

# Chapter 3

## The Multiple Potentials of Urban Brownfields



**Abstract** The phenomenon of urban brownfields is significant throughout European metropolitan areas. In this chapter, we assess, both in qualitative and quantitative terms, the inherent potential of urban brownfields to provide a relevant and substantial densification strategy for metropolitan areas. First, we explore the various opportunities for improvement of the built environment offered by urban brownfields in terms of environment, society, and economics, which are the core principles of sustainable development. This analysis is, *inter alia*, a juxtaposition between urban brownfields and the compact and polycentric city model, adapted to the metropolitan area. While brownfield regeneration appears to be a relevant densification strategy, it nevertheless implies that a sufficient reserve of land is available to engage policy-makers. Thus, we attempt to estimate the urban brownfield stock in three countries: the United Kingdom, Switzerland, and France. The data subsequently serves as a basis for our calculation of the theoretical construction potential of brownfield sites.

**Keywords** Urban brownfield regeneration · Compact and polycentric city model · Densification strategies · Urban brownfields potential · Urban brownfield stock

### 3.1 Urban Brownfields as a Range of Opportunities

The different categories of urban brownfields presented in Chap. 2 highlighted the great diversity of this type of site. The multiplicity of former activities translates into not only a great variety of situations, but also significant spatial dissemination of the phenomenon within European metropolitan areas. Indeed, at the time of establishment, the choice of where to install the activity—and ergo buildings and facilities—was thoroughly studied particularly with regard to accessibility conditions and raw materials available onsite. As a result of this, many urban brownfields benefit from a strategic location.

The present chapter aims to assess, both in qualitative and quantitative terms, the inherent potential of urban brownfields to provide a relevant and substantial densification strategy for metropolitan areas. In other words, the regeneration of urban brownfields offers a range of opportunities to transform these territories by fostering their transition towards sustainability. Our purpose, in particular, is to raise

awareness of policy makers and actors involved in regional and city planning on the importance of the issue.

### **3.2 The Qualitative Potential of Urban Brownfields (Environmental, Sociocultural, and Economic)**

The definition adopted for urban brownfields reveals a great diversity of derelict sites which, mainly due to their abandonment, appear a priori to be unattractive or even dreary. It is therefore relevant to underline why urban brownfields can, on the reverse, be of interest for the sustainable transition of European metropolitan areas. To appreciate their qualitative potential, we propose a juxtaposition between urban brownfields and the reference model of the compact and polycentric city adapted to the metropolitan area (more on this reference model in Chap. 5), which is organized around three major principles: density, mobility, and functional mix. Subsequently, we will explore through a literature review various opportunity for the built environment's improvement offered by urban brownfields, in terms of environment, society, and economics, which represent the core principles of sustainable development.

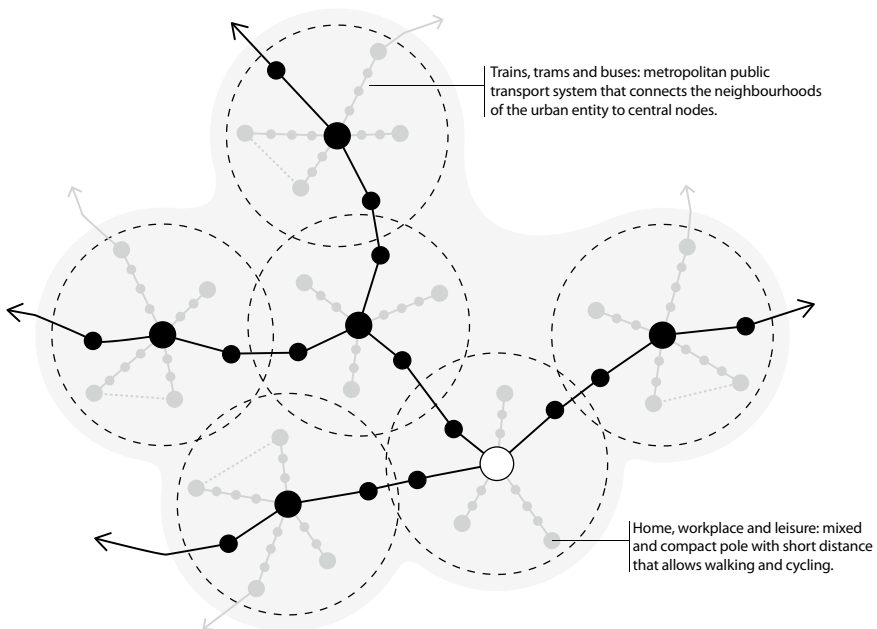
#### ***3.2.1 Opportunities for Density, Mobility, and Functional Mix***

