

3 THE URBAN SPRAWL EXPLORATORY TOOL

The Urban Sprawl Exploratory Tool is available on www.casa.ucl.ac.uk/monitor and also from the SCATTER web site www.casa.ucl.ac.uk/scatter .

3.1 Objectives

The Urban Sprawl Exploratory Tool (USET) is an interactive tool implemented on Internet. It is intended for local authorities and planning actors involved in decision making. Its objectives are to inform and raise awareness about issues related to urban sprawl (especially among authorities of small and medium-size cities) and to explore (monitor) variables related to sprawl. The final objective is to provide some help in making a diagnosis about sprawl and building a strategy.

The USET is the perspective of SCATTER on: local governments information needs, what is essential to know about urban sprawl (indicators), what local governments should do to act strategically on urban sprawl.

Practically, USET gives:

- definitions of concepts related to urban sprawl
- a set of relevant indicators, and the possibility to calculate some of them, if input data are provided by the user
- values for these indicators, calculated in the 6 SCATTER case cities
- a policy database referring to the policies simulated and evaluated in WP5-WP6 and to the case studies analysed in WP4.

The USET binds together planning objectives and information needs in an interactive web-based information explorer.

3.2 Introduction and context

3.2.1 Some important strategic findings of the study

Urban sprawl is hard to define

Urban sprawl is a multi-dimensional phenomenon about which it is quite difficult to make a distinction between causes, conditions and consequences. Furthermore it is perceived differently from place to place and even called differently from one country to another.

But there is an agreement on its negative effects

The usually admitted negative effects of urban sprawl are the following :

- consumption of land, loss of high quality agricultural land and open space
- destruction of biotopes and fragmentation of eco-systems
- higher costs of new neighbourhood infrastructures

- higher costs of public services and especially transport services
- land use patterns which are unfavourable to the development of collective and other sustainable transport modes ; hence, increase of the level of use of private car
- increased trip lengths
- congestion on the radial roads giving access to the urban centres
- increase in fuel consumption
- increase in air pollution
- contribution to the decay of downtown areas
- social segregation and reduction of social interaction
- poor access to services for those with limited mobility such as the young and elderly.

The fact of generally considering these impacts as negative reveals an underlying assumption according to which we should eliminate them and restore the previous situation.

Today our societies are confronted with obligations of reducing their energy consumption and pollutant emissions

The necessity to do something about urban sprawl which generates some unacceptable nuisances is driven by recent international agreements. In Belgium for instance the Government recently decided to decrease CO2 emissions by 9,4% over the next 8 years.

Even if it is a collective obligation it might happen that some cities or areas find it impossible to realize because of their size, or their economic situation,... In this case benchmarking studies can help a lot defining the targets.

3.2.2 The strategy to be elaborated

The strategic approach is composed of three phases :

- Make a diagnosis of the recent evolution and the present situation, comparing the case study with other cases
- Define the targets to be reached in the long term
- Take measures to decrease the observed main negative effects of urban sprawl

3.3 A strategic approach in three phases

3.3.1 Diagnosis of the recent evolution and the present situation

Analyse the present situation and the recent evolution of the case study

The first phase consists of collecting data which are essential to the analysis of the negative effects of urban sprawl (as mentioned above). The nature of these statistics might be different from one country to another or from one city to another, according to the availability of the data : for instance there is no

population census in Germany contrary to other countries ; some cities have made household surveys, others have not; some cities have a GIS, others have not, etc.

The data which are indispensable for a good diagnosis are these indicated in the exploratory tool : evolution of population, evolution of the number of jobs, sectorial net densities (essentially residential net density), average space consumption per inhabitant or job, average home-to-work distance, public transport market share. These basic statistics are available almost everywhere. The other available data will confirm the diagnosis, giving more details on its negative aspects : estimation of the total fuel consumption in the system, estimation of the main pollutant emissions, evolution of the area allocated to agriculture, evolution of the area allocated to natural spaces, age pyramid, average income per inhabitant, structure of the local economy, etc. These last data will also put in light the probable causes of the situation and help to pinpoint the priorities and the best means to overcome urban sprawl.

Compare it to other cases and formulate a diagnosis

The first type of comparison will be made in space and time with other cities or neighbourhoods of the same country in order to comprehend the underlying mechanisms of city growth and specify the range of possibilities in the framework of a well defined local culture.

A second type of comparison can be made with foreign cities or neighbourhoods having other cultural attitudes, behaviours, incomes, land prices, laws, etc.

3.3.2 Define the targets to be reached in the long term

Targets should be reduced to a small number in order to stay coherent. They should be expressed in terms of impacts and not in terms of causes and be simply formulated. For instance : what rate of decrease of the main emissions of pollutants can we expect in the 10 coming years, at a national level ?

3.3.3 Take measures to decrease the observed main negative effects of urban sprawl

Since there are always several ways to reach a target, define the best strategy to reach the predefined targets, according to the local perception of what to do, the financial resources, the acceptability by the inhabitants,...

Aim

The aim of the strategy is to arrange a spatial organization of the territory, able to minimize the negative impacts of urban sprawl.

Measures to be taken

There will always be several possible spatial organizations compatible with the targets. Each city or area will choose the solutions corresponding to its perception of what to do. The only matter that counts is to reach the target. This leaves much room for democratic debate and participation of people to the decisions. Freedom of choice and governance is also an important part of sustainable development.

So far already many measures have been explored either in reality in different cities or with computer simulations. The reader will find a summary of the findings in the following chapters.

A temporal strategy also

Define the main steps in time of this strategy. Indeed it is important not only to follow the results through time – which justifies again the existence of an exploratory tool – but also to conceive a real temporal strategy. The sequence of measures taken through time can influence the results. The temporal strategy will then focus on the optimization of the sequence of measures through time.

Legitimacy of the strategy

Define the best institutional tools to implement the strategy. A strategy might be totally inefficient if it doesn't fit into the proper institutional tools giving to it its legitimacy. The example of Belgium is very enlightening in this matter. For the moment it is impossible to implement some wide scale measures to decrease urban sprawl around Brussels because there is no legitimate place to discuss these matters.

3.4 The Exploratory Tool proposed

USET is addressing two different spatial scales:

- concentric macro-zones: urban centre, outer urban ring, hinterland
- or micro-zones: single municipalities, communes or wards.

The user is asked to choose the scale in which he is interested.

To make the diagnosis about the urban growth and possible sprawl, the USET tool suggests a set of indicators, belonging to the following fields:

- densities (gross and net densities)
- part of build-up land
- individual land consumptions
- housing prices
- transport indicators
- emissions.

The tool suggests to calculate values for these indicators at two dates, to get a view on their evolution.

