

06.03 Open-Space Development (Edition 2013)

Overview

Green and open spaces are defined as non- or minimally built-up areas, such as woods, fields, allotment gardens, sports areas, parks and fallow areas. They are of great importance for the **quality of life** within a city. The existence of a variety of open spaces, from near-residential parks up to farmland and wooded areas, is a prerequisite for the fulfilment of the needs of residents for relaxation.

Green and open spaces enrich the urban features by their contribution to the residential structure of a city. They serve as habitats and retreats for plants and animals, and fulfil important **compensatory functions for the urban ecosystem** of the city. They improve the urban climate, promote air circulation and air exchange, and moderate warming. They relieve surface waters by retaining and permitting the evaporation of rain water.

As pervious areas, they enable **undisturbed soil life**, with all the ensuing effects for the ecological balance. The soil is a decomposition, compensation, and construction medium for processes of material transformation; its filtration, buffering, and metabolic qualities also serve, particularly, the protection of the groundwater. Increased impervious soil coverage and substance input into the soil can destroy its functions permanently or even irreversibly.

In the context of the environmental discourse, there is a great need for precise data on the extent of land consumption, and its developments during recent years and decades. These data are needed both to define quality goals for soil protection, and as indicators for the discourse on sustainability.

In addition to the Environmental Atlas map described here, there are two resources for observing the spatial aspects of the various land uses in Berlin, which can be consulted for a description of land consumption. Due to their differing goals and methodologies, each of these three sources has arrived at different results. Please see the chapter on Methodology for an excursus on the "Methodology / Supplementary Notes."

Developments in Germany

According to the Federal Statistical Office, which uses the only figures available for a nationwide comparison of the figures from the statistical offices of the German states, a continuous **increase in residential and traffic areas** to 130 hectares per day could be observed in **Germany** up to the turn of the millennium. The areas thus consumed, primarily at the expense of farmland and forest, dropped to 99 hectares per day in 2003, only to increase to 131 hectares per day again in 2004. Since then, land consumption decreased to 77 ha per day in 2010. In 2002, the Federal Government adopted the "30 ha goal" into the German Sustainable Development Strategy. It states that land consumption for residential and traffic purposes are to be reduced to 30 ha per day by 2020 (cf. Federal Statistical Office, Sustainable development in Germany, Indicator report 2012, only in German).

The chapter "Land-use and urban land consumption" of the [Regional Planning Report 2011](#) (Federal Office for Building and Regional Planning 2011, only in German) presents additional data and analyses on land consumption at national level.

Developments in Berlin

In Berlin, as elsewhere in the Federal Republic, the increase in residential area was carried out mainly at the expense of farmland. The **consumption of open spaces** for residential purposes proceeded **within the city limits**.

The 20-year period through 2010 was marked by a continued low consumption of space. In the excursus "Methodology / Supplementary Notes", Table 3 presents land consumption based on three different sources. Further information can be found in the report of the Senate Department for Urban Development and the Environment, Department I A on [Land-use development in Berlin 1991 - 2010 - 2030](#) (SenStadtUm 2011, only in German).

Statistical Base

The Environmental Atlas Map 06.03 **Open-Space Development since 1950**, dated 1985 and used as the major source, shows open-space losses for **West Berlin** for the periods 1950-1970, 1970-1980 and 1980-1984, and open space gains based on the open space existing in 1984 (scale: 1:50,000). The city atlases used, the 1950 and 1970 editions of Berlin in der Tasche (Berlin in your pocket), scale 1:20,000-25,000, the 1975 Berlin City Atlas, scale 1:8,000, and the 1980 East Berlin atlas Buchplan Berlin Hauptstadt der DDR (Atlas of Berlin, Capital of the GDR), scale 1:25,000, were used to ascertain the open-space stock in **1950, 1970 and 1980 in East Berlin**. The open-space stock in both East and West Berlin in 1990 was taken from the Euro-Großraumstadtatlas Berlin 1990 (Euro City Atlas of Greater Berlin), scale: 1:20,000, and the 1991 Berlin city map, scale: 1:25,000/ 35,000.

The Environmental Atlas Maps [06.01 Actual Use of Built-Up Areas](#) and [06.02 Inventory of Green and Open Space](#), which were drafted parallel to the present map, were consulted for the definition and delimitation of the open-space stock, and for the open-space losses and gains. These maps show the green and open-space stock at block and block segment level. In addition, the infrared aerial images from a fly-over in August 1990 were used to ascertain the open-space stock in 1990. They are available in two different photographic scales: in a scale of 1:4,000 for West Berlin and the areas near the former border, and in a scale of 1:6,000 for the area of East Berlin.

For an ascertainment of the open-space losses and gains for the **1990 to 2000** decade and for the **2000 to 2005** period, the information in the geo-database "Areas with Change Potentials of City-Wide Significance" of the Urban Development Planning and Soil Management Section of the Senate Department for Urban Development was consulted. Based on the assignment issued with the FNP resolution of the Berlin state parliament in 1994 to check the basic conditions regularly, the actual consumption of land is documented here. Areas investigated are those with a minimum potential of 100 housing units, 10,000 sq. m. of gross floor space (BGF) for services, 5,000 sq. m. of retail selling space, 1 hectare of commercial basic space or 3 hectares of green space or woodland. Items described include previous use, planned use, projected and actual completion. In order to show the actual state of land consumption, projects were also taken into account, the realization of which had already begun, but had not yet been concluded.

For the check of changed areas and the ascertainment of the open space stock in 2005, digital orthophotos at a scale of 1:5,000, from an overflight in 2004 (Sect. III), were used.

The update of the 2013 edition was based on Environmental Atlas Maps 06.01 Actual Use of Built-Up Areas and 06.02 Inventory of Green and Open Spaces, Edition 2011, drawing on factual data from 2010.

Methodology

As stated above, there are, in addition to the present Environmental Atlas map described here, two other resources for the observation of land consumption for structural purposes in Berlin. A detailed comparison of the different goals, methods and results of these three sources can be found in the excursus "Methodology / Supplementary Notes".