In 2011, in its “Roadmap to a Resource Efficient Europe”, the European Commission called on politicians from member states to be accountable for their land use, with the aim to put an end to the net increase in urbanized land by 2050 (European Commission 2011). In this context of reconsideration of urban sprawl, giving priority to projects located on urban brownfields appears to be a relevant strategy to reach these densification objectives. Indeed, urban brownfields enable greater compactness within cities and metropolitan areas, especially due to their localization within existing urban fabrics. In that sense, they offer a unique opportunity to participate in efforts towards limiting urban sprawl. This feature is probably one of the most obvious and spontaneous potentials offered by brownfield sites. It is acknowledged as such by a large number of territorial authorities (Thornton et al. 2007; Apparau 2011; ARE 2014; DGO4 2014).

In terms of public policy, one of the most notorious examples comes from the United Kingdom, where in 1998 the government introduced an ambitious target for the reuse of brownfields. The initial objective was to reach at least 60% of new residential housing built on brownfields by 2008. For the record, the objective was reached eight years earlier than the deadline (politics.co.uk 2011; Schulze Bäing and Wong 2012). Since 2010, the new political approach is to make local planning authorities responsible for establishing the level and localization of dwellings on their

territory. More concrete rules concerning the redevelopment of brownfields, however, still need to be refined (Department for Communities and Local Government 2015). In 2016, a 1.2 billion £ special fund was created to support the purchase of and construction on abandoned land, thus encouraging the densification of urban regions (Carr 2016). It is, however, expected that the funding allocated to soil remediation will be withdrawn, which will most likely penalize such developments in the poorest regions of the country (Harvey 2016).

We have seen previously that the geographical definition of a metropolitan region is far from limited to the city centre (see Chap. 2). A large number of urban or metropolitan brownfields are located in the suburbs or on the peripheries of urban areas. Following the compact and polycentric city model adapted to the metropolitan area (see Fig. 3.1), the notion of urban brownfield finds its place among the multiplicity of territories waiting to be reconquered. Urban brownfields are likely to promote the creation of mixed-use, compact polarities or, in other words, to contribute to the (re)development of dense secondary centres that redistribute to public transport hubs the functions normally found in the inner city (Rogers and Gumuchdjan 1998). In view of all this, brownfields represent particularly strategic opportunities



**Fig. 3.1** Schematic representation illustrating the compact and polycentric city model adapted to the metropolitan area. From the metropolization phenomenon emerges a hierarchy within the city and its transport network. The neighbourhoods are mixed and compact poles, which allow a certain reduction in the need for individual motorized journeys by the creation of dense and multifunctional secondary centres

for the sustainable transition of metropolitan territories considered as a whole (Rey and Lufkin 2015; Rey et al. 2015).

In that sense, it is also worth strengthening those secondary centres' accessibility and multifunctionality (Lufkin 2010). Let us first remind the reader how important the proximity of modal transport nodes is for that model and, by extension, for urban brownfields. By definition, the densification of those sites will always offer more opportunities in terms of connection to public transport networks and soft mobility than the development of peri-urban or rural sites. Therefore, their densification makes sense only if coordinated with a reflection on mobility (Williams et al. 2000).

