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Brownfield site, derelict/vacant site



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URN: 0156-55992837

This is a translation of the following entry:

Rößler, Stefanie; Mathey, Juliane (2018): Brachfläche, Konversionsfläche. In: ARL – Akademie für Raumforschung und Landesplanung (Hrsg.): Handwörterbuch der Stadt- und Raumentwicklung. Hannover, 293-305.

The original version can be accessed here:

urn:nbn:de:0156-5599283

Typesetting and layout: ProLinguo GmbH

Translation and proofreading: ProLinguo GmbH

Recommended citation:

Rößler, Stefanie; Mathey, Juliane (2018): Brownfield site, derelict/vacant site.

<https://nbn-resolving.org/urn:nbn:de:0156-55992837>.

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Brownfield sites comprise areas which previously had built use, but which have been abandoned and have not been actively used for a defined subsequent use for a certain period of time, whereby the term derelict site originally referred to brownfield sites that were formerly used for military purposes, but are now also commonly comprise large-scale industrial and infrastructure brownfield sites.

1 Background

The site use structure in settled areas is subject to constant processes of change that result from changing usage requirements and various external influences. As a result, site uses are sometimes abandoned without any subsequent uses being implemented immediately. The resulting brownfield sites present a wide range of potential, but also constitute challenges for spatial development. They are often the only available spaces in settled areas where land use requirements can be realised, without making use of new areas on the outskirts of cities. However, competing demands on the available land, ownership structures, the utilisation expectations of site owners, residual buildings or contamination on the site (▷ *Contaminated sites*), but also lengthy and complex processes can make subsequent use more difficult (*MIL* [Ministry for Infrastructure and Agriculture of Brandenburg] 2013: 7).

Determining which sites are in fact brownfield sites is full of uncertainties due to differing survey methods and incomplete data. Current figures for Germany are based on projections from surveys of built land, estimates, the land registry for brownfield site land registries and GIS-supported sample surveys of brownfield sites and vacant lots in the existing settlement. It can be assumed that there are 120,000 to 165,000 hectares of brownfield sites (*BBSR* [Federal Institute for Building, Urban and Spatial Research] 2013: 3).

2 Definition of terms and classifications

Depending on the factual and planning context, there are different definitions for brownfield sites. In the German term for brownfield, *Brachfläche*, 'Brache' means 'fallow', and originally comes from agriculture. It refers to an area that is not cultivated for typically one growing season to facilitate soil regeneration. Subsequently, it is brought ('gebracht') back into use by ploughing. Essentially, brownfield sites are sites which previously had a built use which characterised the site, but which have been abandoned and have not been actively used for a defined subsequent use for a certain period of time (cf. Wittig/Zucchi 1993). In the European context, the understanding is even broader: brownfield sites are defined as 'Sites that have been affected by the former uses of the site and surrounding land; are derelict and underused; may have real or perceived contamination problems; are mainly in developed urban areas; and require intervention to bring them back to beneficial use' (CABERNET 2006).

Still, brownfield sites can be used and there are often residual or temporary uses for them (▷ *Temporary use*). It is not always possible to clearly differentiate such temporary use from stable subsequent use. In cases where areas are left untouched for a longer period of time, the deterioration of buildings and the growth and spread of vegetation create 'green' brownfield sites (see section 3.3).

The term *fallow* is used to describe sites that may include partial buildings or, in some cases, to refer to the buildings themselves. There are a variety of approaches to developing categories for these sites, based on the spatial context, the previous use, the potential for reuse or the current state. Brownfield sites can arise both within the settlement context and outside of it, e.g. abandoned agricultural facilities, arable and grassland brownfields. This article focuses mainly on

urban brownfield sites. As a rule, brownfield sites are described and differentiated with respect to their *original use* (BBSR 2013: 2; Hansen/Heidebach/Kuchler et al. 2012: 14):

