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## Categorizing urban commons: Community gardens in the Rhine-Ruhr agglomeration, Germany

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**Abstract:** Urban gardening has become a growing international movement. Many urban gardens are established, organized, and managed collectively as commons. Particularly in developed countries, these community gardens (a subset of urban gardens) emerge not only in response to a lack of locally produced food, but also in response to a lack of democratic use of public spaces or missing opportunities and time for socializing. They then give rise to social networks that fulfil various social functions. Although community gardens are often listed as examples of commons, they have thus far lacked closer scientific examination. Hence, we present criteria to explore and categorize community gardens as commons by their degree of collectivity. This is based on five components: resource system, infrastructure, resource units, work, social time. We classify these criteria further according to various styles of use, ranging from individual use to sharing. To demonstrate the utility of this model we implement a quantitative study of community gardens located in one of the most urbanized area in Germany, the Rhine-Ruhr Agglomeration. Our results show a high diversity of collective use and the importance of sharing immaterial components in sustaining community gardens, notably social values. We can empirically demonstrate that gardeners develop diverse ways of collective action and social interaction to manage and change their urban environment. To aid in thinking about these issues, we provide an initial typology of community gardens according to their relative degrees of collectivity, reflecting the underlying values of these alternative agricultural system.

**Keywords:** Categorizing system, collective action, commons, community gardens, Rhine-Ruhr Agglomeration, urban agriculture

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## 1. Introduction

Urban Agriculture (UA) has become a dynamic international movement, summarizing a diversity of forms and types. A particular type of UA are urban gardens (UG). Community gardens, the focus of this paper, are in turn a subset of UG. These collectively organized and self-managed gardens, provide not only locally-produced food for urban residents, but rather additional benefits (Armstrong 2000; Guitart et al. 2012; Lohrberg 2016) such as agricultural knowledge and education, community cohesion and development, new experience inherent to democratic forms of governance, well-being, ecosystem services or green infrastructure (Saldivar-Tanaka and Krasny 2004; Foster 2011; Bendt et al. 2013; Nettle 2014; McIvor and Hale 2015; McClintock et al. 2016; Spilková 2017). Regarding these multiple benefits there are various motivations as to why residents participate in community garden projects (Draper and Freedman 2010). While food production is one reason for collective gardening in developing, as well as in developed countries (Rogus and Dimitri 2014; Opitz et al. 2016), Pourias et al. (2016), Spilková (2017) and Nettle (2014) mention particularly the social function through collective action as the main motivation for gardeners in Europe and Australia. Despite the international importance of community gardens, there is a recognized lack of statistics and academic research on international and national level (Guitart et al. 2012; Bendt et al. 2013; Lohrberg 2016; Vejre and Simon-Rojo 2016).

Because community gardens are communally provided resources, self-managed mostly without local government intervention in management,<sup>1</sup> and established to meet several social needs, they are also referred to as commons (Lawson 2005; McClintock 2010; Foster 2011; Colding and Barthel 2013; Colding et al. 2013). Commons are in general complex institutions in which land and other resources are used collectively by self-governance and rules that are self-restrictive and self-sanctioning (de Moor 2015). Understanding community gardens as commons can be very helpful in structuring garden management, and institutions

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<sup>1</sup> This does not mean that there is no governmental involvement at all. While the gardeners itself mostly initiate and manage the community garden project, local governments often support these projects through land use approval or by funding and resource support (Lawson 2005; Drake and Lawson 2015).

in the surrounding community, to support gardeners seeking to foster collective use and social interaction. Following Hess (2008), Foster (2011), and Colding et al. (2013), we define community gardens as *new* and *urban commons* that have recently evolved. The core characteristics they share is their joint provision of various economic, ecological, and social goods such as open space, education, intergenerational and intercultural exchange (Foster 2006; Hess 2008). In addition to that, both new commons and community gardens are referred to as a movement, where new forms of self-governance and collaboration are developed (Hess 2008; Rosol 2010; Bendt et al. 2013). Hess (2008, 4) additionally, describes new commons like community gardens as “*publicly shared resources that have been reconceptualized as commons*”. Further, not only the urban space but also various urban resources such as financial means, organic waste, or reused building materials are used collectively which makes community gardens urban commons, too (Foster 2011). The management of new and urban commons, in contrast to the management of traditional common-pool resources, such as fisheries or irrigation systems, have broader objectives and a larger group of beneficiaries (Pieraccini 2015). Although studies on commons is an emerging field, and community gardens are often listed as examples of commons (Linn 1999; Lawson 2005; Hess 2008; McClintock 2010; Eizenberg 2012; Colding and Barthel 2013), only a few studies actually examine community gardens in this respect (Foster 2011; Colding et al. 2013; Nettle 2014). To foster research in this area, key characteristics defining community gardens as commons must first be specified. Furthermore, a typology of community gardens as commons, will inform future investigation.

Drawing on the recent studies of Pourias et al. (2016), Nettle (2014), and Spilková (2017) which point to the relevance of collective action in community gardens, the objective of this paper is to examine further what defines community gardens as commons and particularly how they can be classified in regard to the intensity of their collective actions. Regarding this, we are focusing on the collective use of diverse resources within community gardens and aim to explore what exactly is used and done collectively. Therefore, we are implementing an in-depth case study analysis, done here with a selection of community gardens located in the Rhine-Ruhr Agglomeration. We further aim to provide an initial classification of community gardens as commons regarding various degrees of collectivity. Our hypothesis is that community gardens differ widely in terms of which components are used individually or collectively.