Ultimately, we also note that because of their very size (at least a half hectare), urban brownfields truly represent a piece of the city. In other words, they clearly relate to neighbourhood-scale issues. Their redevelopment thus provides an opportunity to create a mixed-use built environment that combines housing, shops, offices, services or craft workshops, as well as quality public spaces and infrastructure. This diversity aims at avoiding monofunctional spaces, such as bedroom communities or business districts, which empty out completely at certain hours of the day (Merlin and Choay 2010). Moreover, merging density and functional mix reduces the geographical gap between activities and supports the creation of a short-distance territory (Hauri 2011).

### ***3.2.2 Opportunities for the Environment, Society and Economy***

As previously explained, in accordance with the compact and polycentric city model adapted to the metropolitan area, the regeneration of urban brownfields is a relevant strategy for containing urban sprawl (Schulze Bäing and Wong 2012) and thus for minimizing its numerous negative impacts (European Commission 2013). We highlight here how the regeneration of urban brownfields embodies significant potential to improve the built environment, with positive repercussions on environmental, sociocultural, and economic levels.

We can start by considering projects located on brownfields with contaminated soil. Their remediation represents a real improvement for a wide range of ecosystems (small wildlife, groundwater, soil quality, etc.) (Martin et al. 2005; ADEME 2014). From this perspective, we can cite the “greening” and “soft re-use” approaches, both fast-growing fields of research (Doick et al. 2009; Padiaditi et al. 2010; De Sousa 2014; Bardos et al. 2016). Furthermore, brownfield decontamination provides the advantage of reducing health hazards, and even premature deaths (Rowan and Fridgen 2003; Gilderbloom et al. 2014).

Studies have established a link between abandoned sites and low property value of adjacent plots, as well as an increased number of foreclosures associated with residents' precarity and low quality of life (Gilderbloom et al. 2014). Although decontamination costs can be extremely high, a strategic redevelopment project can create a win-win scenario for the local economy, the environment, and the community

(Thornton et al. 2007; Kotval-K 2016). Indeed, works have highlighted the capacity of regeneration projects to positively influence the economy (Sousa 2002; Lange and McNeil 2004), generate local tax income (Kotval-K 2016), increase employment levels (Sousa 2008), as well as revitalize communities and property values (Dennis and Norman 2006; Schulze Bäing and Wong 2012). Furthermore, some rehabilitation projects count among the strategies developed to tackle the phenomenon of urban shrinkage, which mainly affects Eastern Europe (Rall and Haase 2011). Even though brownfields are an unfortunate (but natural) consequence of a maturing metropolitan economy, their regeneration can become a significant—even vital—contribution to the local economy, notably as an opportunity for diversification.

In parallel, it is essential to understand that regeneration projects enable a restructuring of the metropolitan area, reflected in the emergence of a new urbanity serving the community (Dumesnil and Ouellet 2002). This urban remodelling can occur either by erasing the history of the brownfield, when negatively perceived, or by enhancing the site through an emblematic architectural project (ADI 2015). From the sociocultural perspective, redeveloping a brownfield site can act as a powerful tool to valorise abandoned cultural heritage (Berens 2011; Mieg and Oevermann 2014), creating, once again, positive impacts on neighbouring property values (Van Duijn et al. 2014) (see also Chap. 5 for more detail on preservation of architectural heritage). In addition, the valorization of this heritage contributes to improving the public's perception of the abandoned site, all while reviving a site's specific history (CABERNET 2004). The previously cited example in Germany of Emscher Valley (see Chap. 2) is particularly emblematic of those dynamics.

