Housing, compact city and sustainable development: some insights from recent urban trends in Switzerland

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Abstract:

One of the debates on the sustainability of housing is the spatial dimension of human settlements and the importance of location in influencing the level of resource and energy consumption. Urban sprawl has often been criticized given its environmental, social and economic impacts. In reaction to sprawl city, the model of the compact city has been promoted in many countries. Based on empirical data and information on urban trends in Switzerland, this paper discusses three critiques that are usually addressed to the model of the compact city. These critiques are related to its feasibility and desirability, its social consequences and its environmental implications.

Keywords:

Housing; Compact City, Sustainable Development; Urbanization; Residential Mobility; Urban Regeneration; Switzerland.

1 INTRODUCTION: HOUSING AND THE SUSTAINABILITY AGENDA

Sustainability has been on the political agenda for more than two decades as shown by the organisation of international summits such as the United Nations Conference on Environment and Development in Rio de Janeiro (1992) and, more recently, the United Nations Climate Change Conference in Copenhagen (2009). There has been a wide ranging discussion about implementing sustainable development most notably concerning issues related to agriculture, mobility, industry, tourism as well as housing.

Debates on the environmental sustainability of housing have addressed two main aspects: housing as an “envelope” and its location. The first aspect has lead to the definition of construction guidelines in order to reduce the ecological footprint of housing. These principles concern issues like the life cycle of building materials, or the choice of techniques (heating, lighting, etc.) in order to limit the level of resource and energy consumption. Such principles have been implemented in projects of eco-buildings, eco-neighbourhoods or low-carbon cities. The second aspect, which is addressed in this paper, has stressed the spatial dimension of human settlements and the importance of location in influencing the level of resource and energy consumption (notably through mobility practices). A lively debate has tackled these questions by focusing on urbanization trends and urban morphology. It has opposed the model of the sprawl city with the one of the compact city.

Urban sprawl – or the strong demographic growth of suburbs with a low density pattern – has been the main urbanization trend since the Second World War (European Environment Agency 2006). This urban development has been strongly criticized from an environmental point of view because it implies an important level of land consumption (and soil is a non renewable resource) and automobile dependence (Newman and Kenworthy 1999; Kahn 2000; Squires 2002; Cieslewicz 2002). To regulate urban sprawl, the alternative model of the compact city has been promoted (Ewing 1997; Frey 1999; Holden 2004). It has been argued that the densification of the built environment would slow down urban sprawl and limit both resource and energy consumption by reducing the role of the car and increasing the number of trips made by foot, by bicycle or by public transport (Fouchier 1997; Newman and Kenworthy 1999; Holden 2004). Several planning principles underlie the model of the compact city (Rérat 2008): densification o f the built environment, regeneration of industrial and urban wastelands, raising the height of buildings, functional mixing, articulation between urbanization and transport development, etc. From a demographic point of view, the compact city aims at increasing the population of cities by building new dwellings on underdeveloped sites contained in the urban fabric.

These principles have come increasingly to the fore in debates on land use planning policies in many countries. In the United States for example, anti-sprawl movements appeared in the 1990s (Burchell and Shad 1999). In the same way, coalitions are formed under the banner of smart growth or growth management, and call for a renewal of land regulation in order to take into account the environmental impacts of urban sprawl. In England, the government promotes an urban renaissance and has committed itself to the goal that 60% of new housing should be built on brownfield sites (Urban Task Force 1999). In the Netherlands, the ABC-policy is based on accessibility profiles and on the number of personnel/visitors of different types of activities so that the “right business is located to the right place”. In Switzerland, the federal government has defined guidelines for spatial development more in adequacy with sustainability. In its strategy to implement sustainable development it has for example suggested to stabilise the urbanized surface at the current level of 400 square meters per capita (Federal Office for Spatial Development 2005; Swiss Federal Council 2008, 19).

An intense debate has taken place for more than fifteen years on the supposed advantages of the compact city as well as on the drawbacks that might come along with it (Breheny 1992; Frey 1999; Jenks, Burton and Williams 1996; Holden 2004; Dubois and Van Criekingen 2005). Dubois and Van Criekingen (2005) identified more precisely three sets of critiques: the feasibility of the compact city, its social implications and its environmental consequences.