- *Industrial and commercial brownfield sites* are former production and storage sites, unused commercial sites for the trades as well as horticultural brownfield sites. Investors, owners or users have withdrawn temporarily or permanently (Rebele/Dettmar 1996).
- *Infrastructure and transport-related brownfield sites* are abandoned locations previously used for transport, logistics or supply and disposal infrastructure (including former freight depots and loading stations, post offices, airfields).
- *Housing brownfield sites* include derelict sites used for housing which have been abandoned due to lack of demand or housing quality (building fabric, equipment, location). In the case of single sites that are undeveloped but that can be developed, as well as few contiguous sites in settled areas that have grown or been newly developed, these are also referred to as vacant lots (BBSR 2013: 2).
- *Cultural and social brownfield sites* are abandoned sites previously used for social (e.g. schools, day-care centres) and cultural infrastructure (e.g. cinemas).

The reasons for the emergence of brownfield sites in cities vary:

- *Changes in the economic structure* and the associated changes in entire branches of industry, but also in the demands on logistics and other commercial operations, lead to continuously changing location requirements with the consequence of location closures and production transfers. This affects old industrialised areas as well as locations with a high degree of specialisation and centralisation. If the sites can no longer be used economically due to their location, conditions intrinsic to the site or their former uses, and the costs of providing local public infrastructure or processing are not profitable, this results in industrial and commercial brownfield sites (Dieterich 1984).
- *Demographic change*, characterised by decreases in the population and changes in the population structure, can lead to changes in demand for housing (▷ *Demographic change*). In shrinking cities, which are severely affected by vacant housing, both housing and social infrastructure facilities have been and are being demolished for housing and urban planning reasons (▷ *Shrinking cities*; ▷ *Urban redevelopment*). This creates housing brownfield sites which, according to the applicable funding guidelines, cannot be rebuilt for a certain period of time, or can only be rebuilt to a limited extent. These areas are often subsequently used as temporary open space (Rößler 2010).
- After *natural disasters*, locations can also fall into disuse, e.g. if commercial and residential locations are abandoned after (recurring) flooding incidents.
- In German cities there are still a few scattered brownfield sites as a result of *war damage*. In many cases, these are vacant lots that have not (yet) been rebuilt due to low demand or lack of resources on the part of the owners.
- As a result of German reunification, the continuous withdrawal of Allied troops and the structural reform of the Federal Armed Forces, numerous *military locations* (barracks, ammunition storage, training areas) in settled areas were abandoned (BMVBS [Federal Ministry of Transport, Building and Urban Development] 2013). Both the federation, as the owner,

as well as the local authorities concerned have a great interest in bringing these locations back into civil use quickly. This process of the abandonment of areas used by the military until they are used for new urban development purposes is referred to as conversion and the corresponding locations as derelict land (Bunzel/Michalski 2012: 9 et seq.).

3 Potential for urban and regional development

For urban and regional development, brownfield sites present varying potential for development and use (Mathey/Rößler/Banse et al. 2015).

3.1 Potential for subsequent densification

In the inner zone, brownfield sites are usually the only areas that can be used to cover development needs requiring building, e.g. for housing, commercial and industrial purposes. This ranges from developments of detached houses on vacant lots to large urban development projects on larger brownfield sites, which present the possibility of developing residential neighbourhoods, inner-city commercial and service areas or university and educational locations (*BMVBS* 2013: 10 et seq.). In this way, the goal of ▷ *Inner development* for the benefit of reducing new land take (see section 4.1) can be implemented and reurbanisation can be promoted.

3.2 Socio-cultural potential

Brownfield sites offer opportunities for trying out unconventional uses. They provide space for socio-cultural activities in the creative sector (▷ *Creative sector and cultural sector*). This ranges from temporary use for events, artist interventions, the establishment of community gardens or the use of empty buildings by clubs, associations or artists. These selective, temporary interventions draw attention to areas that appear functionless, can stimulate new ideas for new uses and bestow value on the sites (Rall/Haase 2011).