The present map is the fourth updated and expanded version and has been transferred to the block map 1 : 5,000 (ISU5, Spatial Reference Environmental Atlas 2010) based on a geometry that is true to location. With the help of the maps mentioned above, the aerial images and the Environmental Atlas maps, the open space stock was determined for the respective years. The Environmental Atlas [Map 06.02 Inventory of Green and Open Spaces](#) defines the following categories of green and open spaces: Forests, Meadows and Pastures, Farmland, Parks/Green Space, City Squares/Promenades, Cemeteries, Allotment Gardens, Fallow Areas, Sports Facilities/Outdoor Swimming Pools and Tree Nurseries/Horticulture. Areas with building use, especially public-use areas, are also considered open space if they have large coherent pervious areas with vegetation. This partially applies to areas that are characterized by both construction use and green use (dual use) as open space use. This includes, for example, the zoological gardens, which have been assigned to construction use "Public and other special uses" under construction use as well as to "Park/ green space" under green use. Accessibility or use possibilities were not considered in this classification process.

The comparison of the surveys of the various years permits an ascertainment of open-space losses and gains.

The **open-space losses** were shown for the intervals indicated, while the open-space gains refer to the entire time period. **Open-space gains** were areas which were built-up prior to 1950 and are today

used for one of the open-space categories mentioned above. All open spaces that saw new construction in the respective time periods were identified as open space losses.

From **1990 to 2010** information from the geo-database "Areas with Change Potentials of City-Wide Significance," based on the digital base map, scale 1 : 5,000 (cf. SenStadt 2000a) was drawn on. The aerial images and orthophotos from 1998, 2002, 2004 and 2010 (cf. SenStadt 1998, SenStadt 2002, SenStadt 2004) were used to check the information. As a rule, areas smaller than 1 hectare in size, or a minimum breadth of 20 m, were not ascertained.

The method for ascertaining open space losses and gains was fundamentally changed for the fourth updated edition, i.e. Edition 2013.

Until Edition 2006, open space losses and gains were identified based on the digital block map 1 : 50,000 (ISU50, Spatial Reference Environmental Atlas 2005) using the data outlined above. This also involved defining block borders that deviated from the block geometry.

Due to the fact that the positions in digital block map 1 : 50,000 are not quite true to geometry and the roads have been superimposed on the same for illustrative purposes, the map was transferred to the digital block map 1 : 5,000 (ISU5, Spatial Reference Environmental Atlas 2010), based on a geometry that is true to location, for **Edition 2013**. Initially, the map of Edition 2006 was collated with the new ISU5 geometry. The existing classes were adopted according to their area share, i.e. if a class predominated in a new ISU5 area, this loss or gain class was copied out onto the new map (cf. Fig. 1). Block borders that deviated from those in ISU5 were not adopted and were subsequently transferred manually. Based on the 2010 Use and Urban-Structure mapping, the area types "Track area, railway station and railway ground", "Weekend cottages" and "Camping grounds" were revised comprehensively. As a result, the inventory of open spaces in Edition 2013 was adapted to and consolidated with the presentation of green and open spaces in Map 06.02. (2010).

The automated process was followed by a manual correction step involving visual checks based on aerial images. Open space loss due to road construction, included in the 1995 printed edition but not in the digital editions, was digitized, too, and integrated into the new map.

Generally, when perusing the areas at a block level, it should be noted that minute losses of open space within a block were oftentimes not digitized.

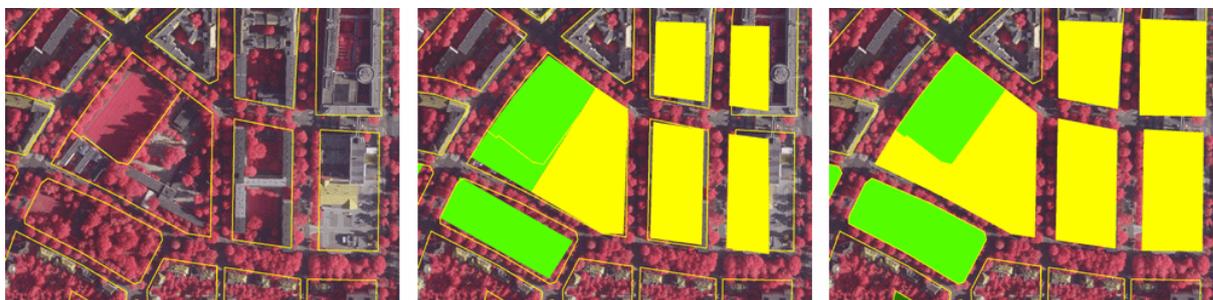


Fig. 1: Adopting existing classes from the ISU50 to the ISU5 geometry (centre: ISU50, Edition 2006; left and right: ISU5, Edition 2013; yellow lines: ISU5 block borders; yellow areas: open space loss, 1950-1970; green area: inventory of open space in 2010; background: CIR aerial image, 2010)

Methodology / Supplementary Notes

The State of Berlin has **three different tools** for the observation of the spatial aspects of the various land uses, which can be consulted for a description of land consumption. They are:

- The regularly published figures according to types of use of the **Statistical Office for Berlin-Brandenburg** (State Statistical Office before 2006),
- the land-use surveys, in a scale of 1 : 5,000 in the context of the City and Environment Information System, and the map of open-space development derived from it in the **Environmental Atlas** (06.03) (Sect. III),
- the evaluation of the **GIS "Areas with Change Potentials of City-Wide Significance,"** as documented in the reports "Urban Development 2000: Report on Spatial Development", "Spatial Development in Berlin, Balance Sheet for 2001-2005" as well as "Area Development in Berlin, 1991-2010-2030" (Sect. I).