The first critique addressed to the compact city is its feasibility from the point of view of both supply and demand in the housing market. On the one hand, the potential of densification in urban areas could be too limited to curb urban sprawl. On the other hand, the compact city is said to be unworkable because it would be undesirable for households and incompatible with their residential aspirations (Gordon and Richardson 1997). Some scholars even speak of undemocratic planning:

“Such a prevention of dispersed city growth could only be implemented by draconian interventions which could hardly be achieved in our democratic, freedom-orientated society and would represent encroachments on the self-determination of the communities and of people, on the land property market, the traffic and transport economy and the free choice of residence which could not be democratically legitimized through constitutional law. At present, only undemocratic countries can still enforce a compact city.” (Sieverts 2003, 123)

The second critique focuses on the social implications of densification and is rather contradictory with the former argument: the compact city is actually desirable but not socially neutral. The current projects of sustainable cities and eco-neighbourhoods are likely to focus only on the middle to upper class and therefore deepen social inequalities (Emelianoff 2007). The "zero-default city", according to Theys' word, would be financially inaccessible to most households (Theys 2002). Several researchers have underlined the risk of creating new social inequalities and of initiating gentrification processes. For example, the report of the Urban Task Force about urban renaissance in England has been considered as a "text-book gentrification" (Lees 2003). In its classic definition, gentrification designates the physical and social transformation of the existing housing stock in inner city neighbourhoods (Lees, Slater and Wyly 2008). This definition has been extended to new developments in which case we speak of new-build gentrification (Davidson and Lees 2005; Rérat, Söderström and Piguet 2010a). On the whole gentrification stresses the class aspects of urban changes and the social upgrading of some urban spaces.

The third critique is related to the environmental consequences of the compact city. This urban form is not necessarily compatible with the requirements of sustainable development because it could imply an increase in traffic congestion and in pollution, and a decrease in the quality of life (Breheny 1995). Functional mixing (housing and economic activities) would not reduce motorized traffic since it concerns only a small minority of urban dwellers who still experience the unity of time, of place and of work. For all the other inhabitants, the society of the functional division of space has withdrawn the possibility to work near the residence (Sieverts 2003). Others argue in the same vein that the benefits of proximity promoted by the model of the compact city are at odds with current trends:

"The revolution in information processing and telecommunications is accelerating the growth and dispersion of both economic activities and population, possibly moving towards the point where "geography is irrelevant". Yet at the same time, many planners (and policymakers) advocate "compact cities" as an ideal in contrast to the reality of increasingly spread-out metropolitan development." (Gordon and Richardson 1997)

A final critique regarding the environmental impact of the compact city is that the rationale underlying this model refers to the everyday mobility. Holidays and leisure could however fulfil a compensatory role for people living in a central location and create additional journeys (Holden 2004).

This paper aims at discussing the model of the compact city. It is based on different researches carried on urbanization in Switzerland and more precisely on the demographic evolution and the residential attractiveness of cities in this country. The methods, sources and elements of contexts are presented in the next section. The three kinds of critiques addressed to the compact city are then successively evaluated on the basis of empirical data and information regarding Switzerland as well as some theoretical considerations about urban change. The conclusion will review and assess some of the principle of the compact city.

2 CONTEXT AND METHODOLOGY

Switzerland has a highly integrated urban system. According to the Federal Statistical Office, 73.3% of the population lived in an urban area in 2000. The urban system is polycentric and reflects the federal and decentralized political organisation of the country. According to the official definition, the urban system is composed of 55 core cities of various size and their respective functional areas. In Switzerland the term city means the municipality (a political

entity) at the core of the urban region and is therefore larger than the city centre. Suburbs are defined according to functional and structural criteria such as the percentage of commuters (Schuler et al. 2005).

In this paper, some results are related to 25 cities[1] comprising over 1.5 million people in 2000. They constitute the main centres of the country, correspond to the densest areas and gather the common attributes of urbanity. Two data sources have been used. Population censuses provide exhaustive information on the characteristics and residential behaviour of city inhabitants. The 2000 census was the last to be organised and there is no similar subsequent data. The Annual Population Statistics complete the censuses by providing data on the resident population since 1981.

The analysis of recent regeneration projects in Swiss cities is based on two case studies: Neuchâtel and Zurich West. Neuchâtel is a medium size French speaking city (33,000 residents, 80,000 including suburbs). The housing units studied were either recently built or thoroughly transformed (former industrial buildings or warehouses) and the result of different size projects mainly located near the city centre or the train station. Zurich West is a district of German speaking Zurich, the country's largest city (359,000 residents, 1,132,000 including suburbs). In comparison to Neuchâtel, Zurich West is characterised by a higher degree of urbanity and the dwellings under study belong to projects of a hundred units or more located near the city centre. This district was previously one of the most important industrial areas in Zurich and has been regenerated during the last decade. In summer 2007, resident profiles were studied through questionnaires sent to all households living in dwellings built between January 2001 and August 2007 (493 in Neuchâtel and 630 in Zurich West). The response rates amount respectively to 46.3% and 44.8%.