Regenerated sites, which are very often transformed into cultural spaces, must continue to offer creative and fertile spaces, avoiding the pitfalls of “museumification” (Mieg and Oevermann 2014; Matthews et al. 2014). Indeed, regardless of the building quality, brownfields often temporarily host artist groups and associations with social added value, who take advantage of low-cost premises offering high flexibility of use. The redevelopment of these sites provides an occasion to include a cultural component embedded in local economic and social life, improve user services, regularize situations, and secure the spaces (Barthel 2009; OFEV 2010a; Lusso 2013). The previously mentioned Belle de Mai brownfield in Marseille provides a successful illustration of these processes (see Chap. 2). However, if culture and “patrimonialization” can provide lever effects, their broader definition encourages the diversification of objectives in terms of social, functional, or even economic mix (Mckenzie and Hutton 2014). Figures 3.2, 3.3 and 3.4 show two successful brownfield regeneration projects in France that illustrate this point.

Our multiple converging findings clearly underline the richness of urban brownfields' qualitative potential. Politics aiming at controlling urban sprawl and strategic brownfield regeneration offer the advantage of improving the built environment for the simultaneous benefit of projects' initiators, future users, and the metropolitan territory as a whole. Therefore, in many European countries, that kind of argument has slowly contributed to shifting the perception of urban brownfields from burden to opportunity (Adams et al. 2010).



**Fig. 3.2** EuraTechnologies Campus, Lille (FR). Transformation of a former spinning mill into a start-up incubator and accelerator. B + A Architectes, 2009 (photo: Stefan83~fwiki, 2018)



**Fig. 3.3** La Cité du Cinéma, Paris (FR). Conversion of a former power station into a film studio complex supported by director and producer Luc Besson. Reichen et Robert & Associés Architectes Urbanistes, 2012 (photo: © Reichen et Robert – Architectes Urbanistes © Laurent Desmoulins, photographer, 2016)



**Fig. 3.4** La Cité du Cinéma, Paris (FR). Conversion of a former power station into a film studio complex. View of the central nave. Reichen et Robert & Associés Architectes Urbanistes, 2012 (photo: © Reichen et Robert – Architectes Urbanistes © Laurent Desmoulins, photographer, 2016)

### 3.3 The Quantitative Potential of Urban Brownfields

After this qualitative perspective, we now propose to evaluate the quantitative potential of urban brownfields, that is, the magnitude of the available European brownfield stock. Indeed, while brownfield regeneration appears to be a relevant densification strategy, it nevertheless implies that a sufficient reserve of land is available in order to engage policymakers. Therefore, inventories are key. Beyond static inventories, the main objective is to enable a community to observe its territory in order to anticipate and detect transformations, and to proactively address the spaces about to become available. An inventory is not only the basis for promoting dialogue between private and public partners (Williams and Dair 2007), but it also contributes to reducing the transitory period during which a site remains abandoned. Ultimately, inventories are powerful tools to help brownfields serve the urban development objectives that the community has set for itself (ACUF 2010).

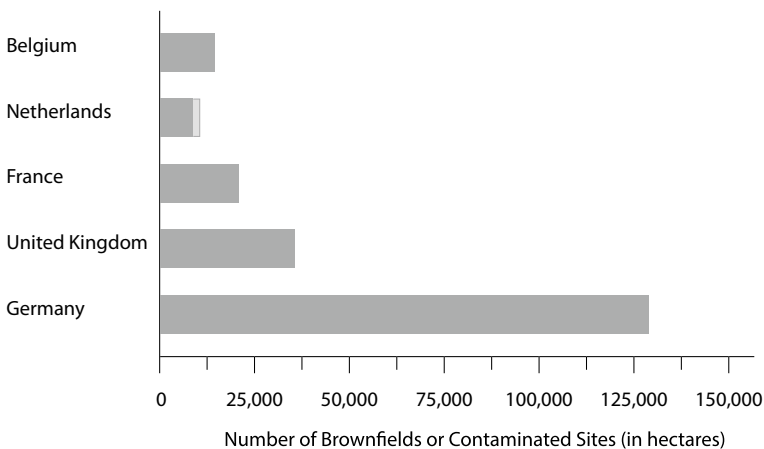
To proceed with an efficient and reliable census approach, a robust shared definition of a brownfield is required (Oliver et al. 2005). However, as mentioned in Chap. 2, since the EU does not yet have a general brownfield policy (Vanheusden 2009), there is no such thing as a common definition at the European level; nor is there an inventory. Overall, when it comes to collecting data on brownfields, technical issues—in particular contamination—are the main concern. Our understanding of brownfields must therefore evolve beyond simple contamination risks and extend