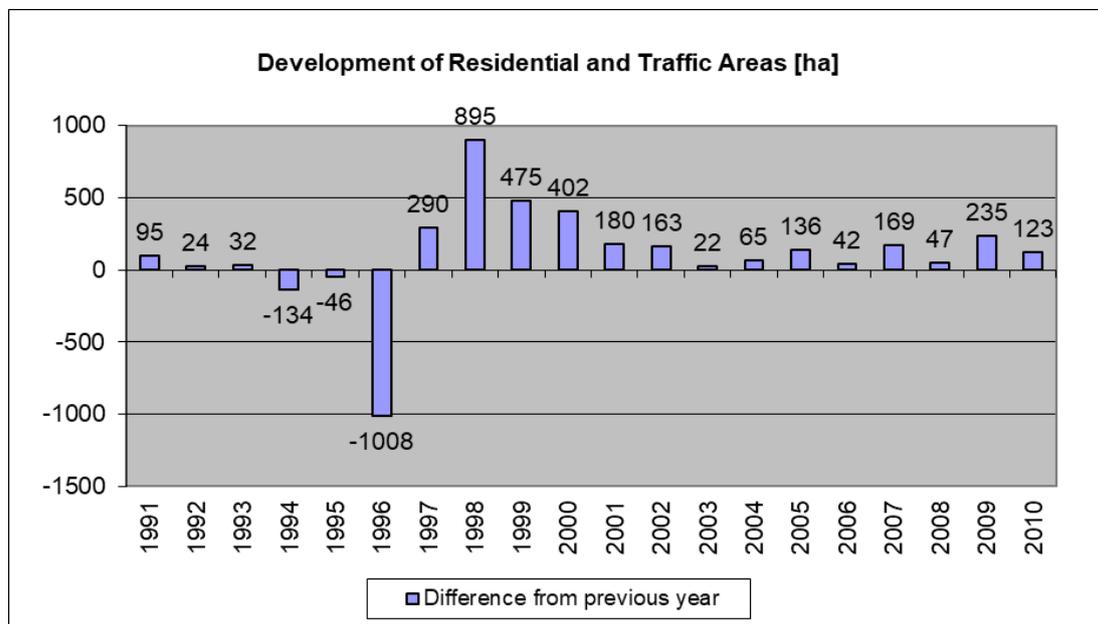
What is Land Consumption?

Land consumption is the use of not previously built-up areas for residential development. The consumption could thus be quantified either via the increase in residential area, or of the area used predominantly for purposes associated with built-up areas, or via the subtraction of non-residential areas, or of the area not used for purposes predominantly associated with built-up areas. In the following, an attempt is made to demonstrate that it is precisely here, in the problems of the definition of "residential" and "non-residential," that the essential reasons are to be found for the fact that the use of different sources for the description of land consumption yield such – often considerably different – figures.

Frequently, the term land consumption is used as an equivalent to an increase in impervious coverage. However, these two terms describe different factual conditions, and must also be considered differently in the context of the ecopolitical discourse. While land consumption describes the increase in areas used predominantly for purposes associated with built-up areas, or for residential purposes, at a highly abstracted and aggregated level, the actual mixture of impervious and pervious areas for such uses is disregarded at this level (cf. here the excursus accompanying the map [Comparison of the impervious coverage data for 2011 and 2005 with the Impervious Coverage Indicator of the Economic Accounting of the German States](#)).

Statistical Office for Berlin-Brandenburg: The Municipal Area, by Type of Use, or Residential and Traffic Area

The Statistical Office for Berlin-Brandenburg (AfS; before 2006 State Statistical Office) regularly publishes figures on the municipal area, broken down by borough and type of use, and compiles them together with information on the residential and traffic areas. The figures are based on the evaluation of the registers of land property in the borough land survey offices. In the preliminary notes on the figures published in the Statistical Yearbooks, it is pointed out that the type of uses of the registers of land property were not updated completely and that some types of use are missing information altogether (Yearbook of Statistics 2012). This is linked to different survey methods in East and West.



*Fig. 2: Development of residential and traffic areas, 1990-2010
(Source: Statistical Yearbooks of the Berlin Statistical State Office and of AfS after 2006)*

Especially the drop in residential and traffic areas by more than 1,000 hectares in 1996 can only be explained as a result of the systematic adaptation of the figures, justified in the methodology of the survey. It does not in any way reflect actual developments.

It should be noted that all area-use classes other than Farmland and Forest are counted as Residential and Traffic Areas. This means that such uses as Allotment Gardens, Parks and Cemeteries, or large non-built-up fallow areas, are classed as "Residential and Traffic Areas," so that if

they are then in fact used for residential and traffic areas, this will not be counted as an overall increase in such area.

An evaluation of the figures for the development of "non-residential areas" yields the following:

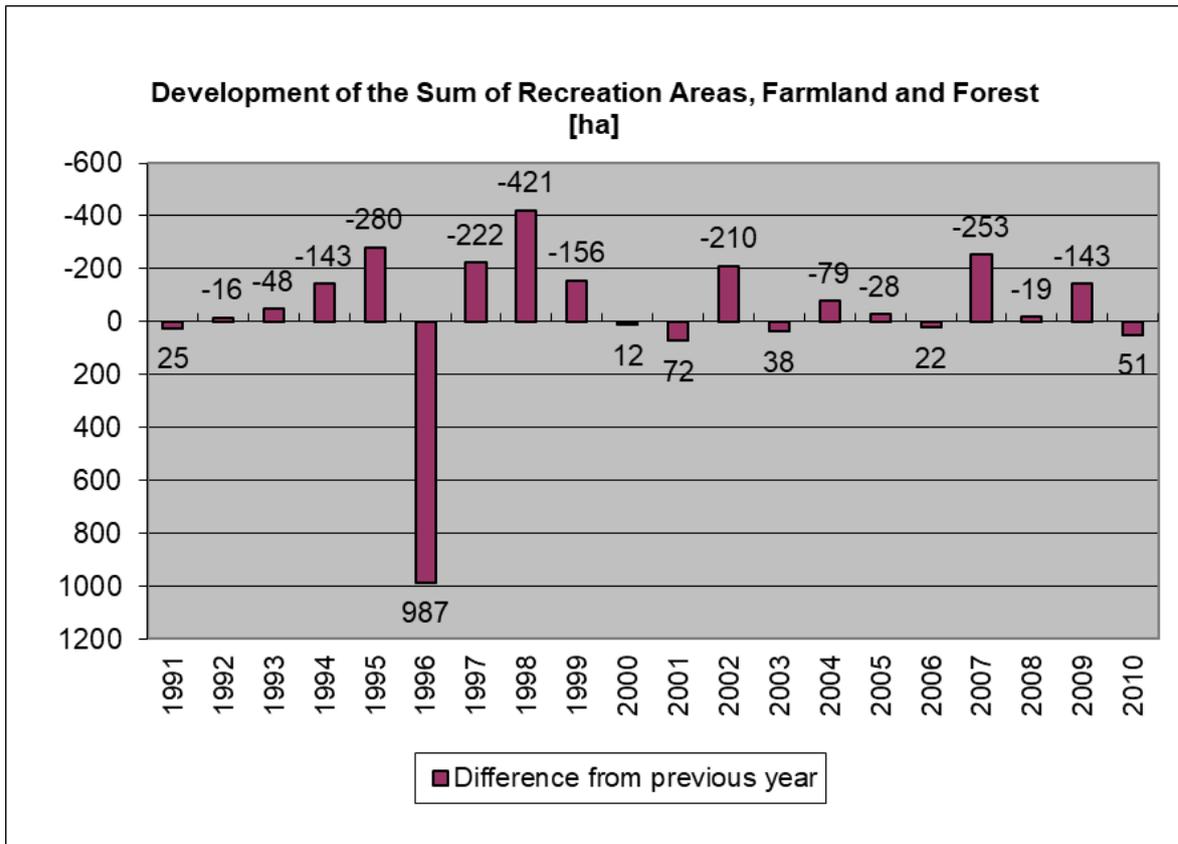


Figure 3: Development of the areas used for forest, farmland and recreation, 1990-2010 (Source: Statistical Yearbook of the Berlin Statistical State Office and of AfS after 2006)

Here, it should be considered that "the farming area of the East Berlin boroughs ..., may also include allotment gardens, front yards, decorative gardens, and built-up areas" (Statistical Yearbook, 2012). During the early '90s in the eastern boroughs for example, streets other than main streets were assigned to the respectively predominant area uses (Statistical Yearbook 1991). The statistical figures from before 1990 contain even greater imponderables. Due to different procedures for land-use statistics, reliable time lines cannot be derived here. Since the register of land property is the basis for the survey, the actual nature of land coverage will not be correctly ascertainable in the future, either. Thus for example, even large lots which are listed as a "building and open space" may not in fact currently contain any buildings at all. One advantage of the method, however, is its nationwide applicability. Both the environmental barometer of the Federal Ministry of the Environment and a large number of other indicators use the state data on the "increase in residential and traffic area" compiled by the Statistical Office for Berlin-Brandenburg.

Result:

The figures on residential and traffic areas are more suitable for the characterization of the increase in residential space as such. Land consumption means only the consumption of forest and farmland. For non-city-states or for Germany as a whole, such figures may usefully describe land consumption. However, this will apply only once the methodology has been successfully and permanently harmonized, and hence only for future figures, but not for the analysis of past developments. Moreover, for the State of Berlin, the limitation of the uses to be considered to Forest and Farmland does not seem to be a suitable procedure for describing land consumption. Since forest areas are under very far-reaching protection, land consumption would thus be confined to reduction of agricultural areas. But in any event, it does not appear to make sense that the construction of buildings on allotment gardens or parks should not be considered land consumption.

Map 06.03 Open-Space Development of the Environmental Atlas

The Environmental Atlas Map Open-Space Development, first drafted in the mid-eighties, was primarily designed to document the loss of areas predominantly covered with vegetation in favour of primarily built-up areas. Based on historic city maps etc., several real-use maps were prepared according to the general key of the two real-use maps of the Environmental Atlas, which showed land-use at intervals of one decade each. These maps were superimposed, and the open-space losses, or if applicable, the gains, were copied out onto other maps, and then a balance sheet of the respective losses and gains was drawn up, showing the respective area sizes. It was thus possible to quantify use change in decade increments since 1950.

A change in land use was assessed as a loss if the use changed from a category contained in the map "Inventory of Green and Open Space" to a use category contained in the map "Real Use of Built-Up Areas." And the important fact is: The open spaces in the map "Inventory of Green and Open Space" represent, as it were, the maximum stock of non-built-up areas. It shows land coverage, rather than use according to urban-planning categories. All vegetation-covered areas of one hectare or more are generally identified as open space in this map. Thus, lawn sections between Berlin Tegel airport runways are counted as open space, as are larger inner-city fallow areas.

Result:

With this method, the loss of major open, largely non-built-up and pervious areas is documented better than is the case with the figures of the Statistical Office for Berlin-Brandenburg. Typical inner-city open-space uses like parks, allotment gardens, cemeteries etc. are assessed as open space and not as residential and traffic area – unlike under the system used by the Statistical Office for Berlin-Brandenburg.

A disadvantage is that the data are available only for the stated decades, so that a higher time-line resolution, e.g. on an annual basis, would require an insupportably high expenditure of effort.

Senate Department for Urban Development, Sect. I: Report on Area Development

In the **GIS "Areas with Change Potentials of City-Wide Significance,"** maintained by Section I A of the Senate Department for Urban Development and the Environment, all areas of a certain minimum size (1 ha) have been listed on which changes of use type, basic restructuring or important use intensifications have been carried out or are planned. Based on the assignment passed by the state parliament with the Land-Use Plan Resolution of 1994 to check the basic conditions regularly, areas with a minimum potential of 100 residential units, 10,000 sq.m of gross floor space for services, 5,000 sq.m retail-sales space, 1 hectare commercial area, or 3 hectares green space or woodland are ascertained. Described, among other things, are previous use, planned use and planned and actual completion. All changes refer to actual use in 1990 (Urban Development 2000, Report on land-use development, Land-use development in Berlin, audit, 2001-2005, only in German). The data are updated annually.