Some results of other studies as well as theoretical discussions on urban sprawl complete the sources mentioned above. On the whole, this empirical material is used to discuss some aspects of the three kinds of critiques addressed to the model of the compact city and related to its feasibility and desirability, its social consequences and its environmental implications.

3 ASSESSMENT OF THE COMPACT CITY MODEL IN REGARD TO URBAN DYNAMICS IN SWITZERLAND

3.1 Feasibility of the compact city

The feasibility of the compact city has two applications: the potential of densification in central areas and its desirability for households. Several studies have addressed the first question in Switzerland. In the synthesis of a research programme on land use, it has been estimated that it would be theoretically possible to satisfy the total demand of housing space for 20 years within the existing built environment and even in existing buildings (Häberli et al. 1991). They would represent a stock of about 120 millions square meters of usable areas (in attic, in adjacent unused buildings, etc.) where two millions dwellings could be created. Another survey has estimated the potential of industrial wastelands equal to 17 millions square meters, which is equivalent to the area of the city of Geneva that includes 190,000 inhabitants and 140,000 jobs (ODT and OFEFP 2004). Medium and big cities concentrate 40% of these surfaces, which shows existing opportunities in the development of central

[1] These cities are : Aarau, Baden, Basel, Bellinzona, Bern, Biel, Chur, Fribourg, Geneva, Lausanne, Locarno, Lugano, Luzern, Neuchâtel, Olten, Schaffhausen, Sion, Solothurn, St. Gallen, Thun, Vevey/Montreux, Wil, Winterthur, Zug and Zurich,

areas. A second survey – more precise – has counted 350 wasteland sites for a total of 18 millions of square meters (Wüest & Partner 2008). This total is higher than the 2004 results although numerous densification projects have been carried out in the meantime. On the whole, these studies give a first hint that there is a real potential to increase the number of dwellings within the built environment of cities. The real potential of these areas will eventually depend on the density allowed by the planning documents (densities higher than what is usually found in Swiss cities would of course increase this potential) but also on the strategy of land owners and investors.

More than the question of the physical potential of densification, the main critique addressed to the feasibility of the compact city is its supposed inadequacy with residential aspirations and with the logical outcome of the market (Gordon and Richardson 1997; Sieverts 2003). One of the observations usually backing up this argument is the demographic decline of core cities and the growth of suburbs that have taken place for some decades in many contexts. In the case of Switzerland, according to population censuses, the 25 biggest cities lost one-tenth of their inhabitants (-10.47%; -191,176) between 1970 and 2000. Meanwhile, the suburbs registered high growth rates (+36.20%; +764,556).

To discuss the feasibility of the compact city, it is however necessary to go beyond the sole demographic evolution by taking into account the underlying mechanisms of urban sprawl. Among the numerous interpretations of the residential choice of households to live in suburbs (Bourne 1996), two types can actually be identified (Mieszkowski and Mills 1993; Adams et al. 1996). The first one explains urban sprawl as the outcome of households' preferences for residential amenities. It stresses for example some push factors of core cities (such as pollution or noise; that view has given birth to expressions like "flight from blight" or "urban exodus") and/or some pull factors of suburbs (proximity to nature, type of habitat, access to home-ownership, rural nostalgia, etc.). The latter interpretation has been dominant in many contexts such as in the United States (see Beauregard [2003] about the "voices of decline") and in Switzerland (Salomon Cavin 2005). Figure 1, which is taken from official publications, illustrates this perspective: it clearly links push factors (in that case, traffic, congestion and road enlargement in cities) with pull factors (quality of life in the "countryside") that generate a "flight from the city" and the "vicious cycle" of urban sprawl.

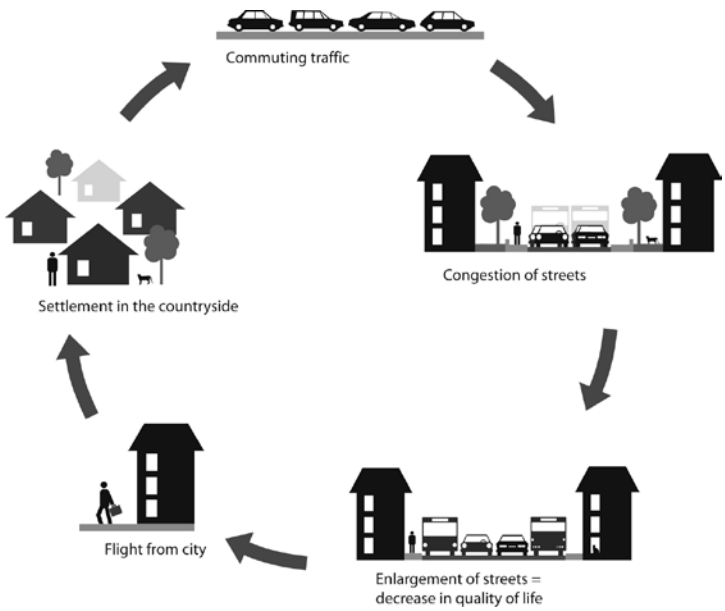

Figure 1: The vicious circle of agglomeration traffic[2]

