Chapter 2
The Urban Nature Concept—of What Urban Green Consists of

Jürgen Breuste

Abstract Urban nature is notably diverse and species-rich. This is partially due to the particular ecological conditions provided by the urban environment. Due to the broad spectrum of human activity, the urban environment offers a range of habitats for different species. The "four natures approach" is a simple method for presenting urban nature in a clear and concise manner. It focuses on the particular features of urban nature (fauna, flora, and vegetation) and distinguishes between four different "types of nature" based on the degree of anthropomorphic influence that the landscape has experienced. Urban parks, woodlands, forests, gardens, agricultural land, wetlands, and new urban wildernesses contribute to urban nature. Each type of nature provides specific urban ecosystem services as benefits for urban residents. These urban nature types have specific structure, design, management, utilization forms, locations, and embedding into urban forms. Urban forest refers to the entirety of urban tree stock, irrespective of ownership and is considered a resource and provider of ecosystem services benefitting the city residents. It includes woods and woodlands as well as all trees on both public and private land (street trees, trees in parks, private gardens, cemeteries, brown fields, orchards).

Keywords Urban nature · Urban parks · Urban woodlands · Urban wetlands · Urban agriculture · Urban wilderness

2.1 The Four Urban Natures Approach

In most parts of the world agrarian landscapes and forests are considered to be the original contrast of the cultural appropriation of nature. Culturally shaped nature showed that "culture" was achieved, irrespective of "Wilderness," which has traditionally been represented as forests. Both agrarian landscapes and forests have

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been symbolically incorporated in cities and can be encountered in various forms ranging from lawns as remnants of livestock pastures in cultivated meadow landscapes, urban kitchen gardens originating from a once agrarian-rural lifestyle to trees, bushes and shrubs symbolizing natural forests (Breuste et al. 2016). Hence, urban nature has historic-cultural foundations as well as symbolic properties (Breuste 1994; Gilbert 1989; Aitkenhead-Peterson and Volder 2010).

Urban Nature Is Diverse!
Urban nature is notably diverse and species-rich. The causes for the comparably high degree of biodiversity in cities can be partially attributed to the decreasing biodiversity in agricultural landscapes due to intensive farming and to the ecological conditions provided by the urban environment. Due to the broad spectrum of human activity, the urban environment offers a range of habitats for different species. The main causes for urban biodiversity and species-richness are attributed to

- Structural variability within the urban landscape.
- Supply of nutrient-poor, dry and warm habitats.
- Favorable for species tolerant of pollution and disturbances.
- Support of pollution and disturbance resistant species.
- Supply of certain habitats and food resources.
- Introduction and propagation of non-native species (Breuste et al. 2016).

A simple method for presenting urban nature in a clear and concise manner was suggested by Kowarik (1992) in her "four natures approach." This categorization focuses on the particular features of urban nature (fauna, flora, and vegetation) and distinguishes between four different "types of nature" based on the degree of anthropomorphic influence the landscape has experienced. This approach allows for a better classification of further in-depth studies (Kowarik 1992, 2018, Breuste et al. 2016) (Fig. 2.1).

"First nature" (Kowarik 1992) includes remnants of primeval landscapes as well as ancient forms of land use such as forests and wetlands, which are often idealized as "pristine nature." They are the "old wilderness" to which something primeval still adheres and which is still a substantial part of spontaneous vegetation in general. Particularly forests are associated with "first nature" (Fig. 2.2).

"Second nature" consists of agricultural land which continues to be (commercially) used, although it has been engulfed by urban expansion and either lies on the outskirts of the city or has already been integrated into the city suburbs. This includes meadows, pastures, and cropland as well as related landscape elements such as hedges, heather, drifts, and grassland. "Second nature" is often heavily influenced by the city and typically characterized through intense management (Fig. 2.3).

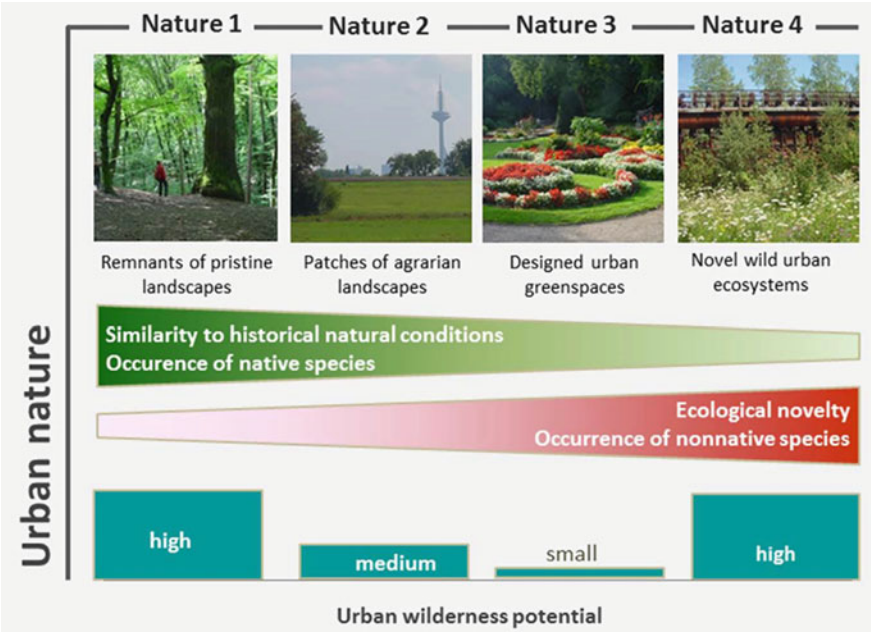

Fig. 2.1 The four urban natures approach (Kowarik 2018)

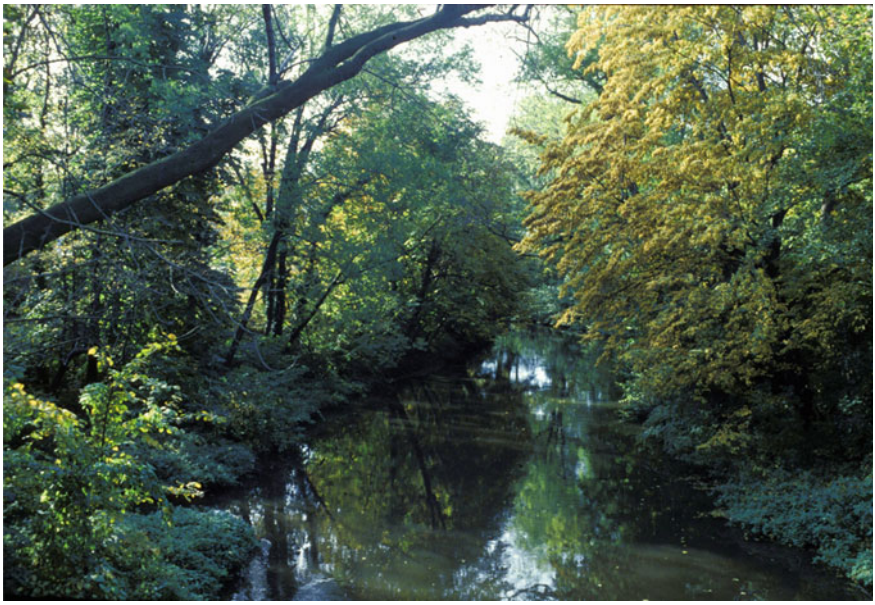

Fig. 2.2 Urban floodplain forest in Halle/Saale, Germany (Jürgen Breuste, picture taken in 2006)