towards a more integrated reflection in terms of sustainable urban development. This naturally requires a broader definition, allowing public institutions to realize the full potential of brownfield regeneration strategies (Oliver et al. 2005).

Due to the lack of definition at the European level, a very few, yet valuable works have taken up the challenge of outlining a European brownfield inventory based on the available data. As far as we are aware, two studies are worth mentioning. The first one was realized in 2002 by the “Brownfield Redevelopment” working group of CLARINET (Ferber and Grimski 2002). Although by then, most European countries were already aware of brownfield issues, the report stated that only a few countries have started collecting data. It estimated or identified approximately 128,000 ha of brownfield land in Germany, 39,600 ha in the United Kingdom, 20,000 ha in France, between 9,000 and 11,000 ha in the Netherlands, and some 14,500 ha in Belgium (Fig. 3.5).

The second study, carried out by the CABERNET network in 2005 (Oliver et al. 2005), is the most recent and comprehensive European brownfield inventory work as of today. Since the report by CLARINET, the 2004 expansion of the European Union from 15 to 25 member states significantly increased the brownfield stock by adding a large number of former industrial, mining, railway, and military sites (Franz et al. 2006), making the task of collecting data even more complex. The study first identifies a list of countries that present no data at all, or very limited data: Bulgaria, Greece, Hungary, Slovak Republic, Denmark, Finland, Ireland, Sweden, Italy, Portugal, and Spain. The surfaces for nations with some form of national dataset available are consistent with the previously cited CLARINET study, in particular Germany, France, and the Netherlands.

The cases of Poland and Romania, respectively, 800,000 and 900,000 ha, reveal the methodological issues with recording brownfield land statistics without a generic



**Fig. 3.5** Estimation of the area of urban brownfields in European regions and countries. Data according to Ferber and Grimski (2002)



definition. Indeed, the authors of the study suggest that the magnitude of brownfields in these two latter countries could be explained by how brownfields are defined and information is collected. Since Polish and Romanian brownfield lands are defined by the presence of contamination, large sections of contaminated coalfields that remain in operation have been inventoried as brownfields—which would not be the case in Western Europe. This illustrates the considerable impact of methodology and criteria when collecting data for inventorying purposes.

In order to illustrate the diversity of approaches, we briefly discuss the strategies developed by three countries: the United Kingdom, Switzerland, and France. We analyse the different existing brownfield inventories for each of these nations, which allows an understanding of the urban development potential offered by these specific territories. The data will subsequently serve as a basis to calculate the theoretical construction potential of brownfield sites for the three nations.

### ***3.3.1 Situation in the United Kingdom***

Of all the European countries, the United Kingdom is a role model when it comes to brownfield inventory. The fact that the UK was the birthplace of the industrial revolution—after centuries of intense industrial activities generating large numbers of brownfield—certainly helps explain this situation. After publishing the revised version of its development strategy in 2005, which aims at achieving sustainability with the planning system (DEFRA—Department for Environment, Food and Rural Affairs 2005), the UK government has made brownfield regeneration one of its top priorities. It has provided incentives for remediation and redevelopment with recent legislation and made available monitoring tools and triggering networks (Williams and Dair 2007; Uklanddirectory 2014).