At first glance such an interpretation sounds appropriate to explain the demographic loss of cities. It seems by the same token to back up the argument that the compact city is neither workable nor desirable. This view is however not sufficient to encompass all the complexity of urban development. This is more particularly the case in Switzerland where most core cities are characterized by a shortage of their housing market (the proportion of vacant dwellings is indeed very low; it accounts for example for 0.07% of the housing stock in Zurich in 2005). A second type of factors is needed to understand the demographic decline of core cities and the growth of suburbs. This type of factors, which is not exclusive with the first one (based on residential amenities), is called "natural evolution theory" (Mieszkowski and Mills 1993; Adams et al. 1996). It stresses the demand for new housing and for more land which can be explained by two phenomena: the decreasing size of households and the rising purchasing power. The former phenomenon is part of a wider trend called the "second demographic transition" (Van de Kaa 1987; Lesthaeghe and Neels 2002).

To understand the population evolution of core cities, it is necessary to unfold the mechanisms of the second demographic transition. It is mainly characterized by an ageing population and the destabilisation of the nuclear family (two married heterosexual adults with children). The declining fertility rate, the postponement of marriage, the instability of couples, and the longer life expectancy imply, on the one hand, a decrease in the average size of households and, on the other hand, a disparity between the pace of population evolution and a much stronger rate of increase in terms of households (Ogden and Hall 2000, 2004; Bunting 2004). This phenomenon is little present in the literature in urban studies so that it is considered as "the silent dimension of urban change" (Buzar, Ogden and Hall 2005). The number of households is however of utmost importance. As it is defined by the number of people sharing a flat, this indicator enables to link up demographic phenomena and the housing market. Non-traditional households are usually small and adult-centred (in contrast with families that are children-centred). Their number is not only increasing but they represent a demand for residential location in central areas (Frey and Kobrin 1982; Fishman 1999).

[2] This figure is taken from a publication of the Federal Office for the Environment (journal *Environnement*, 2, 2005). It was first published by the Canton of Bern (newsletter *Bulletin d'information pour les clients et les partenaires du Service des ponts et chaussées du Canton de Berne*, 7, 2004).

Such trends are clearly observable in Switzerland (table 1). As already mentioned, the 25 biggest cities lost one-tenth of their population between 1970 and 2000. The number of households increased meanwhile by 15%. This apparent contradiction is explained by the reduction of the average size of households (from 2.49 persons in 1970 to 1.91 in 2000), which is the consequence of a differentiate evolution according to the kind of household. One-person households doubled in three decades whereas three-person and larger households declined. This phenomenon is explained by the second demographic transition and by the fact that cities attract small adult-centred households while families tend to settle in suburbs.

In addition to their declining size and migration behaviour, households live in bigger housing units now than some decades ago due to the rising purchasing power. For example, the proportion of two-people households living in four-room apartments (three bedrooms and a living room) increased from 15.66% in 1970 to 28.65% in 2000 in the 25 cities taken into account. The proportion of people living alone in three-room apartments increased from 17.46% to 32.23% during the same period.

Table 1: Evolution of the number of households and inhabitants, 25 cities (1970-2000) (Sources: population censuses)

	In absolute number	**In percentage**
1-person households	+194,752	+100.91%
2-person households	+16,974	+7.71%
3-person households	-43,273	-34.10%
4-person and more households	-59,814	-38.21%
Total of households	+108,639	+15.60%
Population	-191,176	-10.47%

Due to the rising purchasing power and the decreasing size of households, housing space consumption has steadily risen, which explains why cities lost population with a housing market both in expansion and having a shortage. On the whole, a much more positive image of cities is given as they seem to have lost population between 1970 and 2000 because their housing stock was too limited to meet the rising demand for housing space and not only because many people aspire to owning a detached house in the suburbs. The weak attractiveness of cities seems to concern larger households – e. g. families – even though available data are not sufficient to measure the part of choice (residential aspirations) and of constraint (economic resources and availability on the housing market) in their behaviour[3].

