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SCATTER

Sprawling Cities And Transport: from Evaluation to Recommendations

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State of the Art Review of Urban Sprawl Impacts and Measurement Techniques

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1. EXECUTIVE SUMMARY

We begin with some brief comments about the nature of urban sprawl and how long lived a phenomenon with respect to the growth of cities over the last 200 years. We then divide the report into three sections and first deal with a review of urban sprawl from the Anglo-Saxon literature from around 1940 to the present day. This first review identifies that urban sprawl is one of the key issues facing cities today. There is an enormous volume of literature on the topic but despite this, there is little agreement as to its characteristics and effects. The part of the review discusses some of the most contested issues of urban sprawl. It looks at the various definitions of sprawl; examines the effects of sprawl, assessing these in relation to planning and market led approaches; and discusses methodological approaches relating to measures of sprawl in terms of its impacts and forms.

We then develop the review from the perspective of the development of cities on the European mainland – the continent and this exposes us to a wider literature on the nature of city growth and change and we deal with urbanisation and urban growth more generally as it has been studied in Europe by urban geographers. We also introduce for the first time more specific issues of urban planning policy and point to the European Spatial Development Perspective. This section also begins to introduce more specific measures as well as a preliminary typology based on different types of urban morphology.

Finally we review some of the measures that can be used to detect and quantify urban growth in general and sprawl in particular. Our review here is preliminary. We do not define in the detail the quantitative measures that we will use later in this study for these will depend on later workpackages, particularly workpackage 3 which involves statistical analysis of the effects of urban sprawl.

Our review in general is inevitably a first statement, that is subject to continued changes as we gain more insights into urban sprawl in European cities. In workpackage 2 for example we will begin to assess the evidence on the ground in our 6 case study cities through detailed interviews and this will certainly inform the ultimate typology of sprawl that will result from this project. By the end of the project, we will define a final typology of sprawl so that we are able to use this to guide academics and practitioners as well as the wider public interested and concerned in these matters. In this sense, our ultimate review which will emerge by the end of the project, will be a synthesis based on all the workpackages yet to be developed as well as important issues revealed by other projects in the LUTR cluster of related projects under the City of Tomorrow and Cultural Heritage Key Action.

2. AN OUTLINE OF THE WORKPACKAGE

2.1. Introduction: What Is Urban Sprawl?

Urban sprawl is usually assumed to refer to the uncoordinated growth of cities, particularly around their edges or peripheries. The lack of coordination which often results in severe negative externalities such as the lack of new facilities in places where sprawl is taking place and its low accessibility to existing facilities elsewhere in the city is key to our concern for its understanding. At the very onset of this project we must make a distinction between urban growth and sprawl in that growth can take place in a coordinated manner and in this sense cannot be considered as sprawl. Historically as soon as cities began to grow during two centuries or more ago during the industrial revolution in Europe and North America, concern was felt for the growth further and further away from the small contained nuclei which contained the medieval city. William Cobbett best summed up the spirit of his age in 1830 when he likened London to a cyst by calling it the “Great Wen”. But it was the development of mechanical technologies, first the tramway and then the railway and finally the automobile which greatly accelerated the development of cities in the peripheries, further displacing populations from their traditional place of work. The argument about sprawl has been significant for at least 100 years if not longer. In the early and mid 20th century, sprawl was often confused with suburban development and there was considerable disquiet with the way lower density urban living was becoming the dominant way in which peoples’ aspirations about living in cities were moving. But in one sense this was a reaction to something new and the early suburbs now appear to be considerably more coordinated than the kinds of developments which have taken place in the last 25 years, particularly in North America. Nevertheless, it is useful to identify the origins of urban sprawl as it emerged as a concept during the late 19th and early 20th centuries in western cities.

William H. Whyte writing in 1959 put his finger firmly on the issue of sprawl as opposed to urban growth per se which of course is inevitable given population growth and the continuing urban transition. He said:

“The problem is the pattern of growth – or, rather, the lack of one. Because of the leapfrog nature of urban growth, even within the limits of most big cities there is to this day a surprising amount of empty land. But it is scattered: a vacant lot here, a dump there – no one parcel big enough to be of much use. And it is with this same kind of sprawl that we are ruining the whole metropolitan area of the future.” (page 116)

This kind of analysis is as relevant today as it was then but much of the debate has been rhetorical without serious reflection and there is a tacit assumption that sprawl is bad. Again Whyte sums it up cogently when he says:

“Sprawl is bad aesthetics; it is bad economics. Five acres are being made to do the work of one, and do it poorly. This is bad for farmers, it is bad for communities, it is bad for industry, it is bad for utilities, it is bad for railroads, it is bad for recreation groups, it is bad even for developers. And it is unnecessary” (page 117)

More considered analysis is clearly required but the role of population density in urban areas is clearly central for sprawl implies low densities in general when the general urban landscape is considered. There may be pockets of high density in a sprawling landscape but the key issue once again is that uncoordinated growth leads to piecemeal development which in general is low density development. Of course sprawl and suburbanisation must be

contrasted against compactness and concentration which also have their problems. Lewis Mumford (1964) sums this up rather well in his argument that the dilemma of urban growth revolves around both “.....metropolitan congestion and suburban scattering” (p252). In this he argues as we will do so throughout this project that sustainable planning which reduces the problems of sprawl is essentially dependent upon the control of densities. He says :

“..... there can be no sound planning anywhere until we understand the necessity for erecting norms, or ideal limits, for density of population. Most of our congested metropolises need a lower density of population....; but most of our suburban and exurban communities must replan large areas at perhaps double their present densities” (p.252)

What we will do here is elaborate all these ideas in this first workpackage through various reviews of the literature pertaining to research and to projects. The review will be wide ranging and will cover many different aspects of urban growth but it is worth beginning with the statement that we made in the initial proposal.

2.2. The Initial Statement from the Proposal

In the proposal, we stated that the first workpackage would produce a review of the state of the art so that both partners and the Commission would be briefed as the nature and the problem of urban sprawl in western cities in general and in European cities in particular. This workpackage referred to hereafter as WP1, would:

- Firstly, carry out a review of all possible impacts of urban sprawl (the first part of the review); secondly, to carry out a review of techniques for measuring urban sprawl and analysing its impacts (the second part of the review).
- The first part of the review will first tackle with the question of the definition of urban sprawl, and compare the different possible definitions, then will propose a definition to be agreed on for this particular study.
- It will then review all possible impacts of urban sprawl, on urban structure, built forms, economy, social aspects, transport (mobility and accessibility) environment (energy consumption, pollutant emission, vitality of ecosystems, ...). One aim of the review will be to point out positive effects of urban sprawl, if there are any : urban sprawl is responsible for numerous negative effects, but it must be checked whether there are not also some positive effects.
- This will contribute to properly design the analysis canvas and interview canvas for WP2 (expert interviews).
- The second part of the review will review techniques for measuring urban sprawl and analysing the impacts. This part will provide inputs for WP3 (statistical analysis) WP6 (assessment of impacts of simulated measures) and WP7 (task 7.2 – design of an “urban sprawl monitoring tool”).
- There are several approaches to measure urban sprawl and evaluate its impacts. Some of them require sophisticated tools, such as GIS or integrated land-use models. Other require less sophisticated and more usual tools, such as population statistics, national surveys ...

- The aim of the second part of the review is to properly select the most appropriate analysis techniques, for WP3, for WP6 and for the monitoring tool of WP7, taking into account the type and level of sophistication of the available data.
- In particular for the 'urban sprawl monitoring tool' (WP7) the idea is to design a tool which can be useful for all European cities faced with sprawl, whatever the level of sophistication of available data can be. Accordingly, the tool will be made up of several sections, corresponding to different levels of analysis that can be added up.

2.3. Outline of the Review of the State of the Art

We have divided the review into three parts. The first part is a review of literature, research and projects since around 1940, which concentrates on the American and British experience. The logic for this is based on the casual but informed observation that urban sprawl has to date been a peculiarly British and American phenomenon, particularly due, we think, to the relatively lower density of cities in both Britain and America and to the notion that home-ownership with a garden are core values of the Anglo-Saxon heritage. Moreover the literature is dominated by discussion in English and it is clear that a special vocabulary has been developed for these aspects of urban growth in the English speaking world. In contrast the second part of our review is from the continental European perspective in which the conditions for urban growth have only very recently begun to mirror those in Britain and North America. Towns in Europe have tended to remain more compact with higher densities and more uniform densities while sprawl in so far as it can be recognised in visual terms is much more due to the merging of distinct urban settlements as conurbations or to use the more current jargon, as polynucleated clusters. This second part of the review takes a rather different perspective with stresses urban growth at a more aggregate level. Finally, in the third part, we deal briefly with measures of urban growth and sprawl. From the literature we have identified several key measures and we present a preliminary typology of measures below. However many of the measures will be informed by later workpackages, particularly WP3 which involves statistical analysis of the features and effects of sprawl.

One key issue relates to the scale at which urban growth and sprawl is identified. There is a strong disjuncture in research and proactive between thinking of cities as socio- economic nodes in a network and thinking of them as physical entities. This is reflected too in the literature on sprawl which spans the scales from low level physical concerns at the level of site development to much more abstract pictures of how cities are growing in terms of population and employment. Our review illustrates how these two traditions intersect within the debate and how both are relevant to a deep understanding of this phenomenon.

3. UNEARTHING THE ROOTS OF SPRAWL: A REVIEW OF THE KEY IDEAS FROM 1940

3.1. Introduction

The phenomenon of urban sprawl has received extensive attention in the literature particularly since the 1980's, but despite this wealth of information the nature of sprawl and its impact on city form and urban function remains un-illuminated. Much of this debate assumes an ideal urban form - of the compact, self sufficient city- the roots of which can be traced to cities of the past, including the Mesopotamian city, the Greek polis, and the medieval walled city, despite their diverse nature certain common elements can be extracted. These cities had small populations by modern standards, were limited in physical size with a clear demarcation between rural and urban, and provided the focus of economic and cultural life.

Sprawl is compared to this ideal, and for the most part, emerges as a poor loser. Whether justified or not sprawl is perceived as a negative urban form with costs including un-aesthetic development; poor access to services for those with limited mobility such as the young and elderly; increased trip lengths, congestion and increase in fuel consumption due to low densities; overwhelming dependence on automobile use; higher costs of neighbourhood infrastructure; and loss of agricultural land and open space. These perceived negative effects are tackled with growth management policies which attempt to restore a more compact urban form by channelling development to the downtown, and attempting to set physical limits to growth through growth boundaries and land preservation.

The paper will work towards a definition of sprawl and will summarize the debate aiming to throw light on the variety of perspectives by which sprawl is approached, in the main between those advocating a planning paradigm and those taking an urban economic approach.

3.2. Definitions

Sprawl has become an umbrella term, encompassing a wide range of urban forms, indeed, "the term has become so abused that it lacks precise meaning, and defining urban sprawl has become a methodological quagmire (Audirac, Shermeyen, & Smith, 1990). Given that there is no agreed definition, it is not surprising that there is also little agreement on the characteristics, causes and impacts of sprawl. It is agreed that sprawl occurs on the urban fringe in rapidly growing areas but apart from this there is little consensus. The various elements which feed into a definition of sprawl, will be discussed under urban form, land uses, and the functional relationships between land uses and users.

3.2.1. Definitions of Form

A variety of urban forms have been covered by the term "urban sprawl" ranging from contiguous suburban growth, linear patterns of strip development, leapfrog and scattered development (Ewing 1994, Pendall 1999, Razin & Rosentraub 2000, Peiser 2001). In terms of urban form, sprawl is positioned against the ideal of the compact city, with high density, centralized development and a spatial mixture of functions, but what is considered to be sprawl ranges along a continuum of more compact to completely dispersed development. Sprawl is a matter of degree, not an absolute form.

At the more compact end of the scale suburban growth has been identified as sprawl. This is defined as a contiguous expansion of existing development from a central core (Self 1961, Gottmann & Harper 1967, Gottdiener 1977, Hall 1997). This characterization of sprawl is typical of the early literature of the 1950's and 1960's, but this more compact form is not classified as sprawl in later literature.

"Scattered" or "leapfrog" development lies at the other end of the scale (Clawson 1962, Harvey & Clark 1965, Lessinger 1962, Weitz & Moore 1998). This form exhibits discontinuous development away from an older central core, with the areas of development interspersed with vacant land. This is generally perceived as sprawl in the current literature, although less extreme forms are also included under the term. Commentators such as Ewing (1994) distinguish between "scattered" and "leapfrog" development, where "leapfrog" development assumes a monocentric city, while "scattered" development may be multi centred.

Compact growth around a number of smaller centres which are located at a distance from the main urban core is also classified as sprawl (Clawson & Hall 1973). This is superficially similar to the poly-nucleated city (which is not referred to as sprawl) where the downtown is served by several more distant centres. The distinction between the two depends on the level of services offered by the centres and the level of interaction of the city centres with the surrounding suburbs. Linear urban forms, such as strip development along major transport routes have also been considered sprawl.

One problem with these definitions is that developments as diverse as contiguous suburban growth and scattered development are both classified as sprawl, however, the forms and resulting impacts are vastly different. The literature uses different definitions of sprawl or none at all, which creates difficulty in identifying the phenomenon and when comparing the impacts of sprawl. It may therefore be more useful to define sprawl, not as an absolute form, but as a continuum of development from compact to completely scattered. This idea is acknowledged by (Harvey & Clark 1965) who identify three forms of sprawl: low density continuous development, ribbon development and leap frog development, and acknowledges that these comprise different levels of sprawl which require varying levels of capital expenditure.