Fig. 2.3 Orchard meadow in Halle/Saale, Germany (Jürgen Breuste, picture taken in 2006)

"Third nature" describes the "symbolic nature" found in gardens and parks—the type of urban nature typically perceived as "urban green" and specifically used to shape the city landscape as well as provide economic and aesthetic value. "Third nature" ranges from kitchen gardens created out of economic necessity to decorative gardens ("city gardens" or parks) as aesthetic elements of division and design. Included are very diverse yet typical urban living spaces such as house gardens, allotment gardens, roadside green, city parks, large recreation parks, single trees, tree avenues, etc. Their degree of anthropogenic shaping due to use and maintenance, however, varies strongly and is influenced by economic circumstances, trends, and temporal fluctuations. Management use and style are subject to trends, fashion, and economic factors. Spontaneous growth is typically not tolerated and suppressed as the focus lies on aesthetic interpretation of nature.

"Fourth nature" is often given special attention in the research of urban ecology, as this form of nature is neither sown nor planted but instead occurs naturally in urban-industrialized areas. This type of nature emerges under anthropogenic influences as spontaneous growth and is closely linked to the degree of habitat change (soil, hydrological balance, microclimate, etc.) following the cessation of specific land use. In accordance with typical urban-flora, pioneer species develop, followed by spontaneous shrub-communities and urban pioneer-forests. This type of nature is frequently the subject of urban-ecological studies and has increasingly become the main area of interest in botanical research since the 1970s (e.g. Kowarik 1993, 2018, etc.).

Types of Green Spaces—How City Planners and Landscape Architects Perceive Nature in Cities as "Green" Planning Objects

City planners and landscape architects frequently describe urban nature as "green spaces" and distinguish according to location, accessibility, and importance for city dwellers. These distinctions usually only pertain to publicly accessible areas. Private areas such as gardens and parks on owned land are rarely considered as they are not subjects of city planning. Instead city planning typically focuses on usage categories such as parks, sports fields, allotment gardens, cemeteries, forests, etc. These areas are supposed to represent the types of urban nature as well as the way they are used (Gälzer 2001; Gälzer and Hansely 1980, p. 43).

1. *Green spaces related to housing/housing-related green spaces*:

   Gardens in homes (e.g., house gardens and tenant-gardens), play areas for children, leisure and movement areas for mothers with toddlers as well as the elderly who are restricted in their mobility. Distance less than 500 m or within 5 min walking distance (pram-distance).

2. *Green spaces relating to residential areas/housing areas*:

   Especially play areas for older children and teenagers, recreation and lounge areas (parks) for families and groups of adults, spaces used for small-scale gardening (allotment gardens) for certain groups of people (e.g., families with small children, elderly), facilities for popular sports (e.g., sports fields in school and youth centers). Distance no more than 1000 m or 15 min walking distance.

3. *Green spaces in districts/neighborhoods*:

   Allotment gardens, public swimming pools, and sport facilities, cemeteries, larger parks with a range of usage possibilities, easily reachable with public transport.

4. *Regional and city-based green spaces (local recreation areas)*:

   Recreation areas, allotment gardens, larger sport facilities (stadiums, facilities for more specialized sports), camping grounds, botanical, and zoological gardens.

A green city is a shaped landscape with interlinked nature allowing for connectivity between neighboring cities to create an urban landscape such as the Ruhr area (Vogt and Dunkmann 2015). In a green city all four approaches of nature (Kowarik 1992) can contribute to the nature experience within the urban environment (Ossola and Niemelä 2018; Rink and Arndt 2011).

2.2 Urban Woodlands—Remnants of Pristine Landscapes

Urban woodlands are typical (residual) elements of cultural landscapes used for agriculture and forestry, which have expanded into the city and now exist within the direct vicinity of urban development. These areas typically lie on the city's periphery but can also be fully integrated within the city itself.

There is an ongoing debate regarding the use of the terms "urban woodlands" and "urban forests" (e.g., Randrup et al. 2005). The terms are not synonymous and are used differently in English and German-speaking countries. The English expressions "urban woods and woodlands" include "forest," "wooded land," "natural forest," "plantations," "small woods." and "orchards" irrespective of the ownership of said land (Randrup et al. 2005).

Urban Woodlands

- Is characterized by the tree population, which creates a distinct forest climate and specific habitat conditions.
- Lies embedded within the city or on the city's periphery (urban, peri-urban).
- Has an area of at least 03/05 ha.
- Can be either publicly or privately owned and is typically accessible for the public.
- Provides a variety of ecosystem services such as recreation, health and wellbeing, climate regulation and hydrological balance, forestry as well as biodiversity.
- The services provided primarily benefit the city residents.

The lower limit for the areal size of urban woodlands is reached once the limited expansion of the area can no longer create its own microclimate and specific habitat characteristics. Leser (2008) and Dietrich (2013) set the lower areal limit at 0.5 ha, Burkhardt et al. (2008) (p. 33) at 0.3 ha with a minimum circumference of 50 m.

As previously mentioned, urban woodlands can either be publicly or privately owned. They are usually either planted or created through (vegetative) succession and are typically commercially used. Their accessibility is an essential prerequisite for the cultural ecosystem services they provide for the city residence (Randrup et al. 2005; Konijnendijk 2008; Konijnendijk et al. 2005, 2006; Gilbert 1989; Burkhardt et al. 2008; Leser 2008).

Urban Forest—Urban Tree Stock

Urban forest refers to the entirety of urban tree stock, irrespective of ownership and is considered a resource and provider of ecosystem services benefitting the city residents. It includes woods and woodlands as well as all trees on both public and private land (street trees, trees in parks, private gardens, cemeteries, brown fields, orchards) (Dwyer et al. 2000; Randrup et al. 2005; Konijnendijk et al. 2006; Konijnendijk 2008; Pütz et al. 2015; Pütz and Bernasconi 2017) (Table 2.1).

