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The Impact of Resident Participation on Urban Woodland Quality—A Case Study of Sletten, Denmark

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Received: 22 September 2018; Accepted: 23 October 2018; Published: 25 October 2018



Abstract: Despite the potential of urban woodlands for recreational use and participatory management, citizens' perception of urban woodland quality, as well as the impact of citizens' co-management on urban woodland quality, have not been thoroughly studied to date. The present study investigated how residents in Holstebro, Denmark define urban woodland quality in their neighborhood named Sletten and how they perceive the quality impact of their participation in the management and maintenance of a transition from private gardens to public urban woodland—the so-called co-management zone. Field survey of participation for all housing units with a co-management zone ($n = 201$) informed strategic selection of residents for individual interviews ($n = 16$). It was found that social, experiential, functional, and ecological dimensions are all part of residents' perception of urban woodland quality, whereby maintenance, accessibility, and nature are dominating aspects of these dimensions. While these aspects are already integrated in quality assessment schemes for other types of urban green space, our study revealed the importance of structural and species diversity between and within woodland stands as central for the perceived woodland quality—a quality aspect that distinguishes woodland from other types of urban green space. Participation in the management and maintenance positively influenced the perceived woodland quality. Residents found that their participation in the co-management zone created functional and ecological, physical qualities in the woodland. Moreover, the active participation provided the residents with a range of social and experiential benefits, many of which they themselves argue that they would have missed out on if they were only allowed to use the woodland “passively”. These findings suggest a large—but also largely untapped—potential of participatory urban woodland management to contribute physical qualities to urban woodlands and benefits to its users.

Keywords: green space quality assessment; user participation; urban woodland management

1. Introduction

Historically, forests are a natural and indispensable part of most people's lives. People used the forest and left their imprints in the form of winding tracks, traces of work and fire, coppicing of firewood, and so forth. People were dependent on the forests, all year round, and at all times [1]. Only when modern methods of forest management were introduced in the 19th century did forests become a field of action for specialists, i.e., foresters [1]. Nowadays, “ordinary people” are again claiming forests, not only for recreation, but increasingly also to participate as volunteers in their management.

The increased focus on engaging local communities in their “neighbor-wood” is part of a general governance trend toward increased user involvement in the management of local green space, especially in urban settings [2]. This governance approach is due, in part, to widespread agreement on the many benefits citizens gain from using local green spaces such as urban woodlands [3,4], and the importance of involving users in decisions regarding their everyday landscapes [5].

There are several societal trends currently affecting user involvement in the management of urban woodlands (i.e., wooded areas more than 0.5 ha in size, located within an urban context) and other types of urban green space (such as parks, street trees, and neighborhood green spaces). One of these involves the cuts in maintenance budgets forcing authorities to find alternative solutions to maintaining public green space quality, including public–private partnerships and user participation [6]. Woodlands constitute a vital component of urban green infrastructure in terms of both areal cover and ecosystem service provision [7–9]. It is, therefore, particularly relevant and potentially beneficial to involve users in the co-management of urban woodlands. Despite this, there is a lack of knowledge on how participation is affecting urban woodlands and their quality, something which is more studied in other types of urban green spaces. Yet, in most studies, the benefits of participation, including the physical outputs to urban green spaces are assumed rather than empirically evaluated [10].

When local authorities involve users in public green space management, the different actors bring different forms of knowledge to the process and, as a result, their participation may create green spaces that differ from the results of management by local authorities and with other quality norms [11]. The few empirical studies conducted to date show that users participating in management can benefit through an increased sense of satisfaction with their neighborhood [12], greater recreational and social use of green space [13,14], and an increased sense of attachment to the green space [5]. In empirical studies where users’ physical participation is part of nature conservation, outcomes benefiting the users involved, e.g., environmental awareness or social cohesion, are labeled “co-benefits”, which are either the first step toward more direct benefits to nature conservation or, sometimes, in conflict with these [15]. The majority of empirical studies of physical participation in community woodlands in the United Kingdom (UK) focused on outputs, e.g., number of trees planted, while only 21% studied outcomes, e.g., enhanced neighborhood, or well-being [16]. Green space quality for users becomes a secondary priority when nature conservation, rather than physical qualities in general, is the overall aim. Fors et al. [10], therefore, argue that more empirical studies are needed to develop the knowledge base on how user participation may impact green space quality for both users and the physical environment. In the present study, a “co-management zone” (see definition in Section 2) in a publicly accessible neighborhood woodland in the residential area of Sletten, Holstebro, Denmark was used as a case study in an exploration of how urban woodland quality is affected by residents’ participation in management.

“Quality” of urban woodland and other types of green space is a contested concept. Practically all definitions and models of quality for a specific green space are debatable, and include some values and world views of particular actors and interests while excluding others [17]. No global or universal definition of quality exists; rather, the definition that is most appropriate varies depending on the specific situation and context [18]. Claims that quality lies in the eyes of the beholder [11] and that it is context-dependent [18] indicate that the concept is very subjective and practically impossible to measure. That said, there are some aspects of public green space quality, in focus in this study, that reflect general preferences, such as being well-maintained, safe places with vegetation [19]. These aspects are also reflected in existing assessment schemes and tools designed to measure green space quality. The majority of these schemes and tools deal specifically with how green space quality is associated with physical activity, an aspect also noted in earlier reviews [20,21]. However, quality assessments of green spaces on a regional or national scale become synoptic by nature, focusing on, e.g., tree canopy cover, and they are unable to capture what benefits local green space users. On searching the literature dealing with quality assessments schemes for local green spaces in relation

to use, some overall aspects emerge repeatedly, namely “maintenance”, “accessibility”, “nature”, and “facilities” [20–24].