3.2.2. Definitions Based on Land Use

Land use patterns are the second element which can be used to define sprawl. The Transportation Research Board (1998) lists the characteristics of sprawl which apply to the U.S. as low density residential development; unlimited and non contiguous development; homogenous single family residential development, with scattered units; non residential uses of shopping centres, strip retail, freestanding industry, office buildings, schools and other community uses; and land uses which are spatially segregated. Further characteristics are given as heavy consumption of exurban agricultural and environmentally sensitive land, reliance on the automobile for transport, and construction by small developers and lack of integrated land use planning.

The characteristics provided by the Transportation Research Board (1998) are broad and cover almost all post World War 11 development in the U.S., the authors themselves claim that "sprawl is almost impossible to separate from all conventional development." (Transportation Research Board 1998, page 7). Unfortunately, while this ensures that no aspect of sprawl is omitted, it does little to differentiate sprawl from other urban forms. Sprawl is most commonly identified as low density development with a segregation of uses, however, it is not clear which other land use characteristics must be present for an area to be classified as sprawl. Use based definitions are less common than those based on forms, and

are often combined with definitions which include descriptions of urban forms (Downs 1999, Johnson 2001).

3.2.3. Definitions Based on Impacts

The other alternative method of definition is based on the impacts of sprawl. The idea was first put forward by Ewing (1994), and later by Johnson (2001) and Razin & Rosentraub (2000). It provides an alternative to definitions based on urban form, and is based on the idea that the distinction between sprawl and other forms is a matter of degree. Sprawl is thus difficult to distinguish from other forms and in any case it is the impacts which make sprawl undesirable not the form itself. Ewing (1994) has identified poor accessibility of related land uses, and lack of functional open space as a way to identify and define sprawl. It is suggested that sprawl can be defined as any development pattern with poor accessibility among related land uses, resulting from development which is not concentrated and which has homogenous land uses.

The problem with a definition based on function is that it assumes there are negative consequences to sprawl and creates a temptation to label any development with negative impacts as “urban sprawl”. Indeed, defining sprawl in terms of its costs, such as poor accessibility and lack of open space should be avoided, as this creates a tautology when discussing the impacts of sprawl. This method also means the urban sprawl is identified indirectly, when it is a type of urban form, and should be defined as such.

Despite this diversity of forms and definitions, there is an assumption that the urban form is monocentric, most definitions identify sprawl as leap frog or scattered development, with a focus on the density of development and its distance from the city centre. However, too many urban types are lumped together under the term sprawl, and more distinction is needed to identify various types of sprawl, as each type will have different characteristics and impacts. In addition, development at the urban fringe is simply classed together with no distinction of its internal form, such as inner and outer suburbs.

3.2.4. Density

Many definitions of urban sprawl use the concept of low density to identify sprawl, however, this is neither quantified, nor explained adequately. What is considered low – density is relative and varies with each countries cultural expectations. For instance, in the U.S. low density is development of two to four houses per acre while in the U.K. low density would not consist of less than eight to twelve houses per acre. However, in definitions of sprawl low-density is not usually quantified.

The impression of low density urban form varies depending on the variables used for the numerator, and particularly the denominator of the density calculation, a number of methods are listed by Churchman (1999). Density in terms of sprawl represents the relationship between the number of people living in or using an area and a given land area, which gives some indication of the intensity of land use. Residential units are used for the numerator. The variable used for the denominator varies depending on the definition of land area. Gross density, the simplest measure, uses the total land area of the suburb as the denominator, this includes vacant, agricultural and un-developable land, as well as land devoted to residential use, commercial use, services and streets. Gross density is not the most useful measure, as it includes un-developable and reserved land and as a result underestimates density, since this land is not available for development anyway.

More discriminating density measures are gross residential density and net residential density. Gross residential density includes residential land area and streets, but excludes land in commercial and service uses. Net residential density includes residential land area

but excludes land devoted to streets and other transport uses. These two measures include only built up areas, and overestimate density by omitting vacant land which is available for development.

A more useful descriptor of density would include all urban land areas, including residential, industrial, institutional, service, commercial, vacant land in leapfrogged tracts and agricultural land which has been withdrawn from active use for land speculation. Agricultural land, parks, and land unsuitable for building, e.g. marshy land would not be included as there is no potential for development.

3.3. Context

The fact that cities are growing, is often neglected by commentators on sprawl, however, this focus on the city in isolation, without regard to wider regional and national processes, leads to inappropriate interpretations of the impacts of sprawl and methods for its containment. The following section will therefore provide a discussion of urbanization and its effect on urban form.

3.3.1. Urban Growth

Recent statistics on urbanization indicate that 46 percent of the worlds population lived in urban areas in mid-1995, with an even higher figure of 75 percent for more developed regions. In the U.S. the urbanization rate has been growing or constant. The 1900's – 1920's saw higher levels of urban than rural population for the first time. The trend to urbanization peaked in 1950 –55 with a rate of 2.7 percent, with a drop to 1 percent in 1970 - 1975. Since then there has been a slight increase, with an expected stabilization at 0.5 percent by 2030 (United Nations, 1998).

These rather bookish figures illustrate that the growth of cities is a significant phenomenon. There is some discussion of urban growth following a pattern of "urban transition" (United Nations, 1998). The first phase is of fastest growth in the core of the city, termed urbanization in the U.N. report; the second phase is suburbanization with fastest growth just outside the city core; the third phase is counter urbanization a term coined by Berry (1976), with population in the core and suburbs moving out to more rural areas, and the fourth phase is re-urbanization with an increase in population in the core of the city. According to this model, the phenomenon of urban sprawl would fall into the third phase of growth

At the city scale, the 1950's – 1960's saw growth within the official municipal boundaries, with later suburbanization and overspill either annexed or incorporated as separate towns. The above description of transitions merely describes the movement of population at the scale of the city, and between official city boundaries. Urban population is still growing if the problem is examined at a regional and national scale. These urban concentrations of population take the form of megalopolises (a term coined by Jean Gottmann) or metropolitan regions, which are urban regions consisting of several large cities and suburbs that adjoin each other. Most management of sprawl takes place at the scale of the city, however, sprawl is part of overall regional growth and may be more effectively dealt with at this level.

Urban regions are growing, and the consequences for urban form are a

"breaking out of the old bounds, walls, boulevards, or administrative limits which set it apart, the city has massively invaded the open country, though parts of the countryside may have kept their rural appearance. The growth in size of population has also meant a spectacular growth in area for the modern metropolis." (Gottmann & Harper, 1990), page 101.

This fact is ignored by current commentators -that the increased population cannot physically be accommodated within existing city limits, the result of an increase in urban growth is therefore urban sprawl.

This trend to outward growth can be traced to the beginning of the twentieth century. The growth of the cities created congested and unpleasant urban cores, with overcrowding and poor quality housing. This was one factor pushing population outward, however, changes in urban form are also related to changes in society, the accompanying technological and economic progress created greater fluidity in the population, with changes in transport and technology allowing the outward dispersal of manufacturing, retail trade and housing, and increases in the standard of living increasing the spatial demands of the city dwellers (Gottmann & Harper 1990). New technology and changes in a city's functions inevitably lead to new urban forms. The city is no longer restricted in size and its dispersal is simply part of larger social and technological changes.

3.3.2. Consumer Demand

The U.S. can be taken as an example to illustrate these changes. In recent academic literature the major focus is on the effects of sprawl, with little discussion of its causes. In the popular press, however, there are many historical summaries of the causes of sprawl, but these focus on general suburban growth, rather than pointing to factors which cause the scattered form of development which is sprawl at its most distinct. The main causes of suburban growth are given as changes in housing demand and transportation changes.

Accompanying the increase in the population of cities was an increase in the demand for housing. The lack of available housing in the central cities meant that the population had to be accommodated elsewhere. In the case of the U.S. the outward movement of residential population began in the nineteenth century. This trend increased in the post war era, and included the movement of not only residential development but also manufacturing and services, fuelled by higher levels of income, increased personal mobility and improvements in transportation. The movement is seen by advocates of the free market approach as a result of consumer demand for low-density single family housing on large lots, (Cullingworth 1960, Self 1961, Audirac, Shermeyen, & Smith 1990, Danielsen, Lang, & Fulton 1999). According to this view demand is driven by individual preferences,

“the ideal of owning a single family home, the need for an adequate environment for raising a family, a strong desire for privacy, and the appeal of a rural ambiance are among the most prominent reasons for choosing suburban and exurban locales.”(Audirac, Shermeyen, & Smith, 1990, page 473).

Evidence for this is based on consumer preference surveys: in Florida the Bureau of Economic and Business Research Survey, 1989, showed that least preferred locations were suburbs of major cities and the suburbs and downtowns of small cities; and the most preferred locations were the downtowns of major cities and rural and semi rural areas (Audirac, Shermeyen, & Smith 1990). Further evidence, is provided by the American LIVES survey, 1995 and the NAHB 1995. The LIVES survey showed that 20 percent preferred New Urbanist communities with higher density subdivisions, 50% preferred New Urbanist design with standard subdivision densities and 30% preferred standard suburban communities. The NAHB survey traded off house size with commute time to work and services, and showed that 83% preferred a detached house in the suburbs over a town house in the city. Surveys, however, provide only indirect evidence, another approach could look at the market demand for different housing types through data on house sales.

It is agreed that there is consumer demand for single family low density housing, but there is also the view that this demand has been manipulated by public subsidies. In the U.S. these

took the form of federal assistance on mortgages through the 1932 Federal Home Loan Bank Act and the Veterans Administration, which financed existing mortgages and provided mortgage insurance. These provided home financing to a wider range of income groups through low down payments, with lenders insured against mortgage defaults. Further incentive was provided by deductions to income tax through home ownership – deductions were given for payment for real estate taxes and interest on home mortgages (Jackson, 1985). The importance of this argument is that it affects whether consumer demand can be altered by government policy. This appears to be the case but there is also evidence that the preference for single family housing changes with household size and level of income, with demand for better quality housing rising as income rises (Clawson, 1971).

3.3.3. Transportation

Accompanying the growth of the cities and the changes in housing demand was a change in the mode of transportation, with the development of the private automobile and the corresponding growth of the highway system. There is some debate in the literature over the influence of public subsidies versus market forces in the growth of automobile use. There are claims that this growth, and by extension the increase in urban sprawl, is due to government subsidies for automobile use (Ewing 1994, Jackson 1985). This increase in private transport and the subsequent decline of public transportation to the suburbs is attributed to government having “taxed and harassed public transportation, even while subsidizing the automobile like a pampered child” (Jackson 1985, page 170).

This change in mode of transportation, by providing increased mobility and allowing for the outward movement of the population is perhaps the single most important enabling factor leading to urban sprawl. It should be noted that the growth of the suburbs with the increase in automobile use is a North American phenomenon and does not explain the development of urban sprawl in the U.K. In Britain the growth in the public transportation network was more important in the development of suburban housing. In London, for example, the growth of the suburbs began with the extension of the rail network to the suburbs in the 1860's, producing a radial pattern of growth along the lines of transportation. The latter development of a more widely spread, circular pattern of growth was also a result of the development of public transportation, in this case by motor bus. The private automobile played little part in the development of urban sprawl.

New modes of transport can be seen merely as an enabling factor allowing access to undeveloped areas at further distances from the city. However, it is also claimed by Clawson (1971) that the economic advantages of suburban living are more important in the creation of sprawl than changes in transportation. This may certainly be true in Europe.

3.3.4. Administration

The other aspect of urban growth which is often neglected is the change in the administration of the city. There are two issues, both of which are important for data collection. In the first instance, the legal boundaries of the city may not coincide with the functional or economic units of study. In these cases the suburban or sprawl areas may lie outside the legally defined city. Data collected for the legal city may not cover city – periphery interactions. The question to be asked is what is the appropriate area of study, and for which areas are data available. A concept such as the U.S. census SMSA (standard metropolitan statistical area) includes functionally related areas in a region. Although this is convenient for data collection, some thought must be given to deciding the spatial area that best represents the relation of the centre or centres to the periphery.

The second consideration is the change to the boundary of the city due to annexation of areas on its periphery. These changes to the legal boundaries of the city are important when

comparing data over different time periods. Although the city is nominally the same, it can refer to a different spatial area at different periods in time (Clawson 1971). . In these instances care must be taken to adjust the data for differences in spatial area.

3.4. Effects of Sprawl

The effects of urban sprawl are one of the most hotly debated issues in the literature, with sprawl often branded as the cause of all the evils of modern urban life. This negative view is richly illustrated by a glance at popular works in the urban literature, titles such as: Fighting Sprawl and City Hall, Divorce Your Car, and Home From Nowhere, illustrate the polemical nature of the discussions. There are a myriad of points both for the costs and benefits of sprawl. Discussions of these often degenerate into long lists which provide no way to sort through the debates. Despite the volume of rhetoric, the verdict is not yet out on the impacts of sprawl, and it should be viewed in the context of social and urban changes discussed in the section above.

Further confusing the issue is the lack of reliable empirical evidence to support the arguments made either for or against sprawl. The summary provided by the Transportation Research Board (1998) lists some of the limitations of the current research on costs of sprawl. This report divides the effects of sprawl into five groups, public and private capital and operating costs, transportation and travel costs, land/natural habitat preservation, quality of life and social issues. The amount of empirical or quantitative work for each category is shown in Table 1 - discussions using quantitative analysis based on census or case study data are most often found in literature discussing transportation and travel costs, social issues and public and private operating costs; literature using econometric modelling or simulation are found mostly in public and private capital and operating costs; literature using descriptive studies are mostly found in discussions of land/natural habitat preservation, quality of life and social issues.