Table 2.1 Elements of the urban forest (see also Pütz and Bernasconi 2017)

Element	Description	Classified as Forest under the forestry law	Private property
Urban forest/urban woodland	Forest within the city boundaries, often intensely/frequently used for leisure and recreation	Yes/No	Typically not
Forests in peri-urban areas	Forests in the greater city area	Yes	Yes/no
Woodland in residential areas	Wooded areas with „forest character"	No	Typically not
Parks	Forest-parks with relatively dense tree stock, but also all other parks with woodland, patches of trees or individual trees	No	Typically not
City parks	Privately owned gardens with fruit tree stock/orchards	No	Yes
Orchards, tree nurseries	Agriculturally used land	No	Yes
Canopy roads (tree avenues), tree patches, individual trees	Remaining urban tree stock (excluding forests and parks) in public spaces, town squares, and along streets	No	No

> … urban forest includes all trees and their habitat within the city's urban area boundary. This includes trees on both public and private property: along city streets; in parks, open spaces and natural areas; and in the yards and landscaped areas of residences, offices, institutions, and businesses. The urban forest is a shared resource that provides a wide range of benefits and services to the entire community (Copestake and City of Ottawa 2017).

Cities that are located in zonobiomes with climax forests can enable forest growth more easily through vegetative succession and might feature residual forests (Fig. 2.4).

Most urban forests are planted and often feature species compositions that are not typical for their location. In such cases, the term "forest" appropriately describes the character of these urban woodlands. Hence, the term "forest" is often reserved for woodland that is comprised of indigenous species, irrespective of being deliberately planted or the result of natural development (Kowarik 1995) (Fig. 2.5 and Table 2.2).

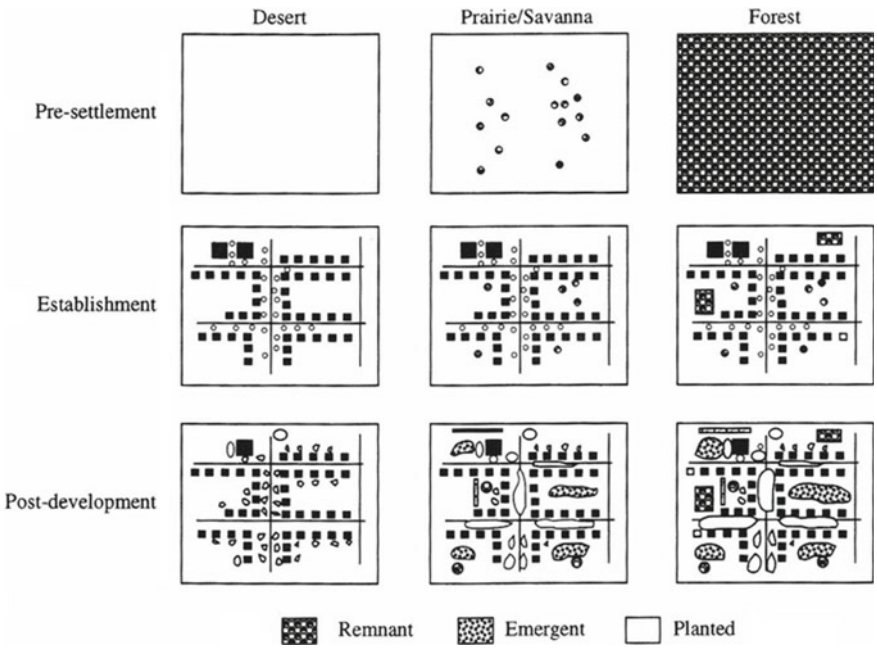

Fig. 2.4 Development of urban forests through residual forests, natural succession and planting in three ecoregions (Zipperer et al. 1997, p. 235 in Breuste et al. 2016)

2.3 Public Urban Parks—Designed Urban Green Spaces

City parks belong to the most common and thoroughly researched forms of urban nature worldwide. This can be attributed to the fact that they are among the most intensely used forms of urban nature and are typically perceived by the public as the most important and oftentimes only useable form of urban nature. However, urban parks were only eligible for broad public use at a relatively late stage.

Park (Synonym Urban Park, Metropolitan Park, Municipal Park/North America, Public Parks, Public Open Space, Municipal Gardens (UK)
Landscaped public green spaces within the city, designed to contribute to the beautification of the urban landscape, as well as provide recreation for the city residents and tourists alike. Design-elements include vegetation structures, infrastructure (pathways, resting places), water areas, in larger parks, also buildings, sports facilities, playgrounds, cultural or retail facilities, toilettes, etc. (Schwarz 2005; Konijnendijk et al. 2013)

The attractiveness of city parks and the intensity of their use based on the diversity of the park's features (natural elements and infrastructure) as well as the corresponding range of possible uses, which cater to the various interests of potential park users. For many people living in the densely populated city center, city parks are often the only possibility to experience and enjoy nature as well as escape the daily stress of city life (Fig. 2.6).

Fig. 2.5 The "Kapuzinerberg" hill in Salzburg is a woodland island in the center of the city (Jürgen Breuste, picture taken in 2003)

Table 2.2 Distinction of forests based on settlements/type of residential area (Kowarik 2005, p. 9, altered in Burkhardt et al. 2008, p. 31)

Forest type	Subtype	Location	Function		Urban influence
			Social function	Production	
Urban forests	Forests within city boundaries Forests at the city outskirts/ periphery	Isolated in developed areas Between developed areas and open landscapes			
Semi-urban forests	Forests in the vicinity of cities	Part of the cultural landscape bordering on urban areas			
Nonurban forests	Forests (located) far away from cities	Part of the open (near-natural) landscape, far away from cities			

Fig. 2.6 Lumphini Park in Bangkok, Thailand (Jürgen Breuste, picture taken in 2006)

While city parks were once typically located on the outskirts of the city (i.e., Hyde Park, London Park, Central Park New York, English Garden in Munich), they soon became embedded into the urban environment as cities expanded during the nineteenth and twentieth century. In the twentieth century, new parks were established at the city's new periphery, often as vast landscape parks, intended to be used for leisure and recreation on weekends. The transition into the "open landscape" is often smooth, as is the transition between park, forest-park and urban woodland.

While parks of the nineteenth century were artistically designed and compromised landscapes, they now represent the (surrounding) landscape—particularly when located at the city's periphery. Parks are a public asset and should be equally accessible to all people.

However, in practice this notion of equality seldom applies, as parks are rarely distributed evenly in cities and thus distance alone often limits their accessibility for some city residents. Further reasons for the unequal accessibility of parks can be attributed to the historical development of parks, the willingness of municipalities to provide parks as public assets, the availability and affordability of land, the morphology of the city itself, and lastly the interest-driven policies of certain population groups.