While woodland is generally distinguished from other types of urban green space (e.g., References [25,26]), quality assessment schemes focusing specifically on “urban woodland” do not—to our knowledge—exist. Several studies claim that user-perceived quality influences park use more than objectively expert-measured green space quality (see, e.g., Ries et al. [27]), which could potentially also be valid in relation to user participation. Aspects of urban woodland quality as perceived by local communities or the general public have nonetheless been studied. A study in the UK of attitudes toward urban woodland vegetation showed that people of all ages associated meanings such as “relaxation”, “peacefulness”, “seasonal change”, “scenery”, and “education” with urban woodlands, whereas people aged over 65 particularly valued the woods for their links with the past and opportunities for deeply engaging in nature, and were more concerned about their personal security in the woodland [28]. A study of local woodland use in Scotland identified freedom from rubbish as being the most important physical quality to people, and directional signs, good information boards, variety of trees, and tidiness of appearance as being the most decisive physical qualities for woodland visits/use [29]. Most respondents in that study reported that they feel at peace in woodlands. Ode and Fry [30] developed a model for quantitative assessment of visitor pressure on urban woodlands on a regional scale in Sweden. Distance and access to woodland were found to be the main factors; however, the woodland qualities “size” (large enough to provide a forest feeling), “forest structure” (broad-leaved forests preferred for their diversity) “path density”, and “protection status” (since protected areas have recognized botanical, cultural, or recreational qualities) also affected visitation rates [30]. Based on both preference studies and expert assessments, it was concluded that visual aspects that are important for urban woodland management can be reduced to scale, structural and species diversity, naturalness/continuity, stewardship, visual accessibility, and coherence, with all dimensions except coherence being well represented in management guidelines from the UK and Sweden included in that review [31]. Nielsen and Jensen [32] developed this further, concluding, from an expert perspective, that different planting designs for urban woodlands had different visual qualities, focusing on scale, diversity, naturalness, and visual accessibility, with mature woodland generally having higher levels of visual qualities than young woodland. In Finland, survey respondents commonly associated their favorite green spaces (mainly urban woodlands) with peacefulness, the feeling of forest, naturalness, and functionality [33]. A study in the UK showed that residents saw the following qualities in local urban woodlands: important for nature and wildlife conservation and human co-existence with nature; making residents aware of natural cycles and seasonal change; connecting them with nature giving them existential experiences; relaxation, contentment, and stress relief, and the feeling of being in a rural idyll [34]. At the same time, woodlands with valued qualities were also perceived as unsafe, due to a perceived lack of woodland management among some people who, therefore, probably derive less restorative benefits from urban woodland use [34].

The findings regarding urban woodland quality identified through the perception and preference studies referred to above reflect and confirm the four dimensions of urban woodland design as defined by Bell et al. [35], “the social”, “the experiential”, “the functional”, and “the ecological”, and that they all need to be considered when assessing urban woodland quality. Acknowledging the importance of employing a situation and context-specific quality definition [18], we, therefore, converted design dimensions into an assessment scheme for “urban woodland quality” (Table 1). The scheme resembles existing quality schemes for urban green spaces [20–24], as it also includes the aspects of maintenance, accessibility, nature, and facilities.

In the assessment schemes referred to above, quality is described as consisting of different aspects that need to be present for a high-quality local green space (e.g., maintenance, accessibility, and so forth) as opposed to quality assessments of green spaces on a regional or national scale. In this study of the impact of participation on urban woodland quality, such aspects were included, but with a focus on the result of *outcomes* of participation [15,16] as *perceived* by residents. Participation outcomes

affecting users could be seen as *benefits* to users, while outcomes affecting the physical woodland could be seen as *physical qualities* being created.

Table 1. Assessment scheme for “urban woodland quality”, based on dimensions presented by Bell et al. [35].

Dimension	Aspects of Dimension	Indicators for Urban Woodland Quality
Social	Escape	Is the possibility to escape the urban scene provided? Impression of naturalness/wildness? Are cultural references incorporated to help people identify with their community?
	Social activities	Are there possibilities for social activities (e.g., walking, sitting, socializing with friends, children’s play)? Is there a mix of larger and smaller spaces for different activities?
	Safety and security	Is there greater visibility along paths and beneath trees? Are there more obvious signs of management presence? Is there clear signposting?
Experiential	Aesthetics	Are multi-sensory experiences available? Is seasonal change perceivable?
	Design style	What degree of control or active presence of people is shown in the design of paths, planting patterns, and open spaces? Do they affect the user experience?
	The role of the urban forest in urban life	Does the woodland provide a non-urban experience? Is there a sense of timelessness and continuity? Does the urban woodland act as a stepping stone between built city and nature?
Functional	Accessibility	Is the woodland accessible to all societal groups?
	Carrying capacity	Is the woodland designed to satisfy both physical and visual carrying capacity? Are there winding paths among trees or straight paths in the open?
	Climate	Do woodland trees provide the site-specific desired climate-regulative functions (e.g., shade, shelter from the wind, and moderation of extreme temperatures)? Is year-round use possible?
Ecological	Urban ecology	Does the urban woodland help improve or revitalize the natural capital of an urban area (e.g., increase of ground water infiltration, soil amelioration, or erosion control)? Are new habitats developed?
	Landscape ecology principles	Were landscape ecology principles employed as a key part of the design process (e.g., linking corridors to connect scattered habitat fragments, and allowing wildlife species to move in between)? Do woodland design and management promote habitat diversity (not necessarily only natural habitats)? Is it possible for people to get close to nature in their everyday lives?

Using the scheme for the assessment of “urban woodland quality” (Table 1) as an analytical framework, the present study explores how urban woodland quality, in general and as affected by residents’ participation in management and maintenance, is described by residents. The research was guided by the following research questions:

- How do residents perceive (residential) “urban woodland quality”?
- How do residents describe “urban woodland quality” as affected by participation?

2. Materials and Methods

2.1. The Case Area: Sletten

The study of urban woodland quality, in general and as affected by local residents' participation in management and maintenance, was conducted in north-western Denmark in the 160-ha large urban neighborhood Sletten (The Plain), Holstebro city (Figure 1). Sletten was developed in 1999–2004, including commercial areas (20 ha) and 400 housing units arranged in eight forest villages, six fortress villages, and a retirement home (21 ha). The housing is set in a matrix of new woodland plantings (32 ha) and pastures (30 ha), intersected by the road infrastructure (27 ha), existing shelterbelts, wetlands, and natural brooks (30 ha) that flow into the lake. The present study focused on the so-called “forest villages”, i.e., the eight housing areas within Sletten that are surrounded by woodland ($n = 201$ housing units). The residents in the forest villages are a rather homogeneous societal group of middle-class people.

The woodlands in Sletten were established as a publicly accessible “landscape laboratory” in three phases, in parallel to residential development, in the period of 1999–2004. Landscape laboratories are experimental woodland areas in a local landscape context where innovative design and management concepts for urban forests are tested in full scale [36]. The woodland design comprised 52 stand types and 85 tree and shrub species, resulting in differing appearance (e.g., tree height, planting distance, vegetation structure, and species composition) between different parts of Sletten [32].



Figure 1. Plan of Sletten. Varied woodland surround the forest villages. The colored fields in the woodland correspond to the 52 different stand types. The yellow border around each forest village shows the stipulated width of the co-management zone, i.e., the first 4 m of the public woodland. Based on an aerial photo, © GST.