Table 1: An Analysis of the Literature Concerning Sprawl

Impact Category	Levels of Analysis		
	<i>Descriptive: Little or No Analysis</i>	<i>Empirical: Census or Case Study</i>	<i>Simulation: Econometric or Modelling</i>
<i>Public and Private Capital and Operating Costs</i>	≈ 15%	≈ 50%	≈ 35%
Transportation and Travel Costs	≈ 10%	≈ 80%	≈ 10%
Land/Natural Habitat Preservation	≈ 45%	≈ 35%	≈ 20%
Quality of Life	≈ 40%	≈ 50%	≈ 10%
Social Issues	≈ 30%	≈ 60%	≈ 10%

(Transportation Research Board, 1998), page 115

Further issues adding to the poor quality analysis of the costs of sprawl, as summarized by the Transportation Research Board (1998) are the widespread use of secondary data despite

the quotation of a wide variety of data sources in the literature; unclear definitions of the costs being measured, for instance, density is improperly defined and this makes it difficult to measure travel behaviour or infrastructure costs which are related to the density of a region; a focus on only a few aspects of sprawl, without looking at the causal elements; few empirical studies and many case studies which are difficult to generalize from; the benefits of sprawl are often ignored; quantitative analyses are mostly found for physical infrastructure, rather than for social costs or quality of life – when these are some of the most hotly debated issues in the literature; most discussions focus on the new growth areas, without looking at the impacts on the city core or inner suburbs; the literature looks only at one point in time without examining the effects over a longer time scale; few feasible alternative forms are proposed as a solution to the negative impacts of sprawl; and modelling of the analysis is too simplistic. In general, most findings are either descriptive or where empirical work is carried out, the conclusions vary depending on the viewpoint of the researcher. These critiques point to a need for clearer definitions, more quantitative measures of sprawl, a broader view both in time and space, and greater comparison with alternative urban forms.

The effects of sprawl are too numerous to discuss fully. The following discussion will look at the major debates in the literature as a way to examine the most pressing concerns and to illustrate the problems mentioned above. One way to provide some general organization of the debates is to note that most of the arguments either support urban sprawl or advocate compact development. Those from the planning family usually support compact development and advocate greater regulation and planning to solve the 'problems' of sprawl. The other main champions of the sprawl debate are those who take an economic perspective – in this group there are both supporters of compact development and of sprawl, however, in both cases the view is that the economic market will ensure efficient development.

The debate on sprawl can therefore be reduced to an older set of arguments, between those advocating a planning approach and those advocating the efficiency of the market. Those supporting planning justify intervention on the grounds that the market is not efficient due to externalities, or unintended effects of actions, the costs of which are not borne by the producer; the existence of public goods which are freely available and therefore not provided by the market; and lack of equity in that the goods and services are not distributed evenly among areas. Those advocating the free market approach assume competitive and efficient markets; point out that actions should be taken to place the cost of externalities on the producer rather than using regulation; and that public goods are limited and can be provided by the market. (Richardson & Gordon 1993)

3.4.1. Summary of Effects

Discussion of the effects of sprawl belong to the more recent literature. In the post war period, despite criticisms of urban growth, suburbanization was seen in a positive light, as a means to provide housing for the burgeoning population of the cities (Self 1961, Clawson & Hall 1973). At this point in time the impacts of sprawl were less widely discussed than its causes. Table 2 provides a summary of the major costs and benefits of sprawl.

Table 2: The Effects and Costs of Sprawl*Italics indicate positive impacts*

Effect of Sprawl	Condition Exists	Condition is Strongly Linked to Sprawl
<i>Public/Private Capital and Operating Costs</i>		
Higher infrastructure costs under sprawl than compact development	General agreement	Some agreement
Higher public operating costs	Some agreement	No clear outcome
More expensive private residential and non-residential development costs	Some agreement	No clear outcome
More adverse public fiscal impacts	Some agreement	Some agreement
Lower public operating costs	Some agreement	No clear outcome
<i>Less expensive private residential and non-residential development costs</i>	Some agreement	Some agreement
<i>Fosters efficient infill development</i>	No clear outcome	No clear outcome
<i>Transportation and Travel Costs</i>		
More vehicle miles travelled	General agreement	General agreement
Longer travel times	No clear outcome	No clear outcome
More automobile trips	General agreement	General agreement
Higher household transportation spending	No clear outcome	No clear outcome
Less cost efficient and effective transit	General agreement	Some agreement
Higher social costs of travel	Some agreement	Some agreement
Shorter commuting times	No clear outcome	No clear outcome
<i>Less congestion</i>	General agreement	No clear outcome

<i>Lower governmental costs for transportation</i>	No clear outcome	No clear outcome
<i>Automobile most efficient mode of transportation</i>	General agreement	Some agreement
<i>Land/Natural Habitat Preservation</i>		
Loss of agricultural land	General agreement	General agreement
Reduced farmland productivity	Some agreement	No clear outcome
Reduced farmland viability(Water Constraints)	No clear outcome	No clear outcome
Loss of fragile environmental lands	General agreement	General agreement
Reduced regional open space	General agreement	General agreement
<i>Enhanced personal and public open space</i>	Some agreement	No clear outcome
<i>Quality of Life</i>		
Aesthetically displeasing	Some agreement	No clear outcome
Weakened sense of community	Some agreement	Some agreement
Greater stress	Some agreement	Some agreement
Higher energy consumption	Some agreement	Some agreement
More air pollution	Some agreement	Substantial disagreement
Lessened historic preservation	Some agreement	No clear outcome
<i>Preference for low-density living</i>	General agreement	Some agreement
<i>Lower crime rates</i>	Some agreement	No clear outcome
<i>Enhanced value or reduced costs of public and private goods</i>	Some agreement	No clear outcome
<i>Fosters greater economic well being</i>	Some agreement	Some agreement

<i>Social Issues</i>		
Fosters suburban exclusion	Some agreement	Substantial disagreement
Fosters spatial mismatch	General agreement	Some agreement
Fosters residential segregation	Some agreement	No clear outcome
Worsens fiscal stress	Some agreement	Some agreement
Worsens inner city deterioration	Some agreement	Some agreement
<i>Fosters localized land use decisions</i>	General agreement	Some agreement
<i>Enhanced municipal diversity and choice</i>	General agreement	Some agreement

Based on (Transportation Research Board, 1998)

3.4.2. Land Speculation

The first major debate discusses whether land speculation fosters an efficient land market, infill development and therefore higher densities, or whether it contributes to sprawl. This was a major issue in the literature of the 1960's and 1970's reflecting the emphasis on causes of sprawl rather than costs, the literature also emphasizes reasons for discontinuous/scattered development rather than suburbanization. It also interestingly examines the influence of individual actors which is not common in more recent literature. This issue brings to the fore the need to look at sprawl over longer periods of time.

The first issue is whether land speculation is part of an efficient land market. Under traditional theories of the land market the expected pattern of development would be continuous development from the urban centre. Efficient development would first make use of the land closest to the centre, as this is the highest value, is the most accessible and utilizes existing public services. Discontinuous, scattered development can therefore be seen as a result of market failure. On the other side of the debate scattered development is seen as part of an efficient land market which provides the highest price for land owners, and allows for appropriate provision of infrastructure and services.

Land speculation is seen as the cause of discontinuous development, at least in the short term (Archer 1973, Ottensmann 1977). The process as described by Clawson (1962) is one in which land is withdrawn from the land market and its price is placed above its current market value in anticipation of future demand for higher value urban uses. The time at which the particular parcel is released onto the market depends on the rate of development of surrounding tracts, the availability of capital to the speculator and the cost of holding land in taxes. When demand is high and profits are greater then more land parcels will come onto the market. Due to individual differences in parcel characteristics and land owners individual preferences, land development is haphazard, leading to scattered development. The withheld land is often vacant since land cannot be used for other purposes, such as farming, as it is necessary to maintain flexibility of use so that the parcel is available for sale when prices are high.

On the other hand, over a longer time period land speculation creates an efficient allocation of land uses. Although initial development is low density, the vacant land is later developed at higher densities as infill development or is used for higher value commercial uses. This is dependent on land owners allocating a high price for land based on its prospective value in the future. Land is therefore not developed under existing lower value uses, but only when the more productive uses are economically feasible (Harvey and Clark 1965, Ohls & Pines 1975, Peiser 1989). It is well established in the literature that density of development increases with land value. This assumes that land values on infill sites will be higher than land at the urban fringe, this is not always the case due to zoning restrictions and decline of the inner cities, and ignores the question of overall density – development will continue at the urban fringe, even as higher density infill development occurs, as fringe land will continue to be attractive (Breslaw 1990)

Although the issue of land speculation is not discussed in the current literature, it provides some understanding of the working of the land market, highlights the causes of scattered development rather than suburbanization and points to the need to look at the whole cycle of development in an area, not just at its inception but also at build out. Further questions for study are the role of land use policies in controlling speculation and subsequent scattered development, the timing of this infill development, that is how long it takes for these higher density uses to emerge, the necessary conditions for this and the effect this has on the overall density of development in the region.

3.4.3. Costs of Sprawl - Gordon & Richardson versus Ewing

The second debate which returns to the costs of sprawl is essentially one between advocates of a compact city form with development control through planning (Ewing 1997) and those supporting the dispersed pattern of development with market led development (Gordon & Richardson 1997a, Gordon & Richardson, 1997b).

Gordon and Richardson look at several costs of sprawl: lack of open space and use of agricultural land, low density residential development as caused by income tax breaks and subsidies to the automobile and highway, wasteful use of energy, lack of public transit, traffic congestion and trip times, the decline of the downtowns, and residential segregation between suburbs and inner cities.

They do not attempt to claim that these costs are non-existent, merely that they do not hamper efficient development at higher densities, or are not caused by urban sprawl. For instance, Gordon and Richardson agree that low density development makes public transit unfeasible, however, they also claim that ridership is in decline despite increases in public subsidies and that more compact development in the form of New Urbanist neighbourhoods does not make a difference in transit use. Another claim is that suburbanization has not increased congestion, and that commuting trip times of central city and suburban residents are similar, due to the movement of industry to the suburbs; a third claim is that infrastructure costs savings at higher densities are small.

Despite the impact of this debate, Gordon and Richardson do not provide any empirical analysis to support their claims, and rely on secondary evidence. Underlying the refutations of sprawl's costs is a perception of city form as a more dispersed polycentric city not as emanating from a central core,

“ the central city vs. the suburbs is yesterday's battle. Even “edge cities” are becoming old news. Today's contest, ...is between the suburbs and the exurbs.” (Gordon and Richardson, 1997b)

The counterpoint by Ewing (1997) shares similar deficiencies in empirical evidence, and contains an implicit assumption of the ideal city as a compact form surrounding a central core. He attempts to refute each of the arguments of Gordon and Richardson, however,

while it is established that the negative impacts exist, he does not manage to tie these directly to sprawl as a causal factor. Many of the costs mentioned are just the costs of modern urban living, regardless of urban form. Ewing rightly points out that Gordon and Richardson do not provide a clear definition of sprawl, but he does not address the influence of definition on their relative findings. Additionally, much of the disagreement on the costs of sprawl is due to the lack of empirical evidence, and the comparison of costs based on different methods of measurement. For instance, when discussing the level of congestion in sprawl communities, Gordon and Richardson quote travel times of 18.2 minutes for central city residents in urbanized areas and 20.8 minutes for those outside central cities for all modes of travel, based on 1990 NPTS files. Ewing finds trip times of 40 minutes less for those in most accessible locations over those in least accessible locations, using auto trips only. The main discrepancies are in the definition of the comparison areas – Gordon and Richardson base this on density, while Ewing uses accessibility; and the modes of travel measured – all modes versus auto trips. Further confusion is added by the use of secondary data, indeed Ewing does not cite any source of data.

3.4.4. Costs of Sprawl – Gordon & Richardson versus Pendall

The debate between Gordon and Richardson (1997a) and Pendall (1999) on consumer preference for low density living further illustrate the methodological problems plaguing the costs of sprawl literature. Pendall attempts to refute Gordon and Richardson's claim that consumer preference leads to low density development, instead he aims to show that land use controls and fiscal arrangements can influence density. The implication is that the market is flawed and that policy intervention can create higher density development. Gordon and Richardson quote consumer preference surveys, for example, the Federal Home Mortgage Association's National Housing Survey, as evidence of a desire for low density living. On the supply side, they claim that even where higher density development is allowed, developers do not build at higher densities and that sales of higher density development are slow. However, no empirical studies are used and no literature is cited. Pendall uses OLS regression to test seven factors which influence density, with findings that land use controls have a significant impact. From this he concludes that government actions can be more important than consumer preference on densities and spatial patterns. However, the argument is very indirect, and although it establishes a causal relationship between land use control and density, it ignores the issue of consumer preference and the workings of the land market. Once again data is flawed or missing, and empirical studies while of sound methodology do not directly measure the cost of sprawl, and perhaps stretch too far in their conclusions.

3.4.5. Municipal Fragmentation

One factor which deserves some mention as exacerbating the costs of sprawl is municipal fragmentation. This is a problem for the U.S. where regional government is weak, and control over land use falls to local municipal authorities. Planning is therefore uncoordinated and fragmented. Policies to prevent sprawl therefore have little effect, as they are uncoordinated and not implemented over a wide enough area (Clawson 1962, Razin & Rosentraub 2000)

3.5. Conclusion

The search for an ideal city form is a long standing one, at present this is presented as a compact city form, surrounding a central core. The prevailing form however, is one of 'urban sprawl', this paper has attempted to clarify some misinterpretations of this pattern of urban growth. The major concern of the current literature is on the effects of sprawl, while its causes are largely agreed upon, there is little consensus on whether sprawl is a positive or negative form. Much of this confusion is due to the unclear definition of what the term means,

and what characterizes this pattern. Most definitions are based around the concept of density and land uses. Further work is needed to clarify the term, but there is also an increasing realization that the term urban sprawl covers many forms of development, which cannot be adequately classified under one definition, so what is needed is some way to define the variety of sprawl types.