Furthermore, the criteria "park-area per inhabitant" fails to equally distribute parks as a public good (Greiner and Gelbrich 1975, p. 114). Irrespective of the location, size, and accessibility of parks, city planners continue to utilize "metres of park per inhabitant" as a "supply value" for assessing and comparing the quality of

cities as well as a reference for the development of objectives for the satisfaction of (public) demand.

Standards for park design, management and distribution are also subject of debate. An area of contention, however, can be found in the hierarchical categorization of parks based on the criteria: area (size), catchment area (supply for residents within a certain distance of the park), and available space in parks per potential user (i.e., per person in the catchment area). These figures are to be estimated as precisely as possible and can differ due to factors such as culture, tradition, and local availability. Although basic standards are frequently proposed, they too are subject of debate. Comber et al. (2008) have proposed "Accessible Natural Green Space Standards" (ANGst) for the assessment of Parks in England, yet may also be applicable for European cities:

- Everybody should live no further than 300 m from a park (or similar form of urban nature) of at least 2 ha in size.
- A publicly accessible park of at least 20 ha in size should be within 2 km of every urban dwelling unit.
- A publicly accessible park no smaller than 100 ha should be no further than 5 km of each dwelling unit
- A publicly accessible park no smaller than 500 ha should be no further than 10 km of each dwelling unit.

As these standards primarily focus on the provisioning of urban green, parks can be substituted with other forms of urban green spaces such as urban woodland or a publicly accessible part of the (open) landscape surrounding the city. Nevertheless, it remains unclear whether urban green spaces are truly interchangeable as they differ quite strongly concerning their range of benefits, services and uses, their inner structure, management, etc.

In 1995 The European Environmental Agency (EEA) published a report in which it is mentioned that in most European cities urban green spaces could be reached within 15 min, which is considered to be a reasonable distance with regard to the provisioning of urban green for city residents.

Grunewald et al. (2016, 2017) calculate the accessibility of public green spaces for the residential population in Germany by using the digital vector-dataset of the landscape model "AKTIS-Basis-DLM". Although "parks" are amongst the most important categories of urban nature, they are by no means the only category listed as a viable option for leisure and recreation. Kabisch et al. (2016) calculate the degree to which urban green is accessible, based on similar categories of use. Based on its location, size, and features, each park is allocated a "supply area" comprised of the expected users.

The results of several studies (e.g., Belgium/Van Herzele and Wiedemann 2003; Sheffield/Barbosa et al. 2007; UK/Comber et al. 2008; London/Kessel et al. 2009; Denmark/Toftager et al. 2011; Sheikhupura, Pakistan/Javed et al. 2013; Adana, Turkey/Unal et al. 2016) show that in many European cities the majority of residents can reach a green space within a distance of 900–1000 m (Breuste and Rahimi 2015). In other parts of the world this ease of accessibility might only apply for a minority of city residents (e.g., Pakistan, Javed et al. 2013). The sufficiency rate by bigger parks from an appropriate catchment area diminishes as the size of the parks decreases, even when the size of the catchment area increases accordingly (e.g., Breuste and Rahimi 2015, Table 2.3).

The importance of the local supply of parks can be observed in many large cities, especially in developing countries—as can be seen in several studies such as those conducted in Istanbul, Turkey (with an average of less than 0.5 m^2 of urban green spaces per resident) Karachi, Pakistan and Tabriz, Iran (Qureshi et al. 2010; Breuste and Rahimi 2015).

Table 2.3 Examples for the hierarchical categorization of parks based on the criteria of size (ha) and expected walking distance (m)

Type of park		Central Europe (Greiner and Gelbrich 1975)	Great Britain (Dunnett et al. 2002)	China, Nanjing (Liu 2015)	Iran (Parsanik and Maroofnezhad 2017)	Iran, Tabris (Breuste and Rahimi 2015)
Local park	m	400	500–1000		200	200
	ha	1	1.2		0.5	0.5
Neighborhood park	m	800	1000–1500	500	400–600	200–600
	ha	6–10	4	1–10	1–2	0.5–2
District park	m	1600	1500–2000	2000	800–1200	600–1200
	ha	30–60	8	10–100	2–4	2–4
City park	m	3200		5000	1500–2500	1200–2500
	ha	200–400	>8	>100	4–6	4–10
Landscape park/regional park at the city outskirts	m	6500			25–30 drive	
	ha	1000–3000			10	

Park Categories in Great Britain

A study of the Institute of Leisure and Amenity Management has attempted to categorize parks currently used in Great Britain with the following terminology:

Local Park—up to 1.2 ha, coverage area 500–1000 m, usually includes a playground and landscaped green, no further infrastructure or facilities.

Neighborhood Park—up to 4 ha, coverage area 1000–1500 m, landscaped green with versatile infrastructure.

District Park—up to 8 ha, coverage area 1500–2000 m, diverse landscape features/design and infrastructure, i.e., sport's fields, play areas, children's play areas.

Principal/City/Metropolitan Park—more than 8 ha, coverage area includes the entire city, diverse landscape designs and infrastructure of particularly high quality and attractiveness (Dunnett et al. 2002).

Internationally, it is commonplace to structure parks hierarchically. However, the applied parameters significantly deviate on a regional and national level—as do the designations used for said parameters. Table 2.3 attempts to make the different designations comparable by standardizing the language used while avoiding the use of the different designations (Fig. 2.7).

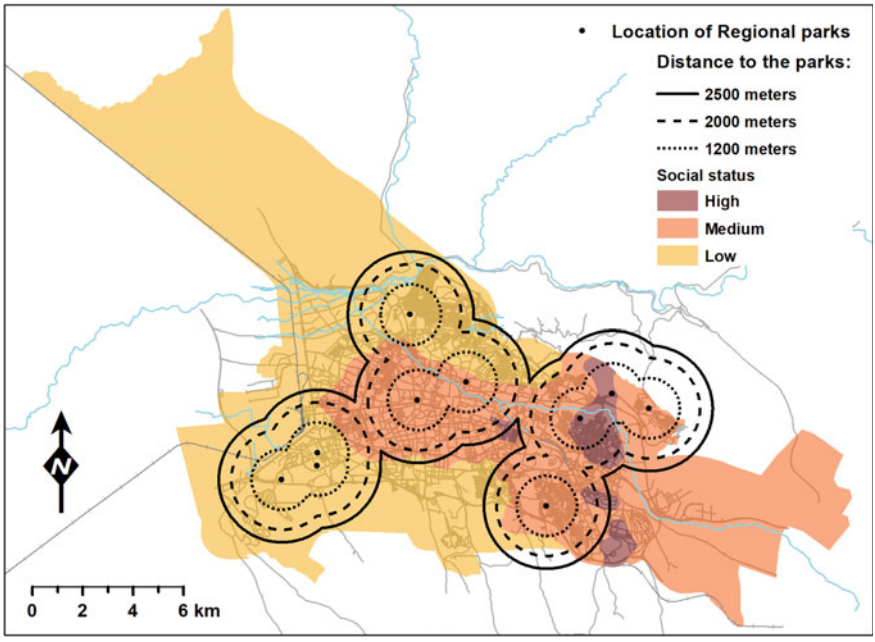

Fig. 2.7 Catchment area and social status of neighborhoods surrounding city parks in Tabriz, Iran (Breuste and Rahimi 2015; Breuste et al. 2016, Fig. 4.22, p. 117)

2.4 Urban Gardens—The Private Urban Green

Gardens are the last remaining connection between city residents and rural life. Hence, both private and public gardens are remnants of nature within the city.