In order to examine community gardens with regard to their collectivity, we consider the material components resource system, infrastructures, inputs and outputs of food production, as well as the immaterial components work and social time. We assume, that the more of the five mentioned components that are used or fulfilled collectively, the more cooperation, communication and organization are required to manage these collective uses.

In the following pages, we describe the development and the state of the art of community gardens as a subset of UA. Therefore, Section 2 outlines diverse types of UA. In Section 3, we first explain the case study selection. Second, we

present the criteria that serve to classify various community gardens according to their degree of collectivity. Third, we describe the questionnaire development and survey. Section 4 then presents the findings of our survey related to community gardens located in the Rhine-Ruhr Agglomeration in Germany. In Section 5, we discuss our findings and challenges of the study before we conclude in Section 6.

## 2. Diversity of urban agriculture

This section gives an overview of the multifaceted aspects and different forms of UA, which includes community gardens as a subset. Since there is no specific widely-used definition for the term community gardens yet (Rosol 2010; Guitart et al. 2012), we will propose one, highlighting the aspect of collective action.

### 2.1. Contrasting urban agriculture, urban gardens and community gardens

UA is a growing international movement that encompasses various forms and activities, involves various actors and pursues many objectives. The Food and Agriculture Organization (FAO) acknowledges its diversities and defines UA as

*“[...] crop and livestock production within cities and towns and surrounding areas. It can involve anything from small vegetable gardens in the backyard to farming activities on community lands by an association or neighbourhood group.”* (FAO 2010).

Many other definitions are to be found in the scientific literature, however most of them highlight food production in urban areas as the core concept of UA (Opitz et al. 2016). Nevertheless, there is a broad understanding that UA comprises diverse activities, since it includes all kinds of urban farms, ranging from commercial farmers who grow food for market to small-scale gardening activities.

UG are a subset of UA (Figure 1). It includes gardens with many purposes and various locations, like the backyard or balcony of a house, rooftops, or open vacant spaces, often available only for temporary use (Smit et al. 2001). Therefore, cultivation is mostly taking place on smaller urban areas sometimes unsuited for

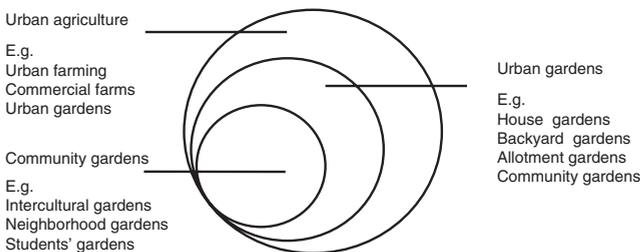


Figure 1: Community gardens as part of urban gardens and urban agriculture.

Source: Own Figure.

food production, while UA in general, ranges to peri-urban plots of agricultural land with 10 or more hectares (Smit et al. 2001). Numbers of these UG are used individually (house gardens, allotment gardens), while a sizeable subset qualifies as community gardens (Figure 1).

Examples of community gardens are neighborhood gardens, intercultural gardens or students' gardens.<sup>2</sup> Community gardens often emerge as bottom-up initiatives and their collective character is essential to their creation (Rosol 2010; Nettle 2014; Drake and Lawson 2015; Simon-Rojo et al. 2016). Opitz et al. (2016, 343) further describe that “[...] *members participate in the decision processes and share resources such as space, water and tools.*” The focus of community gardens is not simply gardening, but rather developing social networks and establishing a sense of community (Simon-Rojo et al. 2016). In addition, as UG and UA in general, community gardens show various aims, motivations, structures and forms of organization, and further differ e.g. in size, location, and services they offer to the community. While community gardens are often called public gardens, a closer look reveals that gardens further differ in ownership of the land being used that can likewise be public, private, or collective (Ferris et al. 2001; Colding et al. 2013).

Drawing from Ferris et al. (2001); Mougeot (2006); Rosol (2010); Randolph (2011); and Krikser et al. (2016), we define community gardens as follows: collectively used and self-organized open places situated in urban areas, where food, non-food plants, and a sense of community is grown, to address diverse local needs and to generate personal and common benefits.

Due to their self-governance, their collective use of various resources, and their services offered to the society, community gardens can be considered to represent new and urban commons (Linn 1999; Lawson 2005; Hess 2008; Foster 2011; Eizenberg 2012; Colding et al. 2013). Being aware, that the characteristics of common-property regime is much more complex according to e.g. self-monitoring, self-sanctioning, and rule design, this research is focusing on disentangling the collective use of diverse resources.

## 2.2. Current scope of community gardens

The fact that community gardening is relatively new and a fast growing movement may account for the notable absence of systematic data, whether on a national or international level (Guitart et al. 2012; Bendt et al. 2013; Lohrberg 2016; Vejre and Simon-Rojo 2016). In Germany, 624 community gardens are listed in the most comprehensive database available (Stiftungsgemeinschaft anstiftung & erto-mis 2017). Most of these community gardens can be found in the federal states of Berlin (75), Bavaria (93) and North Rhine-Westphalia (NRW) (87).

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<sup>2</sup> Various expressions can be used to specify community gardens regarding location or actors. For instance, intercultural gardens especially address migrants from different countries of origin (Moulin-Doos 2014).