The list of costs are endless, but with little empirical work and no consistency in methods of measurement there is no way to evaluate these. An understanding of the impacts of urban sprawl would also be aided by making greater distinction between the types of sprawl and by distinguishing the various residential zones at the urban fringe. There is also little comparison with alternative urban forms, which makes it difficult to evaluate the impacts of urban sprawl. These should be similar in terms of population, functions and growth rates. The literature on costs of sprawl also assumes a monocentric city, however, there is an increasing realization that the present pattern of urban form is one of polycentric or multi-nucleated cities. This has certain assumptions for the methods and scale of analysis and some re-evaluation is necessary.

4. SCENARIOS FOR AN URBAN EUROPE: A RESEARCH AGENDA

4.1. Introduction

It is not until recently that the planning literature has started to refer to the problem of urban growth in European cities in terms of sprawl. However the theoretical framework of this concept is still not well founded and a clear definition is lacking. Diverse definitions, explanations and operationalisations of sprawl coexist, the diversity originating from a complexity inherent to all urban issues, from the different reaction of local contexts to growth dynamics and from the often unclear use of the word in each country's language.

One more reason for the lack of a univocal definition of urban sprawl is the theoretical pluralism on the basis of which the topic has been approached. Several different disciplinary perspectives overlap each of them providing unique insights and descriptive and analytical approaches which range from argumentative, qualitative methods to the more institutionalised, rigid and formal quantitative research models.

Pluralism, even though it may hampers the quest for a common definition of urban sprawl in Europe, should be considered as an enrichment of the theoretical framework and as an essential support in the design of land-use and transport policies whose efficiency often lies in their flexibility.

Even when considering these diversities, some common elements can be identified which repeatedly mark the recent literature in its attempt to identify and explain the features of European cities' growth and the emergence of new spatial and a-spatial patterns of development in continental Europe's urban systems:

- The different configurations of urban sprawl are often described as a local response to demographic, economic, social and political trends. The stress is on the dynamic interactions between, on one hand, the pre-existing socio-economic and urban settlement structures and hierarchies, which often display extraordinary levels of persistence (Batty, 2001; Hall *et al*, 2001) and, on the other hand the global "forces shaping urban Europe" (Hall, 1993; Sassen, 1997). The current spatial and functional urban patterns are the results of these interactions.

The conceptualisation of urban growth as context and path-dependent however doesn't concern only the future evolution of European cities and territories but works also as analytical probe in the analysis of the origins of sprawl. It holds the assumption that 'sprawl' is not likely to take place unless a particular combination of historical and environmental backgrounds, economic and social trends, political, institutional and regulative framework, technology innovations and infrastructure investment occurs. This leaves a question mark on which combination generates sprawl and which generates 'other' forms of urban growth.

- Descriptions of urban trends are not bound to one single spatial (and therefore reasoning) scale but seamlessly shift between the local and the regional or even international levels. A typical example is the case of polycentric systems, which are often, described both as intra-urban patterns of clustering of population and economic activities (London, Paris, Milan) and inter-urban patterns such as the Dutch Randstad, the Flemish Diamond and the area of Padua, Treviso and Venice in northern Italy

(Kloosterman and Musterd, 2001; Batten, 1995). This is not a trivial argument because the spatial scale at which urban sprawl is observed can heavily influence the identification of relevant issues and the selection and design of suitable measurements technique and indicators.

A similar and related problem involves the spatial delimitation of the urban areas on the basis of which the characteristics of urban dynamics should be investigated. Different definitions of urban population and of the spatial delimitation of urban areas may hamper international and inter-temporal comparison of urban growth. National statistical offices have a leading role in the definition of these dimensions. With regard to sprawl for instance if commuting is used as the 'rule' for the inclusion/exclusion of outer administrative units to the core city, this rule may lead to the definition of wider 'urban areas' including peripheral and even rural territories and to a misinterpretation and census-based definition of urban sprawl.

- The lack of a clear distinction between the causes, conditions, and consequences of urban sprawl. This is particularly true at the smaller scales at which single cities are investigated. As it is mentioned above, sprawl is often a local response to global trends and in this sense it is less a structural than a [contingent question](#). However when it comes to empirical investigations rather than theoretical speculations, recent literature, considered as a whole, reveals a world of contradictory causal and temporal relationships between several events, sprawl being often just one of them. As an example of the intertwined nature of the problem, consider the following hypothetical 'progression':
 - A growing demand for infrastructures arises due to the relocation of economic and residential activities, which is the response to economic restructuring trends, households' 'evacuation' in search for better life-styles, etc.
 - Investments and interventions in transport infrastructures facilitate accessibility to peripheral areas, which become available for further (re)location of new housing, productive and commercial activities.
 - Patterns of mobility change. A wider territory, the so-called 'urban field' is invested by traffic flows that now involve city-to-city and suburb-to-suburb trips instead of just core-to-periphery ones (Bontje, 2001). This and the dispersal of settlements make it almost impossible to organize public transport services and therefore use of private cars increase. Modal splits, trips other than commuting and freight transport also become harder to grasp.
 - Issues of economic and ecological sustainability emerge which demand for policy measures and land-use and planning interventions whose effects however, are uncertain.
 - On top of this hypothetical format simultaneous conditions may exist which make it more difficult to 'extract' individual causes or consequences: the planning system in force, the housing and land policies, the fiscal framework, economic and demographic trends.

This emerging complexity of settlements and mobility patterns seems to escape all attempts to plan or model it, if not by parts. According to Peter Hall (1997) "the urban world of the 1990s is a profoundly different world". Processes like globalisation, tertiarisation, quaternarisation, informationalisation and the shift from centrality to polycentrality (Kloosterman and Musterd, 2001) are shaping a different urban Europe. In spite of this "the new metropolitan dynamics [...] are not being adequately captured by

urban theory and urban models, which have not been adapted to the changed urban world of the 1990s” (Hall, 1997).

Such is this inadequacy that moving from a qualitative description to a more formal quantitative one seems difficult. “Without robust empirical metrics to inform the debate, however, much of this argument remains conceptual, even speculative. The lack of understanding and consensus does little to contribute to practical, real world problem solving.” (Torrens and Alberti, 2000)

Considering all that has been said above a (formal) definition of European sprawl is still in its infancy. The plural form (sprawls) should be used, since it can take account of the need to keep an open definition when we consider the European context. Despite the common trends, being sprawl, as any other form of urban growth, a dynamic and complex phenomenon and possibly just one stage of a longer evolutionary trend, we must consider the fact that not all cities and countries share the same combination of the mentioned conditions. Particular attention should be given not only to the different definitions of sprawl but also to the factors and features underlying these definitions.

4.2. Growth Trends in European Cities and Territories

After World War II, both Western Europe and the United States faced unprecedented increase in population, mobility and prosperity. On both sides of the Atlantic there were large demands for urban space, infrastructure and facilities. The result was a massive development that put pressure on the built and natural environment. However, the response in Europe and the US was different. European countries tried to meet the increased demand essentially through state intervention and planning while the US adopted a decentralised *laissez faire* approach. These opposite approaches generated patterns and landscapes of urban peripheral growth that remain typical of the two continents: the periphery of subsidised housing featuring tower blocks and neighbourhoods of flat-blocks in continental Europe and the dispersal of single-family, detached houses in the US. Between the 70s and 80s while ‘growth management’ legislation started in several American States (Evers *et al*, 2000) leading to an attempt to control the spread of urbanisation, in European countries two simultaneous events opened the door to the first important wave of uncontrolled sprawl: the end of the welfare state, which dramatically reduced the level of national government subsidies to, among others, the housing sector; and the misinterpretation of demographic trends which, while showing a total decline of population (the end of the baby boom) were instead hiding an increase in the demand for new housing due to an unforeseen reduction in the size and lifestyles of households. The demographic explosion and immigration cycle of the post war period which had accelerated the concentration of population in towns and cities was now pushing towards the suburbs that part of the middle-class population which, helped by the *economic expansion*, the *increased levels of income*, the *change in life-styles*, and the affirmation of an *anti-urban ideal* chose to relocate in the outer suburban areas.

4.2.1. Spatial Trends in the Evolution of Urban Population

At the beginning of the 80s national census surveys started to reveal a different trend in urbanisation processes across Europe: in the previous decade small towns and rural areas had grown, in terms of population, more than the central areas of most urban agglomerations especially of large cities. Tables 3 to 6 show spatial trends of demographic growth for areas selected in four European countries.

Table 3. Percentage change in population in The Netherlands, by municipality type

Municipality type	1970-75	1975-85	1985-95	1970-95
Cities > 200,000 inhabitants	-9.6	-10.0	4.1	-15.3
Cities 100,000–200,000 inhabitants	-0.5	0.8	3.3	3.9
Cities 10,000–100,000 inhabitants	4.5	5.8	6.2	17.4
Suburban areas	12.0	6.9	6.2	27.1
Urbanised rural areas	11.1	9.1	6.1	35.7
Rural areas	11.5	9.5	6.1	29.5
Growth centres	27.0	74.3	28.3	184.2
<i>The Netherlands</i>	4.8	6.4	6.8	19.3

(Source: Bontje, 2001)

Table 4. Percentage change in population in West Sweden, by municipality type

Municipality type	1970-75	1975-85	1985-95	1970-95
Metropolitan centres	-5.8	-4.7	6.0	-4.8
Large cities 50,000–200,000 inhabitants	2.9	2.2	8.7	14.4
Medium cities 20,000–50,000 inhab.	2.7	1.9	7.1	12.1
Manufacturing towns	3.3	0.6	3.1	7.1
Suburbs	22.8	12.5	12.7	55.7
Urbanised rural areas	1.8	4.1	3.1	10.4
Other, 15,000–20,000 inhabitants	4.8	4.2	5.9	15.7
Other, < 15,000 inhabitants	6.9	10.9	8.5	28.7
<i>West Sweden</i>	2.7	2.1	7.3	12.6
<i>Sweden</i>	1.5	1.8	5.7	9.2

(Source: Bontje, 2001)

Table 5. Percentage change in population in Northern England, by municipality type

Municipality type	1971-76	1976-86	1986-95	1971-95
Principal metropolitan cities	-5.7	-6.7	1.0	-12.8
Other metropolitan districts	-0.5	-2.4	0.6	-2.3
Non metropolitan cities	-1.3	-4.0	2.0	-3.5
Industrial districts	1.3	-1.1	1.0	1.2
Districts with new towns	5.3	5.6	0.4	11.7
Port, resort and retirement areas	3.0	1.1	4.6	9.0
Mixed urban-rural areas	4.0	4.3	2.3	11.1
Remoter largely rural areas	6.6	3.9	7.0	18.6
<i>Northern England</i>	<i>0.0</i>	<i>-1.8</i>	<i>1.0</i>	<i>-1.0</i>
<i>England</i>	<i>0.5</i>	<i>1.5</i>	<i>3.3</i>	<i>5.4</i>

(Source: Bontje, 2001)

Table 6. Percentage change in population in Switzerland, by municipality type

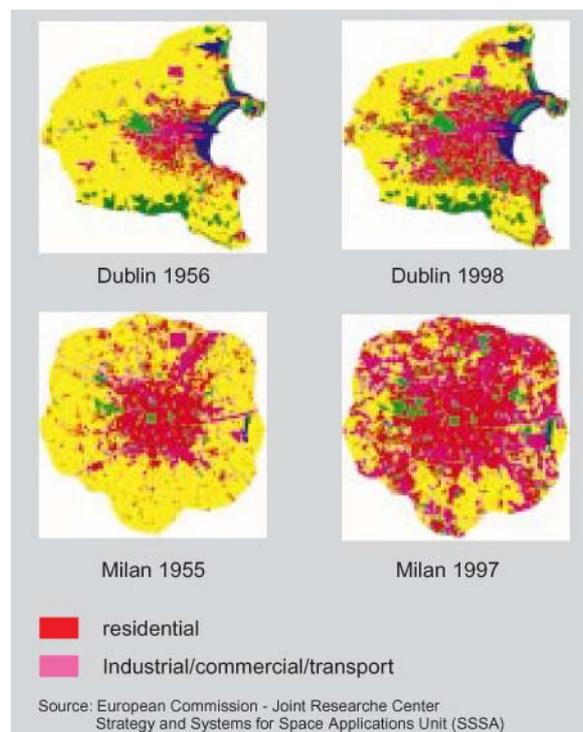
Municipality type	1971-76	1986-95	1971-95
Large centres	-11.6	-0.2	-11.8
Medium sized centres	-6.3	0.5	-6.0
Small centres	-0.9	4.5	3.7
Centres in periphery	-3.0	6.0	2.7
Suburbs	15.8	14.1	32.1
Peri-urban municipalities	17.4	14.8	34.7
Manufacturing municipalities	3.1	11.0	14.4
Rural commuter municipalities	4.0	15.0	19.6
Rural municipalities	-3.2	10.4	7.0
Other municipalities	6.7	9.2	16.5
<i>Switzerland</i>	<i>1.5</i>	<i>8.0</i>	<i>9.6</i>

(Source: Bontje, 2001)

Even though the purpose of the comparative study by Bontje is to investigate the role of spatial planning in determining the distribution of population and the structuring of urban fields, the reported data can still be used to describe trends that are common in all European countries. Interpretation of these trends has been twofold (Guérois and Pumain, 2002).

The higher growth rate of smaller towns, the decrease of urban densities in the central areas of most urban agglomerations, the out migration from city-centres towards urban suburbs and rural peripheries was initially and rather simplistically interpreted in terms of counter-urbanisation processes (Champion, 1989) as those described by Berry (1976) in the United States. However more careful analyses (Pumain, 1983) suggested that a distinction should be made. On one side long-term interurban trends denote growing concentration of population in the main urban areas. The total number of these areas has decreased while the total number of communes involved and the amount of population gravitating around the main core city have increased generating new urban hierarchies (Guérois and Pumain, 2002, Cattán *et al*, 1999). These processes of concentration of urban population and spatial polarisation at the national and international level are leading towards the rise of the global cities and city-regions (Friedmann and Wolff, 1982; Sassen, 1991; Knox, 1995; Castells, 1996; Taylor, 2000; Scott, 2001).