Tab. 1: Consumption of open spaces greater than one hectare in Berlin, 1991-2010, by previous use

Year	Agriculture	Allotment gardens	Other open spaces	Total
1991	2.0			2.0
1992	8.9			8.9
1993	16.7	4.4		21.1
1994	11.9		0.7	12.6
1995	14.5	13.5		28.0
1996	86.4	1.9		88.3
1997	126.6			126.6
1998	38.6	14	0.3	52.9
1999	32.5		3.9	36.4
2000	99.1	2.1	2.8	104
2001	33.0	1.0	1.5	35.5

2002	34.7	3.5	18.2	56.4
2003	10.4	5.4		15.8
2004	4.2	10.3	1.3	15.8
2005	23.9	5.3	4.9	34.1
2006	30.8	4.4	3.0	38.2
2007	81.3	46.5		127.8
2008	9.7		6.8	16.5
2009	48.9	5.9		54.8
2010	70.9	6.8	15.2	92.9
Total 1991-2010	785	123.1	60.5	968.6

Tab. 1: Consumption of open spaces greater than one hectare in Berlin, 1991-2010, by previous use (based on GIS "Areas with Change Potentials of City-Wide Significance," SenStadtUm, I A 16, 2010)

Result:

It should be noted that urban fallows, the former border strip along the Wall, and horticultural businesses are classed as residential areas, so that consumption of such land is not assessed as loss of open space, while if they are transformed into green space, such as the Mauerpark, it counts as a gain in open space. The use categories for the newly realized use are in some cases different from the categories of the previous use. In the long run, this makes systematic observation difficult, since the categories to some extent conflict. The fact that ascertainment is carried out annually is positive.

Comparison of Use Categories and Results

The considerable differences in goals and methodologies of the three tools described for the ascertainment of land consumption are also apparent when the land-use categories are juxtaposed. The list shows the land-use categories which are grouped respectively as built-up or residential areas on the one hand and green or open-space use on the other, in each of the three sources.

Tab. 2: Juxtaposition of the use categories for the ascertainment of the land use		
AfS	Environmental Atlas	Report on Land-Use Development
Residential areas		
Buildings and open spaces	Residential area	
Living space	Mixed area I	Urban fallow
Commercial and industrial area	Mixed area II	Border strip
Factory area	Traffic area	Public service
Traffic area	Core area	Commercial
Streets, urban squares	Commercial and industrial area	Railway
Railway area, airport	Public service and other special uses	Other traffic area
	Utility area	Technical infrastructure
Parks, zoos, allotment gardens, playgrounds	Weekend cottage area	Military, built-up areas
Sports fields, open-air swimming		Government facility
Cemeteries		Other built-up uses
Recreation area	Construction site	
		Horticulture

Open Space		
Forest	Forest	
	Woodlands	
	Wooded areas outside the Berlin forests	Allotment gardens
Agriculture	Grassland (meadows and pastures)	Farmland /fallow
	Farmland	
	Park, green space	Green spaces
	Urban square /promenade	
	Cemetery	
	Allotment garden	
		Military area, outdoor area
	Fallow areas	
	Campsite	
	Sports field / open-air swimming pools (incl. water sports, tennis, horse riding etc.)	
	Tree nursery / horticulture	

Tab. 2: Juxtaposition of the use categories for the ascertainment of the land use (based on AfS, Environmental Atlas and GIS of Sect. I)

The figures on land consumption ascertained using the respective methods obviously also arrive at different conclusions. Table 3 shows the information in hectares for the periods from 1991 to 2000 and from 1990 to 2010.

Tab. 3: Land consumption between 1991-2000 and 1990-2010 [ha], based on various sources			
Source	Reference quantity	Land Consumption (1991 / 2000) [ha]	Land Consumption (1990 / 2010) [ha]
State Stat. Off. / AfS	Increase of residential and traffic areas	1.064	2.341
State Stat. Off. / AfS	Increase in the sum of built-up and open space and traffic areas	341	1.507
State Stat. Off. / AfS	Decrease in the sum of farmland, forest, cemeteries and recreation areas	355	903
Open-space development, Environmental Atlas	Open-space loss	540*	1.282
Report Area Development	Total previous use of open space	500	969
* Land consumption 1990-2000 [ha]			

Tab 3: Land consumption from 1990 - 2000 and 1990 - 2010, [hectares], based on various sources

Map Description

Between 1950 and 2010, 11.5 % of the green and open spaces within the municipal area (10,362 hectares) were consumed for purposes of construction in Berlin, while only a very few formerly built-up areas were changed into open space during the same period (0.5 % of the municipal area, 450

hectares). The open-space losses were predominately on the outskirts of the city, and were frequently achieved at the expense of farmland and allotment gardens.

Tab. 4 : Open-space losses and gains since 1950 (referring to January 1 of each year) in Berlin according to Environmental Atlas 06.03, Population Statistical Yearbooks, Statistical Office for Berlin-Brandenburg

Class	Area [ha]	Population average	Years	ha/year	m ² /inh./year
Open-space loss 1950-1970	4,137	3,296,379	20	207	0.63
Open-space loss 1970-1980	1,722	3,105,517	10	172	0.55
Open-space loss 1980-1990	3,221	3,145,519	10	322	1.02
Open-space loss 1990-2000	540	3,443,430	10	54	0.16
Open-space loss 2000-2010	742	3,402,916	10	74	0.22
Open-space loss 1950-2010	10,362	3,284,625	60	173	0.53
Open-space gains 1950-2010	450	3,284,625	60	8	0.02
Inventory of open space, 2010	33,967	3,460,725	1	33,967	98.15

avg. population: Population Statistical Yearbooks, Statistical Office for Berlin-Brandenburg,
https://www.statistik-berlin-brandenburg.de/produkte/produkte_jahrbuch.asp only in German

Tab. 4: Open-space losses and gains since 1950 (referring to January 1 of each year) in Berlin, according to Environmental Atlas 06.03, Population Statistical Yearbooks, Statistical Office for Berlin-Brandenburg

Individual gains in open space, mostly due to the impacts of war, are predominantly found in the inner city, such as in Görlitzer Park or Mauerpark.