### 3. Research design and method

The research design consists of three steps: 1) the case study selection, 2) the criteria development to operationalize the collectivity characteristics, and 3) the questionnaire development and garden survey.

#### 3.1. Case study selection

We expected to gain knowledge on the complexity of resource use not only through comparing diverse community gardens, but also by scrutinizing into the individual garden projects. To illustrate the diversity of individual community gardens, we chose a multistage selection procedure, starting with an area sampling.

To study community gardens as new and urban commons we opted for the most urbanized area in Germany. We chose the *Rhine-Ruhr Agglomeration*<sup>3</sup> as the examination unit, since this area is one of the most important dense-population areas in Germany and one of the biggest areas of concentrated population in Europe (BBR 2008). The *Rhine-Ruhr Agglomeration* is located in the federal state of North Rhine-Westphalia (NRW), has a total area of 11,738 square kilometers, and a population of 11.6 million (BBR and IKM 2012). Twelve counties and 20 urban municipalities (German: *kreisfreie Städte*) including major cities such as Cologne, Düsseldorf, Dortmund, or Essen belong to that area.<sup>4</sup>

According to *Stiftungsgemeinschaft anstiftung & ertomis* (2016), there are 65 community gardens in the *Rhine-Ruhr Agglomeration*. Thus, 75% of the community gardens in NRW, are listed in that region. Since community gardens in NRW are further networked through the online platform *UrbaneOasen* we identified for the year 2016 a total number of 79 community gardens located in the *Rhine-Ruhr Agglomeration* (Die Urbanisten 2016). Consequently, this selection offered a number of various community gardens located in diverse cities within a very urbanized area.

Verification of the 79 gardens indicated that some gardens are still in the planning stage (13 gardens) while others have ceased to exist (6 gardens). Of the remaining 60 garden projects listed, we further excluded activities of gardening that appeared to be public beds, with no characteristics of community gardens (e.g. <5 square meters, single flower beds tended by neighbors, or gardening activities that do not take place on a permanent area) and projects that can be characterized as closer to parks than community gardens (e.g. >10.000 square meters) (13 gardening activities in total). We further excluded community gardens which were established since 2014 (25 gardens). We can therefore guarantee that the examined gardens passed through at least two garden seasons and can report

<sup>3</sup> Due to a lack of commonalities between the cities, the limited cooperation, and a lack of self-identification as part of a metropolitan region, the term *Metropolitan Region Rhine-Ruhr* is regarded as very controversial (Bege 2010), thus *Rhine-Ruhr Agglomeration* is preferred.

<sup>4</sup> Altogether, 24 of the 79 major cities in Germany, are located in the *Rhine-Ruhr Agglomeration*.

on detailed rules of sharing as well as success and failure. Overall, we identified 22 community gardens suitable for our investigation.

### 3.2. Criteria development

Based on the core characteristic of community gardens that centers around their manifold ways and intensity of collective resource use, we developed criteria that allow investigation of the degree of collectivity. The criteria development is based on literature review and on several prior research projects (Schlager and Ostrom 1992; Armstrong 2000; Ostrom 2003, 2009; Hess and Ostrom 2006; Rosol 2010; Bendt et al. 2013; Opitz et al. 2016; Pourias et al. 2016), as well as on own experience as an urban gardener. The criteria should examine what exactly is used collectively and to which degree. Therewith we can test our hypothesis that gardens differ depending on whether and how key components in gardens are used individually or collectively. Thus, we examine how these processes work in detail.

The bundles of rights approach (Schlager and Ostrom 1992) appears helpful in that respect. For instance, while authorized people may hold access rights to the gardens, they lack other rights such as withdrawal (Colding et al. 2013). Another classification is done by Hess and Ostrom (2003, 2005, 2006) who look at knowledge as a form of new commons and make a threefold distinction in facilities, artifacts, and ideas to assess what exactly is shared and how. More helpful is the distinction in resource system and resource units, done in most traditional common-pool-resource studies to analyze individual cost and benefit streams of use or provision (Ostrom et al. 1999; Hess and Ostrom 2003, 2005, 2006).

We aimed to construct a more detailed distinction and designed a core building block with five components that can be used collectively in community gardens, namely: resource system, infrastructure, resource units (including inputs and outputs), work, and social time (Table 1).

These five components are based on various criteria found in scholarly literature (Ferris et al. 2001; Hess 2008; Eizenberg 2012; Bendt et al. 2013; Nettle 2014; Drake and Lawson 2015; Opitz et al. 2016; Spilková 2017) (Table 1).

In addition to differentiating five components that can be used collectively, the extent of collective use in each component varies. Similarly to different property-rights systems existing in parallel, e.g. Swiss peasants who divide their agricultural land into separate owned parcels, but use grazing land collectively<sup>5</sup> (Ostrom 2003), we find such characteristics in community gardens as well. For example, in some community gardens, gardeners have an individual used garden plot, while a shared garden plot used by all gardeners exists in parallel (Bendt et al. 2013; Drake and Lawson 2015). Regardless of the plot design there is always a

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<sup>5</sup> The diversity of property-right systems by Swiss peasants was noted by Robert Netting, who observed that the same individuals used different property-right systems side-by-side (Netting 1976, 1981; Ostrom 2003).

Table 1: Collectively used components of community gardens.