The next pages present the USET tables of indicators to be completed by the user (they were completed for the 6 case cities and are provided in the tool, for purpose of example and benchmarking) and some “screens” of USET.

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INDICATORS	UNITS	DEFINITION	DATA SOURCES
In yellow: mandatory input variables (for calculations)		OF THE VARIABLES AND INDICATORS	
In green: outputs			
In orange: mandatory inputs for diagnosis			
In white: optional input variables			
GENERAL CHARACTERISTICS			
<i>Population characteristics</i>			
Total population	inhabitants	Total population	Census or annual population data per age group
Age structure of population			
< 15 years	%	Percentage of age category in the total population	Census or survey
15-64 years	%	Percentage of age category in the total population	Census or survey
65 years and more	%	Percentage of age category in the total population	Census or survey
Part of population living in apartments	%	Percentage of people living in apartments in the total population	Census or survey
Total nb of working people			
working in the commune of residence	%	Total working population recorded at living place, by location	Census or survey
working outside the commune of residence	%	of their working place	Census or survey
<i>Jobs characteristics</i>			
Total nb of jobs	jobs	Total number of jobs	
Jobs structure			
Agriculture, forestry	%	Percentage of the job category in the total number of jobs	Jobs statistics or surveys
Retail and local services	%	Percentage of the job category in the total number of jobs	Jobs statistics or surveys
Other	%	Percentage of the job category in the total number of jobs	
SUPERFICIES CADASTRALES			
<i>Built-up area</i>	ha	Total built-up cadastral parcels	
Residential land	ha	Built residential cadastral parcels (homes + apartments)	
Non-residential land	ha	Rest of the built cadastral parcels	Cadastral census, surveys, GIS
<i>Unbuilt area</i>	ha	Total unbuilt cadastral parcels	Cadastral census, surveys, GIS
Agriculture (fields, meadows, fruit trees)	ha	Unbuilt parcels devoted to agriculture (fields, meadows, fruit trees)	Cadastral census, surveys, GIS
Woods and parks	ha	Unbuilt parcels devoted to woods and parks	Cadastral census, surveys, GIS
Other	ha	Unbuilt parcels devoted to other land uses	Cadastral census, surveys, GIS
<i>Total area</i>	ha	Total nber of ha of the commune or the zone	Cadastral census, surveys, GIS
GENERAL INDICATORS			
Gross density of population	Population/total area	Total population / total nb of ha of the area	
Net residential density	Population/residential land	Total population / nb of built-up residential ha of the area	
Gross density of jobs	Jobs/total area	Total nb of jobs / total nb of ha of the area	
Net jobs density	Jobs/non-residential built-up land	Total nb of jobs / nb of built-up non-residential ha of the area	
Urban density	(Pop + jobs)/total built-up area	(Total nb of jobs + total population) / total nb of ha of the built-up area	
Part of built-up land in total land	%	Percentage of built-up ha (residential + non-residential) in the total nb of ha of the area	Cadastral census, surveys, GIS
Average taxable income per inhabitant	Euros/inh.	Average taxable income per habitant	Fiscal statistics
Housing price			
apartments	Euros/m ² of the housing surface		Surveys
houses	Euros/m ² of the housing surface		Surveys
Car ownership	vehicles/100 inh.	Number of private vehicles / 100 inhabitants	Transport statistics, surveys
Market share of public transport	%	Percentage of trips made by public transport / total nb of trips / 2h morning ph (one way)	Surveys, traffic simulation models
INDIVIDUAL CONSUMPTIONS			
Residential land	m ² resid. land/inhab.	Nb of residential ha / total population * 10000	
Non-residential (built-up) land	m ² non-resid. land/job	Nb of non-residential ha / total nb of jobs * 10000	
DIRECT IMPACTS			
Average home to work distance per worker (one way at the peak morning)	km/trip	Possible method of calculation (for 1 municipality) : average of home-work (one way) distances from that given municipality to each work place (e.g. each municipality) , weighted by the proportion of workers going to work in that work place	Traffic simulation models or census matrices or survey matrices
Total vehicle* km by car during the 2 hours morning peak	vehicle*km/2 h morning p (10 ⁶)	Nb of cars per link x link length (km) for the 2h morning peak	Traffic simulation models
Total passenger* km by public transport during the 2 hours morning peak	passenger*km/2 h morning p (10 ⁶)	Nb of passengers on public transport links x link length (km) for the 2h morning peak	Traffic simulation models
INDIRECT IMPACTS			
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak	Possible method of calculation : sort the links according to their average speed,	Emission models or average rate of emission in function of the average
CO emissions during the 2 hours morning peak	kg/2 h morning peak	calculate the total length of the links for each class of speed,	speed of vehicles on the links of the traffic simulation models
COV emissions during the 2 hours morning peak	kg/2 h morning peak	and multiply by the emission rate corresponding to the each class of speed	
NOX emissions during the 2 hours morning peak	kg/2 h morning peak		
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak		

INDICATORS	UNITS	1991 Situation								
		Commune St Josse	Zone 1 City center	Commune Watermael	Zone 2 Rest of the urban center	Commune Lasne	Zone 3 Outer urban ring	Commune Nivelles	Zone 4 Hinterland	Total Area
GENERAL CHARACTERISTICS										
<i>Population characteristics</i>										
Total population	inhabitants	21 317	311 329	24 567	642 116	12 729	577 518	23 217	1 311 052	2 842 015
Age structure of population										
<15 years	%	23.4		16.1		20.4		18.3		
15-64 years	%	65.1		64.7		68.9		67.3		
65 years and more	%	11.5		19.2		10.7		14.4		
Part of population living in apartments	%	81.1		43.6		9.8		24.5		
Total nb of working people										
working in the commune of residence	%									
working outside the commune of residence	%									
<i>Jobs characteristics</i>										
Total nb of jobs	jobs	14 186	354 886	11 408	268 172	2 944	204 799	13 051	386 267	1 214 124
Jobs structure										
Agriculture, forestry	%									
Retail and local services	%									
Other	%									
SUPERFICIES CADASTRALES										
<i>Built-up area</i>										
Residential land	ha	44	1 012	175	2 911	795	12 351	378	30 104	46 378
Non-residential land	ha	26	1 100	64	1 776	59	4 446	358	11 128	18 450
<i>Unbuilt area</i>										
Agriculture (fields, meadows, fruit trees)	ha	0	257	16	902	2 763	49 357	4 404	213 439	263 955
Woods and parks	ha	7	529	878	2 802	691	14 421	277	30 867	48 619
Other	ha	37	1 679	160	3 170	474	11 301	643	39 631	55 781
<i>Total area</i>										
	ha	114	4 577	1 293	11 561	4 722	91 876	6 060	325 169	433 183
GENERAL INDICATORS										
Gross density of population	Population/total area	187	68	19	56	3	6	4	4	7
Net residential density	Population/residential land	484	308	140	221	17	47	61	44	61
Gross density of jobs	Jobs/total area	124	78	9	23	1	2	2	1	3
Net jobs density	Jobs/non-residential built-up land	546	323	178	151	50	46	36	35	66
Urban density	(Pop + jobs)/total built-up area	507	315	151	194	20	47	49	41	63
Part of built-up land in total land	%	61.4	46.1	18.5	40.5	16.8	18.3	12.1	12.7	15.0
Average taxable income per inhabitant	Euros/inh.	4 432		10 141		11 760		9 090		
Housing price										
apartments	Euros/m ² of the housing surface									
houses	Euros/m ² of the housing surface									
Car ownership										
Market share of public transport	vehicles/100 inh.									
INDIVIDUAL CONSUMPTIONS										
Residential land	m ² resid. land/inhab.	21	33	71	45	577	214	163	230	163
Non-residential (built-up) land	m ² non-résid. land/job	18	31	56	66	200	217	274	288	152
DIRECT IMPACTS										
Average home to work distance per worker (one way at the peak mornin	km/trip									17.3
Total vehicle* km by car during the 2 hours morning peak	vehicle* km/2 h morning p (10 ⁶)									9.1
Total passenger* km by public transport during the 2 hours morning peak	passager* km/2 h morning p (10 ⁶)									8.5
INDIRECT IMPACTS										
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak									1 657
CO emissions during the 2 hours morning peak	kg/2 h morning peak									19 363
COV emissions during the 2 hours morning peak	kg/2 h morning peak									1 809
NOX emissions during the 2 hours morning peak	kg/2 h morning peak									5 642
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak									301