Early on, some individual residents in the forest villages on their own initiative started weeding around the planted seedlings or growing flowers and vegetables at the woodland edge. As the tree canopy started closing, residents engaged in pruning and thinning amongst the trees, planting their own plants, providing nesting and feeding boxes for birds, setting up hammocks, placing garden furniture, making paths or huts as part of children's play, and so forth. These activities were tolerated and even encouraged by the local authorities as they created a gradual transition from the plant communities, maintenance levels, and activities in private gardens to those of the public woodland. The local authority green space manager regarded this transition and resident engagement as positive for the long-term integration of residential housing and woodland and for the residents' attitudes to

having a neighboring woodland, in particular as the trees grow taller and shade the gardens. In 2010, these resident activities became formalized into collaboration in a so-called “co-management zone” (Figure 1) with guidelines set by the local authority green space managers:

- The co-management zone extends 4 m into the woodland (three planting rows) and must be accessible to the public.
- Each household may choose whether and to what extent to participate in the section of woodland edge that borders its property (i.e., the width of its garden).
- A minimum of 30% of the originally planted trees and shrubs (planted with a spacing of 1.5 m × 1.5 m) must be retained.
- Up to 40% of the trees may be replaced with other trees or shrubs.
- Up to 30% of the trees may be replaced with herbaceous plants, etc.
- Weeding, pruning of trees and shrubs, removal of field layer vegetation, and other management and maintenance activities should respect and maintain a forest character.
- Establishment of permanent structures such as sheds and greenhouses is not permitted, nor is keeping storage space for firewood, tools, garden compost, etc.

The guidelines were distributed to all residents and meetings were arranged to give inspiration and clarify questions and uncertainties. The guideline document also provided inspiration in the form of a list of suitable woody plants, summer flowers, vegetables, and woodland herbs. Procedures for guideline enforcement were not described; rather, residents were encouraged to contact the local authority when in doubt about whether a specific management action was permitted. Since then, manager presence in the neighborhood and enforcement of the co-management zone guidelines were limited, and information about the co-management zone was not distributed to newcomers.

Participation in Sletten

Field surveys of physical signs of resident participation in the woodland management in Sletten conducted in 2010 and 2015 showed an increase in participation, from 41% in 2010 to 65% in 2015, out of the 201 households with gardens bordering on the woodland. From the field surveys, four main types of resident participation were distinguished: plant maintenance, plant establishment, function establishment, and misuse, i.e., all actions prohibited in the guidelines [37].

2.2. Individual Interviews with Residents

In green space where participation occurs, participation affects both participants’ and non-participants’ recreational experiences. Acknowledging this, we aimed to include both non-participating and participating residents as interviewees. Information on participants and non-participants was retrieved from the 2015 field survey of participation in the co-management zone. The local authorities of Holstebro assisted in booking interviews with the residents in their homes during four consecutive days in October 2017. In total, 16 residents were interviewed, of which only two were non-participants, as non-participants were less eager to participate in the study. Residents were approached in each of the eight forest villages, in order to obtain an even spatial distribution in the neighborhood and to capture potential local variations caused by, e.g., differences in woodland attributes. Eventually, residents from one to three households from each forest village were interviewed. It varied between interviews whether one or two family members were at home. Because of this, some of the interviews were conducted with two family members in the household, resulting in 21 interviewees in total (Figure 2). Interviewees were between 31 and 79 years old, with a mean age of 55.1 years. This can be compared with the mean age of all Sletten residents, which was 46.8 years (standard error (SE) = 1.491 years) in 2015.

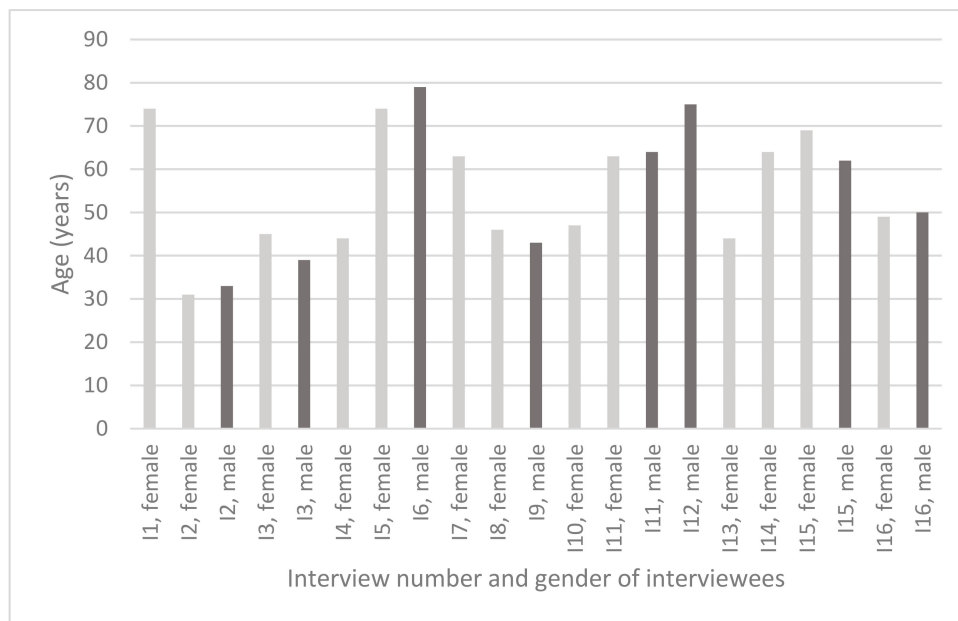


Figure 2. Age and gender of the 21 residents interviewed in the 16 interviews. I1 = Interview 1, etc.

Interviews were semi-structured and focused on residents' definitions of urban woodland quality, descriptions of their own participation, and views on the impact of resident participation on urban woodland quality. Each interview lasted 27–77 min and was audio-recorded and transcribed verbatim. Interviews were qualitatively analyzed by coding, followed by categorization of codes [38]. Finally, findings were structured according to the quality assessment scheme for urban woodland quality (Table 1).

3. Results

3.1. Resident Definition of “Urban Woodland Quality”

3.1.1. Nature Experience

The residents interviewed were asked to describe what urban woodland quality in Sletten meant to them. Quality aspects mentioned motivated a further development of the experiential dimension of the urban woodland quality scheme by adding the aspect “structural and species diversity” and “management and maintenance style” to the existing “design style”, the latter since both design and management and maintenance influence user experience (Table 2). Many interviewees (hereinafter referred to as “I” for interview followed by interview number, e.g., I12) mentioned the possibility of experiencing nature and wild animals such as birds, squirrels, and roe deer, i.e., part of the social and experiential quality dimensions, or natural woodland for its own sake, i.e., part of the ecological dimension (I1, I2, I4, I6, I7, I11, I13, I15, I16). An interviewee enjoyed following the animals throughout the year: “In the wintertime, you can see all the animals inside the forest, and, in the summertime, they simply come out. It is fantastic to sit and look at the squirrel flying around in all the trees” (I1). Interviewees found it important that the woodland was not too “plantation-like”, but rather, looked like “wild nature” (I4), as well as functioned like “natural nature”, since it led to increased biodiversity: “the trees that die, they die, and then some insects can live in the half-dead trees” (I11).