Criteria	Components				
	Resource system	Infrastructure	Resource units	Work	Social time
Area		Kitchen	Tools	Creating beds	Consumption of the harvest
Plot		Tool shed	Soil	Planting	Garden parties
Bed		Greenhouse	Compost	Weeding	Cultural events
		Water connection	Seeds	Watering	Excursions
		Toilets	Plants	Cleaning-up	
		Furniture	Harvest	Constructing work	
			Financial means	Organizing	
			Costs		

Source: Own Compilation.

minimum of shared areas like pathways or social spaces to be found (Drake and Lawson 2015). In some gardens, a combination of individual and collective use exist, while in others all components are used collectively (Rosol 2010; Nettle 2014; Drake and Lawson 2015). Notably, components can be used collectively in two ways: through dividing or through sharing. In Figure 2, the term *collective divided* indicates that collective use occurs within the community through joint assignment or division. Under *collective shared*, collective use occurs within the community without a clear assignment.

We break down the first and most basic component, (at the bottom in Figure 2), the resource system (the total garden or urban area) into the criteria: area, plot, and bed (Table 1). Then, we examine which of those is used individually or

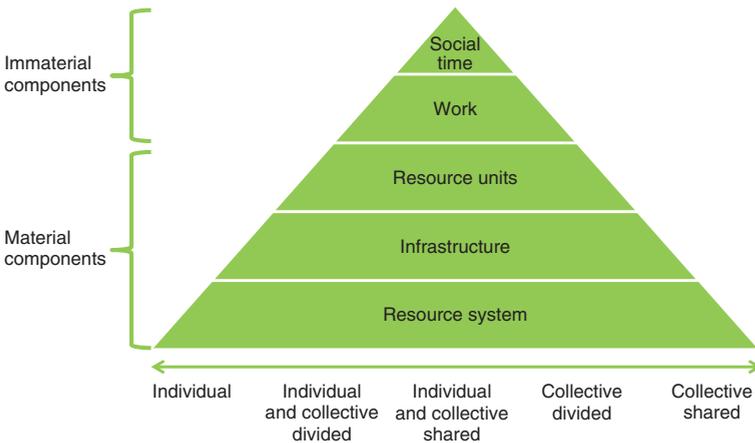


Figure 2: Five components and five styles of use in community gardens.

Source: Own Figure.

collectively through dividing, sharing, or a combination of both individual and collective use (Figure 2). In a collectively used resource system, the community can divide the total system through for example, simple division of areas, plots or beds between different users. In another collectively used resource system, however, there may be a combination of individually and collectively used areas, plots or beds. Still another form of a collectively used resource system is sharing of the entire space. In this case, there are no divided or individually used areas, plots or beds. The community shares the system without a clear assignment.

In addition to the resource system, infrastructure is another collectively used component. Infrastructures may include a kitchen as well as toilets, access to water, outdoor furniture, a tool shed or a greenhouse (Table 1). In some gardens each gardener has an individual tool shed. In other gardens we find a combination of individually and collectively used tool sheds or tool sheds that are only used collectively. At the subordinate-level of collectively used tool sheds we can differ again between dividing and sharing. A collectively used tool shed can be divided by gardeners, who are allocated a specific space in a tool shed, which they are allowed to use and where they may store their individual tools. If the tool shed is used collectively by sharing, all gardeners can use it without a clear assignment of rights to space.

Furthermore, some gardens may also use certain inputs or outputs (resource units) collectively. These include tools, seeds, plants, soil, compost, water, financial means, costs, and harvest (Table 1). On the one hand, there may be rules to divide the harvest collectively according to working hours spent or according to individual needs of each gardener. On the other hand, the harvest can be shared without any clear withdrawal rule. One example for this default rule may be that all gardeners prepare and eat the harvest together. While the latter constrains an individual in his or her withdrawal rights, it increases the socially shared time.

In contrast to resource system, infrastructure and resource units, which are material components, work and social time are immaterial components (Figure 2). We subdivide the component work under the following criteria: creating beds, planting, weeding, watering, cleaning-up, constructing work, and organizing (Table 1). In some gardens work may be done individually, for example on gardeners' individually used beds. However, work may also be done collectively, again through dividing or sharing. Usually, in community gardens collective work is divided by working time or working activities. For instance, a community may allocate a specific working hour or specific tasks – like watering – to each gardener. The work is divided and that means the work is not done together. Sharing work, by contrast means that there are specific times or meetings for gardening when people work together, e.g. spreading new soil on all beds together. In such cases, gardeners share working time and working activities, and so they share social time, too.

Another immaterial component is social time. Besides working together, social time can be spent together through events such as the consumption of the harvest, garden parties, cultural events or excursions. In contrast to all other

components, the benefits of socializing – spending time with other gardeners – can only be shared, not divided. Therefore, we examine which of the four mentioned collective activities (consumption of harvest, garden parties, cultural events, and excursions) take place, which other collective activities happen and how often these collective actions are organized.

In line with Glaeser et al. (2002) and Adger (2003) we assume that there are various positive feedbacks between a high frequency of community social activities and trust, which in turn influences norms and rules of collaboration in a positive way. The better the members know and spend time with each other, the less free riding there should be (Foster 2006, 2011; Ostrom 2010), making an expansion of collective action more likely and more successful and thus reinforcing social interaction.