INDICATORS	UNITS	2001 Situation								
		Commune St Josse	Zone 1 City center	Commune Watermael	Zone 2 Rest of the urban center	Commune Lasne	Zone 3 Outer urban ring	Commune Nivelles	Zone 4 Hinterland	Total Area
In yellow: mandatory input variables (for calculations)										
In green: outputs										
In orange: mandatory inputs for diagnosis										
In white: optional input variables										
GENERAL CHARACTERISTICS										
<i>Population characteristics</i>										
Total population	inhabitants	22 208	311 389	24 609	653 016	13 634	604 433	23 882	1 375 878	2 944 716
Age structure of population										
<15 years	%	23.9			17		19.6		16.8	
15-64 years	%	67.0			63.3		67		65.8	
65 years and more	%	9.1			19.7		13.4		17.4	
Part of population living in apartments	%	61.9			38.8		3.9		24.4	
Total nb of working people										
working in the commune of residence	%									
working outside the commune of residence	%									
<i>Jobs characteristics</i>										
Total nb of jobs	jobs	14 278	378 000	12 304	297 919	3 917	261 314	14 278	443 630	1 380 863
Jobs structure										
Agriculture, forestry	%									
Retail and local services	%									
Other	%									
CADASTRAL AREAS										
<i>Built-up area</i>										
Residential land	ha	70	2 192	256	4 951	951	19 652	837	49 771	76 566
Non-residential land	ha	45	1 052	192	3 125	889	14 671	442	36 651	55 499
Unbuilt area	ha	25	1 140	64	1 826	62	4 981	395	13 120	21 067
Agriculture (fields, meadows, fruit trees)	ha	44	2 384	1 037	6 611	3 771	72 225	5 223	275 397	356 617
Woods and parks	ha	0	209	14	746	2 636	46 156	4 384	211 060	258 171
Other	ha	7	536	867	2 729	653	13 893	185	30 936	48 094
Total area	ha	37	1 639	156	3 136	482	12 176	654	33 401	50 352
GENERAL INDICATORS										
Gross density of population	Population/total area	195	68	19	56	3	7	4	4	7
Net residential density	Population/residential land	494	296	128	209	15	41	54	38	53
Gross density of jobs	Jobs/total area	125	83	10	26	1	3	2	1	3
Net jobs density	Jobs/non-residential built-up land	571	332	192	163	63	52	36	34	66
Urban density	(Pop + jobs)/total built-up area	521	315	144	192	18	44	46	37	56
Part of built-up land in total land	%	61.4	47.9	19.8	42.8	20.1	21.4	13.8	15.3	17.7
Average taxable income per inhabitant	Euros/inh.	5 196		12 643		14 532		12 419		
Housing price										
apartments	Euros/m ² of the housing surface									
houses	Euros/m ² of the housing surface									
Car ownership	vehicles/100 inh.									
Market share of public transport	%									
INDIVIDUAL CONSUMPTIONS										
Residential land	m ² resid. land/inhab.	20	34	78	48	652	243	185	266	188
Non-residential (built-up) land	m ² non-resid. land/job	18	30	52	61	158	191	277	296	153
DIRECT IMPACTS										
Average home to work distance per worker (one way at the peak morning)	km/trip									18.8
Total vehicle* km by car during the 2 hours morning peak	vehicle* km/2 h morning p (10 ⁶)									11.2
Total passenger* km by public transport during the 2 hours morning peak	passager* km/2 h morning p (10 ⁶)									8.6
INDIRECT IMPACTS										
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak									2 042
CO emissions during the 2 hours morning peak	kg/2 h morning peak									23 698
COV emissions during the 2 hours morning peak	kg/2 h morning peak									2 268
NOX emissions during the 2 hours morning peak	kg/2 h morning peak									6 863
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak									363

