discussion forum was introduced where all actors could exchange views and ideas. At the same time, an independent department was created to coordinate all municipal activities and strengthen links between interdisciplinary actors. Regional cooperation has a long history in Munich.

In 1998, the new integrated urban development plan (the ‘Munich Perspective’) was adopted. The plan covers economy, social issues, transport, environment and town planning. The main urban structure objectives include continued reuse of brownfields and avoidance of expansion. Some key objectives for the Munich area can be derived from the ‘Munich Perspective’:

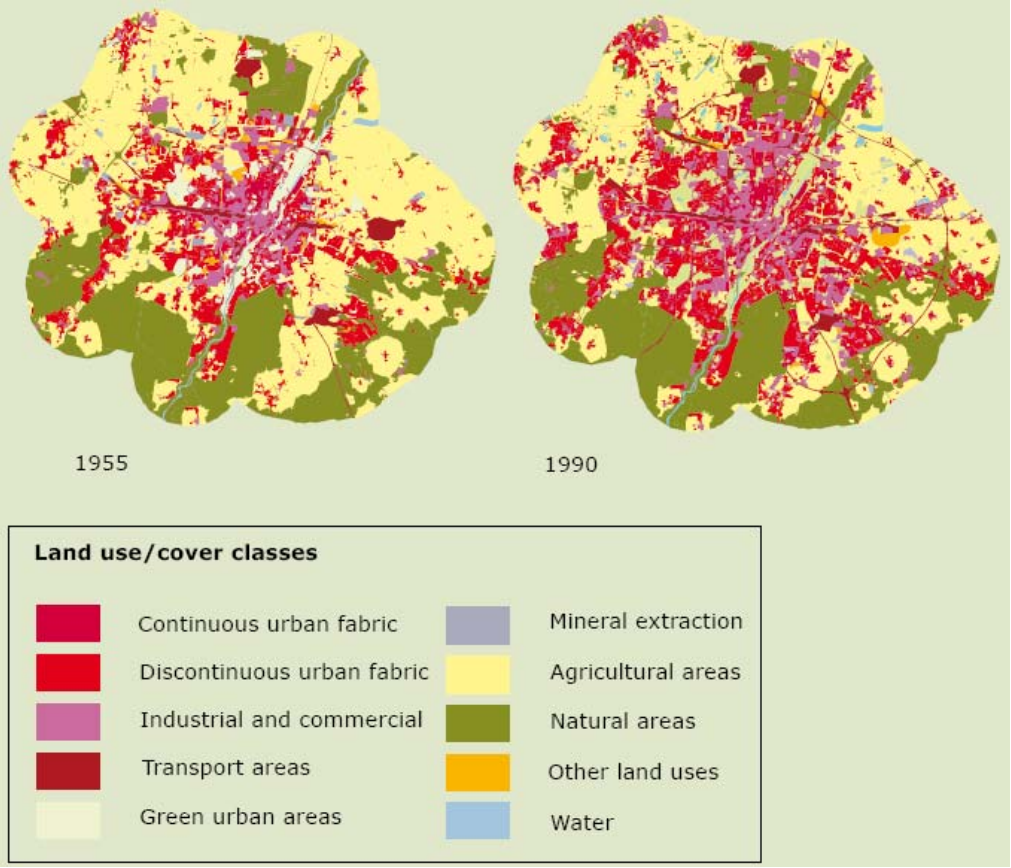
- Integrated city development plan
- Regional cooperation
- Stakeholders' involvement in city planning

[102] Downs, A. (1999): *Some Realities about Sprawl and Urban Decline*, in: Housing Policy Debate. Volume 10, Issue 4, p. 971.

[103] Cp. European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 5.

- Emphasis on reuse of vacant brown fields
- Continuously improving public transport with as few new roads as possible
- Compact-urban-green — keep the city compact and urban and green areas green
- Guarantee the necessary resources for implementing the strategies of all relevant policy areas (transport, housing etc.) for both 'business as usual' situations and through major renovation projects.[104]

Figure 16: **Land use changes in Munich urban area from 1955 to 1990**



***Source**: EEA 2006*

[104] Cp. European Environmental Agency (EEA) (Ed.) (2006): *Urban Sprawl in Europe. The ignored challenge.* Luxembourg, p. 47.