Table 2. Urban woodland quality as perceived by residents in relation to the urban woodland quality assessment scheme based on Bell et al. [35]. “Management and maintenance style” and “structural and species diversity” were added to make the scheme better reflect user perceptions.

Dimension	Aspects of Dimension	Resident-Perceived Urban Woodland Quality
Social	Escape Social activities Safety and security	Nature experience
Experiential	Aesthetics Design, management and maintenance style The role of the urban forest in urban life Structural and species diversity	Management and maintenance Nature experience Structural and species diversity
Functional	Accessibility Carrying capacity Climate	Accessibility Facilities (paths)
Ecological	Urban ecology Landscape ecology principles	Management and maintenance Nature experience

3.1.2. Structural and Species Diversity

Some residents mentioned structural and species diversity of the woodland stands as important for quality, including diversity and density of the woodland and species characteristics (I2, I3, I5, I9, I10, I13, I14, I15). One interviewee thought that woodland density was a quality aspect that affected use during walks: “that the forest is dense, that it is nice to walk in, and that there is a path to walk on . . . that it is not too open” (I3). Some appreciated species diversity and said that it meant that wild animals such as birds, squirrels, and roe deer kept coming close to the gardens (I13 and I15), while others described diversity more in terms of variety in experiences along a walk than in species diversity per se, e.g.,

I think it [the woodland] is very diverse . . . Different forests in one way or another. Different trees. You walk out there, and all of a sudden you are out in something open, you turn right and then you are inside something, so different forests . . . You get different experiences. (I10)

Interviewees even linked the experience of woodland diversity to human well-being: “I believe it is good for the soul . . . because it is a great sense-experience to get the impressions from the different woodland stands” (I14). An aspect of species characteristics is the age of trees. An interviewee looked forward to the succession of the woodland, since older trees have a higher play value for children than the black thorn they had in their co-management zone: “With small children, it is no fun to make a den in black thorn. It is better with some old oak trees” (I2). Possibility to pick edible berries and fruits was also perceived as a quality associated with woodland diversity and species characteristics (I2 and I9), something that could make it fun for children to come along to the woodland “because there is something to come for” (I9).

3.1.3. Accessibility

Other aspects of urban woodland quality that were repeatedly mentioned by the interviewees were that they were allowed to use the woodland and that it was accessible at their doorstep, to look at from inside, as well as for use, where residents especially emphasized the importance of functional paths (I1, I3, I4, I6, I7, I8, I10, I12), and that “it would be a disaster to fence in the forest” (I6). This means that, under the functional dimension, they mentioned accessibility and the single facility *paths*. An interviewee viewed the accessible co-management zone as part of urban woodland quality and woodland access: “I just think it is nice that it is there and that you are allowed to use it. That there is no barrier against each garden, but the co-management zone instead of a large hedge in the border.

It is just the freedom to use it as it is" (I8). Another interviewee described how the paths and the proximity made nature accessible to her:

The trampled paths let you get into the nature rooms with trees and water and where you are completely in nature, where you completely shut the rest of the world out, I think that is incredibly nice, so that I see as high quality . . . The best thing about taking the trampled path is that if you walk from the right end, you get to gaze over the lake several times. If you go the opposite direction you have to turn around to be able to see it, because of where the trees stand and how the path turns. That I find unique, to have so close by. That when you walk down there, you have the trees in the background and then you have [the view] over the lake. Sometimes it is motionless and the sun is about to set over it or about to rise or mirrors in the lake, and other times it is nasty weather and rainy and windy and a restless water surface. But both are just as life-affirming. It is when it becomes life-affirming that I think it is high quality. (I4)

3.1.4. Management and Maintenance

Two of the interviewees thought that, to achieve a high-quality woodland in Sletten, better management or maintenance would be needed, i.e., thinning of the dense woodland to allow better development of remaining trees (I11), i.e., part of the ecological dimension, and weeding and more frequent mowing of the high grass between the trees in some parts of the neighborhood for a better appearance, i.e., part of the design, management and maintenance style of the experiential dimension (I16).

3.2. Impact of Resident Participation on "Urban Woodland Quality"

Table 3 shows the impact of resident participation on urban woodland quality, as described by the residents interviewed, charted through the assessment scheme for urban woodland quality based on Bell et al. [35] in the version where the experiential dimension was further developed as described in Section 3.1.1. Some households extended their participation in the woodland beyond the stipulated 4-m-wide co-management zone. Outcomes of participation primarily benefiting users are rarely visible in the physical landscape, but could nonetheless be very valuable for the individual. For this type of benefit, there was a predominance of outcomes benefiting participating residents (14 positive outcomes) over outcomes benefiting all residents (10 positive outcomes). The majority of the physical qualities created as an outcome of participation benefited all residents (45), while 16 outcomes benefited individuals. Outcomes impacting users are henceforth termed *benefits*, while outcomes impacting the urban woodland are termed *physical qualities*. Figure 3 shows four examples of resident-created environments and lists the outcomes participation had for the interviewee participating in that particular part of the co-management zone.

Table 3. Outcomes of participation in Sletten compared against the assessment scheme for “urban woodland quality”, based on Bell et al. [35]. “Management and maintenance style” and “structural and species diversity” were added to make the scheme better reflect user perceptions. Resident-described outcomes of their own participation, as well as outcomes seen (or believed to result) from participation by other residents. Examples of codes: 2 (I) means that two residents mentioned this participation outcome and that it benefits the individual; 4 (A) means that four residents mentioned this participation outcome and that it benefits all/many residents in the neighborhood.