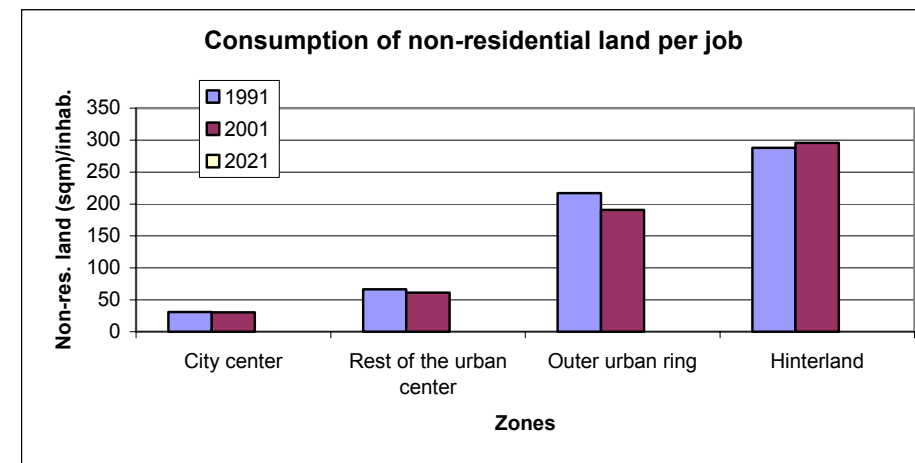
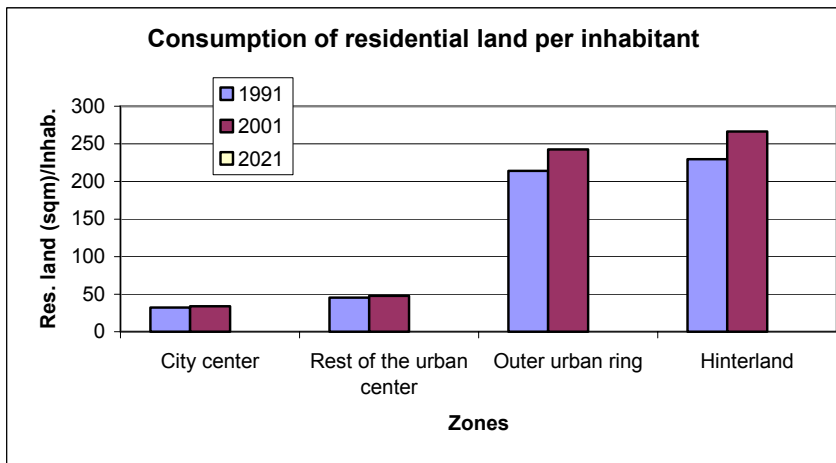
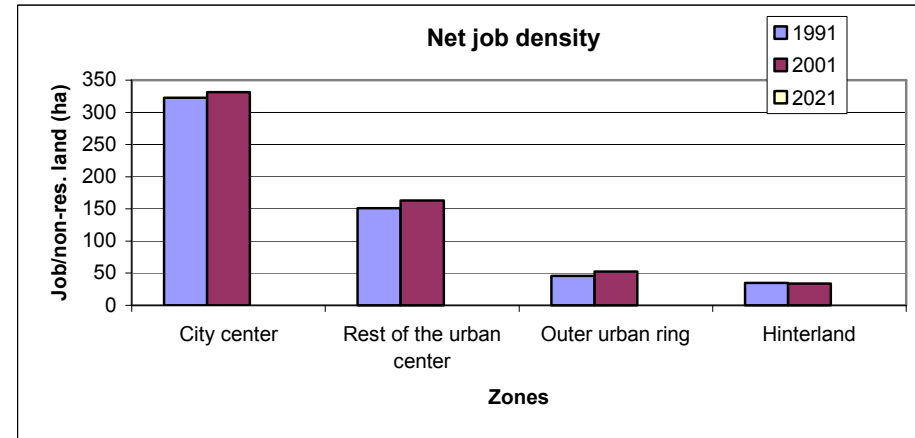
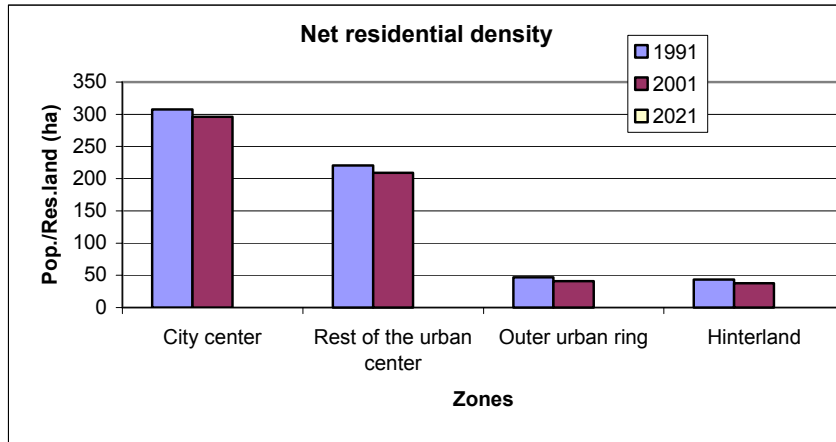
INDICATORS	UNITS	1991-2001 evolution													
		Commune St Josse	Zone 1 City center		Commune Watermael	Zone 2 Rest of the urban center		Commune Lasne	Zone 3 Outer urban ring		Commune Nivelles	Zone 4 Hinterland		Total area	
			abs. val.	%		abs. val.	%		abs. val.	%		abs. val.	%	abs. val.	%
GENERAL CHARACTERISTICS															
<i>Population characteristics</i>															
Total population	inhabitants	891	60	0.02	42	10 900	1.70	905	26 915	4.66	665	64 826	4.94	102 701	3.6
Age structure of population															
< 15 years	%	0.5	0		0.9	0		-0.8	0		-1.5	0		0	
15-64 years	%	1.9	0		-1.4	0		-1.9	0		-1.5	0		0	
65 years and more	%	-2.4	0		0.5	0		2.7	0		3	0		0	
Part of population living in apartments	%	-19.2	0		-4.8	0		-5.9	0		-0.1	0		0	
Total nb of working people															
working in the commune of residence	%	0	0		0	0		0	0		0	0		0	
working outside the commune of residence	%	0	0		0	0		0	0		0	0		0	
<i>Jobs characteristics</i>															
Total nb of jobs	jobs	92	23 114	6.51	896	29 747	11.09	973	56 515	27.60	1227	57 363	14.85	166 739	13.7
Jobs structure															
Agriculture, forestry	%	0	0		0	0		0	0		0	0		0	
Retail and local services	%	0	0		0	0		0	0		0	0		0	
Other	%	0	0		0	0		0	0		0	0		0	
CADASTRAL AREAS															
<i>Built-up area</i>															
Built-up area	ha	0	80	3.79	17	264	5.63	157	2855	17.00	101	8539	20.71	11 738	18.1
Residential land															
Residential land	ha	1	40	3.95	17	214	7.35	154	2320	18.78	64	6547	21.75	9121	19.7
Non-residential land	ha	-1	40	3.64	0	50	2.82	3	535	12.03	37	1992	17.90	2617	14.2
<i>Unbuilt area</i>															
Unbuilt area	ha	0	-81	-3.29	-17	-263	-3.83	-157	-2 854	-3.80	-101	-8 540	-3.01	-11 738	-3.2
Agriculture (fields, meadows, fruit trees)	ha	0	-48	-18.68	-2	-156	-17.29	-127	-3201	-6.49	-20	-2379	-1.11	-5784	-2.2
Woods and parks	ha	0	7	1.32	-11	-73	-2.61	-38	-528	-3.66	-92	69	0.22	-525	-1.1
Other	ha	0	-40	-2.38	-4	-34	-1.07	8	875	7.74	11	-6230	-15.72	-5429	-9.7
Total area	ha	0	-1		0	1		0	1		0	-1		0	
GENERAL INDICATORS															
Gross density of population															
Gross density of population	Population/total area	8	0	0.04	0	1	1.69	0	0	4.66	0	0	4.94	0	3.6
Net residential density															
Net residential density	Population/residential land	9	-12	-3.78	-12	-12	-5.27	-2	-6	-11.89	-7	-6	-13.80	-8	-13.4
Gross density of jobs															
Gross density of jobs	Jobs/total area	-1	5	6.54	1	3	11.08	0	1	27.59	0	0	14.85	0	13.7
Net jobs density															
Net jobs density	Jobs/non-residential built-up land	26	9	2.78	14	12	8.05	13	6	13.89	0	-1	-2.59	0	-0.4
Urban density															
Urban density	(Pop+ jobs)/total built-up area	14	-1	-0.30	-6	-2	-1.11	-1	-3	-5.41	-4	-5	-11.19	-6	-9.7
Part of built-up land in total land															
Part of built-up land in total land	%	0.0	1.8		1.3	2.3		3.3	3.1		1.7	2.6		2.7	
Average taxable income per inhabitant															
Average taxable income per inhabitant	Euros/inh.	764			2502			2772			3329				
Housing price															
apartments	Euros/m ² of the housing surface	0	0		0	0		0	0		0	0		0	
houses	Euros/m ² of the housing surface	0	0		0	0		0	0		0	0		0	
Car ownership	vehicles/100 inh.	0	0		0	0		0	0		0	0		0	
Market share of public transport	%	0	0		0	0		0	0		0	0		0	
INDIVIDUAL CONSUMPTIONS															
Residential land															
Residential land	m ² resid. land/inhab.	-0.4	1.3	3.93	6.8	2.5	5.56	74.6	28.9	13.49	22.3	36.8	16.01	25.3	15.5
Non-residential (built-up) land															
Non-residential (built-up) land	m ² non-resid. land/job	-0.8	-0.8	-2.70	-4.1	-4.9	-7.45	-42.1	-26.5	-12.20	2.3	7.7	2.66	0.6	0.4
DIRECT IMPACTS															
Average home to work distance per worker (one way at the peak morning)															
Average home to work distance per worker (one way at the peak morning)	km/trip													1.5	8.7
Total vehicle* km by car during the 2 hours morning peak															
Total vehicle* km by car during the 2 hours morning peak	vehicle* km/2 h morning p (10 ⁶)													2.1	23.1
Total passenger* km by public transport during the 2 hours morning peak															
Total passenger* km by public transport during the 2 hours morning peak	passenger* km/2 h morning p (10 ⁶)													0.1	1.2
INDIRECT IMPACTS															
CO2 emissions during the 2 hours morning peak															
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak													395	23.2
CO emissions during the 2 hours morning peak															
CO emissions during the 2 hours morning peak	kg/2 h morning peak													4 335	22.4
COV emissions during the 2 hours morning peak															
COV emissions during the 2 hours morning peak	kg/2 h morning peak													459	25.4
NOX emissions during the 2 hours morning peak															
NOX emissions during the 2 hours morning peak	kg/2 h morning peak													1 221	21.6
PM10 emissions during the 2 hours morning peak															
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak													62	20.6