The extensive consumption of hitherto non-built-up areas in East Berlin after World War II began approx. twenty years later than in West Berlin. In West Berlin, most open spaces were built up between 1950 and 1970, while in East Berlin, this occurred during the 1970s and 1980s. These differences in urban development reflected the political division of the city after World War II.

At the end of the war, approx. 30 % of all buildings had been totally destroyed or seriously damaged. The boroughs of Mitte and Tiergarten were the most strongly affected; there, the proportion was over 50 % of all buildings; in Friedrichshain, it was 45 %. Initially, the economic situation in both the Soviet and the western sectors restricted building activity largely to repair. After the end of the blockade in 1949, West Berlin was able to profit from US economic aid under the Berlin construction programme. By contrast, East Germany and East Berlin were additionally burdened by reparation confiscations and dismantling.

During the 1950s and 1960s, the urban-development strategy of the **West Berlin** construction programme consisted in the separation of municipal functions and the relief of urban centres from dense construction. In the inner city, a large-scale de-coring, tearing-down and rebuilding programme was initiated. Large, consolidated, residential areas and new commercial districts grew up at the outskirts of the city on formerly open space. With the International Building Exhibition in 1956, large residential areas were built, such as the Schillerhöhe at the Schiller Park in Wedding, or in North Charlottenburg. However, new housing estates were also built on formerly built-up areas destroyed during the war, such as the Hansaviertel in Tiergarten.

From the mid-1960s to the mid-1970s, major housing estates were built at the outskirts of Berlin. Examples were the satellite towns Gropiusstadt in Neukölln and Märkisches Viertel in Reinickendorf.

During the 1970s, construction activity was concentrated on the revitalization of the inner city.

During the 1980s, when the demand for living space had essentially been met, construction activity was in general confined to small fallow areas which were, for instance, built up in the context of the International Building Exhibition in 1984-87. Only rarely did any major consumption of open space occur. New industrial and commercial areas were established in Ruhleben, Marienfelde, and west of Neuköllnische Allee.

The few areas built up after 1990 involved compact residential areas on former rural and allotment-garden areas in Spandau, Steglitz, Rudow and Reinickendorf, as well as the buildings around Potsdamer Platz.

As a reaction to increasing apartment vacancy rates, construction of multi-storey residential buildings declines sharply after 2000; in many plans for urban expansion and utilization-change of areas, plans for such buildings were cancelled. A few new apartment buildings can be found in Frohnau, Buckow, Dahlem, Lichtenfelde West and Altglienicke. Single-family housing moved into the foreground. The Government Quarter was completed. Internal development obviously has priority; less than 10 % of land consumption is allotted to urban expansion (e. g. the Diplomatenviertel (Diplomats' quarter), the building of the Foreign Intelligence Service of Germany (BND) at Chausseestraße between Potsdamer Platz and Pariser Platz). Since its low in 2006, residential construction has been on the rise again. From 2007, the construction of multi-storey housing, too, has gained in importance again (SenStadtUm 2011).

Increased land consumption was carried out for large-scale retail and traffic projects, such as the freeway in Neukölln.

In **East Berlin**, the reconstruction of the city proceeded only slowly. During the 1950s, the most important industrial plants and utilities were brought back into operation, and reparable residential buildings were provisionally restored, but there was hardly any concerted construction of new residential buildings. The only important project was the construction of the buildings on Stalin-Allee (today Karl-Marx-Allee) at the beginning of the 1950s in the context of the National Construction Programme, the counterpart to the West Berlin construction programme.

Only during the 1960s, after the construction of the Wall and the industrialization of the East Berlin construction industry, did the reconstruction of the city centre begin. The goal was the fundamental restructuring of the city centre. The old tenement apartments were to give way to new buildings. The extensive demolition plans failed however, because of the difficult economic conditions and because of the existing housing shortage. At first, the areas along Unter den Linden and Karl-Liebknecht-Straße, around Alexanderplatz, and along Karl-Marx-Allee up to Frankfurter Allee, heavily destroyed during the war, were rebuilt. New construction then continued in the Fischerkiez (the southern part of the main Spree Island), and along Leipziger Straße.

The reconstruction of the city centre during the 1960s did not lead to any major loss of open space. However, the concentration on restructuring the city centre led to the neglect of new housing construction. Discontent with the living situation increased among the East Berlin population. As a result, the housing programme was proclaimed as the main emphasis of the social program in 1971. The goal was the elimination of the housing shortage through the construction of new apartment buildings and through the rehabilitation of the old buildings in the city centre, which had until then been neglected. During the 1970s and 1980s, large satellite towns were built on formerly open space by means of industrial prefabricated construction, with an immense mobilization of labor from all over East Germany. New boroughs were established: Marzahn in 1976, Hohenschönhausen in 1979 and Hellersdorf in 1980. Other, albeit considerably smaller, residential estates were built along the entire outskirts of East Berlin through 1990.

The large development areas of Marzahn, Hohenschönhausen and Hellersdorf arose to a large extent on the former sewage fields of Malchow and Hellersdorf which were closed down in 1968-1969. Near-natural areas along streams such as the Wuhle or Nordgraben were not built up, since the underground was not suitable for construction. However, smaller near-natural areas, such as pools, were often filled in and built upon.

In new residential areas or large housing estates on large contiguous open spaces, some small, isolated green spaces of no recreational or free-time value were sometimes left behind. One example is the construction carried out during the 1970s and 1980s in Lichtenberg, between Rummelsburger Straße and Saganer Straße. All that remained here of this large, formerly horticulturally or agriculturally used area was a narrow strip of parkland and a little green space.