The cultivation of fruits and crops has always been a subsidiary use of nature in cities and primarily serves as food supply for the city residents. As this form of food provisioning fails to support the demands of a growing city population, urban gardening and agriculture is typically only a supplementary form of food provisioning. The term Urban Agriculture has been used since the 1930s in reference to the production of food within the city boundaries (Qinglu Shiro: Agricultural Economic Geography) (Mougeot 2006; Swintion et al. 2007; Barthel and Isendahl 2013). The FAO uses the term "urban and peri urban agriculture" (FAO 2018).

According to the FAO definition, gardening is part of the more broadly defined term Urban Agriculture (Mougeot 2006). This perspective on city gardens sees food production as the main goal of urban gardening yet fails to recognize that in many developed countries urban gardening has shifted toward leisure and recreational gardening.

Urban and Peri-Urban Agriculture (UPA)

Urban agriculture refers to the primary food production in urban and suburban areas. This includes gardening (e.g., house gardens, allotment gardens), agriculture, livestock farming (poultry, rabbits, and beekeeping), and aquaculture. Urban agriculture can be pursued in various legal forms (privately to collectively) and is not tied to any ulterior socioeconomic motive.

In practice, however, some forms of urban agriculture are not intended for local food provisioning but cater to international markets. Although this form of agriculture is localized in urban areas, it is not tied to the requirements of the FAO regarding food safety and self-subsistence.

> Urban and peri-urban agriculture (UPA) contributes to food availability, particularly of fresh produce, provides employment and income and can contribute to the food security and nutrition of urban dwellers (FAO 2018).

Urban and peri-urban agriculture (UPA) is primarily defined based on content (food production) and location (urban) (Mougeot 2006; Swintion et al. 2007). Aside from food production, UPA provides a multitude of ecosystem services (Artmann and Sartison 2018).

Urban Gardens

Gardens are nature elements between privacy and publicity. The private gardeners are also the garden users.

The gardeners of public city gardens create aesthetic nature for others, typically broad groups of users (ideally the entire city population), who can

generally neither partake in the designing of city gardens, nor participate in any form of gardening after their completion. Public city gardens include both city parks as well as public green spaces (e.g., Breuste et al. 2016).

Private and communally managed gardens are usually no larger than several hundred square meters and located within proximity of their users, i.e., as home-gardens, allotment-gardens or community gardens. In contrast to large public city gardens, they allow for shaping and design according to the desires and needs of their users. Hence, the users are those who shape and manage the gardens. These types of gardens are frequently used for recreation and horticulture (Dietrich 2014; Breuste et al. 2016).

Urban gardening and urban agriculture cannot be definitively separated from each other—particularly at the level of small-scale production.

City gardening has a variety of objectives aside from food production, which have broadened considerably in the past decades due to "Urban Gardening" (Stewart 2018) (Fig. 2.8). Private and community gardens differ considerably from urban agricultural areas (see Table 2.4).

Fig. 2.8 Lad Phrao city farm, Bangkok, Thailand (Jürgen Breuste, picture taken in 2016)

Table 2.4 Categorization of urban gardens and urban agriculture (Greensurge 2015; Breuste et al. 2016)

Type	Type of green space	Description	Use/ perception	Management/ maintenance
Urban gardens	Front yard	Decorative gardens (5–20 m^2) in front of dwelling units, on open street areas	Private/ public	Individual/ maintenance company
	House garden	Garden connected to a private domicile used for both decoration and food production. 150—over 1000 m^2	Private/ private	Individual
	Allotment garden	Patch of rented land used for recreation and food production 200–400 m^2	Private/ publicly visible	Individual
	Green buffers	Garden area between more storied apartment building several 1000 m^2	Semi-public/ semi-public	Maintenance company
	Community gardens	Kitchen gardens, 100—several hundred m^2	Collectively/ semi-public	Collectively
Urban agriculture	Arable land	Wheat production	Commercial/ private or public	Privately/ machines
	Grassland	Fields and meadows/ meadows and pastures	Commercial/ private or public	Privately/ machines
	Orchards	Fruit production—high stemmed trees	Commercial/ private or semi-public	Privately
	Plantation	Fruit production—small trees/bushes, biofuel production	Commercial/ private	Privately/ machines
	Horticulture	Land devoted to growing vegetables, flowers, berries, etc.	Commercial/ private	Privately/ Individually or with machines

In the wake of the improvement of living conditions, such as in central and northern Europe, there has been a noticeable transition from kitchen gardens to aesthetic gardens catered to recreation and leisure. In southern Europe kitchen gardens continue to persist.

Urban Gardening—Private and Community Gardening

Gardening is the practice of shaping and maintaining nature (soil, relief, vegetation cover) as a usage- and aesthetic object with freely chosen goals. Individuals and

families are typically the main users of private gardens (home-gardens and allotment gardens being the main forms). In community gardens a (often socially heterogenous) group of city residents jointly shape and use the garden according to a mutual agreement.

In both cases, the motivation to engage in gardening includes a passion for shaping nature, cultivating healthy fresh produce for personal consumption, and active recreation through gardening. In community gardens social collaboration may also be a motivation.

In many cities around the world, urban gardening is neither a trend nor a lifestyle, but a significant part of the economy and a necessity for human subsistence.

> Urban gardening' is a term that encompasses many forms of gardening in urban areas. The woman who grows herbs on her window sill is as much a part of the urban gardening movement as the man who has tomatoes on his balcony or the collective who have turned an abandoned lot into a thriving community vegetable garden, though collective projects make up the majority of the people who currently identify with the label (Stewart 2018).

Gardening is among the oldest occupations. To do the right thing and to live a good life is inherently part of the motivations for gardening.

> By shaping a garden, one creates an ideal image of the world. One takes from nature that which cannot run, the soil, the plants, and shapes them according to one's desire. Land is used for the sake of people, with different intentions that either complement each other or compete and is inherently an issue of political dispute (Reimers 2010, p. 7).