INDICATORS	UNITS	2001-2015 change - 2015 TARGET													
		Zone 1 City center		Target	Zone 2 Rest of the urban center		Target	Zone 3 Outer urban ring		Target	Zone 4 Hinterland		Target	Total area Scenario	
		abs. val.	%		abs. val.	%		abs. val.	%		abs. val.	%		abs. val.	%
In red: target															
In yellow: results obtained by the scenario of measures															
In white: optional input variables															
GENERAL CHARACTERISTICS															
<i>Population characteristics</i>															
Total population	inhabitants	57 121	18.3	↗	6 996	1.1	↗	13 534	2.2		69 357	5.0		147 008	5.0
Age structure of population															
< 15 years	%														
15-64 years	%														
65 years and more	%														
Part of population living in apartments	%														
Total nb of working people															
working in the commune of residence	%														
working outside the commune of residence	%														
<i>Jobs characteristics</i>															
Total nb of jobs	jobs	44 306	11.7		25 503	8.6		16 083	6.2		29 645	6.7		115 537	8.4
Jobs structure															
Agriculture, forestry	%														
Retail and local services	%														
Other	%														
CADASTRAL AREAS															
<i>Built - up area</i>															
Residential land	ha														
Non-residential land	ha														
<i>Unbuilt area</i>															
Agriculture (fields, meadows, fruit trees)	ha														
Woods and parks	ha														
Other	ha														
Total area	ha														
GENERAL INDICATORS															
Gross density of population	Population/total area	12.5	18.3		0.6	1.1		0.1	2.2		0.2	5.0		0.8	5.0
Net residential density	Population/residential land									↗			↗		
Gross density of jobs	Jobs/total area	9.7	11.7		2.2	8.6		0.2	6.2		0.1	6.7		0.3	8.4
Net jobs density	jobs/non-residential built-up land									↗			↗		
Urban density	(Pop + jobs)/total built-up area									↗			↗		
Part of built-up land in total land	%														
Average taxable income per inhabitant	Euros/inh.														
Housing price															
apartments	Euros/m ² of the housing surface									≡			≡		
houses	Euros/m ² of the housing surface									≡			≡		
Car ownership	vehicles/100 inh.									≡			≡		
Market share of public transport	%									↗			↗		
INDIVIDUAL CONSUMPTIONS															
Residential land	m ² resid. land/inhab.									↘			↘		
Non-residential (built-up) land	m ² non-resid. land/job									↘			↘		
DIRECT IMPACTS															
Average home to work distance per worker (one way at the peak morning)	km/trip													19.2	2.1
Total vehicle*km by car during the 2 hours morning peak	vehicle*km/2 h morning p (10 ⁶)													-1.7	-15.2
Total passenger*km by public transport during the 2 hours morning peak	passager*km/2 h morning p (10 ⁶)													0.9	10.5
INDIRECT IMPACTS															
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak													-279	-13.7
CO emissions during the 2 hours morning peak	kg/2 h morning peak													-1 297	-5.5
COV emissions during the 2 hours morning peak	kg/2 h morning peak													-66	-2.9
NOX emissions during the 2 hours morning peak	kg/2 h morning peak													-208	-3.0
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak													-10	-2.8