In terms of brownfield inventory, England is clearly a few steps ahead of the other countries in the UK (Scotland, Wales, and Northern Ireland). In 2019, the Campaign to Protect Rural England (CPRE) affirmed in its annual State of Brownfield report that “each local planning authority now has a brownfield register recording brownfield land considered to be suitable for housing led development” (CPRE—Campaign to Protect Rural England 2019). These brownfield registers reported over 18,000 sites, covering over 26,000 ha, which could accommodate more than 1 million homes, according to CPRE calculations. Interestingly enough, these estimates differ substantially from the numbers published by the CABERNET study, which calculated 65,760 ha for England (and 10,847 ha for Scotland) based on data from 2003–2004 (Oliver et al. 2005).

Aiming at extending the English approach nationwide, the UK Government communicated the launch of a national brownfield sites map in its 2020 policy document “Planning for the Future” (Ministry of Housing, Communities and Local Government 2020). At the time of writing, the announced document—geared at complementing the existing interactive English brownfield land map (National Housing Federation 2019)—was not yet published.

### 3.3.2 *Situation in Switzerland*

Switzerland, due to its small territory and limited urbanization possibilities, is another interesting example. Although the country does not have official, exhaustive statistics on urban brownfields, several surveys on industrial and artisanal brownfields have demonstrated the scale of the phenomenon. In 2003, a study estimated approximately 1,700 ha of Swiss industrial brownfield land, which may seem of lesser significance given the previously mentioned surfaces across European countries. It nevertheless corresponds approximately to the area of the city of Geneva (Valda and Westermann 2004). In 2008, a report including military, railway, and infrastructural brownfields estimated the total surface at 1,820 ha (ARE 2008), mainly located within urban areas (Rey and Froidevaux 2009).

In 2014, the new legislation on territorial planning (Loi sur l'aménagement du territoire, or LAT), aiming at stabilizing urbanized land, in particular by exploiting existing under-utilized reserves more rationally (DETEC 2014), resulted in prioritizing the redevelopment of urban brownfields (CH 2013). In this context, a private company created a database called "Development Atlas", a nationwide database of Swiss sites with a densification potential that are at least 10,000 m<sup>2</sup> (Wüest & Partner AG 2014). The inventory identifies 704 sites, for a total surface of 5,626 ha. Among those sites, 381 items (or 1,922 ha) are clearly industrial, railway, or military brownfields. The remaining 323 sites, which include neighbourhood developments, existing buildings with transformation potential, and vacant building plots, are not considered as brownfields based on the previously proposed definition (see Chap. 2).

However, since the Development Atlas only reports sites measuring 1 ha and more, the Swiss quantitative potential could be more important if we consider brownfield sites from 0.5 ha, as specified in the definition section of this book (see Chap. 2). Completing this dataset, the Federal Office for the Environment (FOEN) launched a web platform designed as a continuously updated observation and information tool on industrial brownfields. Aiming at bridging the gap between private and institutional landowners, site developers, temporary users, investors and public authorities, the platform also presents useful information on legal procedures (in particular, sourcing financial aid) and best practice projects of redeveloped sites (OFEV 2010b).

Based on these multiple sources, a more recent study calculates the total surface of Swiss brownfield land at between 2,500 and 3,500 ha (Rey and Lufkin 2015). While this number remains an indicative range, it nonetheless provides a realistic order of magnitude and serves as a benchmark on the subject.

### 3.3.3 *Situation in France*

Although France is also a country with a rich industrial past and, therefore, great diversity and abundance of brownfields, until recently it had neither an official territorial planning definition for the term "urban brownfield", nor did it have a planning

or monitoring tool likely to enable the realization of a consistent nationwide inventory. However, as we will see at the end of this section, things are rapidly progressing, thanks to many actors insisting on the necessity of agreeing on a common, integrative definition established at the national level (ACUF 2010), capable of extending the brownfields phenomenon beyond the notion of potentially contaminated former industrial sites (ADEME, Agence de l'Environnement et de la Maîtrise de l'Energie 2014).