Fig. 1. Urban Expansion



(Source: European Commission, 1997)

At the same time, local trends have shown de-concentration of urban population densities for the main centres, increase of population in the suburbs, outer ring and rural peripheries. Causes to de-concentration/counter-urbanisation processes are to be found in a large number of factors: economic, socio-cultural and demographic influences are involved (Champion, 1989, 1994; Cheshire, 1989; Cheshire and Hay, 1989; Champion, 1999, 2001; Champion and Dorling 1994; Vining and Pallone, 1982). Table 7 suggests a list derived from nine national case studies.

Table 7. Explanations for ‘counter-urbanisation’. Bold denotes most quoted issues by other authors

1	The expansion of commuting fields around employment centres
2	The emergence of scale diseconomies and social problems in large cities
3	The concentration of rural population into local urban centres
4	The reduction of the stock of potential out-migrants living in rural areas
5	The availability of government subsidies for rural activities
6	The growth of employment in particular localised industries like mining, defence and tourism
7	The restructuring of manufacturing industry and the associated growth of branch plants
8	Improvements in transport and communications technology
9	The improvement of education, health and other infrastructure in rural areas
10	The growth of employment in the public sector and personal services
11	The success of explicitly spatial government policies
12	The growth of state welfare payments, private pensions and other benefits
13	The acceleration of retirement migration
14	The change in residential preferences of working age people and entrepreneurs
15	Change in age structure and household size and composition
16	The effect of economic recession on rural-urban and return migration
17	The first round in a new cyclic pattern of capital investment in property and business

(Source: Champion, 1989)

For most researchers, the leading factors behind urban centre decline and the emergence of sprawl and sub-urbanisation have been the changing economic base and the housing and spatial planning policies. Both will be further discussed in the following sections.

During the last two decades Europe has seen the emergence of new trends of demographic behaviour, family formation and household structure. Aspects of this “second demographic transition” are the appearance of new and more varied household forms and the increase of migration flows from Eastern European and North African countries towards the major European. The ageing of the population, the decline of fertility to below replacement levels, the decline in marriage rates and the rise in the age of marriage, the increase in cohabitation and the rise in divorce have had profound effects on household and families. Households are becoming smaller, with up to 75 per cent of households consisting of 1 or 2. This is accompanied by the decline of the “traditional families” and the rise of immigrants’ community cities (Bontje, 2001; Hall, 1993; Ogden and Hall, 2000). The spatial implications of these demographic trends are manifold.

First these processes have marked a new phase of urban growth and re-urbanisation for European cities. These new social identities show a preference for central city locations as their living environment (Bontje, 2001) where they can find “kin, supportive social and cultural institutions, and easy access to low-income, sometimes casual work” (Hall, 1993). Second cities are now facing complex gentrification trends in the inner city districts, which may lead

to social exclusion. Higher price levels in inner districts, a result of urban renewal policies and gentrification, have led to displacement of the disadvantaged out of the core and inner districts into the transitional zone (Smyth 1996).

What is emerging from the description of the demographic trends in European cities?

- a. The theory of urban life cycle is becoming less and less able to explain the dynamics of cities. Although several authors use the common terms of urbanisation, sub-urbanisation, counter-urbanisation and re-urbanisation, all the demographic processes described above are simultaneous and not consequential.
- b. There is a growing divergence between population projections and housing projections. Aggregate data of population growth are not sufficient to describe the social and morphological landscapes related to urban sprawl.

These factors have direct influence on the possibility to grasp and model contemporary urban dynamics and population location from a quantitative perspective. Interpretations, not to mention the definition of future scenarios for the European cities therefore, often rely only on qualitative descriptions.

4.2.2. Morphological Landscapes of Urban Sprawl

The waves of growth-decline on the different areas surrounding the city centres have produced a *variety of spatial forms* of urban growth but only some of them have been described as sprawl. Rather than being an all-inclusive term, as in most of the United States-based literature, sprawl has been used to describe only some of the possible and existing types of urban growth, even though disagreement, discordance and uncertainty still remains in European literature as well.

Attention is especially given to the “geometrical” dimensions, such as the size, shape and density of the city and its development and often works at the small scale. It is within this framework that sprawl is referred to as low density urban patterns where density ambiguously refers to population, built-up areas, employment, etc. Table 8 lists only few of the possible measurements techniques.

Table 8. Density indicators

Measure/indicator	Sources
<i>Gross density, 1991</i> (density of local authority district)	
Persons per hectare	1991 Census <i>Key Statistics for Local Authorities</i>
Households per hectare	1991 Census <i>Key Statistics for Local Authorities</i>
Persons per hectare in built-up area	1991 Census <i>Key Statistics for Local Authorities</i> and Ordnance Survey maps (<i>Pathfinder</i> range; scale 1:25000)
Households per hectare in built-up area	As above
Persons per hectare in residential	1991 Census <i>Key Statistics for built-up area Local Authorities</i> ; Ordnance Survey maps (<i>Pathfinder</i> range; scale 1:25 000); and DoE (1995) <i>Commercial and Industrial Floor-space Statistics 1995</i> , HMSO, London
Households per hectare in residential built-up area	As above
<i>Population-weighted density, 1991</i>	
Average of ward densities, measured in terms of persons per hectare	OPCS (1995) <i>Population Density, Change and Concentration in Great Britain 1971, 1981 and 1991</i>
<i>Density of sub-centres, 1991</i>	
Density of most-dense ward measured in persons per hectare	1991 Census <i>Ward and Parish Council Monitor</i>
Average density of four most-dense wards, measured in persons per hectare	1991 Census <i>Ward and Parish Council Monitor</i>
Variation in density across city: variance, calculated using SPSS	1991 Census <i>Ward and Parish Council Monitor</i>
<i>Housing density, 1991</i>	
Percentage of total housing stock made up of higher-density dwellings(terraces, flats and conversions)	1991 Census <i>County Monitor</i> , Table H
Percentage of total housing stock made up of lower-density dwellings(detached and semi-detached)	1991 Census <i>County Monitor</i> , Table H
Percentage of total housing stock represented by small dwellings (1–3 rooms)	1991 Census <i>County Report</i> , Table 57
Percentage of total housing stock represented by large dwellings (7 or more rooms)	1991 Census <i>County Report</i> , Table 57

(Source: Burton, 2000)

According to these dimensions, different classifications of development patterns have been advanced. Camagni, for instance, has used levels of land consumption (which can be considered a parameter of density) as a quantitative measure to classify urban development patterns (Camagni et al., 2002):

- *in-filling* (T1), characterised by situations in which the building growth occurs through the in-filling of free spaces remaining within the existing urban area
- *extension* (T2) which occurs in the immediately adjacent urban fringe

- *linear development* (T3) which follows the main axes of the metropolitan transport infrastructure
- *sprawl* (T4) which characterises the new scattered development lots
- *large-scale projects* (T5) which concerns new lots of considerable size and independent of the existing built up urban area.

Through the combination of these “simple” and theoretical typologies of land-uses Camagni has identified ten prevalent forms (Table 9).

Table 9. Types of urban development patterns

	T1	T2	T3	T4	T5
T1	pure in-filling				
T2	in-filling/extension	pure extension			
T3	N/A	extension/linear development	pure linear development		
T4	in-filling/sprawl	extension/sprawl	linear development/sprawl	pure sprawl	
T5	N/A	N/A	N/A	N/A	large scale projects

(Source: Camagni, 2002)

The expansion of the individual housing has created in the outer urban areas, vast zones of low elevation, low density urbanisation. These are sometimes organised in development areas, sometimes follow more scattered pattern. The latter often involve more than just residential activities but also retail buildings, industrial zones, and all those elements, which shape the urban landscape of sprawl. However “less dense” patterns don’t occur always and everywhere in the same way. The levels and spatial distributions of density differ depending on regional and local variations. In search of this variations a second approach has widened this analytical framework to the distribution and organisation of land-use activities and urban functions. As a result different patterns of urban development have been identified: mixed or single land-use patterns, patterns of different rural-urban relationships, concentrated, clustered or dispersed patterns.

4.2.3. Location Strategies of Economic Activities

The goal of this section is not to retrace the history of economic trends in European countries and of their impacts on urban and territorial systems but to identify among the most recent events those which have been detected as the most influential in the emergence of dispersed pattern of urbanisation and as the most specific of urban sprawl.

4.2.3.1. The shift to the informational and service sector

During the past half-century, even though at different speed, all western economies, including those of the European Community have passed from being fundamentally industrial economies based on the production and handling of goods, to informational and service economies, in which the majority of the workforce no longer deals with material outputs (Hall, 1993; Castells, 1989, 1996; Graham and Marvin, 1996; Storper, 1997). The successors of the manufacturing industries, businesses engaged in the handling of information, face a

rather different set of options with respect to their location than those of goods-handling firms. Their constraints do not lie in the costs of moving goods from one place to another, but are determined by the extent to which they need (frequent) face-to-face contacts. In this case, the benefits of choosing a central location should be weighed against the costs, both in terms of renting office space and of moving people to this place. Centrality, meaning accessibility and visibility, remains of higher importance for firms. However differences should be made with regard to the level of activities, which locate and/or relocate. Company headquarters, public bodies, activities that require international connections still favours central location, despite the increase in office rent and sale prices due to the highly competitive market of space in central urban areas. Those businesses that are not highly dependent on frequent face-to-face contacts will opt for cheaper non-central locations (European Commission, 1991; 1994). New technology intensive firms, which don't take advantage of central locations, seek to avoid the congestion diseconomies in the older growth areas and move towards new areas offering an attractive environment for the new flexible and knowledge base industries. Some observers have argued that informational and service activities are still fundamentally dependent upon demands from the industrial sector (Gershuny and Miles, 1983). What has become evident is that, locationally, services have become increasingly disarticulated from production; the spatial disintegration of work that is enabled by the information technologies would fragment the spatial distribution much further than is already happening in polycentric urban regions (Couclelis, 2000).

4.2.3.2. Economic crises and the rise of small-medium enterprises

Another significant trend linked with the shift towards more flexible production is the emergence of spatially contiguous innovative industrial clusters consisting of large numbers of SMEs that tend to concentrate and exploit the benefits of networking (Van Den Berg *et al*, 2001; Simmie, 2001).

The term 'cluster' refers to the grouping of firms in a locale among which there is a high density of local transactions and exchange of knowledge. Similar terms are 'system area' or 'industrial district'. Compared to the original definition this concept has now been widened out to include social, cultural and political qualities of the *milieux* within which economic activity occurs. These clusters can lead to the formation of system areas or industrial districts specialising in specific industrial branches. These trends thus promote both spatial concentration and dispersal. Different production processes and different sectors develop different spatial trajectories. As a result, locales and territories find themselves positioned in a range of spatially differentiated economic relations.

4.2.4. The Urban Impact of Economic Trends

Despite a wide and rich literature on the spatial, infrastructure and institutional conditions that create a fertile environment for the rise and upholding of such innovative *milieux* and therefore contribute to the success of city in the growing competitive European market, still very little investigations exist on the impact of these economic changes on the locals urban context.

The decisions of individual firms, as the primary agent for the location of production, are made on the basis of intra-firm or intra-cluster strategies and often with very limited knowledge of the long-term consequences of the future decisions of others. This has very important consequences for the rationality of the location patterns of production. However sprawl is very much dependent upon the cumulative outcome of the many individual decisions of investors to locate or re-locate production facilities, as well as on the relative spatial dispersion/concentration of economic activities.

When considering the urban impacts of economic trends, differences should be made both on the *spatial scale* (inter-urban trends or local and intra-urban trends). At the inter-urban scale trends show a concentration of jobs for sectors such as business services, high-tech service and culture industries, while at the local level there is a de-concentration of the same jobs towards the fringes and outer rings. According to Lainé (1996, 1998, 2000) in France jobs have been growing rapidly in the suburbs, more slowly in the outer urban fringes and are declining inside urban centres.

4.2.4.1. Spatial mismatches and intra-urban polycentricity

Among the possible spatial impacts of on-going economic changes an important issue to be considered is the mismatch between population and jobs location, as this is one of the factors influencing commuting both between the core city and the outer areas and among peripheral areas.

Analysis of daily flows inside different urban areas shows systematic migration of the barycentre of these flows (Orhan, 1998), as an effect of a new spatial distribution of functional centres. The qualitative selection of locations, which were discernible in Europe from the mid-1970s (Pumain and Saint-Julien, 1985), have worked towards an over-concentration of new economic functions activities. Combined with urban sprawl, these qualitative selections are also responsible for an at least partial revision of the traditional models of intra-urban spatial organisation, reflected in functional and residential specialisations of the urbanised zones (SPESP, 2000b).

Besides, economic trends have also created jobs across a wide spectrum of skills, categories and income, which hold different but specific demands and requirements. Such requirements may have placed them beyond the possibility of sections of the population. As a consequence pattern of spatial mismatch, where jobs and unemployment lie side by side, have emerged.

Proponents of the spatial mismatch hypothesis, originally formulated by Kain (1968, 1992) argue that job decentralisation harms low-income residents of central cities because of barriers that limit their access to suburban labour markets (Martin, 2001). This hypothesis has been recently reintroduced in the debate on urban sprawl in the attempt to model and evaluate the impact of the distribution of population and jobs on commuting patterns and the costs of such patterns on individual and households (Arnott 1998, Gottlieb and Lentnek 2001), or *vice versa* to test the soundness of the spatial mismatch approach by looking at commuting behaviours. Outcomes have been so far arguable.