Although many aspects of allotment gardens have changed throughout time, its core, namely the shaping of nature, has persisted and continues to be relevant today. Allotment gardens continue to play a significant role in the twenty-first century regarding ecologically oriented urban development, as well as human health and leisure activities within the urban environment—particularly in large cities. In Germany alone there are approximately 17 million hobby gardeners (Breuste 2010; Breuste and Artmann 2015; Bell et al. 2016; Breuste et al. 2016).

Today, allotment-gardening is a European phenomenon with worldwide "outposts." The concept of organized allotment garden clubs originated in Germany (Leipzig) between 1886 and 1910 and swiftly spread throughout Central and Western Europe as well as Scandinavia. During the Interwar period, eastern and southern European countries also adopted the idea and with the emergence of the environmental movements in the 1970s the concept continued to establish itself in southern Europe (Bell et al. 2016) (Fig. 2.9).

In recent years, urban gardening has gained a lot of public attention, which continues to grow and is reflected in its increasing media coverage. This growing publicity has not gone unnoticed by local and regional politics, which has also further contributed to the promotion of urban gardening.

However, this trend has also taken the focus off of allotment gardens, which have existed in Germany for over 100 years. Approximately one million allotment gardeners currently stand alongside several hundred community gardeners. Both stand for the uninterrupted approval and importance of gardening in cities based on many mutual, as well as some individual motives.

Fig. 2.9 Knowledge and Innovation Community Garden (KICG), Shanghai, Yangpu District, China (Jürgen Breuste, picture taken in 2017)

Wildlife Gardening

Wildlife gardens are a model for the reintegration of nature with the processes of gardening and garden-structures. This notion is becoming increasingly attractive as an individual and personal countermeasure against denaturation. As such, wildlife gardening can be seen as a lifestyle and entails certain values, which have established themselves in society.

Wildlife gardens leave some of the gardening to nature and provide a habitat for certain wild plants and animals. Maintenance is reduced in favor of natural processes and natural elements are used wherever possible. This provides the gardener with a sense of contributing to nature and a healthy environment.

Aspects of near nature gardening includes

- **Plant selection**: wild and robust species are planted.
- **Maintenance**: reduced maintenance, no strict order/arrangement, wild meadows —infrequent mowing, reduced soil sealing (greening of pavement grooves), sand, chips (wood/stone) and gravel used for pathways, composting, and permaculture.
- **Habitats**: for insects, bees, butterflies, birds. and small mammals, "Insect-hotels"
- **Fertilizer**: no artificial fertilizers, no insecticides or pesticides, use of home-made (organic) fertilizer.

- **Elements**: shrubs, patches, herb spirals, fruit trees, bushes, predominantly indigenous species, natural materials for fences and boundaries, water areas.
- **Soil**: only natural measures should be implemented to maintain and improve soil.

Community Gardens

A community garden is a publicly accessible piece of land that is collectively maintained and used by a group of people for the purpose of gardening. Unused land areas are frequently converted into such community gardens. The legal status of community gardens varies. The community responsible for maintaining these gardens are united by a mutual interest in gardening, particularly the cultivation of healthy fresh food. Aside from gardening the community is united by a common desire to participate in joint actions to achieve certain social, environmental, or sociopolitical goals. The concept of "community gardens" was developed in the United States during the 1970s and was established in Europe during the 1990s—frequently in conjunction with the goals of social integration (intercultural gardens) (Rosol 2006; Larson 2012).

According to Dietrich (2014) new garden types include

- Community supported agriculture (CSA),
- Regional box schemes/box subscriptions,
- Community gardens,
- Intercultural gardens,

Fig. 2.10 Guerilla Gardening in Lodz (Poland) (Jürgen Breuste, picture taken in 2011)

Fig. 2.11 Karl's Garden at the Karlsplatz in the center of Vienna, a "Display and exploration garden for urban horticulture" (Jürgen Breuste, picture taken in 2015)

- Neighborhood gardens,
- Pedagogic gardens,
- "self-harvest" gardens.
- Guerrilla gardening (Figs. 2.10 and 2.11).

In countries in which private gardening (small gardens, allotments) is not rooted in tradition, Community Gardening has emerged as the most important access to urban gardening in general. Currently, this trend is globally becoming the most widespread (Fig. 2.11).

Community garden organizations also aim to send a political message with their activities, such as actively and concretely contributing to the "cultural and energy revolution" by collectively using and shaping green spaces. They also serve as a field for experimentation regarding new forms of society (Reimers 2010) (Table 2.5).

Table 2.5 Comparison of allotment and community gardens in Germany based on selected features (Breuste 2010; Breuste and Artmann 2015; Anstiftung 2018)

	Allotments	Community gardens
Number of clubs in Germany	5,871	More than 650
Area in Germany in ha	450,000	unknown, about 60,000
Area per club in m^2	10,000	100—more than 1.000
Number of gardeners in Germany	950,000	10–15,000
Number of gardeners per club	50–600	10–50
Percentage of area used for food production (in %)	20–30	60–80
Gardeners	Predominantly pensioners, increasingly also families	Families with children, women, employed adults, only very few pensioners
Exist since	Approx. 140 years	Approx. 20 years
Location	In larger cities	Particularly in large cities
Average percentage of area used for relaxation and leisure (in %)	40–70	10–30
Gazebos	Many per plot (until 21 m^2)	Either none or only one per club
Structure	Individual parcels	Typically no parceling/subdivision
Type of organization	Non-profit organization	Non-profit organization—Ltd.
Proprietorship of land area	Typically tenants	Typically tenants
Toilettes	Usually WCs	Often compost-toilettes
Water supply	Always	Frequently
Raised bed structure	Variable	Often raised beds or transportable pots
Fences and hedges as boundaries	Yes	Yes
Fruit tree stock	Typically present	Hardly present
User fees	Yes	Yes
Stock reliability	Typically provided, occasionally uncertain	Rare due to pressure for housing development
Public work of club	Sparse, small internet presence	Intensive, high degree of Internet presence and social media use
Lobbying	Very rare	Frequently pursued
External financing, donations und Sponsoring	Rare	Frequent, important source of income

(continued)

Table 2.5 (continued)

	Allotments	Community gardens
Political perception	Minimal awareness and public outreach	Strong, frequently well received by municipalities, subject of political events, campaigning and advertising
Sense of community	Profound	Very pronounced
Motivation for gardening	Leisure and recreation, enjoyment of gardening, contact with nature	Enjoyment of gardening, social contact, environmental improvement
Common lifestyle	Not necessarily	Frequently exists
Networking between clubs	Within the association, nationwide umbrella organization	Variable, no nationwide umbrella organization local gardening networks
Nature conservation and education as club goals	Only few	Usually yes

2.5 Urban Waters—The Urban Blue Infrastructure

Wetlands have a great importance for biodiversity, climate, and flood protection. Urban water bodies and wetlands are frequently also part of urban nature, as many cities are built near rivers and coastlines. They are covered in detail in some chapters found in textbooks on urban ecosystems, (i.e., rivers, canals, ponds, lakes, reservoirs, and water mains (Gilbert 1989), urban water bodies (Forman 2014), wetlands and water in the urban environment (Niemelä et al. 2011), urban waters, (Breuste et al. 2016)). However, overall, they are rarely addressed in other textbooks. Frequently, wetlands and water bodies are viewed as different entities (Forman 2014). This may be due to the lack of an accurate definition of the term "wetland" and concrete ecosystems are categorized differently based on national tradition. Open water bodies such as lakes, rivers, and streams are frequently considered not to be included in the definition of "wetland."