We further assume that the more of the five mentioned components that are used or fulfilled collectively, the more cooperation, communication and organization are required to manage these collective uses. Furthermore, shared components require a higher degree of collective action and social interaction than divided components. Therefore, the degree of collectivity can be determined by the style of use ranging from 1 (individual use) to 5 (shared use) (Figure 2). By achieving diverse degrees of collectivity, we aimed to develop an initial typology that leads us to prototypical garden projects.

### **3.3. Questionnaire development and survey**

Based on the above presented criteria, we designed an extensive questionnaire consisting of 57 questions, enabling us to examine the complexity of collective action within community gardens. The online questionnaire was directed to leaders or at least members of the core group of a garden, from whom we expected to have well-founded knowledge to answer specific questions. A number of pre-tests ensured that questions were easily understood and that the wording did not suggest any particular answer.

Of 22 online questionnaires sent out to our case studies, eleven completely-filled questionnaires were returned, a comparatively high response rate for online surveys of such extent. Despite this overall small number of eleven cases, due to the richness of data for each case, we can analyze the varying degrees of collective use of community gardens within each of the five components, described in the next section. In addition, we can illustrate the specificity of each garden project.

## **4. Results**

In this section, we will present the results of our study – i.e. the collective action found for the five components. Diverse degrees of collectivity, meaning measurable degrees of possible social interaction, lead us to an initial typology of community gardens and confirm the categorization of community gardens as new and urban commons.

Table 2: Style of use for component 1: resource system.

Garden	Style of use				
	Individual (1)	Individual and collective divided (2)	Individual and collective shared (3)	Collective divided (4)	Collective Shared (5)
1	Plot, bed	Area	–	–	–
2	–	–	–	Bed	Area, plot
3	–	–	–	Bed	Area
4	–	–	–	–	Bed
5	Plot	–	Area	–	Bed
6	Area, plot, bed	–	–	–	–
7	–	–	–	–	Area, plot, bed
8	–	–	–	–	Area, plot, bed
9	–	Bed	–	–	Area
10	Bed	–	–	–	Area
11	–	–	–	Area	–

Resource system is defined by the criteria area, plot, and bed. If not otherwise stated, missed criteria means that the criterion does not exist in the particular garden.

#### 4.1. Collective action in community gardens in the Rhine-Ruhr Agglomeration, Germany

The research question we aim to answer is: what defines community gardens as commons and how can they be classified in regard to the intensity of their collective actions? The gardens from the *Rhine-Ruhr Agglomeration* in Germany have allowed an initial answer to this question, as they show quite unique patterns of collective action. The following section demonstrates the results of our study. With the help of the five components and the five styles of use, ranging from individual use (Value/Style 1) to sharing (Value/Style 5), we can show a wide variety of collective action in the eleven community gardens examined.

For the first component, the resource system, we can demonstrate a wide range of styles of use in community gardens. Table 2 shows that in four of the 11 examined community gardens several criteria are used individually (Style 1). For instance, in Garden 6 all criteria are used individually, i.e. gardeners have an own area, plot, and beds. Next to the individual use, we find in three garden projects a combination of individual and collective use (Style 2 and 3). For instance, in Garden 5 the area is utilized in a combination of individual use and sharing (Style 3). In addition, plot is used individually while a bed is shared. Hence, Garden 5 is a good example where within the resource system a variety of three different styles of use exist.

Moreover, six gardens use the total resource system collectively (without any kind of individual use). Garden 11 uses the resource system collectively through dividing the area (Style 4), Garden 2 and 3 express dividing and sharing (Style 4 and 5), and Garden 4, 7, and 8 share the resource system without a clear assignment (Style 5).

Table 3. Style of use for component 2: infrastructure.

Garden	Style of use				
	Individual (1)	Individual and collective divided (2)	Individual and collective shared (3)	Collective divided (4)	Collective Shared (5)
1	-	-	Furniture	Water connection	Tool shed, toilets
2	-	-	-	-	Tool shed, furniture
3	-	-	-	-	Water connection, furniture
4	-	-	-	-	Kitchen, tool shed, greenhouse, water connection, furniture
5	-	Kitchen	Tool shed, water connection	-	Furniture
6	-	-	-	Furniture	Tool shed, water connection
7	-	-	-	-	Tool shed, greenhouse, water connection, furniture
8	-	-	-	-	Kitchen, tool shed, water connection, toilets, furniture
9	-	-	-	Kitchen, tool shed, greenhouse, water connection, toilets, furniture	-
10	-	-	-	-	Greenhouse, water connection, furniture
11	-	-	-	-	Tool shed, water connection, furniture

Infrastructure is defined by the criteria kitchen, tool shed, greenhouse, water connection, toilets, and furniture.

Table 3 shows that none of the criteria which define the infrastructure are strictly used individually (Style 1) in any of the gardens examined. Rather, infrastructure use is a combination of individual and collective use (Style 2 and 3). For instance, in Garden 5 the kitchen is used in a combination of an individual and collective divided style: gardeners have their own kitchen(ette) in their garden house, if available, and a joint kitchen is used with a clear assignment.

Furthermore, nine gardens use the entire infrastructure collectively. Garden 9 divides all criteria (Style 4) and Garden 6 divides the furniture (Style 4), but shares the tool shed and water connection (Style 5). Seven gardens use all infrastructures through sharing (Style 5), only.