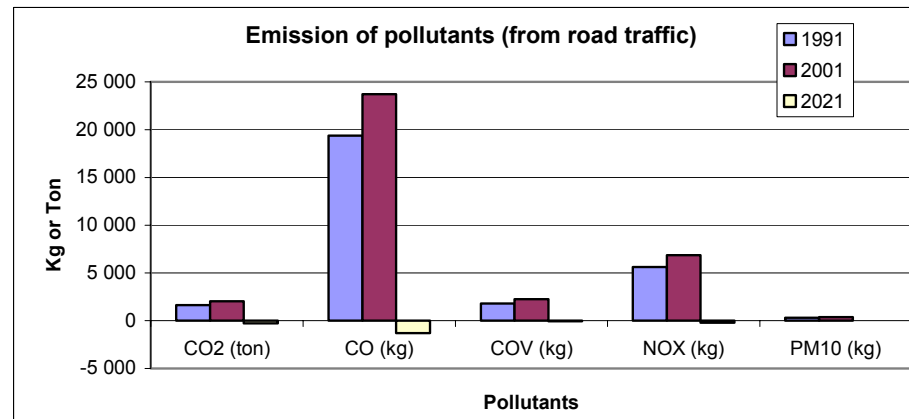
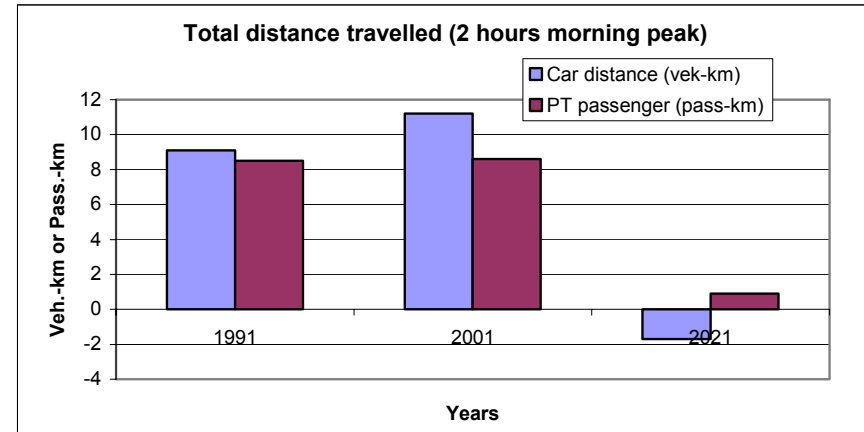
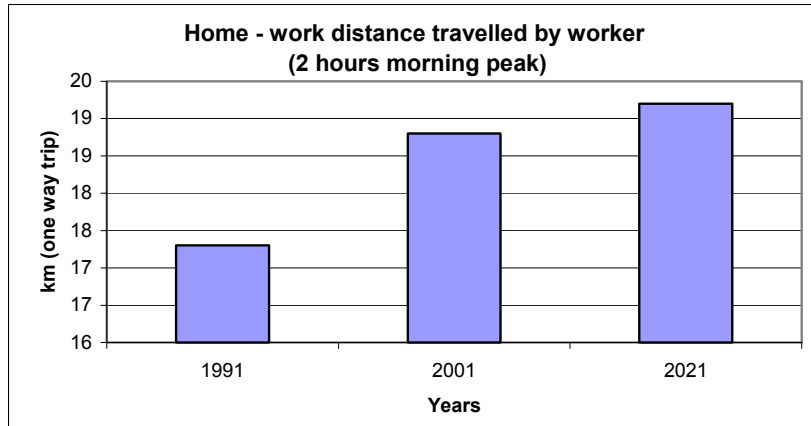
INDICATORS	UNITS	Year t1				Year t2			
		Commune A	Average zone of A	Sprawl case	Dense urban case	Commune A	Average zone of A	Sprawl case	Dense urban case
In yellow: mandatory input variables (for calculations)									
In green: outputs									
In orange: mandatory inputs for diagnosis									
In white: optional input variables									
GENERAL CHARACTERISTICS									
<i>Population characteristics</i>									
Total population	inhabitants								
Age structure of population									
< 15 years	%								
15-64 years	%								
65 years and more	%								
Part of population living in apartments									
Total nb of working people									
working in the commune of residence	%								
working outside the commune of residence	%								
<i>Jobs characteristics</i>									
Total nb of jobs	jobs								
Jobs structure									
Agriculture, forestry	%								
Retail and local services	%								
Other	%								
SUPERFICIES CADASTRALES									
<i>Built-up area</i>									
Residential land	ha								
Non-residential land	ha								
<i>Unbuilt area</i>									
Agriculture (fields, meadows, fruit trees)	ha								
Woods and parks	ha								
Other	ha								
Total area	ha								
GENERAL INDICATORS									
Gross density of population	Population/total area								
Net residential density	Population/residential land								
Gross density of jobs	Jobs/total area								
Net jobs density	Jobs/non-residential built-up land								
Urban density	(Pop + jobs)/total built-up area								
Part of built-up land in total land	%								
Average taxable income per inhabitant	Euros/inh.								
Housing price									
apartments	Euros/m ² of the housing surface								
houses	Euros/m ² of the housing surface								
Car ownership	vehicles/100 inh.								
Market share of public transport	%								
INDIVIDUAL CONSUMPTIONS									
Residential land	m ² resid. land/inhab.								
Non-residential (built-up) land	m ² non-résid. land/job								
DIRECT IMPACTS									
Average home to work distance per worker (one way at the peak morning)	km/trip								
Total vehicle* km by car during the 2 hours morning peak	vehicle* km/2 h morning p (10 ⁶)								
Total passenger* km by public transport during the 2 hours morning peak	passager* km/2 h morning p (10 ⁶)								
INDIRECT IMPACTS									
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak								
CO emissions during the 2 hours morning peak	kg/2 h morning peak								
COV emissions during the 2 hours morning peak	kg/2 h morning peak								
NOX emissions during the 2 hours morning peak	kg/2 h morning peak								
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak								