The expansion of **industrial and commercial areas** also contributed to the loss of open space. The losses in the Rhinstraße/ Gehrenseestraße/ Hohenschönhauser Straße area, along Märkische Allee, and along the motorway in Pankow were particularly high.

After 1990, a few concrete-plate blocks which had already been planned or started were completed in Hohenschönhausen and Marzahn. The largest residential areas were built in the urban-expansion areas certified under the 1994 Land-Use Plan in Buchholz and North Karow.

After 2000, new **residential areas** were built primarily in Falkenberg, South Biesdorf, Buchholz, Wartenberg and in Adlershof.

Overall, during the two decades since reunification, 85 % of urban development in Berlin took place within the body of the city, while only 15 % extended beyond it (SenStadtUm 2011).

Literature

- [1] **Abgeordnetenhaus von Berlin [House of Representatives of Berlin] (ed.) 1999:**
Zukunftsfähiges Berlin, (Sustainable Berlin), Report of the Sustainable Berlin Investigation Commission, 13th Electoral Term, Berlin.
- [2] **Statistical Office for Berlin-Brandenburg 2012:**
Bevölkerungsbestand [Population]
Internet:
<http://www.statistik-berlin-brandenburg.de> [only in German]
(Accessed on 25 February 2019)
- [3] **Statistical Office for Berlin-Brandenburg 2007 - 2011:**
Statistical Yearbooks 2007 - 2011. Berlin.
Internet:
http://www.statistik-berlin-brandenburg.de/produkte/produkte_jahrbuch.asp [only in German]
(Accessed on 25 February 2019)
- [4] **Bundesamt für Bauwesen und Raumordnung [Federal Office for Building and Regional Planning] (ed.) 2011:**
Raumordnungsbericht 2011 [Regional planning report 2011], Bonn.
- [5] **Hauptamt für Statistik [Head Agency for Statistics] (ed.) 1947:**
Berlin in Zahlen 1947 [Berlin in figures 1947], Berlin-Wilmersdorf.
- [6] **Informationszentrum Berlin [Berlin Information Centre] (ed.) 1981:**
Ost-Berlin, eine Beschreibung politischer und gesellschaftlicher Strukturen [East Berlin, a description of the political and social structures], Berlin.
- [7] **MLUR (Brandenburg State Ministry for Agriculture, Environmental Protection and Regional Planning), SenStadt (Berlin Senate Department for Urban Development) (ed.) 2005:**
Zweiter Raumordnungsbericht Berlin und Brandenburg [Second Berlin-Brandenburg Regional Planning Report], Potsdam.
- [8] **planland - Planungsgruppe Landschaftsentwicklung [Landscape Development Planning Group] 1990:**
Ökologische Planungsgrundlage Umweltatlas [Ecological planning base for the Environmental Atlas], Explanatory text for the Map of open-space development since 1950 for East Berlin, Berlin.
- [9] **planland - Planungsgruppe Landschaftsentwicklung [Landscape Development Planning Group] 1991:**
Explanatory text for the Updating of the Maps of the Berlin Environmental Atlas: Maps 06.01 Actual Use of Built-Up Areas, 06.02 Inventory of Green and Open Spaces, 06.03, Open-Space Development and Files on Impervious Coverage, for the Senate Department for Urban Development and Environmental Protection, Berlin.
- [10] **Presse- und Informationsamt des Landes Berlin [Berlin State Press and Information Office] (ed.) 1992:**
Berlin-Handbuch, Das Lexikon der Bundeshauptstadt [Berlin Manual. The Encyclopedia of the Federal Capital], Berlin.
- [11] **SenBauWohn (Berlin Senate Department for Construction and Housing) (ed.) 1990:**
Stadterneuerung Berlin, Erfahrungen, Beispiele, Perspektiven [Urban Renewal in Berlin, Experience, Examples, Perspectives], Berlin.
- [12] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2000:**
Kleingartenbestand 1947 [Inventory of allotment gardens 1947], SenStadt I F 4, Berlin, unpublished.
- [13] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2002:**
Stadtentwicklung 2000, Bericht zur Flächenentwicklung 1990-2000 [Urban development 2000, Report on land-use development 1990-2000], SenStadt I A, Berlin.