This interpretation is reinforced by the demographic turnaround observed in the years after 2000: cities have gained population since then (+5.35% and +84,038 between January 2001 and December 2008 according to the Annual Population Statistics). Despite this recent growth (or reurbanization), suburbs have continued to have a positive – and higher – demographic evolution (+8.24% and +233,319). Thus, reurbanization does not mean the end of urban sprawl which remains the dominant spatial dynamics[4].

[3] In the case of four French urban regions, Kaufmann shows that urban sprawl is related to aspirations (in terms of residential location, social life and mobility practices) but that this model is not generalized: 44% of the owners of a detached house in suburbs who were interviewed claimed that they had rather lived in a more central area. In other words, households, who wanted to access home-ownership and to stay in a central neighbourhood, have been pushed to the outskirts because of the lack of corresponding housing supply or because of their limited financial means (Kaufmann et al. 2001).

[4] Both trends coexist and do not exclude each other as it was postulated by the urban cycle theory (Van den Berg et al. 1987).

These results are ambivalent with respect to the debate on the compact city. On the one hand, the shortage of the housing market despite new constructions and the recent demographic growth of cities show that factors based on residential amenities do not totally explain the dynamics of urban sprawl and that the increasing housing space consumption as well as the residential behaviour of the different population groups have to be taken into account. The resulting image of central areas is more positive and tends to show the feasibility of the compact city. On the other hand, urban sprawl remains the dominant trend even in the years after 2000 and the rising housing space consumption represents a limiting factor to densification. In fact, if the occupation of dwellings had been constant between 1970 and 2000[5], the 25 cities studied would have counted 500,000 more inhabitants because of the development of their housing stock. This number represents a good proportion of the total suburban growth (+36.20% and +764,556 inhabitants during the same period). Consequently, further densification projects in cities will need to overcome the rising housing space consumption that does not seem to come to a halt and that is likely to continue in the future.

3.2 Social implications of the compact city

This second critique focuses on the social implications of densification. As noted in the introduction, it is rather contradictory with the former argument: the compact city is desirable but would be socially not neutral. In order to address this question, some insights about gentrification processes in Switzerland are given beforehand.

Population censuses offer a contrasting view of gentrification in Swiss cities. In the late 1990s, they were still characterised by a negative migration balance of higher socio-professional categories (SPC+), which shows that gentrification is not a generalised phenomenon at this scale. The situation, however, is more nuanced when put in an historical and a geographical perspective. SPC+ left the cities far less in the 1990s than in the 1970s, and a clear reversal of trends is observed in some cases (such as Zurich). The renewed attractiveness of cities for SPC+ has strengthened since the 2000 census. This category is indeed distinctly over-represented in recently built dwellings and new-build gentrification emerges as the main expression of the renewed residential attractiveness of Swiss core cities for the middle to upper class.

Surveys conducted in Neuchâtel and Zurich West show that residents living in dwellings resulting from densification and regeneration projects are individuals whose socio-economic status is clearly above average (tables 2 and 3). The level of education is a lot higher in the new projects: 50.7% of adults living in new homes in Neuchâtel, and 67.4% in Zurich West, have university qualifications or equivalent (against slightly less than one quarter of the two cities' population). Other indicators such as income level, declared occupation, rental cost, or proportion of home-owners, also show that the economic resources of this population are above average so that we can speak of new-build gentrification. People with low qualifications, in contrast, are barely present in these new housing units. Data from the 2000 census show that the overrepresentation of the SPC+ in new buildings has accentuated between the 1990s and 2000s, revealing an increased tendency in the real estate market to produce housing for this particular population group.

[5] That is to say if the dividing up of households according to their size had been constant between 1970 and 2000 for each part of the housing stock (e.g. same proportion of two-person households living in two-, three-, four-bedroom flats, etc.).

Table 2: Education level of the population under study in the city of Neuchâtel (Source: population censuses and own surveys)

	Total population (2000)	**Population living in dwellings built between 1995 and 2000 (2000)**	**Population living in dwellings built between 2001 and mid-2007 (2007)**
Low (compulsory school)	32.40%	26.92%	5.56%
Intermediate (apprenticeship, high school)	43.98%	43.90%	43.72%
High (university or equivalent)	23.62%	29.18%	50.72%

Table 3: Education level of the population under study in the city of Zurich and in the district of Zurich West (*) (Source: population censuses and own surveys)

	Total population (2000)	**Population living in dwellings built between 1995 and 2000 (2000)**	**Population living in dwellings built between 2001 and mid-2007 (2007) (*)**
Low (compulsory school)	28.81%	19.02%	1.44% (*)
Intermediate (apprenticeship, high school)	46.26%	45.90%	31.21% (*)
High (university or equivalent)	24.92%	35.08%	67.35% (*)