Looking at the aggregated data again, Table 4 demonstrates that resource units are more often used individually than infrastructure, shown by the fact that five gardens use certain resource units strictly individually (Style 1). For instance, Garden 1 uses seeds, plants, and the harvest individually. In Garden 8 seeds are used in a combination of individual and shared use (Style 3), while all other resource units are used through sharing (Style 5). Five gardens use their resource units collectively (Style 4 and 5). In Garden 9 all resource units are divided (Style 4) while in Garden 4, 7, and 11 all resource units are used through sharing (Style 5) and therefore without a special assignment.

Table 5 indicates the immaterial component work, and shows that in five gardens some work activities are strictly done individually (Style 1). For instance, in Garden 6 creating beds, planting, weeding, watering, and cleaning-up are done individually (Style 1) while construction work and organizing are achieved through sharing (Style 5). In Garden 2, 3, 4, and 9 most of the work is done in a combination of individual and collective style (Style 2 and 3). Only two gardens do all of their work collectively, while in Garden 11 some work is divided (Style 4) and some work is shared (Style 5) and in Garden 7 all working activities are shared (Style 5).

Besides work, social time is another immaterial component – a style of use that is always shared. In line with scholars in the field (Saldivar-Tanaka and Krasny 2004; Guitart et al. 2012; Nettle 2014; Pourias et al. 2016; Spilková 2017), we found that in modern societies today, social interaction and thus sharing of time represents to a large extent what makes people participate in community gardens. We can empirically support the insights provided from other parts of the developed world (Saldivar-Tanaka and Krasny 2004; Nettle 2014; Pourias et al. 2016; Spilková 2017) that besides gardening, socializing is the most mentioned aim in the garden projects studied and the most mentioned motivation of the gardeners. In addition to that, in ten out of eleven gardens studied, the quality of the garden as a social place was ranked as *quite important* or *very important*. While gardeners share social time through working together, other collective activities involving social time also take place.

Table 6 demonstrates how often, and which kind of, collective activities are taking place. Except for one garden, all gardeners share social time at least once a month. There are diverse types of collective activities, yet as the empirical data show, gardeners share social time especially through garden parties.

Table 4. Style of use for component 3: resource units.

Garden	Style of use	Individual and collective divided (2)	Individual and collective shared (3)	Collective divided (4)	Collective Shared (5)
1	Seeds, plants, harvest	-	-	-	Tools, compost
2	-	-	-	Seeds, plants	Tools, soil, compost, harvest, financial means, costs
3	Tools, seeds	-	-	-	Soil, compost, plants, harvest,
4	-	-	-	-	Tools, soil, compost, seeds, plants, harvest, financial means, costs
5	Compost, seeds, harvest	-	Tools	Plants	Soil
6	Seeds, plants, harvest, financial means, costs	-	-	Soil, compost	Tools
7	-	-	-	-	Tools, soil, compost, seeds, plants, harvest, financial means, costs
8	-	-	Seeds	-	Tools, soil, compost, plants, harvest
9	-	-	-	Tools, soil, compost, seeds, plants, harvest, financial means, costs	-
10	Seeds, plants, harvest	-	-	-	Tools, compost, financial means
11	-	-	-	-	Tools, soil, compost, seeds, plants, harvest

Resource unit is defined by the criteria tools, soil, compost, seeds, plants, harvest, financial means, and costs. Garden 5 responded: "I do not know" the style of use of the criteria financial means and costs. Garden 10 responded "I do not know" the style of use of the criteria costs.

Table 5: Style of use for component 4: work.

Garden	Style of use	Individual and collective divided (2)	Individual and collective shared (3)	Collective divided (4)	Collective Shared (5)
1	Creating beds, planting, weeding	-	Cleaning-up	Watering	Construction work, organizing
2	-	-	Creating beds, planting, weeding, watering, cleaning-up, construction work	Organizing	-
3	-	-	Planting, weeding, watering, cleaning-up, construction work	Organizing	Creating beds
4	-	-	Creating beds, planting, weeding, watering, cleaning-up, construction work	-	Organizing
5	Planting	-	Watering	Creating beds	Weeding, cleaning-up, construction work, organizing
6	Creating beds, planting, weeding, watering, cleaning-up	-	-	-	Construction work, organizing
7	-	-	-	-	Creating beds, weeding, planting, watering, cleaning-up, construction work, organizing
8	Weeding	-	-	Watering, cleaning-up	Creating beds, planting, construction work, organizing
9	-	Creating beds, planting, weeding, watering, organizing	-	-	Cleaning-up, construction work
10	Creating beds, planting, weeding, watering	-	-	-	Cleaning-up, construction work, organizing
11	-	-	-	Watering, cleaning-up	Creating beds, planting, weeding, construction work, organizing

Work is defined by the criteria creating beds, planting, weeding, watering, cleaning-up, construction work, and organizing.