4.2.5. The Facilitated Mobility

A quantitative formulation of the commuting pattern generated by the emerging spatial organisation, although desirable, is not necessary to detect that the nature of mobility has deeply changed in the past decades. Present-day mobility is certainly not a mere extension in time of yesterday's. However recent researches disagree on the reason of increased mobility. While according to Orfeuil (1996, 2001) and Echenique (2001) distance covered by each trip have increased and the number of short journeys has fallen in connection with the fall of densities implying that mobility is the result of longer trips sustained in search of lower prices and better quality, the empirical data presented by Bontje (2000), a time series of daily mobility of the Dutch in the period 1987 to 1997, show that the growth of mobility appears to be one of short trips rather than of long ones. According to Bontje this is also the result of the long-term policies of urban compaction in the Netherlands whereas Wiel (1999) underlines how car use in France was facilitated by the supply of inter-urban and peri-urban transport infrastructures and the absence of institutional barriers to this phenomenon.

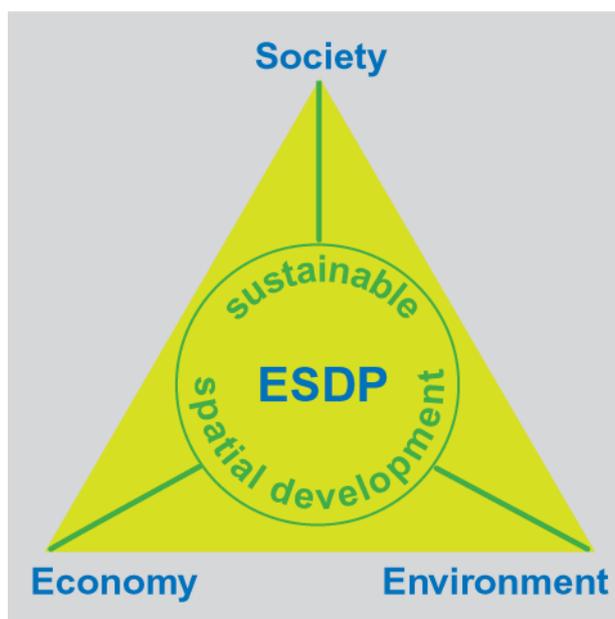
Another relevant issue related to the new forms of commuting is the spatial distribution of flows. The mobility pattern in peri-urban areas is characterised by a 'criss-cross' pattern: daily journeys are no longer for the largest part between suburb and city, but more and more city-to-city and suburb-to-suburb. Though commuting flows between the suburban centres, so-called "tangential" traffic, are still low, their importance is constantly increasing. "Radial" transport connections, linear links directed from the surrounding municipalities to the central cities, still dominate and penetrate ever further into the areas around the cities. This is a result of an efficient and constantly improved transportation system. But in outer metropolitan areas origins and destinations of trips are more diverse and thus more difficult to serve by public transit, especially for suburb-to-suburb trips that do not follow the main radial lines to the centre. In contrast, public transport in suburban areas only fulfils a complementary function, apart from some efficient city railway and express railway systems in large agglomeration areas and inter-city connections (BBR, 2001; Bontje, 2001).

4.3. Consequences of Urban Sprawl

This section doesn't present a review of the debate on the sustainability of the dispersed model as opposed to the compact one. Even though we are aware of such debate we also realize that the existing literature is too rich to be reasonably and usefully reviewed in few paragraphs.

A major strand of the sustainability debate focuses on whether cities can be made more sustainable. In particular, much attention has been paid to the question of whether the arrangement of a city's physical elements, and the intensity of its use, affect its capacity to function in a sustainable way: can urban form itself render a city more, or less, sustainable? Responses to this question have been varied, and remain contentious. However, that there is a relationship of some kind between urban form and sustainability is now generally accepted. As Breheny and Rookwood (1993) argue, "It is clear that a major strategic factor determining sustainability is urban form; that is, the shape of settlement patterns in cities, towns and villages" (1993, p. 151). What this link may be however is less certain and the debate on the sustainability of different city forms, roughly grouped into compact models and diffused models is still open. The complexity embedded in a polysemic and inclusive concept such as that of sustainability do not allow for a straightforward assessment of the different "costs" of urban dispersion. Following the sustainability goals promoted by the European Spatial Development perspective (fig. 2) impacts can be grouped into more or less homogeneous categories, which can help in structuring the research framework.

Fig. 2. Triangle of Objectives: a Balanced and Sustainable Spatial Development



(Source: European Commission, 1997)

4.3.1. Ecological Costs

4.3.1.1. Land consumption

“The use of land for urban development and transport in the EU continues to harm the environment through, for example, loss of high quality arable land, destruction of biotopes and fragmentation of eco-systems. In some regions there are increasing spatial conflicts between additional housing requirements, commercial developments, agricultural use and protection of open space” (European Commission, 1997).

Land consumption depends directly on the relative compactness of human settlements and on residential density. According to Orfeuill (2000) the amount of open space used by each inhabitant has increased in the last 20 years by two or three times. However this measurement of land consumption is not agreed upon. Camagni *et al* (2002) have calculated land consumption in urban development as the ratio of land area developed for residential and service use between 1981 and 1991 in each commune to the number of dwellings. “This indicator was preferred to the per capita consumption of land because the latter may increase in cases where the population of a commune declines, giving a false indication” (Camagni *et al* 2002). The results of their analysis proved that land consumption is actually declining rather than increasing.

But land consumption for residential use is not the only factor to be considered. Another factor to be borne in mind is the high consumption of land for road infrastructure: 25% of the total urban area in Europe and 30% in the United States. Research carried out in the Paris region showed that the private car, which accounts for 33% of total trips, consumes 94% of road space/hour; while the bus, with 19% of total trips consumes only 2.3%: in other words, a bus in movement consumes 24 times less space per passenger than a single car (Servant, 1996).

4.3.1.2. Energy consumption.

Energy consumption depends indirectly on the same variables as land consumption, via their linkage with mobility patterns: trip length and modal choice between private and public means. The level of petrol consumption can be used as a parameter of the level of car use. In these terms this level is increasing constantly since the late 70s. Opinions on the risk of depleting this non-renewable energy source due to urban sprawl tend to differ. However both the United Nations and the European Union have moved in favour of a the compact town model embracing the position, supported by research (Newman, Kenworthy, 1989), that more dense cities consume the least amount of energy for transport. The compact city model is also claimed to allow energy-saving opportunities for new technologies, such as combined heat and power systems (HM Govt, 1994; Elkin *et al.*, 1991).

4.3.1.3. Atmospheric pollution

Before discussing any issues related to the relevance of air pollution and its possible connection with urban sprawl, it should be reminded that at present there is considerably little agreement on what constitutes an acceptable level of pollution and on how this should be measured.

Researchers have proved that these pollutants have dramatically increased the level of risk for human health. However it is hard to establish a direct connection between urban density by itself and the increase in the amount of atmospheric pollution.

The level of pollution due to motorcar dependency can more easily be connected to population densities (Höjer, 2000). Studies have shown different results. Some support the hypothesis that more compact (and therefore dense) city models limit the number of journeys and the length of car travel and that dense areas have three times less emission than dense areas. According to Burton (2000), it is possible that the compact city may present a health risk due to localised air pollution, particularly from traffic, but also from the closer proximity of residential and industrial uses. Increasing trends in air pollution over the past 40 years have been linked with increases in respiratory diseases such as asthma and lung cancer.

Despite these studies it cannot be infer that density alone is sufficient to explain the level of pollution. This relationship between density level and pollution is arguable and should be further investigated to understand which activities should be more concentrated. If population and jobs however concentrated remains separated, little improvement is to be seen with regard to pollutant reduction.

4.3.2. Economic Sustainability

The economic sustainability of the dispersed city model must be addressed at two different scales. On one hand there is the individual level. Urban sprawl tends to impose several and often hidden costs (notably transport costs) on individuals and households. A study on the area of Ile-de-France has shown strong correlation between the distance from the city centre and the percentages of the households' budget devoted respectively to housing and transport (Pumain, 2002). On the other hand, at the macro-economic level, issues of economic efficiency and economic performance of cities emerge.

Urban sprawl is often associated with high costs of urbanisation (Boscacci and Cogato, 2001). Due to the low density of housing and population and to the scattered pattern of urbanisation the economic feasibility of public services, especially transport services could be questioned. Unfortunately data collection and a complex framework of interconnected factors make the economic analysis and modelling of the *costs and benefits associated with urban sprawl* particularly difficult.

Issues of *economic performance and city size or form* can also be raised, even though the debate remains still largely theoretical. If it is difficult to establish a causal link between the size of cities and their economic efficiency, it is even the more speculative to associate the latter with urban density. Recent studies (Prud'homme, 2000; Cervero, 2001), indicate that places with sprawling, auto-centric landscape are poor economic performers while economic advantages of agglomeration and of higher employment densities still persist for large cities and that various innovations (notably new information and communication technologies) can help overcoming the restrictions on growth related to congestion.

4.3.3. Spatial Segregation and Social Cohesion

In European cities mostly affected by dynamics of sub-urbanisation and sprawl, space has developed according to clear patterns of social ecology. These patterns can be described as a concentric model of population distribution on the base of age, family size, social and professional class. The degree of spatial demographic segregation of household and family structures vary sharply as one moves outwards from the central city towards the suburbs and has been greatly accentuated during the 1980s (Gober, 1990). The European city, the very place of social interaction, innovation and exchange, risks weakening this fundamental role as a result of the cumulative effect of decentralisation tendencies, increasing specialisation of land uses and social segregation (Camagni and Gibelli, 1996).

However European cities do not completely conform to the American model, according to which city centres are mainly characterised by the lowest and the highest classes, and the suburban areas by middle class households (Hall, 1993). Moreover differences must be made with regard to the size of cities. Large cities display a different population distribution pattern from medium size cities and seem to comply more to the American model while smaller cities show lower levels of segregation and sometimes trends of social mixing and inclusion in their suburban areas.

Studies for the Paris area and other minor French cities (Berger, 1999) have demonstrated that professional qualification, households' size and income are among the variables which can describe location pattern. However location choices cannot only be explained by sociological factors. The role played by the housing market and policies in nurturing spatial segregation remains dominant to a point, which it has become the mean of social segregation in sprawling cities.

4.4. The Role of Planning

The efficiency of territorial policies is heavily dependent on their flexibility and on their capacity to adapt to specific local situations. A good and spatially exhaustive knowledge of regional variations of urban patterns is therefore needed before any spatial policies can be implemented. The specific processes of diffusion have to be anticipated when significant redistribution of trends is wanted.

4.4.1. The Planning System

The complex system of planning tools and planning levels of European countries (European Commission, 2001; Newman and Thornley, 1996) design an institutional framework, which is only potentially suitable and capable of controlling urban growth. The fragmented planning systems and the parallel institutional fragmentation (table 10) are considered the main barriers to an effective regulation of urban growth and therefore also urban sprawl. Countries with little or no spatial planning activity at the intermediate or regional level lack of the correct perspective to capture actual growth dynamics.

Table 10. Groups of national planning systems in Europe

Group	Countries	Characteristics
1. 'British'	UK, Ireland	'Evolutionary case law' (legal framework for planning is built up gradually, 'decision by decision') No legal protection of local government Strong control/monitoring from national level of local planning actions
2. 'Napoleonic'	Netherlands, Belgium, Luxembourg, France, Spain, Portugal, Italy, Greece	Planning is 'systematic', with general rules and laws (national law on spatial planning) Planning system is hierarchical, with a clear division of tasks and responsibilities between the national, regional and local levels (subsidiarity) National and local levels are the most influential while the regional level is relatively weak
3. 'Scandinavian'	Sweden Norway, Denmark, Finland	National and regional planning is reduced to a minimum Local level is most important; local governments make very detailed plans Planning is 'systematic', with general rules and laws
4. 'Germanic'	Switzerland, Germany, Austria	Planning system is hierarchical, with a clear division of tasks and responsibilities between the national, regional and local levels (subsidiarity) Regional level (<i>Bundesländer, cantons</i>) is the most powerful Federal government gives 'guidelines', but has hardly any powers to force the regions to follow these guidelines

(Source: Newman and Thornley, 1996)

Some European countries (Belgium, Italy, Spain) have redesigned or are redesigning their institutional framework according to a federative model in order to redistribute administrative powers from the central to the intermediate level. In the case of Belgium for example, the Regions set up their own spatial planning framework. On the other hand, what is clear is the effect of the spatial fragmentation of fiscal policies. In France where such framework already exists, not only co-operation between administrative units is poorly practised, but also communes compete with one another in the quest for collecting more population (i.e. housing) and jobs (i.e. business and industrial enterprises) as this will lead to higher public revenues (by means of local taxes). Since each unit autonomously sets its own rates of taxes, less urbanised communes in the peripheral areas will be likely to set low rates to attract economic activities and new residents (Pumain, 2002).

Despite the efforts of the European Union to promote international and interregional co-operation in the field of spatial planning, the role and importance of local and national policies in designing the spatial organisation of European cities and territories remain dominant.

4.4.2. Transport Policies and Infrastructure Investment

In the past 40 years the impact of transport policies and infrastructure investments has been contradictory. The motorway construction in the 50s and 60s has favoured the shift from public transport to the private, which, given all the conditions discussed so far, has brought de-concentration within larger urban areas. Beginning in the 70s and spanning throughout the 80s a shift in public investment for transport infrastructure has tried to reverse these trends. These investment were focused on public infrastructure connecting inner and outer

suburbs and peripheries to the central business district thus supporting a centripetal transport model and a monocentric urban system. Examples of these investments can be found in the light rail, metro, express commuter rail of several European cities (the RER in France or the S-Bahn in Germany; Hall, 1993). Little attention has been given to the problems of commuting and more generally of transit within the emerging intra-urban polycentric systems especially with regards to the so called “tangential” mobility.