New-build gentrification in Switzerland is a process led by capital in the sense that investments are due to private actors (Rérat et al. 2010b). The high status of new developments is explained through several mechanisms such as the price of land, building standards, additional costs related to urban areas, as well as the tendency to produce quality and therefore expensive property. Local authorities have an ambivalent attitude towards new-build gentrification. They have defined planning documents to facilitate the construction of housing and are interested in attracting wealthy taxpayers in order to increase their tax revenue. It is however not appropriate to talk about state-led gentrification in Switzerland, as no major public investment is observed in regeneration projects (unlike in the United Kingdom for example [Cameron 2003]), and as measures may be taken to regulate new-build gentrification by privileging non-profit organisations (such as co-operatives) or by negotiating social housing shares with investors although these measures concern only publicly-owned land.

In relation to the debate about densification, how should this tendency towards new-build gentrification and the social selectivity of regeneration operations in Swiss cities be interpreted? The phenomenon could first be explained by the functioning of the real estate market, which consists in offering newly built housing to the wealthy classes. It could nonetheless also be argued that this evolution is the index of a general evolution towards the renewed attractiveness of cities for the middle to upper class. If so, an eviction effect of the lower class could not be excluded, as it will be more thoroughly discussed in the conclusion.

3.3 Environmental impacts of the compact city

The third group of critiques is related to the environmental impacts of the compact city and claims that it would not necessarily be compatible with the requirements of sustainable development. This section addresses more specifically the question of mobility practices[6].

Several researches have found in Switzerland the general pattern underlined by studies in different contexts (see introduction): the motorization rate increases when density decreases (Bochet 2005), and the less dense a municipality is within an urban region, the more important the car is and the smaller the share of walking, cycling and public transports (Rérat 2005).

The questionnaire surveys already mentioned provide some information about the residential motivations and mobility practices of the inhabitants of new dwellings in Neuchâtel and Zurich West. To go into the details of the results is beyond the scope of this paper but some important elements can be mentioned in regard to the debate on the compact city. When asked survey questions about their residential choice, the inhabitants first stressed the characteristics of the dwelling (such as its size, tenure status, location or the view) and then the convenience of city life. The latter is based on the physical proximity of urban amenities and infrastructures (for example 60.70% and 71.61% of the labour force are employed within the boundaries of the core cities of Neuchâtel and Zurich). Far from a decline of the importance of distance, the surveys show a growing part of the middle to upper class that valorises proximity as well as walking, cycling and public transportation. The role of the car is reduced and the accessibility with this mode of transportation is usually said to be less important.

Another indicator of the mobility practices of the inhabitants of the new dwellings is the percentage of households owning public transport passes (see Table 4)[7]. In comparison to the population of Switzerland as a whole, and in comparison to those living in core cities or their suburbs, people living in the new dwellings in Zurich West and in Neuchâtel are proportionally much more likely to have a public transport pass. This is particularly the case in Zurich West where the proportion with a national pass or a half-fare card was more than double that observed at the scale of core cities. The divergence is even larger for the regional pass (people in Zurich West are five times more likely to have a regional pass). In Neuchâtel, the differences are less marked but the percentages are very clearly above the rest of the core cities (+32% for half-fare card bearers, +44% for national pass bearers and +97% for regional pass bearers).

[6] It can also be argued that without the construction of new dwellings in core cities (and their new demographic growth), urban sprawl would have been even more pronounced so that densification operations have reduced land consumption. Another result taken from the questionnaire shows that the proportion of households having a second home (most of the time a holiday house) is not higher in the population under study (12.39% in Neuchâtel and 14.39% in Zurich West) than in Swiss core cities (14.64%) or in the whole country (15.15%) according the Swiss Household Panel in 2003. Although further research is requested, the residential location in a core city does not seem at this scale to be compensated – at least not more than average – by owning a holiday house.

[7] The results from the questionnaire surveys can be compared with the micro-census on transport released by the Federal Statistical Office in 2005. The latter is less precise and the data is only available at the scale of types of municipalities (core cities, suburbs, etc.), as well as for the whole country. The national pass gives free access to the entire railway network and to most city and regional networks (buses, trams, etc.). The half-fare card gives a 50% discount off all individual fares.