INDICATORS	UNITS	Evolution t1-t2 in absolute value				Evolution t1-t2 in %				TARGET t3		
		Commune A	Average zone of A	Sprawl case	Dense urban case	Commune A	Average zone of A	Sprawl case	Dense urban case	Commune A	Average zone of A	
In yellow: mandatory input variables (for calculations)												
In green: outputs												
In orange: mandatory inputs for diagnosis												
In white: optional input variables												
GENERAL CHARACTERISTICS											abs. Val.	%
<i>Population characteristics</i>												
Total population	inhabitants											
Age structure of population												
< 15 years	%											
15-64 years	%											
65 years and more	%											
Part of population living in apartments	%											
Total nb of working people												
working in the commune of residence	%											
working outside the commune of residence	%											
<i>Jobs characteristics</i>												
Total nb of jobs	jobs											
Jobs structure												
Agriculture, forestry	%											
Retail and local services	%											
Other	%											
SUPERFICIES CADASTRALES												
<i>Built-up area</i>	ha											
Residential land	ha											
Non-residential land	ha											
<i>Unbuilt area</i>	ha											
Agriculture (fields, meadows, fruit trees)	ha											
Woods and parks	ha											
Other	ha											
Total area	ha											
GENERAL INDICATORS												
Gross density of population	Population/total area											
Net residential density	Population/residential land											
Gross density of jobs	Jobs/total area											
Net jobs density	Jobs/non-residential built-up land											
Urban density	(Pop + jobs)/total built-up area											
Part of built-up land in total land	%											
Average taxable income per inhabitant	Euros/inh.											
Housing price												
apartments	Euros/m ² of the housing surface											
houses	Euros/m ² of the housing surface											
Car ownership	vehicles/100 inh.											
Market share of public transport	%											
INDIVIDUAL CONSUMPTIONS												
Residential land	m ² resid. land/inhab.											
Non-residential (built-up) land	m ² non-résid. land/job											
DIRECT IMPACTS												
Average home to work distance per worker (one way at the peak morning)	km/trip											
Total vehicle* km by car during the 2 hours morning peak	vehicle* km/2 h morning p (10 ⁶)											
Total passenger* km by public transport during the 2 hours morning peak	passenger* km/2 h morning p (10 ⁶)											
INDIRECT IMPACTS												
CO2 emissions during the 2 hours morning peak	ton/2 h morning peak											
CO emissions during the 2 hours morning peak	kg/2 h morning peak											
COV emissions during the 2 hours morning peak	kg/2 h morning peak											
NOX emissions during the 2 hours morning peak	kg/2 h morning peak											
PM10 emissions during the 2 hours morning peak	kg/2 h morning peak											

Diagnosis (1) - Densities and land consumption



Diagnosis (2) - Mobility and environmental impacts



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URBAN SPRAWL IN EUROPE

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Definitions of Urban Sprawl

Urban sprawl has become an umbrella term, encompassing a wide variety of urban forms. Given that there is no agreed comprehensive definition, it is not surprising that there is also little agreement on the characteristics, causes and impacts of sprawl.

Clearly, urban sprawl is a multidimensional phenomenon and needs a multidimensional definition.

It is also difficult to make a clear distinction between the causes, conditions and consequences of urban sprawl. The literature reveals a world of contradictory causal, spatial and temporal relationships between several events, sprawl being often just one of them. Furthermore a key issue is how to make a distinction between urban growth and sprawl.

The SCATTER project [Deliverable 1](#) discusses these issues in details.

The various elements that can be used to build a definition of sprawl can be discussed as urban forms, land-use patterns, and their impacts.

The diagram show a simplified concept map of urban sprawl and of how it could be described, explained and evaluated.

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Interactive Monitoring Tool

Which data do you need?

To calculate the indicators for a city or urban region of your choice and compare them with similar indicators from the six cities of the SCATTER project, [basic input data](#) are needed. These data, such as population, total employment and area are commonly available through national census or local survey.

A further set of [optional input data](#) can be used to explore the results from the analysis of the basic data. These optional data are not easily available and are often the outcomes of impact evaluation and simulation models.

In the Interactive Monitoring Tool the optional indicators are available at the regional level only.

Not all the input data are required and the Interactive Monitoring Tool works incrementally: the more data are input the more indicators are calculated.

When collecting or selecting data, always make sure that they are at a [scale and zoning level](#) comparable to those used by the SCATTER analysis method.

As a rule, all basic and optional input data will also be compared with similar data from the six case cities.

The reference date for the data is 2001. Change is calculated from 1991 to 2001.

If you have these basic input data:	You can calculate
Total population <input type="checkbox"/>	Gross population density (inh/ha) <input type="text" value="no"/>
Total number of jobs <input type="checkbox"/>	Net Residential density (inh/ha) <input type="text" value="no"/>
Total area (ha) <input type="checkbox"/>	Gross employment density (inh/ha) <input type="text" value="no"/>
Built-up residential land (ha) <input type="checkbox"/>	Net employment density (inh/ha) <input type="text" value="no"/>
Built-up non residential land (ha) <input type="checkbox"/>	Urban density ((pop + jobs)/ha) <input type="text" value="no"/>
Total built-up land (ha) <input type="checkbox"/>	Consumption of built-up residential land (m ² /inh) <input type="text" value="no"/>
	Consumption of built-up non residential land (m ² /inh) <input type="text" value="no"/>
	Total land per inhabitant (m ² /inh) <input type="text" value="no"/>
	Total land per job (m ² /job) <input type="text" value="no"/>
	Part of built-up land in total land (%) <input type="text" value="no"/>

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Step 1: Select type of analysis

Compare change (1991 -> 2001)
 Compare current situation (2001)

Step 2: Select scale of analysis

by zone
 by typical micro-zone
 by region

Step 3: Select city and zone level (max 2)

Which city to compare?

	Urban centre	Outer Urban Ring	Hinterland	Region
Bristol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brussels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helsinki	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Milan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rennes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stuttgart	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Step 4: Enter input for basic indicators

Input area name:

Input area is:

	1991	2001
Total population	<input type="text"/>	<input type="text"/>
Total number of jobs	<input type="text"/>	<input type="text"/>
Built-up residential land (ha)	<input type="text"/>	<input type="text"/>
Built-up non residential land (ha)	<input type="text"/>	<input type="text"/>
Total built-up land (ha)	<input type="text"/>	<input type="text"/>
Total area (ha)	1991-2001	<input type="text"/>

Enter input for optional indicators (regional level ONLY)

	1991	2001
Market share of public transport (%)	<input type="text"/>	<input type="text"/>
Total vehicle*km by car	<input type="text"/>	<input type="text"/>
Total pass*km by public transport	<input type="text"/>	<input type="text"/>
CO2 emissions (ton)	<input type="text"/>	<input type="text"/>
CO emissions (kg)	<input type="text"/>	<input type="text"/>
COV emissions (kg)	<input type="text"/>	<input type="text"/>
NOX emissions (kg)	<input type="text"/>	<input type="text"/>
PM10 emissions (kg)	<input type="text"/>	<input type="text"/>

Contient les commandes pour les éléments sélectionnés.

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Step 3: Select city and zone level (max 2)

Which city to compare?