One of the main shortcomings of these projects is the lack of consideration for the urban context within which they operate. In most European countries, urban planning and transport planning have been carried out as independent activities, relating to separate services of the local authorities, and co-ordination procedures between the two have been minimal. The result of this lack of integrated planning are both aesthetic, with the destruction of urban and natural landscapes, and functional with a loss of control on the changing land-uses and urbanisation processes. Recognising that the understanding of the links between urban shape and large scale transport infrastructure is becoming more blurred due to the increasing complexity of the dynamics of urban dispersal, recent researches have mainly focused in the collection of case-studies from which an agenda for future transport planning can be drawn (European Commission, 2000).

4.4.3. Urban Containment Policies

The European Union has pronounced itself in favour of the compact city model (European Commission, 1990) and of the polycentric regional systems (European Commission, 1997). In this sense the EU has embraced a successful approach adopted in some European countries where policies of urban containment have been balanced by strategies of “concentrated de-concentration”.

Policies of urban containment are widely used in land-use planning and as a means of reducing urban sprawl and of preserving farmland. Green Belts and buffer zone policies based on more or less strict land-use control are the most common approaches. However critics charge that urban containment policies, like urban growth boundaries, eventually place regions at a competitive disadvantage by driving up land costs and eventually wages. Dawkins and Nelson (2002) have reviewed the current state of knowledge about the effects of urban-containment boundaries on house prices in the US. Their conclusion is that urban containment programs do affect land prices.

The policy of concentrated de-concentration, in which the Dutch government tried to direct out-migration from the largest cities to a selection of growth centres, has reached international acclaim (Faludi, 1994; Hall, 1992). The policy of concentrated de-concentration however has been only a partial success: population and employment growth is becoming more and more scattered; it often takes place independently of the spatial planning goal to concentrate growth on focus locations designated by planning. Thus it can be observed that smaller suburban municipalities without central place functions have the greatest growth (Bontje, 2000, BBR, 2001).

4.5. Conclusions

The issues discussed in this paper do not converge towards a definition of European sprawl but try to outline a research agenda of essential elements that should be taken into account when investigating, both from a qualitative and a quantitative perspective, the differences and similarities of European urban and regional developments.

What should be kept in mind is that the chance to tackle with urban sprawl lies not only in our ability to clearly identify its causes and consequences but also in the capacity to manage and monitor growth in a flexible and feasible way such that it will allow us to reach equitable and

sustainable goals. Summarising the debate on spatial, demographic economic and institutional trends that are running across Europe, confusion emerges rather than flexibility. What is required to bring urban research and policy design out of this confusion could be a step-by-step agenda on the basis of which individual issues first and relationships between them secondly can be investigated. Issues of spatial distribution of population trends reveal how little we know on the new social geography of the European "urban habitat", while the impact of the informational and service industries on local urban environments remains out of the scope of researches which concentrate on the international scale to which issues of urban competitiveness and urban marketing belongs. The weakness of this knowledge framework certainly doesn't help to design, monitor and assess urban and transport policies.

In this perspective, SCATTER will attempt to add some knowledge, as far as possible in a systemic and multidisciplinary way, to the understanding of mechanisms and effects of urban sprawl.

5. MEASURES OF SPRAWL: A PRELIMINARY ASSESSMENT

From the review presented in parts 3 and 4 above, it is clear that there are as many measures of sprawl as there are elements that make up urban growth in general. In short, for every aspect of the city that we consider is changed and influenced by growth, then there might, in principle, be a measure of sprawl that is associated with it. This association, of course, involves the costs and benefits which flow from such growth and its pattern, and thus our measures must be intimately related to such costs and benefits.

We thus propose a two stage process to developing measures of sprawl which will be refined in the subsequent analysis of the 6 case studies that we are engaged in. These two stages are:

- **Stage 1: to define measures which show how the components of urban growth vary under different kinds of growth regime**
- **Stage 2: to generate the costs and benefits that are associated with such measures and their variation.**

Whether or not a measure is useful will depend on how easy it is to associate costs and benefits with it. Moreover, whether it is possible to use it will depend also on whether or not data exists to implement its measurement. Also, the interviews of attitudes towards urban growth and sprawl which will be conducted in Workpackage 2 will give us some sense of the importance of different measures and the final set we will use will take this into account. It is little use defining measures which we consider theoretically perfect if we cannot induce specific costs and benefits associated with them, or find data to measure them. If potential users of these measures do not consider them to be important, then this will limit their relevance too.

We consider that there are at least five types of generic measure, all of which will detect different spatial/physical/geographical configurations of urban growth. These five types are:

- **Density:** these relate to the intensity which land or space is used with the general assumption that as densities increase, then costs and benefits will vary regularly or continuously reflecting economics and diseconomies of scale.
- **Configuration:** the compactness, spread and fragmentation of the urban system is an issue that is reflected in different patterns of urban growth. For example dispersed and fragmented patterns are harder to service and more costlier to interact with than more compact development while more compact developments can increase congestion, hence lead to increased costs.
- **Accessibility:** the interaction between different areas through physical movement of people and goods is reflected in the relative nearness of places. Generally accessibility is a useful measure to detect overall nearness and this has implications for the amount (and cost) of travel as well as the congestion that is generated by such travel.
- **Construction:** the spatial pattern of growth can have implications for construction costs both in terms of getting facilities to sites in dispersed as opposed to compact settlements as well as the actual costs themselves of infrastructures that are dispersed rather than compact. Physical topography can also affect construction and this in turn can lead to dispersed or compact development.

- **Negative Physical Externalities:** there are a whole range of possible costs associated with negative impacts of different types of growth on ecological and natural systems such as animal populations, vegetation, and landscape as well as the hydrological cycle. These not only affect non-human populations but can affect the human population through their location
- **Negative Economic Externalities:** these largely, although not exclusively, relate to man-made elements of the environment and typically involve pollution as well as congestion and over-use of land and other resources.
- **Social Benefits and Costs:** relate to cost of community and neighbourhood, often hard to quantify but important to the interrelationship between populations in terms of social and related networks.

Measures based on these generic indicators will depend on detailed data and on our ability to define spatial variations sufficiently finely to detect significant changes between different patterns. Many measures based on density and on configuration have been developed in the literature on urban morphology to which various members of the CASA team have made contributions while measures of accessibility are very well developed in spatial interaction theory and have been developed, for example, in considerable detail by the STASA team and in the PROPOLIS project of which STRATEC and CASA are participants.

Construction costs are straightforward enough although we need to be careful to make sure that such costs are associated with different aspects of the urban system that do genuinely vary with respect to different types of growth and sprawl. In terms of the physical, economic and social measures which reflect negative externalities, then we need to do much more work on these although the indicators in the PROPOLIS project are a starting point. In a sense, this is where our project begins to link with a variety of other projects dealing with sustainability indicators.

Each of these measures can be applied to different elements that make up the urban system. For example, we can distinguish between different sectors such as population, employment, transport, entertainment and leisure, and various disaggregations of these with respect to type, interactions between sectors, and so on. We can consider the system both in terms of these activities and we can change the scale to more physical elements such as buildings, roads, utilities and so on. For each of these we can develop different measures of density, configuration accessibility and so on.

We could also consider more composite indices of sprawl which might be based on weighted linear combinations of these measures. In this sense, we immediately raise the problem of how important each of these measures might be in any composite evaluation and this introduces the thorny problems of weighting different measures. Finally we consider that we should develop measures which are associated with risk and uncertainty both in terms of the relevance of the measures themselves and in terms of the extent to which these measures detect risk and vulnerability in different patterns of urban growth. To conclude, we refer the reader to a report on specific quantitative measures already written by members of CASA and available on the web (see http://www.casa.ucl.ac.uk/measuring_sprawl.pdf).

6. SUBSEQUENT WORKPACKAGES

6.1. A Continuing Review

As we have been at pains to point out, our review is a continuing one and the various workpackages that are being developed will continue to provide new information and new insights into the nature of sprawl in Europe and how we can deal with it. In fact the SCATTER project is organised to deal with different aspects of sprawl in European cities through many different forums. In the next five workpackages, we will elaborate the typology, and the measure of sprawl, gradually moving to look at policies to deal with sprawl. In WP2 which has just begun, we will initiate a systemic analysis of urban sprawl through interview by experts in the case cities. In WP3, we will take the material of the last section forward with respect to a statistical analysis in the case cities. In WP4, we will look at policy measures to deal with sprawl while in WP5, we will be concerned with simulating policy measures tackling sprawl using established land use transport models. Finally in WP6, we will assess impacts of the simulated measures.

6.2. Next Steps

The next steps are clear. To supplement and complement this review through interviews of experts as to how significant they see the problem of sprawl in our case study cities (WP2), to then examine data and mathematical measures of sprawl (WP3), and then to add to this review, ideas as to how policy makers have begun to tackle sprawl both in Europe and the USA (WP4).

7. REFERENCES

- Archer, R. W. (1973) 'Land Speculation and Scattered Development; Failures in the Urban Fringe Land Market', *Urban Studies* 10, 367-372.
- Arnott R. (1998), Economic Theory and the Spatial Mismatch Hypothesis, *Urban Studies*, 35(7), pp. 1171-1185.
- Audirac, I., Shermeyen, A . H., & Smith, M. T. (1990) 'Ideal Urban Form and Visions of the Good Life: Florida's Growth Management Dilemma', *Journal of the American Planning Association* 56 (Autumn) 470-482.
- Baerwald, T. J. (1978) 'The Emergence of a New Downtown', *Geographical Review* 68 308-318.
- Bahl, R. (1969) 'A Land Speculation Model: the Role of the Property Tax as a Constraint to Urban Sprawl', *Journal of Regional Science* 8 (2) 199-208.
- Batten D.F. (1995) Network cities: creative urban agglomerations for the 21st century, *Urban Studies*, 32(2), pp. 313–327.
- Batty M. (2001), Polynucleated Urban Landscapes, *Urban Studies*, 38(4), pp. 635–655.
- BBR (Federal Office for Building and Regional Planning) (2001), *Spatial Development and Spatial Planning in Germany*, Bonn, BBR.
- Berry B. (1976), *Urbanization and Counterurbanization*, *Urban Affairs Annual Reviews*, Vol 11, Sage Publications, California.
- Blumenfeld, H . (1986) 'Metropolis Extended: Secular Changes to Settlement Patterns', *Journal of the American Planning Association* 52 (3) 346-348.
- Bontje M., (2000), Urban Fields, A Realistic Perspective? Recent Trends in Daily Mobility as Indicators for Urban Field Formation in The Netherlands, Paper presented at the ENHR 2000 conference in Gävle 26 - 30 June 2000.
- Bontje M., (2001), Dealing with Deconcentration: Population Deconcentration and Planning Response in Polynucleated Urban Regions in Northwest Europe, *Urban Studies*, 38(4), pp. 769-785.
- Boscacci F. and Cogato L. (2001), Costi collettivi e benefici economici dei sistemi della mobilità nei diversi contesti dell'area padana. Interrelazioni tra reti infrastrutturali e modelli di insediamento, in F. Boscacci, R. Camagni, G.P. Corda, A. Moretti, *Mobilità, modelli insediativi ed efficienza territoriale*, Quaderni del Dipartimento di Architettura e Pianificazione, Milano.
- Bourne, L. S. (1992) 'Self Fulfilling Prophecies? Decentralization, Inner City Decline and the Quality of Urban Life', *American Planning Association Journal* 58 (4) 508-513.

Boyce, R. R. (1963) 'Myth Versus Reality in Urban Planning', *Land Economics* 39 (3) 241-251.

Breheny, M. (1992) 'The Contradictions of the Compact City: A Review', in M. Breheny, eds, *Sustainable Development and Urban Form*, Pion Ltd, London.

Breheny, M. and Rookwood, R., (1993), Planning the sustainable city region, in Blowers, A. (ed.), *Planning for a Sustainable Environment*, Earthscan, London.

Breslaw, J.A. (1990) 'Density and Urban Sprawl: a Comment', *Land Economics* 66 (4) 464-469.

Burton E (2000), The Compact City: Just or Just Compact? A Preliminary Analysis *Urban Studies*, 37(11), pp. 1969-2001.

Camagni, R., Gibelli, M.C., (1996), *Cities in Europe: Globalisation, Sustainability and Cohesion*, in Presidenza del Consiglio dei Ministri, Dipartimento Politiche Comunitarie, European Spatial Planning, Rome, Poligrafico dello Stato.

Castells, M. (1989) *The Informational City: Information Technology, Economic Restructuring and the Urban-Regional Process*. Oxford, Blackwell Publishers.

Castells, M. (1996), *The rise of the Network Society*, Oxford, Blackwell.

Cattan N., Pumain, D., Rozenblat C., Saint-Julien, T. (1999), *Le système des villes européenne*, Paris, Anthropos, coll. Villes, 201.

Cervero R. (2001), Efficient Urbanisation: Economic Performance and the Shape of the Metropolis *Urban Studies*, 38(10), pp. 1651-1671.

Champion A.G. (1994), Population Change and Migration in Britain since 1981 : Evidence for Continuing Deconcentration, *Environment and Planning A*, 26, pp. 1501-1520.

Champion A.G. (ed.) (1989), *Counterurbanisation: The Changing Pace and Growth of Population Deconcentration*, London, Arnold.

Champion T. (1999), Migration and British Cities in the 1990s, *National Institute Economic Review*, 170, pp. 60-77.

Champion T. (2001), A changing Demographic Regime and Evolving Polycentric Urban Regions: Consequences for the Size, Composition and Distribution of City Populations, *Urban Studies*, 38, pp. 657-677.

Champion T. and Dorling D. (1994), Population Change for Britain's Functional Regions, 1951-1991, *Population Trends*, 83, pp14-23.

Cheshire, P.C. (1989) Explaining the recent performance of the European Community's major urban regions, *Urban Studies*, 27, pp. 311-333.