Table 6: *Socializing in community gardens.*

Frequency of collective activities, in total	Garden	Kind of collective activity
Less than once a month	3	Garden parties
Once a month	1	Garden parties, cultural events
	6	Consumption of the harvest, garden parties, cultural events
Once to two times a month	10	Garden parties
	4	Consumption of the harvest, garden parties, cultural events, excursion, workshops, events outside the garden
	5	Garden parties
	7	Consumption of the harvest, garden parties, cultural events, excursion
Two to four times a month	11	Consumption of the harvest, garden parties, cultural events
	8	Consumption of the harvest, garden parties, cultural events
Four times a month or more	2	Consumption of the harvest, garden parties
	9	Consumption of the harvest, garden parties, excursion

## 4.2. Typology

Our results indicate a variety of styles of use in the individual community gardens. This variety can range on an ordinal scale from 1: the community garden shows only one style of use e.g. all criteria are used individually; to 5: the individual community garden encompasses all 5 styles of use viz. individual, individual and collective divided, individual and collective shared, collective divided, and collective shared.

Depending on the predominant style of use (individual to sharing), community gardens can further reach diverse degrees of collectivity.

Figure 3 demonstrates the variety of styles of use (x-axis) and the degree of collectivity (y-axis) of the 11 community gardens examined.

The results show that gardens mostly combine a variety of styles of use (x-axis). For example, in Garden 1 and Garden 5 all five styles of use, ranging from individual use to sharing prevail (see Tables 2–5 as well). Therefore, Garden 1 and Garden 5 are prime examples of complex and very diverse property-right systems. Unlike in Garden 7 where the variety of 1 indicates that all criteria are used only through one style. The variety of styles of use indicate the diversity of resource use within an individual garden project. However, it does not indicate if resources are predominantly used individually or collectively.

To further qualify community gardens as commons, the degree of collectivity is the important result of our study. To determine the degree of collectivity (y-axis), we first calculated the median of the style of use of each component and each community garden<sup>6</sup> (see results presented in Tables 2–5). We therefore only considered “filled-in” criteria. Afterwards, we calculated the arithmetic mean of

<sup>6</sup> We opt for the median due to the ordinal scale of the primary data. Regarding the component 5 (social time) all gardens reach a value of 5, since social time can only be shared and not divided.

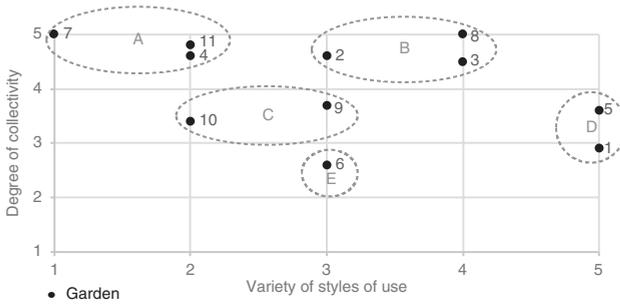


Figure 3: Collectivity of case study gardens.

all five components’ medians. In this respect, we achieved diversified results of collectivity of the examined gardens, shown as metric data in Figure 3 (y-axis).

$$\text{Formula: } C(G) = \frac{\bar{x}_{E1} + \bar{x}_{E2} + \bar{x}_{E3} + \bar{x}_{E4} + \bar{x}_{E5}}{5}$$

C=Degree of Collectivity; G=Garden; E=Component;  $\bar{x}$  =Median

Example calculation Degree of Collectivity Garden 1:

E.g. median of style of use of component 1 (resource system) (see Table 2): Value 1 (individual use of plots), Value 1 (individual use of beds), Value 2 (combination of individual and collective divided use of the total area):  $\bar{x}_{E1}=1$

$$C(G_1) = \left( \frac{1+4.5+1+3+5}{5} \right) = 2.90$$

The degree of collectivity can range from the lowest value 1 (criteria are predominantly used individually) to the highest value 5 (criteria are predominantly used through sharing). For instance, in Garden 7 and 8 criteria are predominantly used through sharing. The example calculation above depicts a more diversified case of Garden 1 reaching a degree of collectivity of 2.9. Because we only examined community gardens, as expected, all gardens have a higher value of the degree of collectivity than one. In fact, all case studies reach degrees of collectivity higher than two (y-axis Figure 3).

Referring to our model of degree of collectivity and variety of styles of use, we present an initial idea of five types of community gardens (Table 7) which serves to illustrate the importance of the degree of collectivity and the variety of style of use within each individual garden. *High collective gardens with less variety of styles of use* (Type A) are community gardens where criteria are mostly used through sharing. This gives indication that those gardens have a clear orientation towards sharing but less diverse property-right systems. *High collective gardens*

Table 7: Typology of community gardens.

Types	Garden
A High collective gardens with less variety of styles of use	4; 7; 11
B High collective gardens with high variety of styles of use	2; 3; 8
C Medium collective gardens with less variety of styles of use	9; 10
D Medium collective gardens with high variety of styles of use	1; 5
E Lower collective gardens	6

with high variety of styles of use (Type B) are community gardens where criteria are mostly used through sharing, while further styles of use exist. In both types, we would have the highest potential for social interaction. *Medium collective gardens* have lower percentage of shared use and higher percentage of individual use, while the variety of style of use ranges from less variety (Type C) to high variety and therefore very diverse property-right systems (Type D). The lower the degree of collectivity of a garden, the less opportunities for social interaction, as shown in Type E, named *lower collective gardens*. Therefore, following our initial idea for a typology, the degree of collectivity on the y-axis should present the major criteria for assigning a garden into a group.