	Urban centre	Outer Urban Ring	Hinterland	Region
Bristol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brussels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helsinki	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Milan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rennes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Stuttgart	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Step 4: Enter input for basic indicators

Input area name


Input area is

	1991	2001
Total population	<input type="text"/>	<input type="text"/>
Total number of jobs	<input type="text"/>	<input type="text"/>
Built-up residential land (ha)	<input type="text"/>	<input type="text"/>
Built-up non residential land (ha)	<input type="text"/>	<input type="text"/>
Total built-up land (ha)	<input type="text"/>	<input type="text"/>
Total area (ha)	1991=2001	<input type="text"/>

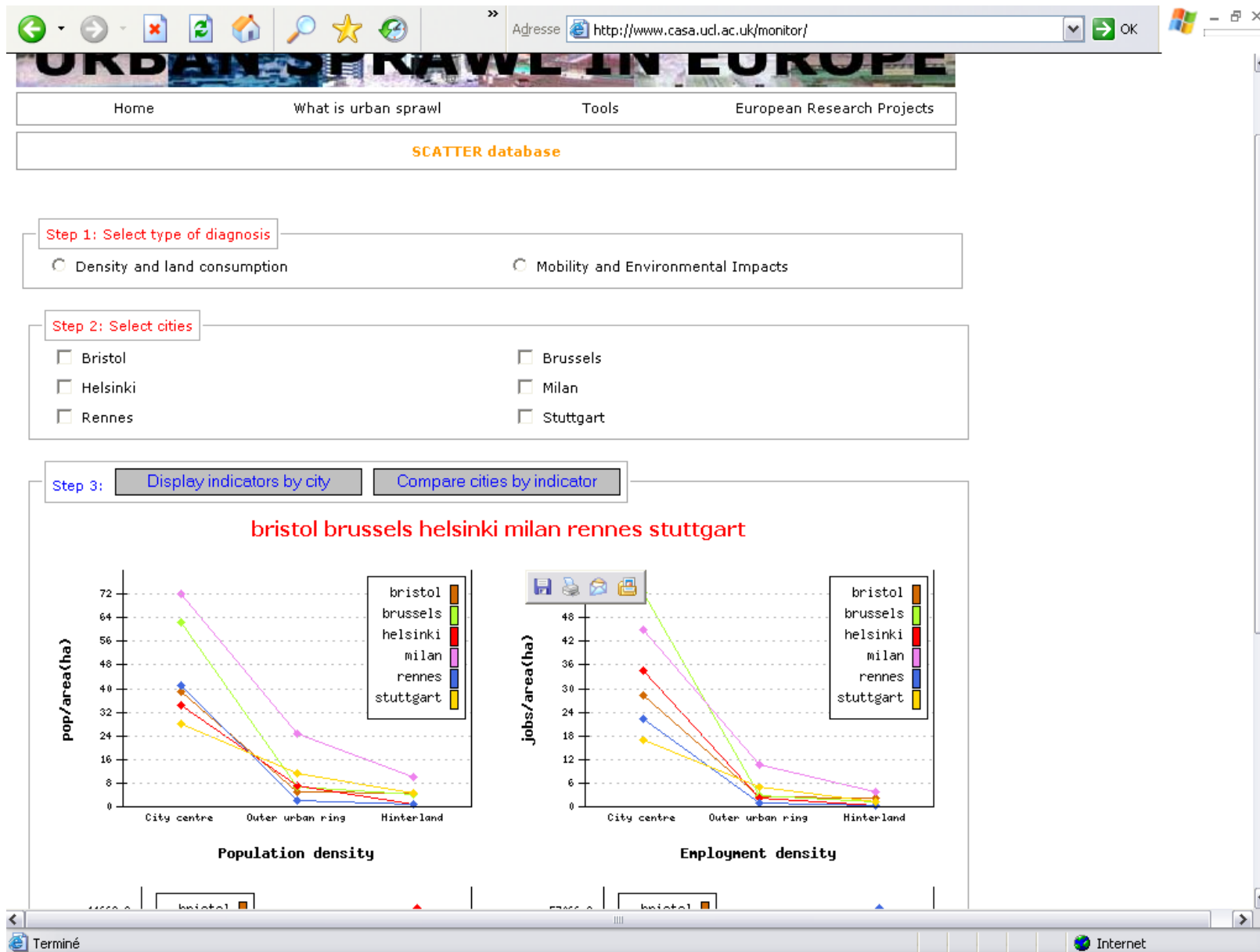
Enter input for optional indicators (regional level ONLY)

	1991	2001
Market share of public transport (%)	<input type="text"/>	<input type="text"/>
Total vehicle*km by car	<input type="text"/>	<input type="text"/>
Total pass*km by public transport	<input type="text"/>	<input type="text"/>
CO2 emissions (ton)	<input type="text"/>	<input type="text"/>
CO emissions (kg)	<input type="text"/>	<input type="text"/>
COV emissions (kg)	<input type="text"/>	<input type="text"/>
NOX emissions (kg)	<input type="text"/>	<input type="text"/>
PM10 emissions (kg)	<input type="text"/>	<input type="text"/>

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Policy Database

How does it work?

The Policy Database contains detailed information on policies which have been designed or implemented to control urban sprawl and its negative impacts on mobility, air pollution, land consumption, social disparities and segregation.

The policies are organised according to a framework developed by the SCATTER project which arrange policies according to the scale of the target area the main sustainability principle (social, environmental, economic), the issues addressed by the policy and the policy type.

The database can also be searched by a list of cities which represent both SCATTER case studies and European cities which have implemented integrated policies to control their suburban development.

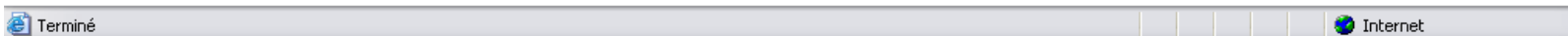
The policies are also classified according to the evaluation method, simulation or case study) used by the SCATTER project to assess their impacts: land use and transport models have been used to evaluate the policies by simulation, whereas case studies have used a more qualitative approach to policy evaluation through the analysis of planning documents and international literature.

Step 1: Enter search criteria

Target scale:	<input type="text" value="any area"/>	Issues addressed:	<input type="text" value="any issue"/>
Sustainability principle:	<input type="text" value="any sustainability principle"/>	Policy type:	<input type="text" value="any type"/>
City:	<input type="text" value="any city"/>		

Step 2:

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Step 1: Enter search criteria

Target scale: any area Issues addressed: any issue
 Sustainability principle: any sustainability principle Policy type: any type
 City: any city

Step 2:

ABC Policy

Description: Obligation for office activities to locate in areas well served by public transport

Type: Land Use Regulation

Target Areas: Urban Centre
Suburban Areas

Issues addressed: High land consumption for housing development
Land consumption for infrastructure development
Higher local government costs
Higher housing and infrastructure development costs

Sustainability Principle: Economic
Environmental

Evaluation methods in SCATTER: Simulation, Case studies

Cities: Brussels (simulation)
Helsinki (simulation)
Stuttgart (simulation)
Amsterdam (case study)
Portland (case study)
Copenhagen (case study)

SCATTER Reports: [D4](#), [D5-D6](#) (see chapter 2, sections 2.1, 2.2 for a precise definition of simulated policies)

SCATTER Simulated Scenarios: 321B, 321H, 321S, 812B, 812H, 812S, 813B, 813H, 813S

Green Belt

Terminé Internet