Urban Water Bodies

Both flowing and standing waters that are subject to the characteristic influences of urban use (i.e., commercial use, flood protection, aesthetic design, pollution, eutrophication, etc.) can be characterized as urban water bodies. The usage can lead to significant changes of ecologically relevant characteristics in urban water bodies compared to water bodies outside of cities (Breuste et al. 2016). Examples for urban water bodies are small water bodies, ponds, lakes, water bodies in parks, rainwater retention basins, streams, rivers, drainage channels, canals, and harbor basins. Hence, urban water bodies do not constitute a specific type as per the classic typology of water bodies (Faggi and Breuste 2015; Brun 2015; Grafton et al. 2015).

- The opportunity to witness the processual character of water, as such impressive dynamic short-term changes are otherwise rarely observed/witnessed in nature.
- The likelihood of being able to observe life forms and processes near the water (animals—birds, fish, insects, etc.—the natural vegetation development between water and land),
- The exclusive accessibility to the water by traveling by boats and vessels (boat trips, water sports, etc.)
- The natural element of water is particularly suited to increasing the attractiveness and quality of public spaces. It is directly linked to high quality of living in cities.

Both open water bodies as well as wetlands of a narrower proportion exist in cities. Open water includes all above-ground flowing water bodies. Still water bodies include naturally occurring small water bodies, ponds, and lakes, but also artificially created water bodies and rainwater retention basins. The transition between "natural" and "artificial" is particularly blurred in cities and "renaturation" is considered a developmental goal (Faggi and Breuste 2015; Grafton et al. 2015).

Water bodies in cities are typically well received by city residents. Prerequisites for this acceptance include minimizing or preferably the complete prevention of the risks associated with water. Most notably

- Flood risk.
- Danger of drowning—especially concerning small children.
- Health hazard due to pollution.
- Olfactory and visual impairment, i.e., due to sewage and waste.
- The high attractiveness of water bodies is based on
- The uniqueness of water as an (inaccessible) counterpart to familiar land.
- The visual aspect (reflection of light, view over water bodies, etc.).

Hence, urban water bodies provide an opportunity of use for city residents of all ages. Together with green spaces they constitute an attractive green and blue infrastructure. The linear structure of flowing water bodies is a unique advantage and—together with waterside vegetation—can create natural corridors in cities. It is necessary; however, that city management and planning are aware of this advantage and that these corridors are not primarily used as traffic routes, as this would increase the conflicts about usage in these areas.

Natural and/or man-made water bodies are frequent elements of city parks and even characterize them (e.g., Summer Garden Beijing, West Lake Hangzhou, and English Garden Munich).

Coastal areas, such as beaches designed for recreation, are considered to be particularly attractive forms of urban nature. Cities in which this benefit has been consciously utilized, are among the most attractive cities in the world and to which they owe their popularity among tourists to some degree (e.g., Rio de Janeiro, Cape Town, Sydney, Tel Aviv, Casablanca, Stockholm, Helsinki, etc.). Wetland meadows,

swamps and marshes, as well as all of the classic elements of wetlands, are also often protected areas (often as nature reserves) within cities and consequently typically have limited accessibility for the public. They are, however, places that offer fantastic opportunities for nature observation.

The main function (namely the preservation of animal and plant life), consequently needn't be impaired, if managed properly. Cities with wetlands are not as rare as one might presume, yet residents are seldom aware of these areas, therefore they are often only infrequently visited and used for nature observation. From the perspective of environmental protection this is not necessarily viewed as a problem, as disturbances caused by humans can interfere with habitat features, whereas their absence could be beneficial for environmental protection. Examples for important wetlands in cities include parts of Chongming Island in Shanghai (RAMSAR Site; Ramsar 1971), Ljubljana marshland in Ljubljana, the Venetian Lagoon, wetlands of the Sabana de Bogota in Bogota, marshlands in Salzburg, etc.

Often Bodies of water and wetlands have not been optimally integrated into the urban landscape. These areas were not made accessible for settlements or as supplementary arable land until relatively late in urban development. Unlike natural "barriers" such as forests, the draining of wetlands required considerable technical effort, which was either unaffordable or involved too much effort compared to the expected benefit of its use. Hence, wetlands often remained unused insular natural elements in the developing city area.

As transport routes and energy sources, rivers were integrated into the urban landscape at an early stage and as a result have been reshaped and reinforced. New bodies of water were created for the growing city population in the form of canals, reservoirs, ponds and, to some extent lakes. The drainage of wetlands and water bodies has also led to increased malaria prevalence, which had been a serious and long-standing health hazard. Table 2.5 summarizes changing function of water bodies in Central European cities throughout the last centuries.

Pollution of urban bodies of water, whether in the wake of regulated or unchecked use, has seen a decline in many cities. This can be attributed to stronger public perception and controlled legal regulation. The pollution of water bodies has largely lost its latent acceptance and urban bodies of water needn't be sewage receptacle. Especially in developing countries, the use of water bodies is significantly limited due to health hazards and lack of aesthetic quality. Efficient monitoring of water quality is required in order to (pre-emptively) recognize and eventually prevent water pollution (Liu and Jensen 2018).