- [14] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2006a:**
Flächenentwicklung in Berlin, Bilanz 2001-2005, [Land-use development in Berlin, audit, 2001-2005] SenStadt I A, Berlin.
- [15] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2006b:**
Flächen mit gesamtstädtisch bedeutenden Veränderungspotenzialen, nach GIS [Areas with Change Potentials of City-Wide Significance, based on GIS], SenStadt I A, Berlin.
- [16] **SenStadt (Berlin Senate Department for Urban Development); MIR (Brandenburg State Ministry for Infrastructure and Regional Planning) (ed.) 2008:**
Raumordnungsbericht 2008. Hauptstadtregion Berlin Brandenburg [Report on regional planning 2008. Capital region Berlin-Brandenburg], Potsdam.
- [17] **SenStadtUm (Berlin Senate Department for Urban Development and Environmental Protection) (ed.) 1985a:**
Berlin Environmental Atlas, Vol. 2, Map 06.01 Actual Use of Built-Up Areas, 1:50,000, Berlin.
- [18] **SenStadtUm (Berlin Senate Department for Urban Development and Environmental Protection) (ed.) 1985b:**
Berlin Environmental Atlas, Vol. 2, Map 06.02 Inventory of Green and Open Spaces 1:50,000, Berlin.
- [19] **SenStadtUm (Berlin Senate Department for Urban Development and Environmental Protection) (ed.) 1985c:**
Berlin Environmental Atlas, Vol. 2, Map 06.03 Open-Space Development since 1950, 1:50,000, Berlin.
- [20] **SenStadtUm (Berlin Senate Department for Urban Development and Environmental Protection) (ed.) 1993:**
Landschaftsprogramm, Artenschutzprogramm, Begründung und Erläuterung, [Landscape programme, species-protection programme justification and explanation], draft, May 1993, Berlin.
- [21] **SenStadtUm (Berlin Senate Department for Urban Development and Environmental Protection) (ed.) 1994:**
Flächennutzungsplan Berlin - FNP 94 [Land-use plan], Explanatory report, Berlin.
- [22] **SenStadtUm (Berlin Senate Department for Urban Development and Environmental Protection) (ed.) 1995a:**
Berlin Environmental Atlas, updated and expanded edition, Vol. 3, Map 06.02 Inventory of Green and Open Spaces, 1:50,000, Berlin.
- [23] **SenStadtUm (Berlin Senate Department for Urban Development and Environmental Protection) (ed.) 1995b:**
Berlin Environmental Atlas, updated and expanded edition, Vol. 3, Map 06.07 Urban Structure, 1:50,000, Berlin.
- [24] **SenStadtUm (Berlin Senate Department for Urban Development and the Environment) (ed.) 2011:**
Flächenentwicklung in Berlin, 1991 - 2010 - 2030 [Report on land-use development in Berlin, 1991 - 2010 - 2030], SenStadtUm I A, Berlin.
- [25] **SenStadtUm (Berlin Senate Department for Urban Development and the Environment; MIR (Brandenburg State Ministry for Infrastructure and Regional Planning) (ed.) 2013:**
Raumordnungsbericht 2013. Hauptstadtregion Berlin-Brandenburg, [Report on regional planning 2013. Capital region Berlin-Brandenburg], draft of 5 February 2013, unpublished.
- [26] **Statistical Offices of the German States 2011:**
Umweltökonomische Gesamtrechnungen der Länder (UGRdL): Inanspruchnahme der Umwelt durch Produktion und Konsum in den Bundesländern - Ausgewählte Indikatoren und Kennzahlen. Indikator Versiegelung [Economic Accounting of the German States (EEAL): Consumption of the environment through production and consumption in the German states – selected indicators and key figures. The indicator “impervious coverage”]. Internet:
<http://www.ugrdl.de/veroeffentlichungen.htm> [only in German]
(Accessed on 25 February 2019).

- [27] **Federal Statistical Office (ed.) 2006:**
Umweltnutzung und Wirtschaft, Umweltökonomische Gesamtrechnung [Economy and use of environmental resources, tables on environmental-economic accounting] 2006, Bonn.
- [28] **Federal Statistical Office (ed.) 2012:**
Nachhaltige Entwicklung in Deutschland, Indikatorenbericht [Sustainable development in Germany, Indicator report] 2012, Wiesbaden.
- [29] **Statistisches Landesamt Berlin [Berlin Statistical State Office] (ed.) 2006:**
Statistisches Jahrbuch (Statistical Yearbook) 2006, Berlin.
- [30] **Umweltbehörde Hamburg [Ministry for the environment] (ed.) 2001:**
Kursbuch Umwelt, Ziele für ein zukunftsfähiges Hamburg (The environment schedule: goals for a sustainable Hamburg), Hamburg.

Maps

- [31] **Falk-Verlag (ed.) 1991:**
Berlin Stadtplan (Map of Berlin), 1:25,000 - 1:35,000, Hamburg.
- [32] **Magistratsverwaltung für Stadtentwicklung, Wohnen und Verkehr, Vermessungs- und Liegenschaftswesen [East Berlin Department for Urban Development, Housing and Traffic, Surveying and Real Estate] (ed.) 1990:**
Übersichtskarte von Berlin [Overview map of Berlin], 1990, 1:50,000, Berlin.
- [33] **Ministerium für nationale Verteidigung [East German Defense Ministry] (ed.) 1986-89:**
Topographischer Stadtplan (militärische Ausgabe) [Topographical city map, military edition], various sheets, 1:10,000, Berlin.
- [34] **RV Reise- und Verkehrsverlag [Travel and transport publishing house] (ed.) 1975:**
Berliner Stadtatlas [Berlin city map], 1:8 000, Berlin.
- [35] **RV Reise- und Verkehrsverlag [Travel and transport publishing house] (ed.) 1990:**
Euro-Großraumstadtatlas Berlin [Euro City Atlas of Greater Berlin], 1:20 000, Berlin.
- [36] **SenBauWohn (Berlin Senate Department for Construction and Housing) (ed.) 1990a:**
CIR aerial photography, 1:4,000, Overflight of 1990.
- [37] **SenBauWohn (Berlin Senate Department for Construction and Housing) (ed.) 1990b:**
CIR aerial photography, 1:6,000, Overflight of 1990, Berlin.
- [38] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 1998:**
Digital orthophotos (black & white), 1:5,000; The digital orthophotos of the Brandenburg Survey Office are the basis for the aerial-photo mosaic, 1994-1998, Berlin.
- [39] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2000a:**
Digital basic map 1:5,000 of the City and Environment Information System, as of 2004, Berlin.
- [40] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2000b:**
Digital basic map 1:50,000 of the City and Environment Information System, as of 2001, Berlin.
- [41] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2002:**
Digital orthophotos (black & white), 1:5,000, Overflight of 2002, Berlin.
- [42] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2004:**
Digital orthophotos, in colour, 1:5,000, Overflight of 2004, Berlin.
- [43] **SenStadt (Berlin Senate Department for Urban Development) (ed.) 2010:**
Digitale orthophotos, in colour, 1:5,000, Overflight of 2010, Berlin.
- [44] **Ullstein Verlag (ed.) 1970:**
Stadt-Atlas, Berlin in der Tasche [City map, Berlin in your pocket], 1:25 000, Berlin.
- [45] **VEB Tourist Verlag (ed.) 1980:**
Buchplan Berlin Hauptstadt der DDR [Atlas of Berlin, Capital of the GDR], 1:25,000, Berlin.
- [46] **Verlag des Druckhauses Tempelhof (ed.) about 1950:**
Stadt-Atlas, Berlin in der Tasche [City map, Berlin in your pocket], 1:20,000 – 25,000, Berlin.