Green brownfield sites can improve the supply of open spaces in urban districts. They offer recreational functions, help the urban population to experience nature and provide opportunities for environmental education (cf. Wittig/Zucchi 1993). The populace tends to be ambivalent toward brownfield sites; besides appreciating the ecological succession or wilderness that can often have great value from a nature conservation perspective, brownfield sites are also perceived as aesthetically detracting from the cityscape or as a danger (e.g. due to neglect or crime) (Banse/Mathey 2013). The characteristics of the sites are important in terms of their acceptance and use.

3.3 Ecological potential

Depending on the initial conditions (age, size, previous use, soil sealing, existing remains of buildings, soil conditions, relief) and the current situation (residual/temporary use, location in the city), ecological succession processes can take place on brownfield sites that lead to different stages of growth and ground cover, (Wittig/König/Rückert 1989) thus allowing green brownfield sites to arise. The succession stages, which are influenced by the initial state of the site, the course

of time and pressure of use, give rise to various ecological, nature conservation, design and functional potentials (cf. Kowarik 2013; Wittig/Zucchi 1993).

As unsealed open spaces characterised by vegetation, green brownfield sites, similar to green spaces, provide various ▷ *Ecosystem services* in the city. Depending on their degree of soil sealing and their vegetation structure, they regulate the microclimate, and enable rainwater infiltration and carbon storage (Mathey/Rößler/Lehmann et al. 2011). As habitats for plants and animals in the city, green brownfield sites are an important component of urban ▷ *Biodiversity*. They can serve as refuge areas for fauna, as additional or replacement habitats and support the development of new habitats and communities. They are generally richer in species than the biotopes found in areas of intensive agriculture and forestry. Above all, this is a result of the relatively high habitat diversity (considerable variations in soil conditions, specific microclimatic situations, etc.) and the high level of dynamics in these sites (cf. Rebele/Dettmar 1996; Wittig/Zucchi 1993). It is not uncommon for their biodiversity to be characterised by rare or endangered species. In some places, however, they also provide a habitat for invasive plant and animal species.

4 Importance of brownfield sites for the challenges and objectives of urban and regional development

With their diverse potential, brownfield sites offer various options to meet different environmental and spatial planning challenges and objectives, which form the framework for decisions on subsequent use.

4.1 Soil conservation and reduction of new land take

The soil conservation objective formulated by the EU (EC 2013: 3) is substantiated with the goal of developing compact settlement structures as a basis for sustainable urban development, as anchored in the Leipzig Charter on Sustainable European Cities. The objective of reducing new land take for settlement and traffic to 30 hectares/day is established (German Federal Government [*Deutsche Bundesregierung*] 2002) in the Federal Government's national sustainability strategy. This is to be implemented by realising a ratio of inner development to outer development of 3 to 1, among other means. ▷ *Soil conservation* and the principle of ▷ *Inner development* are regulated in the Federal Building Code (*Baugesetzbuch, BauGB*) (section 1(5), section 1a(2) of the Federal Building Code). Inner development especially aims at activating the land potential in existing settlements. Further suburbanisation and new land take in the outer zone of cities should be reduced this way. In the context of closed cycle land management (▷ *Land management*), brownfield sites represent land which can potentially cover the development need for residential and commercial areas in the inner zone and thus contribute to fulfilling the objective of saving land (*BBR* [Federal Office for Building and Regional Planning] 2007).

4.2 Climate protection and the energy transition

With the German Federal Government's 2007 Integrated Energy and Climate Protection Programme (*IEKP*), the goal of reducing German greenhouse gas emissions by 40% compared to 1990 was presented as a contribution to reducing global emissions (German Federal Government 2007).