Previously, scarce information could be obtained, and only for the most affected regions. In the 1990s, for instance, it was established that the Nord-Pas-de-Calais region held the sad record of 10,000 ha of industrial brownfields, which represented 50% of the total surface of brownfields in France (Pacaux and Decocq 2010). In 2010, after the redevelopment of approximately 5,000 ha of brownfields, a total of 20,000 ha could be estimated for the country, located mainly in urban areas (Merlin and Choay 2010).

The Delegation for Local Development and Regional Action (DATAR) also carried out a national census, which estimated the same total surface of 20,000 ha of industrial brownfields (Rey 2012). This slightly dated estimate, however, is only a very rough calculation. Moreover, it does not include other types of brownfield—such as military, waterfront, infrastructural, commercial—and reports sites located outside metropolitan or urban regions. Therefore, based on a combination of sources, experts estimated the total surface of urban brownfields of all types between 30,000 and 35,000 ha (Rey 2012). This clearly exceeds the calculations by (Oliver et al. 2005), which approximated the figure of 20,000 ha. Furthermore, the Agency for the Environment and Energy Control (ADEME), which promotes brownfield regeneration (among other things, by financially supporting soil remediation to initiate redevelopment projects) estimated a surface of tens of thousands of hectares of urban brownfields (ADEME 2010).

Very recently, the growing interest for redeveloping brownfields—in particular contaminated ones (ADEME 2020a)—and for land and real estate monitoring tools (ACUF 2010) reflects the emergence of territorial knowledge as a new challenge. In this favourable context, initiatives and activities by various actors, such as the Laboratoire d'initiatives foncières et territoriales innovantes (LIFTI), are about to lead to the creation of a national brownfield inventory. Indeed, such an inventory was recently identified by a working group launched by the Ministry of Ecological Transition as a powerful tool to stop the urbanization of new land and reach the target of net zero artificialization (Laperche 2020). As a result of these joint efforts to support the national brownfield inventory, a test version of an online application called “Cartofriches”, developed by the Cerema, was launched in July 2020 (Cerema 2020).

The realization of this online portal, which should soon provide researchers and practitioners with updated, reliable, and precise quantitative data on the brownfield situation in France, was made possible by the creation in 2020 of a 300 million € government fund aiming at supporting the regeneration of urban brownfields. The main objective of this special “brownfield recycling fund”, open to public authorities and private companies, is to unblock situations which fail to progress without public

support, in particular due to soil contamination (ADEME 2020b; Ministère de la Transition écologique 2020).

However, for the time being, since certain urban communities still lack precise statistics on the scale and nature of brownfields located on their territory, we have to make do with the above-mentioned order of magnitude of 20,000 ha, which, again, reflects the methodological complexities of making an efficient and meaningful inventory.

### 3.3.4 Construction Potential: Urban Brownfields’ Contribution to Containing Urban Sprawl

The previous section demonstrated that the scale of urban brownfields in each of the selected countries—except England—remains a more or less approximate estimate. As illustrated, the numbers from one nation to another are difficult to compare because each inventory is based on a different definition. Despite this, the above-mentioned estimates can allow us to calculate the theoretical construction potential offered by urban brownfields. Based on three densification scenarios: “S1-Low density”, with a floor area ratio (FAR) of 0.5; “S2-Medium density”, with a FAR of 1; and “S3-High density”, with a FAR of 2 (Table 3.1), we now present these densification perspectives (Table 3.2).