## 5. Discussion

With their vast diversity, community gardens are a prime example of the need to explore new and urban commons further. The collective use of resources in community gardens, as in commons in general, is often taken for granted, but our results show an enormous heterogeneity of collective use of diverse components, and thus of collectivity and social interaction, in community gardens. Our results further confirm that the range of components which can be used collectively may go beyond what is usually explored in natural common-pool-resources studies. Here five components – the resource system, the infrastructure, the resource units and immaterial components such as work and social time – can be used collectively at various degrees.

While none of the criteria defining the component infrastructure are strictly used individually (Style 1), the component resource units shows a high share of individual use. We interpret this result as an indication that the collective use of resource units (inputs and outputs) is much more difficult than infrastructure. This can be substantiated by the fact that resource units are subtractable: the seeds or harvest one gardener subtracts, cannot be used by another gardener, while infrastructure is not that rivalrous. Nevertheless, five gardens use all resource units collectively (Style 4 or 5) and of that group, three gardens even so without a clear assignment (Style 5).

Looking at the component work, it is conducted in a combination of individual and collective style (Style 2 and 3), and strictly individual style (Style 1), but the predominant style of work is sharing (Style 5). Gardeners often work together

and thus also share social time. This expresses their underlying motivation to join community gardens, namely social involvement, and shows their underlying values, ideas but also needs. Furthermore, social time is shared through collective activities, mostly garden parties. Therefore, our empirical results let us argue that community gardens to a large extent give gardeners the benefits of increased immaterial components. We further assume that the more immaterial components are shared, the better the new and urban commons movement can address social needs in urban areas.

Since all gardens reached total values of the degree of collectivity higher than two, our results confirm that collective action and social interaction are essential characteristics of community gardens. For almost all components, sharing is the predominant style of use, i.e. most of the resources and tasks are used and fulfilled without a clear assignment.

The diversity of collective action in community gardens is just one expression of how urban residents find multiple ways of social interaction to manage, adapt, and maintain their urban environment. Thereby urban gardeners give a new meaning to property, provide new ways of life and of a sharing economy that emerge in modern urban societies. Community gardens therefore further underline the new forms of collaboration, self-management, and collective action of new commons, mentioned by Hess (2008). If community gardens are to thrive, it is of high importance to provide basic resources such as use rights to urban areas, so that societies can test new and diverse ways of interacting and living together. As we have shown, community gardens are defined by individuals who take the initiative to formulate their own rules and manage their surrounding urban landscape in a creative and diverse fashion. This enables a meeting and exchange of ideas.

## 6. Conclusion

Community gardening is an ongoing international movement. To appreciate their diversity, a large amount of criteria are needed to capture the characteristics of the gardens in a detailed way and to elaborate on their typology. Community gardens are prime examples of collective use and social interaction within urban areas and they have special qualities, illustrating how people in cities start organizing their commons and gain experience in democratic governance. We therefore elaborated on these collective uses of urban resources and examined what exactly is used and done collectively and to which degree. We designed a core building block of five components: the resource system itself, infrastructure, and resource units, as well as the immaterial components work and social time. These five components are defined by diverse criteria (resource units for instance include tools, soil, compost, seeds, plants, harvest, financial means, and costs) which can be used in different styles of use ranging from individual use to sharing.

We initiated a survey in the *Rhine-Ruhr Agglomeration* in Germany, as the most urbanized area, important for community gardening. The results from 50% of all the community gardens which had at least two active seasons give an initial

answer to the questions of what defines community gardens as commons and how they can be classified in regard to their degree of collectivity.

Our results of diverse styles of uses confirm the diversity of resource use and the diversity of property right regimes studied by Huong and Berkes (2011) and Davy (2014). This diversity enables us to systemize gardens according to their degree of collectivity. Thereby gardens can reach values ranging from 1 (criteria are predominantly used individually) to 5 (criteria are predominantly used through sharing, without a clear assignment). Although there is a wide variety of styles of use, most of the criteria that define each component are used through sharing. This is underlined by the fact that, according to our model, all examined gardens reach a total value of collectivity higher than 2, confirming that collectivity and social interaction is the main characteristic of community gardens. Based on our study, we suggest continuing to explore a typology of community gardens based on the degree of collectivity and the prevailing variety of style of use in each garden: high collective gardens, medium collective gardens and lower collective gardens. With this, we aim to fill the lack of in-depth studies on the diversity of community gardens and to scrutinize into their key characteristics from a commons perspective.

Community gardening as a civic movement offers new ways of social interaction and collective use of urban resources, provides space for recreation, knowledge exchange, social cohesion, and experience in implementing basic democratic principles. These benefits are not only shared within a closer community but also with *external users* (Drake and Lawson 2015). In this regard, responses to our survey not incorporated in the overall results are significant. These responses point to the importance of sharing knowledge, not only among members of the garden community but also with the general public, constituting a special characteristic of such new commons. The pace and extent of knowledge sharing is so diverse that it cannot be incorporated in one of the other components, and therefore needs to be examined in further research.

The limitation of the study is that although we can categorize gardens according to their degree of collectivity, we cannot draw conclusions on their performance. Higher degrees of collective action do not automatically mean that those initiatives are more successful than others (Frey et al. 2016). To determine the success of community gardens as new and urban commons – however success should first be defined, further research is required. Since we could demonstrate diverse degrees of collective action within community gardens, we plan on extending our research to analyse the relationship between styles of uses and success factors. We want to consider the size of the resource system, number and composition of the members, rule design, monitoring and sanctioning mechanisms as additional criteria relevant to study community gardens as commons.

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