Dimension	Aspects of Dimension	Participation Outcome Affecting the Physical Environment	Participation Outcome Affecting Residents	Participation Outcome Affecting Participating Residents
Social	Escape		Nature experience 4 (I)	Sense of community 4 (I)
	Social activities	Better usability 4 (I), 1 (A)	Social interaction 2 (I), 1 (A) Increased use of urban woodland 6 (I)	Empowerment 4 (I) Increased participation from inspiration 2 (I)
	Safety and security		Improved safety 1 (I)	Bird boxes as pest control
Experiential	Aesthetics	Experiencing domesticated animals 1 (I), 1 (A)		Happiness and pleasure 4 (I) Relaxation 4 (I)
	Design, management and maintenance style	Better appearance 5 (I), 4 (A)	Enjoyable experiences during walks 3 (A)	Participation as personal hobby 1 (I) Enhancement of private garden 7 (I)
	The role of the urban forest in urban life		Nature experience	Memories stored in resident-planted trees 2 (I) Enhanced view of woodland from inside 3 (I) Recreational experiences for participants 1 (I)
	Structural and species diversity	Better appearance 2 (I), 1 (A)	Enjoyable experiences during walks 4 (A)	
Functional	Accessibility		Better accessibility to woodland 1 (I), 1 (A)	Food 7 (I), 2 (A)
	Carrying capacity	Paths 2 (I), 10 (A)		Firewood 1 (I)
	Climate	Wind-sheltered environment 1 (I) Better usability 1 (I)		Storing firewood in woodland 2 (I)
Ecological	Urban ecology	Fertilizing the woodland/creating mold 7 (A) Increased biodiversity 15 (A) Better tree development 5 (A) Bird boxes as pest control 1 (A)	Clean air 1 (A)	Environmental awareness 2 (I)
	Landscape ecology principles	Increased biodiversity	Nature experience	
Sum of participation outcomes and whom it benefited		Individual participants: 16 All residents: 45	Individual participants: 14 All residents: 10	Individual participants: 44 All residents: 2

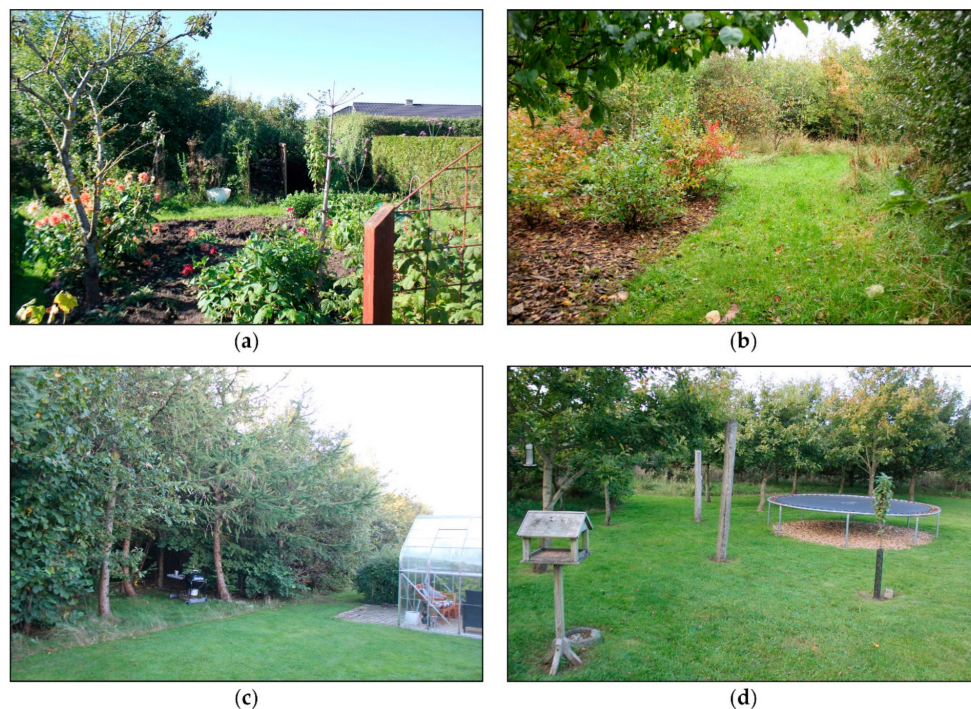


Figure 3. Exemplifying photos of the co-management zone. For each photo, the outcomes that the resident at the address described of their own participation are listed: (a) enhancement of private garden, empowerment, food, increased use of urban woodland, relaxation, increased biodiversity, environmental awareness, nature experience, and better accessibility to woodland; (b) wind-sheltered environment, food, increased use of urban woodland, relaxation, memories stored in resident-planted trees, increased biodiversity, better appearance, and environmental awareness; (c) happiness and pleasure, food, fertilizing the woodland/creating mold, and better usability; (d) happiness and pleasure, enhancement of private garden, increased biodiversity, and better appearance.

3.2.1. Participation Outcomes—The Social Dimension

Several residents, through participation, adapted the woodland to suit their recreational needs and create possibilities for social activities, leading to the outcome *better usability*. Residents, e.g., put out benches in the woodland, making it possible to sit there. Others pruned trees to make room for a hammock, made room for social activity by maintaining a space in the zone keeping it open to provide space for play activities with grand children, or made a glade in the woodland for barbecue (BBQ) parties with neighbors. An example of the same participation outcome, but benefiting more residents than only participants, was when a couple, together with their two neighbors on one side, made a glade in the zone with a table, where the four of them ate lunch together every now and then during the summer; however, they allowed anyone who wanted to use the table (I15).

The benefit *nature experience*, e.g., being able to watch roe deer and squirrels right outside the garden and finding it nice that wild birds use residents' bird houses, corresponds to aspects of the social, experiential, and ecological dimensions of urban woodland quality. Although the co-management zone guidelines allow for individual participation without necessarily coordinating or collaborating with neighbors, participation led to *increased social interaction and sense of community* between some participants. Even though they did not work together in the zone, they appreciated knowing that others participated as well, enjoying the fellowship between participants and the possibility to share ideas and to show each other what they did. Participation also led to more socializing with non-participating neighbors, e.g., a participant sometimes met neighbors when she was thinning among the trees in the zone. Another participant regularly talked with his neighbor in the zone, instead of over the too high hedge between their gardens. A third interviewee organized a trail run around the forest village for the neighboring children—two laps on a path some boys created in the zone. Social interaction

between neighbors was also achieved when a resident who was good at growing tree seedlings helped others plant trees in their zones. Participation also led to *increased woodland use*, among both adults and children. One interviewee said that he would not have used it as much if he was not allowed to also influence the woodland (I2). One interviewee described how participation in the zone was important for children's play:

[Residents living on the other side of the forest village] used a lawn mower to make some mowed grass paths, allowing for not only a single entrance and exit, but possibility to get in and out in several different places. I believe that gives them a greater sense of community . . . I have the feeling that the children living over there . . . they had a great deal of pleasure out of being able to run [through the woodland] to each other and meet in the co-management zone and play there. (I4)

However, for some children, the possibility to participate did not lead to *increased woodland use*, due to woodland characteristics. Early on, the trees were too small to climb and children living next to black thorn could not build dens there. Outputs of participation in this category included *improved safety* through well-balanced pruning so vegetation would not grow too large, while remaining rather closed to screen the public path, since a burglar once went into this resident's house when having more open vegetation (I14). There were also a few participation outcomes affecting the physical participation process itself for individual residents (six positive outcomes), part of the social quality dimension: Firstly, the *empowerment* of residents was mentioned by some residents, appreciating the possibility to influence the woodland as they wanted, instead of watching the woodland outside the garden grow too dense and dark. Secondly, a few residents *increased their own participation after being inspired* by seeing other residents' actions in the zone. An interviewee described how she got really inspired from once seeing some residents living on the other side of her forest village pruning their trees, which she thought looked really nice (I8). However, an interviewee who saw lots of things other residents made in the zone, had not yet thought: "Wow! That's something I will do as well!", i.e., their participation did not have high enough quality for her to become *inspired to participate* more herself.