Table 4: Percentage of people aged six and above holding a public transport pass and percentage of households owning a car (Source: own survey and micro-census "transport")

	Neuchâtel	Zurich West	Core cities	Suburbs	Switzerland
National pass	12.70	19.10	8.8	5.5	6.2
Half-fare card	38.34	59.01	29.1	27.0	26.5
Regional pass	18.94	47.85	9.6	6.0	6.2
Car	86.16	59.21	66.9	87.8	81.2

These results show that households, who have the financial means to live in a wide range of locations, have decided to live in central city locations and valorised urban characteristics such as proximity, density, and the alternatives to the car (table 4). What is observed here is a reclaiming of the advantages of proximity that were thought to have disappeared with the dynamics of urban sprawl.

However, this comment has to be slightly nuanced by two observations. First, the majority of households still own a car. If in Zurich West the percentage of households owning a car (59.21%) is lower than in all the core cities of Switzerland (66.9%), the number observed in Neuchâtel (86.16%) comes close to what is observed in the suburbs at the national scale (87.8%). Second, an important minority of the inhabitants are interurban commuters, that is to say people living in a core city and working in another one (21.40% in Neuchâtel and 9.80% in Zurich West). In other words, if mobility has partly become more localised, the majority of the inhabitants of the new dwellings do not abandon the car and want to be able to choose between different modes of transportation according to their needs. Some even appear to be hypermobile (such as the interurban commuters), which raises the question of the ecobalance of long distance commuting even though the great majority of them use trains.

4 DISCUSSION AND CONCLUSION

Urban sprawl is often criticized given its environmental, social and economic impacts. In reaction to the sprawl city, the model of the compact city is seen as more compatible with the criteria of sustainable development (Breheny 1992; Jenks et al. 1996; Ewing 1997; Frey 1999; Newman and Kenworthy 1999; Holden 2004). Several planning principles underlie this urban form such as densification of the built environment and regeneration of urban wastelands. They have influenced the debates on spatial development in a wide range of countries. From a demographic point of view, the model of the compact city implies to increase the residential attractiveness of cities and their population level by building new dwellings in the potentials contained in the built environment. Three sets of critiques can be identified in the literature (Dubois and Van Criekingen 2005): (1) the attractiveness of the compact city cannot be guaranteed (this model runs counters to the preferences and residential aspirations of households that favour urban sprawl and low-density housing); (2) the social selectivity of the compact city is not sufficiently taken into account (tendency to gentrification and increase in social inequalities); and (3) the environmental impacts of the compact city are not as favourable as expected in terms of resource consumption and mobility practices.

This paper based on recent urbanization trends in Switzerland provides empirical elements to the debate on the compact city. It has to be reminded that further researches are needed to

fine-tune some results (for example the residential motivations of suburbanites or the possible compensatory role of leisure). Moreover, the scales used here – the core city or regeneration projects – are too broadly-defined to take into account the urban design and the macro-structure of the different compact city models (Frey 1999). Some critiques addressed to the model of the compact city can however be discussed in the light of our results.

The phenomenon that convincingly shows the feasibility of the compact city and the residential attractiveness of central areas is the demographic growth of Swiss cities in the years after 2000 (while most of them lost population between 1970 and 2000). Other indicators – such as the very low proportion of vacant dwellings, the increase in the number of households, the changing residential behaviour of some parts of the middle to upper class – reinforce this interpretation. The same can be said of the success met by residential developments in core cities issued from densification and regeneration projects. Unlike claims that densification would require undemocratic practices or goes against residential aspirations (Gordon and Richardson 1997; Sieverts 2003), urban regeneration is essentially market-led in Switzerland since the construction of new dwellings is confined to private investors while local authorities prescribe planning documents defining allocation, density, etc. of certain areas so as to facilitate real estate projects.

The feasibility of the compact city has however to be moderated given that the housing space consumption per capita has been strongly increasing due to a rising purchasing power and the reduction of the average size of households in the frame of the second demographic transition. This trend does not slow down as shown by the evolution of dwelling occupation and housing needs. In relation to the objectives of the compact city, it is necessary that densification compensates and overcomes the rising demand in terms of living space and that the build environment contains enough potential. This criterion has not been met between 1970 and 2000: if the occupation of dwellings had been constant during these three decades, then the 25 cities under study should have counted 500,000 more inhabitants in 2000 with the development of their housing stock.

From a social point of view, surveys conducted in Neuchâtel and Zurich West show that residents living in new dwellings are individuals whose socio-economic status (measured by level of education, income level, declared occupation, rental cost, or proportion of owners) is clearly above average, so that densification operations have most of the time led to new-build gentrification processes (Davidson and Lees 2005, forthcoming; Rérat et al. 2010a). In contrast, people with low qualifications are barely present in the new housing units. These results tally other researches on eco-neighbourhoods (Emelianoff 2007).