The construction of river engineering structures is still widely accepted based on the justified concern of flood risks. In order to minimize or ideally eliminate this threat, great emphasis is put on riverbank reinforcements. Unfortunately, this practice often opposes the goal of shaping water bodies according to a "near nature" approach. Wherever such conflicts of interest have arisen, measures were taken to accommodate both aspects equitably, (even in instances involving spatially different water body segments). Cities typically cannot afford to do without technical

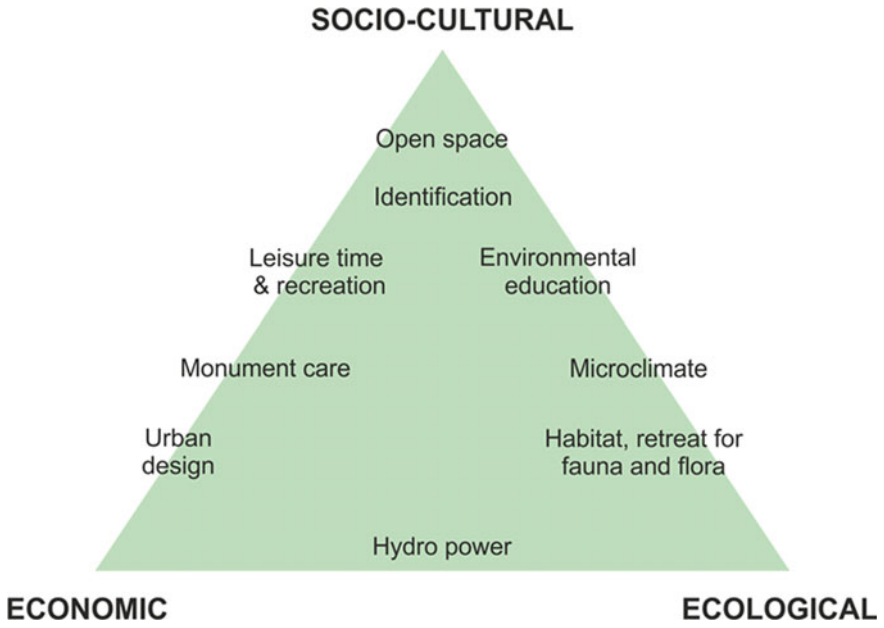

Fig. 2.12 Functions of urban water bodies (DVWK 1996)

protection from flooding, yet this needn't necessarily rule out shaping water bodies in a "near nature" fashion, including the renaturation of suitable areas.

Biological degeneration, the lack of self-purification processes and the persisting threat of flooding are often viewed as negative aspects of urban water bodies (Brun 2015; Grafton et al. 2015; Liu and Jensen 2018; DVWK 1996).

The technical reinforcement and shaping of rivers often lead to the isolation of flowing water bodies and a reduction of their main function. A major problem with urban water bodies and wetlands is their limited or even complete lack of accessibility. This is not only due to a general lack of attention paid to this form of urban nature, but often because of the relatively high effort required to make these areas accessible to the public, while also minimizing risks for both visitors and the animal and plant life. Hence, their isolated location and low accessibility remain a reason for their infrequent use. Wherever these obstacles are not present, and when the water bodies and wetlands are accessible, they are frequently used by visitors—sometimes to an extent requiring regulation of attendance (Figs. 2.12, 2.13, 2.14 and Table 2.6).

Fig. 2.13 Urban water bodies in Mae Sai, Thailand (Jürgen Breuste, picture taken in 2018)

Fig. 2.14 Urban water bodies as areas of recreation and nature appreciation—renaturated part of the Isar river in Munich (Jürgen Breuste, picture taken in 2015)

Table 2.6 Change of the function of water bodies in central European inland cities based on anthropogenic use and perception (Kaiser 2005, p. 22)

	Before 1750	1750–1850	1850–1915	1915–1950	1950–1980	After 1980
Protection	●	●	–	–	–	–
Food production, fishing, irrigation	●	●	●	•	–	–
Transport route	●	●	●	•	•	•
Energy source	●	●	●	•	•	●
Fresh water supply	●	●	●	●	●	●
Service water supply	●	●	●	●	●	●
Waste disposal	●	●	●	●	●	●
Leisure and recreation	–	–	–	•	•	●
Improvement of housing environment	–	–	–	–	–	●
Habitat for plants and animals	–	–	–	–	–	●

Importance: ● great importance, ● moderate importance, • little importance, – no importance

2.6 New Urban Wildernesses—Novel Urban Ecosystems

New urban wilderness in the form of urban industrial-shaped habitats that (re) enable the spontaneous development of nature constitutes the nature of the fourth approach. This type of nature is developed under anthropogenic influences, yet is always in close relationship with these altered habitat conditions (i.e., soil, hydrologic balance, microclimate, etc.) once it has stopped being used. In these areas, pioneer species (spontaneous shrub communities and even urban forests) emerge as succession stages and adaptations to the environment and its disturbances. This type of nature is frequently the subject of urban-ecological research and has increasingly become a central area of interest in botanical research since the 1970s. An understanding of this "new" approach of urban nature is still being developed and established (e.g., Kowarik 1993, 2018; Breuste et al. 2016).

New urban wilderness refers to previously used areas in the city that are temporarily (ranging from years to decades) unused. It typically emerges in industrial areas, near railway tracks, or on independent abandoned areas. War damages, reserving spare areas, as well as socioeconomic reasons (i.e., deindustrialization, demographic transition, land speculation, etc.) are motives for the discontinuation of land use. New urban wilderness can be found all over the world and is particularly widespread within the frame of

Fig. 2.15 New urban wilderness on derelict land in Chemnitz, Germany (Jürgen Breuste, picture taken in 2017)

urban-industrial decline such as Germany (Fig. 2.15), Great Britain, the USA, and Korea. New urban wilderness is predominantly preceded by urban-industrial land use.

New urban wilderness encompasses habitats that have experienced strong anthropogenic changes (i.e., industry) that suddenly came to a standstill. Therefore, these areas often experience few disturbances for several years, enabling the emergence of succession stages ranging from pioneer species to entire urban forests. Thus, they belong to the few urban habitats that are not managed and allow for scientific observation. Hence, new urban wilderness quickly became an experimentation field and object of ecological studies (Gilbert 1989; Ossola and Niemelä 2018). Urban brownfields are valuable habitats for many species—some of which cannot be found elsewhere.

Moreover, they offer opportunities to observe and experience nature, like nowhere else in the city. This importance of urban brownfields will increase, however, as the value of them for said uses has not yet been recognized, the reappropriation of brownfields for developmental use is currently still prioritized. In light of the large number of new urban wildernesses in some cities, this notion is entirely comprehensible.

The acceptance and Kowarik's "fourth nature" approach and its potential uses for experiencing nature as well as the possible integration of succession zones within traditional parks will largely depend on whether people manage to shed their

prejudices toward "unorderly" and "unsightly" natural succession and instead become acquainted with this "fourth nature." In order to facilitate such a change of perception greater efforts for environmental education, especially in kindergartens and schools, are necessary. Mathey et al. (2016) demonstrated in a study that the primary stages of succession through herbaceous pioneer species as well as the end stages characterized by dense woodland were viewed as the least favorable areas for personal use. The intermediary stages of succession where, however, viewed more favorably. This indicates that some "design" intervention might be necessary to manage succession stages and in order to make them more appealing for users.

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