3.2.2. Participation Outcomes—The Experiential Dimension

Participation provided the possibility to *experience domesticated animals*, e.g., a resident enjoying when a neighbor, for a period of time, had pheasants which he let out in the woodland. Several residents said that participation led to *better woodland appearance*. The small original woodland trees were planted in rows; thus, a resident described how he removed some of them to create a more natural path flow, and planted some new, more interesting tree species in between the woodland trees, making a path system of his own (I9). In some cases, this outcome benefited all residents, e.g., where a resident planted hundreds of trees in Sletten from seedlings collected in the woodland and other places, as well as sowed lupins and planted lily of the valley in areas far beyond his own zone (I12). These are two examples of *better woodland appearance* leading to structural and species diversity (Table 3). Other residents "beautified" the woodland by pruning trees, planting winter aconite and flower bulbs, tidying up, removing dead nurse trees, or mowing the grass in the woodland, i.e., *better woodland appearance* as a part of design, management and maintenance style. Low accessibility from paths to the co-management zone or residents feeling uncomfortable walking too close to private gardens meant that some of them did not see other residents' management and maintenance actions, and therefore, they did not benefit from it; for them, participation did not lead to *better woodland appearance*. Another example of this is a resident who thought that, instead of fluent transitions, many residents made ornamental gardens with bark chips in the entire zone and pots with annual flowers, which she found too unnatural and not beautifying (I1). What looked like non-participation for a passerby was sometimes, in fact, conscious resident participation in the management, creating invisible qualities. A woman and her husband created *better woodland appearance* by removing the fruit trees and some other plants that the former owner planted in the zone, considering these to be too

gardenlike, and therefore, not suitable for a wild, natural woodland when striving to create a nice transition from well-maintained garden to the wild woodland with no hedge in between (I7). Apart from removing, invisible participation also took the form of refraining from ornamental gardening in the zone. While a man said that they did not have a gardening interest, his wife said they did, and further explained that they did not find it suitable to have an ornamental garden that close to “nature” (i.e., the woodland). They liked to have an ordered, but at the same time naturalistic garden, and aimed for a fluent transition from garden to woodland. Therefore, they made conscious choices of natural materials, e.g., used wooden posts to hang their hammock and made a fireplace with natural stumps to sit on, the idea being that wood goes well with the woodland. They also trimmed the pine trees that they planted in their garden together with some pillar fruit trees, thinking that the woodland trees should be higher than their garden trees (I16).

Residents reported having interesting, exciting, surprising, fun, and diverse *enjoyable experiences during walks* from seeing other residents’ actions in their zones. One interviewee enjoyed the zone characteristic diversity, widely varying between neighbors, e.g., with regards to open vs. closed woodland appearance and the number of trees being replaced by other species, i.e., part of structural and species diversity (I13). Another interviewee described surprises during her walks along woodland paths: “I often think that, all of a sudden: ‘Oh! It seems like some trees have just popped up here, someone has been working, and here is a new path as well!’” (I10). A man thought that paths running through parts with uniform, thicket-like parts of the woodland were hardly used, since it was too boring to walk there, while finding it exciting to pass by places where residents influenced the woodland through replacing trees and planting new plants (I9). Experiential outcomes also included getting *a personal hobby from participation* and feelings of *happiness, pleasure, and relaxation*. A man described the relaxation he gains from participating and simply spending time in the physical environment he created through participation:

I have noticed that some time passes by when I am out there [in the co-management zone] and just enjoy the quietness . . . out there. It’s more clinical in here [in the garden] while there is more peace out there, with birds and insects. So I really like just walking around out there. I spend a lot of time there! (I2)

One of the most common outcomes to users directly linked to the physical environment was participation leading to *extension or enhancement of the private garden* by pruning or thinning among the trees for more evening sun, or weeding in the zone to limit weeds from spreading into the garden and attempting to “get the forest into the garden” (I10). Another household also managed to do this, saying that participation gave them a totally different garden: “When we sit on our terrace and look [toward the woodland], we almost think that we have Amalienborg royal park! Nothing less! We just have a plain boring garden like most people, but the [woodland] trees in our backyard, they take it all to the next level” (I16). Other outcomes related to experiential and recreational values were when *participants gained recreational experiences*, and *the view of the woodland from inside residents’ houses was enhanced*. Another example of the invisible participation described further above, is interviewees wanting to improve their view from the garden, resulting in them tidying up the woodland after the former owner left trees and branches after thinning, as well as several old Christmas trees on the ground, and also resulting in them removing an old deserted children’s den (I3). For the two households that had *memories stored in the resident-planted trees*, participation had a symbolic value. A man felt connected to the trees he planted through participation: “I know every single tree that I have planted. They are my grandchildren—I have many grandchildren!” (I12). Another man enjoyed following the growth of the trees he planted, especially the little spruce his child sowed when still in kindergarten: “It grows in the forest today and that’s nice to see. We cherish it because it has a symbolic value to us that it stands there” (I9).

3.2.3. Participation Outcomes—The Functional Dimension

Many residents either maintained *paths* for more private use close to home or longer paths further into the woodland, keeping a hand pruner in the pocket cutting twigs along paths during walks, or regularly mowed a longer grass path for everyone to use, or regularly used paths they knew other residents created. One interviewee mentioned that two teenage boys pruned trees and trimmed grass to make a 1.2-km-long mountain bike path around an entire forest village, a path that later was mostly used by adults going for a run (I9). A resident created a more *wind-sheltered environment* by putting straw around exposed trees. The physical quality *better usability* was created by an interviewee who adapted the woodland for it to provide the climate-regulative functions she desired (e.g., shade and shelter from the wind), making a nice place for herself: “I have actually made something cave-like over here, where I have felled or pruned some trees” (I1). Some reported that participation led to *better accessibility* to and within the woodland, where, e.g., a resident meant that, when people participated, woodland vegetation became less dense, facilitating ease of movement during walks. However, for one interviewee, participation did not increase her *accessibility* to woodland, since her thicket-like part of the woodland was practically impossible to participate in (I4). Functional outcomes also included concrete outputs such as getting *firewood* from trees residents felled in the zone, *storing private firewood in the woodland*, and *food* for participants (fruits, berries, hazelnuts, blackcurrants, potatoes, rhubarb, and beetroot) and for all residents (possibility to pick apples from trees other residents planted in their zone and harvest ramson others planted). However, a resident missed picking apples after the neighbors cut down the apple tree in their part of the zone, thereby missing out on the output *food*.