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To implement this objective, it is also necessary to maintain and promote compact settlement structures in order to reduce the volume of traffic. Another component of the efforts to reduce the emission of climate-damaging greenhouse gases is the expansion of renewable energy (▷ *Renewable energies*). Although the use of urban brownfield sites to generate energy (e.g. biomass, photovoltaic systems) can only make a marginal contribution to the objectives, these sites offer locations for which there is less competition than in agricultural areas (Federal Institute for Building, Urban and Spatial Research, *BBSR* 2010). Vegetation on brownfield sites also acts as a carbon sink to reduce greenhouse gases and thus to facilitate (▷ *Climate protection*).

4.3 Adapting to climate change

Cities are severely affected by climate change and must take suitable measures to remain attractive despite the consequences that are now unavoidable (▷ *Climate change adaptation*). The German Strategy for Adaptation to Climate Change (*Deutsche Anpassungsstrategie, DAS*) adopted by the Federal Cabinet in 2008 and the corresponding action plan adopted in 2011 established the nationwide framework for implementing climate adaptation measures in various fields of action as well as at the state, regional and municipal level (German Federal Government 2008, 2011).

Open spaces and urban vegetation play a major role in the design of environmentally-friendly cities. With their often diverse vegetation, brownfield sites can regulate the microclimate and promote the formation of cold air. When it comes to handling stormwater events, largely unsealed brownfield sites with vegetation offer opportunities for decentralised rainwater infiltration and act as retention areas (▷ *Flood protection*) (Rößler/Mathey 2014).

4.4 Promoting urban biodiversity and urban environmental quality

In the National Strategy on Biological Diversity, the aim for urban landscapes is to make settlements greener, to provide access to public green spaces within walking distance and to ensure the diversity of their qualities and functions. At the same time, replacement habitats for native species and settlement opportunities for species that do well in warm areas are to be developed in cities (*BMU* [Federal Ministry for the Environment, Nature Conservation and Nuclear Safety] 2007). The preservation of brownfield sites or their reclassification into green spaces can thus contribute to preserving and strengthening urban (▷ *Biodiversity*) and ecological services (*BMUB* [Federal Ministry for the Environment, Nature Conservation, Construction and Nuclear Safety] 2015a, b). With the aim to safeguard the capacity and functionality of the ecosystems in the long term, the Federal Nature Conservation Act (*Bundesnaturschutzgesetz, BNatSchG*) calls for the renaturalisation of sealed surfaces that are no longer in use or for natural development to be allowed to take place (section 1(3) no. 2 of the Federal Nature Conservation Act).

5 Strategies for dealing with brownfield sites

In considering the possible strategies for dealing with urban brownfield sites, a fundamental distinction should be made between the strategies of regeneration and renaturalisation. Since the needs and resources for targeted subsequent use are not the same everywhere, temporary uses

for certain periods of time may also be considered. The condition of being a brownfield site is not reflected in planning law, nonetheless there are numerous sites that have not been actively used for decades. Especially in cities or urban areas with little pressure to use such sites, just 'leaving them be' is definitely an option.

5.1 Regeneration

Regeneration usually describes approaches that aim to reuse a brownfield site for building purposes (e.g. residential buildings, commercial operations, infrastructure facilities). The new use can correspond to either the original use or a new category of use. Regeneration is primarily aimed at recycling land, i.e. the renewed intensive use of previously developed areas for the benefit of sustainable \triangleright *Land management*.

The concept of conversion, which was originally only used for military sites, is now also used for complex comprehensive measures regarding the subsequent use of large-scale industrial or infrastructure brownfield sites, where conditions are often similar. The release of such large-scale locations offers the opportunity to restructure urban spaces and make them more attractive, as well as providing important stimuli for urban development (Bunzel/Michalski 2012: 9 et seq.). Depending on the previous use, various challenges can arise. With former railway sites, it is the sectoral planning restrictions, the large number of stakeholders involved and the location and size of the sites that place special demands on regeneration (Renner 2004). The conversion of areas formerly used by the military also presents a number of particularities: typically, these are unique, highly complex processes for the stakeholders involved. Once a site has been abandoned, it is owned by the Institute for Federal Real Estate (*Bundesanstalt für Immobilienaufgaben, BImA*), acting as the federal real estate service provider. In accordance with its development objectives, the local authority acts as municipal planning agency and develops prospects for subsequent use within the framework of urban land-use planning, taking into account the objectives of federal state and regional planning (*BMVBS* 2013: 13 et seq.).