8. CONCLUSIONS AND PERSPECTIVE

Finally, does urban sprawl really need to be more constricted, (if this is possible at all)? From a planner's perspective, the answer is inevitably connected to the question of the sustainability of sprawl. Based on the findings of the present document, which has concentrated on the environmental pillar of sustainability, the answer must be "Yes".

It has become clear that urban development fosters tensions between mankind's increasing needs for resources and space on the one hand, and the natural capacities of land needed to support and absorb these needs, on the other hand. Being the predominant driving force behind land consumption, urban development plays a particularly significant part in securing a sustainable future supply of natural resources. Besides the persistent trend towards growing urban population across the world, the total global population is expected to grow by almost 40 percent from 2005 to 2050.[105] These trends further fuel the pressure on natural resources.

Sprawl is a very land consuming, unsustainable form of urban development, fostered by factors such as globalisation, transport networks, societal aspirations and uncoordinated land-use planning at various levels. The influence of such multileveled variables requires urban planning approaches which exceed the local level. This is especially important since borders between cities and the hinterland have started to virtually disappear in many regions, in the U.S. as well as in Europe. 50 percent of the U.S. population live in those parts of large metropolitan areas that spread across vast territories beyond the limits of large core cities.[106]

In Europe more and more urban areas are becoming connected in the context of common political objectives, such as the Lisbon agenda for growth and competitiveness. Such developments underline the need for overcoming local boundaries and closer cooperations in land-use planning and urban development. How this might be achieved has been presented in *Chapter 7*. In short, it requires a mix of regional concepts aiming at interdisciplinary networks and public awareness, combined with new, flexible land-use planning tools applicable on a regional level. In addition, European transport and cohesion policies are crucially important dimensions for future urban and regional development. Particularly EU Cohesion Policy offers an effective framework to implement better coordination of land use policies. Structural and Cohesion Funds can further influence the process by well direct investments between urban and rural areas, and the regions that can effectively manage urban sprawl.

In the near future it will have to be observed, in how far demographic change impacts urban sprawl. Based on current demographic conditions, anticipated population decline in Germany is between 10 and 17 percent, in the period from 2005 to 2050. At the same time, the average population age is prospected to rise from 42 to 50.[107] Urban and regional plan-

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[105] Cp. United Nations World Population Prospects 2006: www.internationalepolitik.de, complete URL [13], (called 2007-05-14).

[106] Cp. Bodenschatz, H., Schönig, B. (2004): *Smart Growth – New Urbanism – Liveable Communities. Programm und Praxis der Anti-Sprawl Bewegung in den USA*. Wuppertal, p. 137.

[107] Cp. Statistisches Bundesamt Deutschland (Ed.) (2006): *Bevölkerung Deutschlands bis 2050. 11. koordinierte Bevölkerungsvorausberechnung*, Wiesbaden, p. 15.

ning will have to adapt to these trends. With a further dispersal of settlements, future vacancies will also increasingly disperse, leading to severe infrastructural inefficiencies.

Altogether, there are no simple solutions to the problems associated with urban sprawl. In both Europe and the United States, sprawl is a product of the fundamental political and social structure and (usually) growth processes. Sprawl provides most residents in urban and metropolitan regions with what they perceive as their major benefits. Consequently, people are not willing to attack these problems, since they would put their own benefits at risk. This is probably the most complicated aspect in approaching urban sprawl. Thus, it is absolutely essential to establish public awareness and sensitise the masses for alternatives. Otherwise, there will be further studies on urban sprawl and never-ending discussions about sprawl-related policies, “but when all is said and done, vastly more will be said passionately than will be done effectively.”[108]

[108] Downs, A. (1999): *Some Realities about Sprawl and Urban Decline*, in: Housing Policy Debate. Volume 10, Issue 4, p. 972.

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