3.2.4. Participation Outcomes—The Ecological Dimension

Several residents neatly spread out garden waste in the woodland, thereby *fertilizing the woodland and creating mold*. Residents also contributed to *increased plant and animal biodiversity* by planting with the intent of attracting animals, also creating diverse vegetation and feeding wild birds, squirrels, and other animals. Participation led to *better tree development* when residents thinned in the dense woodland aiming to give remaining trees a better chance to develop properly. However, some residents did not consider their neighbors’ participation as proper forestry work, missing out on this quality aspect. As an example, a resident did not like when neighbors pruned trees to get a better view from their garden, instead of thinning among the trees, which was needed to give trees room to develop properly. Residents in one of the forest villages jointly put up *bird boxes for starlings as pest control*, since many of the households got their garden lawns destroyed by garden chafers, which starlings like eating. The joint activity makes this outcome belong to the social dimension of urban woodland quality as well. A concrete output under the ecological dimension was *clean air*, which a resident thought the trees he planted contributed to achieving. A man reported that, when his children pick berries and fruits in the zone, they learn where food comes from and see that butterflies and insects are supposed to be there, which can be interpreted as *environmental awareness*. Another example of this was the value a man saw in conversations between him and his children, initiated thanks to apple picking in the zone:

When we pick fruits, harvest something, you talk about it with the children. Saying: “Here [in the co-management zone] you can eat the fruit straight from the tree. You do not have to wash it.” . . . This dialogue makes them more conscious about the difference between going to the forest and picking something, and buying something from the store and how it has been treated and why you have to wash it. (I9)

4. Discussion

4.1. Residents' Definition of Urban Woodland Quality

The residents interviewed generally shared the image of high-quality woodland in Sletten. To them, high quality was (1) to have a natural woodland making nature experiences possible; (2) related to the structural and species diversity of woodland stands, including diversity and density, and species characteristics; (3) accessibility to the woodland, both physical (available at the doorstep and from the paths) and mental (that residents were allowed to use it); and (4) for a few, something for which better management or maintenance would be needed. The majority of the mentioned quality aspects related to residents' passive and active use of the woodland, e.g., experiential values during walks. Residents' definition is in line with the positive qualities Finnish and UK residents associate with local urban woodlands according to other studies, i.e., peacefulness, the feeling of forest, naturalness [33], woodlands being important for nature conservation, providing residents nature experiences making them aware of natural cycles and seasonal change and giving them existential experiences; relaxation, contentment, and stress relief [34], and relaxation, peacefulness, seasonal change, scenery, and nature experience [28].

In all of the general green space quality schemes described in the literature, four overall quality aspects occur repeatedly: maintenance, accessibility, nature, and facilities [20–24]. Except for facilities, these were all also central to Sletten residents' urban woodland quality definition. The facilities aspect was less important, possibly because facilities such as toilets, sports fields, and play equipment are more associated with urban parks and not naturally available in an urban woodland. Furthermore, the urban woodland being situated so close to interviewees' homes made facilities somewhat redundant for their woodland use, with toilets at home and playgrounds in the middle of forest villages. People have also been found to dislike constructed facilities in forests even when placed there in order to support recreational forest use [39]. The only facility mentioned was *paths*, which were also identified by Ode and Fry [30] as important for urban woodland quality.

Structural and species diversity of woodland stands are aspects unique to urban woodland quality studies, both in the literature and in Sletten, as opposed to studies of green space quality in general. Within this category, residents mentioned woodland density, diversity in species, variety in experiences, and the species characteristic age of trees, and plants with edible berries, fruits, and nuts. Resident-perceived urban woodland quality is, in this respect, in line with qualities identified by users or experts in earlier studies, i.e., variety of trees [29], structural and species diversity [31,32], variation between stands [40], size (large enough to provide a forest feeling), and forest structure (broad-leaved forests preferred for their diversity) [30].

At the time of interviews, the Sletten woodland was 17–21 years old, varying between parts. While the interior of young woodlands is generally perceived as visually unattractive and not appreciated for recreational use [41], and mature woodland generally has higher levels of visual qualities than young [32], the age limit for experiential and recreational qualities seems to have been crossed at that point in the Sletten case.

4.2. Impact on Urban Woodland Quality of Physical Participation

The urban woodland quality obtained from public management partly differs from that also obtained from resident participation. Outcomes of participation in Sletten affected both the users, i.e., the residents, and the physical environment (Table 3). The majority of the effects on the physical environment benefited a larger group of the residents in the neighborhood, not only participants. The effects on the physical landscape corresponded much to the functional and ecological quality dimensions of the urban woodland quality scheme based on Bell et al. [35]. The effects on users corresponded predominantly with quality aspects within the social and experiential dimensions for a publically managed urban woodland. The urban woodland quality assessment scheme was further developed to better reflect resident-perceived quality. Together, the effects of participation in Sletten

on users and the physical environment covered all dimension aspects of the adapted urban woodland quality assessment scheme, suggesting that these dimensions and aspects could work well for the purpose of future urban woodland quality assessments.

While the previously mentioned outcomes of participation could also potentially be a result of woodland management by the local authority, benefiting woodland users, it is not given that they do. It depends on the public management and maintenance intensity and whether this is performed with the intent to meet user needs or rather aimed at nature conservation. For the resident-reported outcomes from participation, their passive and active use is practically always in focus, as well as when it comes to physical qualities serving nature conservation. As an example, residents feeding wild animals or planting different trees and shrubs with the aim of increased biodiversity also benefit users, rendering enjoyable experiences during walks and better woodland appearance. User participation in urban green space management has been found to affect urban biodiversity values positively [42]. When it comes to urban woodlands and Sletten, it remains to be studied whether residents create more positive, ecological qualities in the limited co-management zone than would be possible to create through active, systematic, public management of the entire woodland.