The following describes requirements for subsequent use that can apply to all larger brownfield sites or derelict site with prior military, industrial or infrastructural use (Bunzel/Michalski 2012: 11 et seq.): At the beginning of a regeneration process, an urban planning analysis of the brownfield site (location in the city, spatial potential) should be carried out and the ownership and legal planning status should be examined. If possible, existing buildings should continue to be used. This is especially true for listed (heritage protected) buildings. If the existing building can no longer be used or reused, the site must be cleared. Former industrial, infrastructure and military sites are generally subject to a contamination analysis and decontamination, and in some cases, explosive ordnance must be cleared. In previously independent areas such as larger industrial or barrack areas, the infrastructure (e.g. sewage disposal) often has to be rebuilt. Based on a nature conservation analysis and assessment, the interests of nature conservation must be taken into account in the strategy for subsequent use.

5.2 Renaturalisation

The renaturalisation of brownfield sites refers to approaches aiming to convert brownfield sites which formerly had built use into permanent green spaces or areas for the protection of nature and the landscape (*BMVBS/BBSR* 2009). Currently, this strategy is predominantly used in \triangleright *Shrinking*

cities with declining demand for living space. But even in cities with greater pressure to use the brownfield sites, green spaces can be created to improve quality of life and the environment. To some extent, existing ecological qualities can be preserved and expanded. Particularly large military training areas could often develop into landscape areas worthy of protection and be safeguarded in the course of conversion processes (BMVBS 2013).

A reallocation of building plots in green spaces usually means a reduction in the value of the property (▷ *Land market/land policy*). The development of permanent green spaces therefore requires that the local authority purchase the site or exchange another for it. In view of the changed requirements for green spaces and dwindling public funds for maintaining them, in addition to the creation of district parks, alternative options for use are also possible, such as urban agriculture, urban forestry, community gardens or spaces to experience nature, and occasionally wilderness experiments (Rößler/Mathey 2014: 59).

5.3 Integrated strategies

The diverse development potential of brownfield sites and demands for their subsequent use means that coordinated strategies are required. One component for realising this objective is the strategy of ‘double inner development’, i.e. the densification of built spaces while maintaining open spaces and a green living environment to ensure attractive and healthy living conditions (BfN [German Federal Ministry for Nature Conservation] 2008). In this way, environmental qualities are preserved through inner development, which in the long term will turn cities into attractive and competitive places to live in.

5.4 Temporary uses

Temporary uses (▷ *Temporary use*) refers to ways of shaping and using brownfield sites that leave options open for future development without changing the owner or changing planning law, whilst in the meantime reducing urban deficits or bringing about new qualities, whether for a longer or shorter period of time (BBR 2004: 4). Temporary uses are appropriate where there is a prospect of a demand for buildings and where this is also desirable in terms of urban planning (BBR 2006: 207 et seq.). The temporary use of brownfield sites as green space is one way of improving the situation in relation to open space (Mathey/Kochan/Stutzriemer 2003: 77 et seq.); in order to safeguard ecological qualities in the long term, however, a permanent approach to planning is required.

6 Planning instruments

A large number of planning instruments are available for implementing the various options for subsequent use. Development programmes to finance the regeneration of brownfield sites and to implement various subsequent uses are provided on the EU, federal and federal state levels. In addition, (financial) incentivising instruments for private stakeholders are important for regeneration (BBR 2007). In the case of complex projects in particular, interdepartmental coordination and a management unit are necessary (Bunzel/Michalski 2012). Public participation is a prerequisite for the acceptance of larger projects for the subsequent use of a brownfield site.