Based on our calculations and with a medium-density assumption (S2), the current urban brownfield stock could host a population increase between 7% (Switzerland and France) and 11% (England). At first glance, these estimates of the potential number of housings and inhabitants could seem ambitious. But one must take into account that the density of this type of metropolitan site is often higher than the average urbanized land. We would also like to underline the fact that new brownfield

**Table 3.1** Densification scenarios

Scenario assumptions	S1 low density	S2 medium density	S3 high density
Densification potential	FAR = 0.5	FAR = 1	FAR = 2
Housing potential	96 m <sup>2</sup> GFA <sup>a</sup>		
Inhabitants potential	2.3/housing <sup>b</sup>		

<sup>a</sup>European average. Average size of dwelling by household type and degree of urbanization, eurostat, 2012. [https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc\\_hcmh02&lang=en](https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_hcmh02&lang=en)

<sup>b</sup>European average. Taille moyenne des ménages - enquête EU-SILC, eurostat, 2018

FAR = Floor area ratio

GFA = Gross floor area

**Table 3.2** Theoretical construction potential offered by urban brownfields in England, Switzerland, and France

	Reference	UK (England)	Switzerland	France
Estimated surface (ha)	Census (official/partial)	26,000 ha	1,922 ha	20,000 ha
	Rey (2012)	–	2,500–3,500 ha	30,000–35,000 ha
	Oliver et al. (2005)	65,760 ha	–	20,000 ha
	Adopted estimate <sup>a</sup>	26,000 ha	2,500 ha	20,000 ha
S1 low density	Densification potential	130 M m <sup>2</sup>	12.5 M m <sup>2</sup>	100 M m <sup>2</sup>
	Housing potential	1,354,167	130,208	1,041,667
	Total inhabitants	3,114,583	299,479	2,395,833
S2 medium density	Densification potential	260 M m <sup>2</sup>	25 M m <sup>2</sup>	200 M m <sup>2</sup>
	Housing potential	2,708,333	260,417	2,083,333
	Total inhabitants	6,229,167	598,958	4,791,667
S3 high density	Densification potential	520 M m <sup>2</sup>	50 M m <sup>2</sup>	400 M m <sup>2</sup>
	Housing potential	5,416,667	520,833	4,166,667
	Total inhabitants	12,458,333	1,197,917	9,583,333
Percentage of the population	Total population	56,286,961 <sup>b</sup>	8,606,000 <sup>c</sup>	67,098,824 <sup>d</sup>
	Percentage of the population (S1)	5.5%	3.5%	3.6%
	Percentage of the population (S2)	11.1%	7.0%	7.1%
	Percentage of the population (S3)	22.1%	13.9%	14.3%

<sup>a</sup>For Switzerland, due to approximative and/or incomplete data, we adopted an average value. For France and England, we used the more recent, reliable source

<sup>b</sup>Office for National Statistics, National Records of Scotland, Northern Ireland Statistics and Research Agency – Population, 2019 Estimates. <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2019estimates#population-growth-in-england-wales-scotland-and-northern-ireland>

<sup>c</sup>Office fédéral de la statistique, 2020

<sup>d</sup>Population au 1er janvier, eurostat, 2020

inhabitants are hosted without using additional land. In that sense, the higher the hosting capacity, the lower the pressure on developing other, not yet urbanized sites. Therefore, regardless of incomplete or imprecise inventories, we can affirm that urban brownfields offer a very real, far from negligible construction potential. From that perspective, their regeneration is a relevant strategy to limit urban sprawl.

To wrap up this reflection on brownfields' quantitative potential, allow us to digress on the idea that, as certain opponents claim, urban brownfield stock is

about to disappear. On the contrary, as authors L. Andres and B. Bochet remind us, “[brownfields] are a punctual, yet perennial phenomenon in urban history. They reflect economic, political, democratic, ideological and social upheavals in urbanized societies” (Andres and Bochet 2010). They are certainly not perennial on the long-term, but rather are an integral part of a constantly evolving territory. Brownfields can thus be considered as a “perpetually regenerating resource, with the potential to provide a steady pipeline of development opportunities” (CPRE—Campaign to Protect Rural England 2019). Evidence of these processes includes recent events, such as the 2008 economic crisis, which has proven to turn the system into a true “brownfield maker” (Lafeuille and Steichen 2015).

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