The impact of these new-build gentrification processes remains an unanswered question. On the one hand, the phenomenon is limited in quantitative terms and can be explained by the 'normal' functioning of the real estate market, which first and foremost consists in providing newly built housing for the wealthy classes. Some positive outcomes can also be underlined: these new projects allow cities to retain or to attract new inhabitants (and interesting tax-payers), to balance their social structure (where social vulnerable categories are overrepresented) with that of their suburbs, and to release the pressure on the housing market in a situation of shortage. Moreover, demand – related to the weight of these classes within the population – appears to be a restrictive factor. Seen in this light, new-build gentrification in Switzerland is not part of a wide scale process of gentrification engendering the eviction of poorer classes from core cities.

On the other hand, new-build gentrification could be interpreted as an index of a general evolution towards the renewed attractiveness of cities for the middle to upper class. The

phenomenon, in this particular case, may not be limited to new buildings and could generate classic gentrification processes. Henceforth, the eviction of low-income residents is not impossible. As housing specifically intended for the lower class is limited in Switzerland, this category is mainly provided for by "de facto social housing" (i.e. housing which has become affordable through age and which is largely situated in core cities). It can be argued that new developments could act as spearheads for more classic gentrification processes. In the absence of specific public action that could implement densification policies that take into account the social dimension, the increased attractiveness of cities and the functioning of the free market could exert additional pressures on housing rents and vacancies, and have repercussions on the social composition of Swiss cities in the years to come.

As far as environmental impacts are concerned, a positive correlation between density and more sustainable mobility practices has been observed in the Swiss case (Bochet 2005; Rérat 2005) in accordance with the international literature (Fouchier 1997; Newman and Kenworthy 1999; Holden 2004). The survey of residential motivations of the new urban dwellers reinforces the desirability of such models of urban sustainability: households, who have the financial means to live in a wide range of locations, have decided to live in central city locations and they valorise urban characteristics such as proximity, density, and the possibilities on offer as an alternative to using the car (e.g. walking, cycling, and public transport). It can be interpreted as a reclaiming of the advantages of proximity that were thought to have disappeared with the dynamics of urban sprawl. However, some inhabitants of new dwellings also seem hypermobile. Most of them own a car and an important minority works in another core city. This last point raises the question of the ecobalance of long distance commuting even though most of them travel by train.

On the whole, in the case of Switzerland, the model of the compact city seems rather feasible, desirable and environmentally sustainable. Three nuances have to be mentioned though. First, urban sprawl is still the dominant spatial dynamic given the residential behaviour of families and the rising living space consumption. Second, housing projects issued from densification and regeneration operations are socially selective and are addressed mainly to the middle to upper class. Third, mobility practices show that the inhabitants of new dwellings valorise proximity but some are potentially hypermobile.

The implementation of the model of the compact city finally raises the question of public policies and the role of regional and local authorities in the case of Switzerland [8]. Three directions can be mentioned as additional elements to the debate. First, urban regeneration is not often a spontaneous process. This process is complex since it involves many actors (investors, developers, land owners, neighbouring communities, etc). To cope with this complexity implies planning processes based on projects (rather than on plans) and on collaborative approaches (rather than on hierarchical organisations). Second, market-led urban regeneration projects are socially selective. In the case of Switzerland, some local authorities have allocated plots of land they own to foundations or cooperatives at favourable conditions. By relinquishing profits and calculating the rent according to costs, these institutions offer apartments at lower prices than those determined by the free market. In other cases, local authorities may negotiate compensation for leasehold rights with promoters

[8] In Switzerland, the role of the Federal State consists in defining a general policy for spatial development. In their typology of planning systems, Newman and Thornley (1996) categorize Switzerland as a member of the "Germanic family" alongside Germany and Austria. These countries are characterised by a hierarchical planning system with a clear division of tasks and responsibilities between the national, regional and local levels (principle of 'subsidiarity'). The federal government gives 'guidelines', but has hardly any powers to force the regions to follow them, while the regional level is the most powerful.

via the construction of a certain stock of social housing under a private public partnership. This kind of action could be more generalised in order to integrate social equity in densification projects. Third, suburbs are still growing faster than core cities. If the principles of the model of the compact city (densification of the built environment, regeneration of urban wastelands, increasing the height of buildings) focus on central areas, the way suburbs are developing needs to be rethought in order to take into account sustainability criteria (alternative habitat model for the single-family unit, joint development between public transport systems and new settlements). The increased attractiveness of core cities, even though it is clearly confirmed, will indeed not lead to the end of urban sprawl and the disaffection with suburbs given the rise in housing space per capita. These three directions do not only represent challenges for the implementation of sustainable development from a spatial point of view but also need to be addressed by urban and housing studies.

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