The coordinated subsequent use of urban brownfield sites is further facilitated by a brownfield site land registry, central contact persons and advisory services (Brinker/Sinning 2011).

6.1 Urban land-use planning

In considering the potential for inner development within the framework of ▷ *Urban land-use planning*, in accordance with section 1a(2) of the Federal Building Code, determinations of brownfield sites, vacant buildings, vacant lots and other possible sites for densification should be used as a basis. Brownfield site land registries provide a tool for recording brownfield sites and their characteristics as a basis for decisions regarding future use.

In preparatory land-use plans (▷ *Preparatory land-use plan*), brownfield sites are often depicted as commercial or housing land, according to the nature of the surrounding area and their previous use. The reclassification of brownfield sites, especially large areas such as military sites, into new categories of use must be represented accordingly in the preparatory land-use plan. The land uses for areas that do not fall within the unplanned inner zone in accordance with section 34 of the Federal Building Code can be specified in the binding land-use plans. In order to avoid the loss of building rights and property values, it is possible to stipulate temporary uses for a certain period of time or until certain circumstances occur in the ▷ *Binding land-use plan* in accordance with section 9(2) of the Federal Building Code. In order to secure public open spaces on brownfield sites for the long term, they must be designated as green spaces.

Binding land-use plans for inner development in accordance with section 13a of the Federal Building Code can be used as an instrument to support and accelerate the reclamation of brownfield sites, densification and inner development. However, due to the simplified rules for environmental assessments and impact mitigation regulations in this process, the ecological potential of a brownfield site and thus the option of renaturalising the site may not be sufficiently recognised.

6.2 Urban development enforcement orders

In preparation for regeneration or renaturalisation, the dismantling and desealing order in accordance with section 179 of the Federal Building Code can be invoked. Since 2013, it has also been possible outside the scope of a binding land-use plan to oblige owners, especially of so-called junk property, to carry out or tolerate the complete or partial removal of the built structures (BMUB 2014).

6.3 Regeneration of the unplanned inner zone

In accordance with section 34 of the Federal Building Code, for brownfield sites in the unplanned inner zone and in particular for vacant lots, the regeneration can take place in conformity with the previous use or a use that blends in with the surrounding area. The subsequent use can be regulated in urban development contracts (▷ *Urban development contract*) if required.

6.4 Special Urban Development Law

If there are brownfield sites in regeneration areas in accordance with section 136 of the Federal Building Code, their subsequent use can be described in regeneration bye-laws and in corresponding framework plans. In the course of urban redevelopment measures in accordance with section 171a of the Federal Building Code, existing brownfield sites or areas that have been exposed due to demolition measures (housing brownfield sites) are to be used for sustainable urban structural development, in particular for climate protection and climate change adaptation, or for a temporary use that is compatible with this. Depending on the specific objective, brownfield sites can be built on or used as temporary or permanent green space. Integrated urban development concepts or urban development strategies, which must be drawn up as a prerequisite for the allocation of urban development funds, should be used to develop integrated strategies for dealing with the potential of brownfield sites in the corresponding areas (▷ *Integrated urban development*).

6.5 Nature conservation law

The basic principles and approaches for steering densification from an ecological point of view and for the implementation of renaturalisation projects can be developed in municipal landscape plans. Particularly valuable biotopes or species found on brownfield sites can make it necessary to designate ▷ *Conservation areas under nature conservation law*. Impacts caused by the development of ecologically valuable brownfield sites will be compensated for within the framework of the ▷ *Impact mitigation regulation* in accordance with section 1a(3) of the Federal Building Code and sections 13-19 of the Federal Nature Conservation Act, if the corresponding conditions are met. In addition, compensation measures for impacts elsewhere in the municipality can be directed specifically to brownfield sites (Zabojnik 2006; Hansen/Heidebach/Kuchler et al. 2014: 130 et seq.).

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Last update of the references: December 2016