Cheshire, P.C. and Hay, D.G. (1989) *Urban Problems in Western Europe: An Economic Analysis*, London, Unwin Hyman.

Churchman, A. (1999) 'Disentangling the concept of density', *Journal of Planning Literature* 13 (4) 389-411.

Clawson, M. & Hall, P. (1973) *Planning and Urban Growth: An Anglo American Comparison*, Johns Hopkins Press, Baltimore.

Clawson, M. (1962) 'Urban Sprawl and Speculation in Suburban Land', *Land Economics* 38 (2) 99-111.

Clawson, M. (1971) *Suburban Land Conversion in the U.S.: An Economic and Governmental Process*, John Hopkins Press, Baltimore.

Couclelis, H. (2000) From sustainable transportation, to sustainable accessibility: can we avoid a new 'tragedy of the commons'?, in D.G. Janelle and D.C. Hodge (eds.) *Information, Place, and Cyberspace: Issues in Accessibility*, pp. 341–356. Berlin, Springer Verlag.

Cullingworth, J. B. (1960) 'Restraining Urban Growth: the Problem of Overspill', *Fabian Research Series 211*, Fabian Society London

Danielsen, K. A., Lang, R. E., & Fulton, W. (1999) 'Retracting suburbia: Smart growth and the future of housing', *Housing Policy Debate* 10 (3) 513-540.

DeRango K. (2001), Can Commutes Be Used to Test the Spatial Mismatch Hypothesis?, *Urban Studies*, 38(9), pp. 1521-1529.

Downs, A. (1999) 'Some Realities about Sprawl and Urban Decline', *Housing Policy Debate* 104 (4) 955-974.

Echenique M. (2001), Mobility and Space in Metropolitan Areas, in M. Echenique and A. Saint, *Cities for the New Millennium*, London, Spon Press.

Editors of Fortune, eds., (1958) *The Exploding Metropolis*, Doubleday and Co., New York.

Elkin T., McLaren D., Hillman M., (1991), *Reviving the City; Towards Sustainable Urban Development*, Friends of the Earth, London.

European Commission (1990), *Green Paper on the Urban Environment*, Bruxelles, Office for Official Publications of the European Communities.

European Commission (1991), *Europe 2000: Outlook for the development of the Community's territory*, Luxembourg, Office for Official Publications of the European Communities.

European Commission (1994), *Europe 2000+: Co-operation for European territorial development*, Luxembourg, Office for Official Publications of the European Communities.

European Commission (1997), *ESDP—European Spatial Development Perspective: Towards a Balanced and Sustainable Development of the Territory of the European Union*, Luxembourg, Office for Official Publications of the European Communities.

European Commission (2000), *COST Action C2, Impacts of Major Transport Infrastructures on the Quality of Urban Shape, European Case Studies*, Luxembourg, Office for Official Publications of the European Communities.

European Commission (2001), *The EU compendium of spatial planning systems and policies*, Luxembourg, Office for Official Publications of the European Communities.

Ewing, R . (1991) *Developing Successful New Communities*, Urban Land Institute, Washington, D.C.

Ewing, R . (1994) 'Characteristics, Causes and Effects of Sprawl: A Literature Review', *Environmental and Urban Issues. FAU/FIU Joint Center*

Ewing, R . (1997) 'Is Los Angeles Style Sprawl Desirable?', *Journal of the American Planning Association* 63 (1) 107-127.

Faludi, A. (1994) Coalition building and planning for Dutch growth management: the role of the Randstad concept, *Urban Studies*, 31, pp 485–507.

Freeman, L. (2001) 'The effects of sprawl on neighborhood social ties: an explanatory analysis.', *Journal of the American Planning Association* 67 (1) 69-82.

Friedmann, J. and Wolff, G. (1982) World city formation: an agenda for research and action, *International Journal of Urban and Regional Research*, 6, pp. 309–344.

Gershuny, J.I. and Miles, I., (1983), *The new service economy: the transformation of employment in industrial societies*, London, Frances Pinter.

Gober, P. (1990) The urban demographic landscape: a geographic perspective, in: D. Myers (ed.), *Housing Demography. Linking Demographic and Housing Markets*, pp. 232-248., Madison , WI, University of Wisconsin Press.

Gordon, P. & Richardson, H. W. (1997a) 'Are Compact Cities a Desirable Planning Goal?', *Journal of the American Planning Association* 63 (1) 95-106.

Gordon, P. & Richardson, H. W. (1997b) 'Where's the Sprawl?', *Journal of the American Planning Association* 63 (2) 275-278.

Gordon, P. & Richardson, H. W. (1998) 'Defining Cities', *Journal of Economic Perspectives* 12 (4) 236-237.

Gordon, P. & Richardson, H. W. (1999) 'Review Essay: Los Angeles, City of Angels? No, City of Angles', *Urban Studies* 36 (3) 575-591.

Gordon, P. & Richardson, H. W. (1999) 'The City: L.A. and Urban Theory at the End of the Twentieth Century', *Urban Studies* 36 (3) 575-591.

Gordon, P. & Wong, H. L. (1985) 'The Costs of Urban Sprawl - Some New Evidence', *Environment and Planning A* 17 (5) 661-666.

Gottdiener, M. (1977) *Planned Sprawl: Private and Public Interests in Suburbia*, Sage Publications, Beverly Hills, California.

Gottlieb P.D. and Lentnek B. (2001), Spatial Mismatch is not Always a Central-city Problem: An Analysis of Commuting Behaviour in Cleveland, Ohio, and its Suburbs, *Urban Studies*, 38(7), pp. 1161-1186.

Gottmann, J. & Harper, R. . Gottmann, J. & Harper, R., eds., (1967) *Metropolis on the Move: Geographers Look at Urban Sprawl*, John Wiley and Sons, New York.

Gottmann, J. & Harper, R. A., eds, (1990) *Since Megalopolis: The Urban Writings of Jean Gottmann*, Johns Hopkins University Press, Baltimore and London

Graham, S. and Marvin, S. (1996), *Telecommunications and the City; Electronic Spaces, Urban Places*, London, Routledge.

Guérois M. and Pumain, D. (2002), *Urban Sprawl in France (1950-2000)*, Milano, Franco Angeli.

Hall P. et al. (1973) *The Containment of Urban England: Vol. 1 Urban and Metropolitan Growth Processes or Megalopolis Denied*, George Allen and Unwin, London.

Hall P., Marshall S. and Lowe M. (2001), The Changing Urban Hierarchy in England and Wales, 1931-1998, *Regional Studies*, 35(9), pp 775-807.

Hall, P. (1992), *Urban and Regional Planning* (3rd ed.), London. Routledge.

Hall, P. (1993), Forces Shaping Urban Europe, *Urban Studies*, 30(8), pp. 883-898.

Hall, P. (1997) *Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century*, Blackwell Publishers, Oxford.

Hall, P. (1997) Modelling the post-industrial city, *Futures*, 29, pp. 311–322.

Harvey, E. O. & Clark, W. (1965) 'The Nature and Economics of Urban Sprawl', *Land Economics* 41 (1) 1-9.

HM Government, (1995), *Our Future Homes, Opportunity, Choice, Responsibility, The Governments' Policies for England and Wales*, Department of the Environment and Welsh Office, HMSO, London.

Jackson, K. (1985) *Crabgrass Frontier: the Suburbanization of the United States*, Oxford University Press, Oxford.

Johnson, M. P. (2001) 'Environmental Impacts of Urban Sprawl: a Survey of the Literature and proposed Research Agenda', *Environment and Planning A* 33 (4) 717-736.

Kain J. (1968), Housing segregation, negro employment, and metropolitan decentralization, *The Quarterly Journal of Economics*, 82, pp. 175-183.

Kain, J. (1992) The spatial mismatch hypothesis: three decades later, *Housing Policy Debate*, 3, pp. 371-460.

Keil, R. (1994) 'Global Sprawl: Urban Form After Fordism', *Environment and Planning D* 12 (2) 131-136.

- Kloosterman R.C. and Musterd S. (2001); The Polycentric Urban Region: Towards a Research Agenda, *Urban Studies*, 38(4), pp. 623–633.
- Knox, P.L. (1995), World cities and the organization of global space, in R.J. Johnston, P.J. Taylor and M.J. Watts (eds), *Geographies of Global Change: Remapping the World in the Late Twentieth Century*, pp 232-247, Oxford, Blackwell.
- Lessinger, J. (1962) 'The Case for Scatteration', *Journal of the American Institute of Planners* 28 (3) 159-169.
- Martin R.V., (2001), Spatial Mismatch and Costly Suburban Commutes: Can Commuting Subsidies Help?, *Urban Studies*, 38(8), pp. 1305-1318.
- Mumford, L. (1964) *The Highway and the City*, Mentor: The New American Library, New York.
- Newman P. and Thornley A. (1996), *Urban Planning in Europe: International Competition, National Systems and Planning Projects*, London, Routledge.
- Ogden P.E. and Hall R. (2000), Households, Reurbanisation and the Rise of Living Alone in the Principal French Cities, 1975 – 90, *Urban Studies*, 37(2), pp. 367-390.
- Ohls, J. C. & Pines, D. C. (1975) 'Discontinuous Urban Development and Economic Efficiency', *Land Economics* 51 (3) 224-234.
- Orfeuil J.P. (1996), Urbain et périurbain: qui va où?, *Urbanisme*, 289, pp. 52-57
- Orfeuil J.P. (2001), *L'évolution de la mobilité quotidienne. Comprendre le dynamiques, éclairer le controverses*, Synthèses INRETS, 37(146).
- Ottensmann. J. R. (1977) 'Urban Sprawl, Land Values and the Density of Development', *Land Economics* 53 (4) 389-400.
- Peiser, R. (1989) 'Density and Urban Sprawl', *Land Economics* 65 (3) 193-294.
- Peiser, R. (1990) 'Density and Urban Sprawl: a Reply', *Land Economics* 66 (4) 469-473.
- Peiser, R. (2001) 'Decomposing Urban Sprawl', *Town Planning Review* 72 (3) 275-298.
- Pendall, R. (1999) 'Do Land Use Controls Cause Sprawl', *Environment and Planning B* 26 (4) 555-571.
- Prud'homme R. and Lee G. (1999), Sprawl, speed and the efficiency of cities, *Urban Studies*, 36(11), pp. 1849-1858.
- Pumain D. and Saint-Julien T. (1993) Le Réseau des Villes de Dimension Européenne, *Hommes et Terres du Nord*, 1, pp. 15-25.
- Razin, E. & Rosentraub, M. (2000) 'Are fragmentation and sprawl interlinked? North American evidence', *Urban Affairs Review* 35 (6) 821-836.

- Richardson, H. W. & Gordon, P. (1993) 'Market Planning-Oxymoron or Common Sense', *Journal of the American Planning Association* 59 (3) 347-352.
- Sassen S. (1991), *The Global City: London, New York, Tokyo*, Princeton, NJ, Princeton University Press.
- Sassen S. (1997), Electronic Space and Power, *Journal of Urban Technology*, 4(1), pp. 1-17.
- Scott A.J., (2001), Globalization and the rise of the city region, *European Planning Studies*, 9(7), pp.813-826.
- Self, P. (1961) *Cities in Flood: the Problems of Urban Growth*, Faber and Faber, London.
- Servant L. (1996), L'automobile dans la ville, *Cahiers du IAURIF*, n. 114.
- Simmie J. (ed.) (2001), *Innovative cities*, London, Spon Press.
- Sinclair, R. (1967) 'Von Thunen and Urban Sprawl', *Annals of the Association of American Geographers* 57 72-87.
- Smyth, H. (1996) Running the Gauntlet - a compact city within a doughnut of decay, in Jenks, M. et al. (ed.) *The Compact City - A Sustainable Urban Form*, pp. 101-113. London, E & FN Spon.
- SPESP, (2000), *Annex 1 Review of comparative studies on the networks of European towns and cities*.
- Spreiregen, P., eds., (1967) *The Modern Metropolis: Its Origins, Growth, Characteristics and Planning. Selected Essays by Hans Blumenfeld*, MIT Press, Cambridge, Mass.
- Storper M. (1997), *The Regional World. Territorial Development in a Global Economy*. New York: Guilford Press.
- Summers A., Cheshire P.C. and Senn L. (1999), *Urban Change in the United States and Western Europe: Comparative Analysis and Policy* Urban Institute Press.
- Taylor, P.J. (2000), World cities and territorial states under condition of contemporary globalization, *Political Geography*, 19(1), pp5-32.
- Torrens, P. and Alberti, M. (2000) *Measuring Sprawl, Working Paper n. 27*, Centre for Advanced Spatial Analysis, London, UCL.
- Transportation Research Board, National Research Council (1998) *The Costs of Sprawl – Revisited*, National Academy Press, Washington, D.C.
- United Nations (1998) *World Urbanization Prospects The 1996 Revision: Estimates and Projections of Urban and Rural Populations and of Urban Agglomerations*, United Nations, New York.
- Van Den Berg L., Braun E. and Van Winden W. (2001), *Growth Clusters in European Metropolitan Cities*, Aldershot, Ashgate.

SCATTER

Vining, D.R. and Pallone, R. (1982), Migration between core and peripheral regions: a description and tentative explanation of the patterns in 22 countries, *Geoforum*, 13, pp. 339–410.

Weitz, J. & Moore, T. (1998) 'Development inside urban growth boundaries - Oregon's empirical evidence of contiguous urban form', *Journal of the American Planning Association* 64 (4) 424-440.

Whyte, Jr., W. H. (1958) Urban sprawl, in The Editors of Fortune, *The Exploding Metropolis*, Doubleday and Co., New York, 115-139

Wiel M. (1999), *La transition urbaine, ou le passage de la ville pédestre à la ville motorisée*, Liege, Mardaga.