Participation in urban woodland management had additional benefits for participants, showing a difference between the urban woodland quality for participants vs. all residents, as well as between participation and woodland use alone (Table 3). The only exception was *food*, which, to some extent, benefited the resident group as a whole. This type of benefit included, above all, experiential qualities, e.g., residents obtaining happiness and pleasure from the act of participating, sense of community between participants, and an enhanced view of the woodland from inside. Due to only two non-participating residents agreeing to be interviewed, the study could not add much knowledge on how their recreational experience was affected by other residents' participation, apart from the finding that participation had fewer benefits for them than for participants. How non-participants are affected by participation, therefore, remains an interesting topic for future studies. In Sletten, participation led to social qualities for both participants and residents in general, despite the guidelines for the co-management zone not demanding participating neighbors to collaborate with each other. In other words, individual participation can also bring social values.

Sometimes, both participating and non-participating residents missed out on physical qualities and benefits that would have been possible outcomes of participation if it was not for participation of other residents or hindering physical environment characteristics, e.g., low accessibility from paths to the woodland or residents living next to a dense, thicket-like part of the woodland. This means that participation does not only affect urban woodland quality positively. Furthermore, this implies that urban woodland quality that can be obtained from participation is affected by the original urban woodland quality as affected by design (e.g., species selection), and public management (e.g., long-term local authority strategies). The latter has the possibility to respond to new user needs that arise, such as improvement of path systems. Moreover, urban woodland quality in Sletten is affected by the qualities of the neighborhood at large. Features of a high-quality built environment at a neighborhood scale identified by Dempsey [23], such as connectedness and permeability or legibility, are intrinsic qualities in the Sletten landscape plan benefiting all residents, qualities not affected by resident participation.

Aalbers and Sehested stated that, when users are involved in green space management, they create green spaces of a different kind, with other qualities [11]. The fact that there are corresponding quality aspects in the scheme based on Bell et al. [35] for all physical qualities created from participation suggests that little difference exists between physical qualities created through participation and those created through public woodland management. However, a close look at the outcomes shows a number of differences. While managers and residents can both create paths, it is more likely that residents place their path exactly where they are needed to support woodland use. Managers could adapt the woodland for social activities, e.g., create a glade for children's play or prune trees making them ready for someone to install a hammock; however, they are unlikely to identify such needs without asking residents. To put straw around exposed trees to create a more wind-sheltered environment is

a small-scale way of influencing the woodland. Public management does not have the resources to perform such frequent, small-scale management and maintenance contributions. Participation mainly occurs within the limited area of the co-management zone, and, for the creation of some physical qualities, this is not an advantage. Rational, large-scale thinning among the trees, performed by public managers, leads to better tree development for the entire remaining woodland, while a few residents' small-scale thinning only supports a small number of trees.

In sum, Sletten residents created physical qualities better adapted to local user needs, both in regards to the actual needs and the placement of the physical quality. This leads to better urban woodland quality for woodland use, especially for participating residents, while some ecological qualities, such as better tree development, are likely more efficiently created when performed by public managers.

Residents sometimes refrained from ornamental gardening in favor of a more natural woodland character, or removed too garden-like plants, thereby creating "invisible" physical qualities. These could only be identified through participant interviews, since such resident-created qualities cannot be measured in the physical environment. They can be regarded as other types of qualities [11] with regards to the detail and rationale behind residents' "invisible" participation compared to public managers'. While the risk of privatization of public land increases due to the proximity between the garden and the area where the residents participate, the likelihood of residents caring for and protecting their environment also increases, simply because they participate in their local landscape. This was reflected in the finding that the interviewed residents generally seemed to have a sound and conscious nature view and opinion about plants that are suitable in a woodland and how to maintain them, thereby preserving ecological urban woodland quality. Guidelines and municipal control are still needed to prevent misuse, especially since some residents participated in a larger area of the woodland than the 4-m-wide zone stated in the guidelines. Residents sometimes disliking other residents' actions in the zone supports the idea of limiting participation and keeping it within a co-management zone.

With regards to the type of environments and physical qualities created through participation, many residents transferred garden characteristics to the woodland, while few did the opposite and transferred woodland characteristics into their own garden. However, the participation benefits *enhanced view of woodland from inside* and *enhancement of private garden* are examples of residents *visually* bringing the woodland into their gardens. Defining the quality impact of participation on an urban woodland in terms of enhanced nature conservation only, and labeling benefits to users as co-benefits [15], is not reasonable for a woodland integrated with a neighborhood, highly used by residents. Participation in Sletten mainly benefited the people, in particular participating residents; however, those benefits partly build on physical qualities being created, suggesting that benefits to users and physical qualities cannot always be easily separated.

5. Conclusions

The present study explored how residents perceive "urban woodland quality". It was demonstrated that social, experiential, functional, and ecological dimensions are all part of residents' perception of urban woodland quality. Maintenance, accessibility, nature, and, to a small extent, facilities, are quality aspects of these dimensions which are well integrated in existing expert assessment schemes for other types of green space quality [20–24]. Our results provide support to such assessment schemes by showing that these aspects are also important for local residents' quality perception of the specific green space type "urban woodlands". Additionally, results may add to the development of quality assessment schemes focusing on urban woodlands in so far that it points to the structural and species diversity of and between woodland stands and between forested and open habitats as being central for the perceived quality. The relative importance of this quality aspect distinguishes woodland from other types of urban green space. In a wide perspective, this limits the usability of existing quality assessment schemes, since these were mainly developed for other types of urban

green space, such as parks. The study also sought to explore how urban woodland quality is affected by resident participation in woodland management and maintenance, according to residents. The main contribution of the present study is that it demonstrates that residents' participation in their "neighbor-wood", mainly but not only, contributes positively to perceived woodland quality. In plain words, participation in the co-management zone physically affected the woodland's functional and ecological qualities as perceived by the residents. Moreover, the active participation zone provided a range of social and experiential benefits to participating residents, as well as to the residents as a community group, part of which they themselves argue that they would have missed out on if they were only allowed to use the woodland "passively". Participation had additional benefits for participants, showing a difference between the urban woodland quality for participants vs. all residents, as well as between participation and woodland use alone. These findings suggest a large—but still largely untapped—potential of participatory urban woodland management to contribute physical qualities to urban woodlands and benefits to its users.

That said, the present study has some noteworthy limitations. It was explorative in its nature and was confined to a site-specific context and to a limited number of participants (16 respondents, including only two non-participants); further research is needed in order to produce stronger evidence as the basis for recommendations and future development of urban woodland quality assessment methods and their application in practice.

Author Contributions: Conceptualization, H.F. Formal analysis, H.F. Funding acquisition, A.B.N. Investigation, H.F. Methodology, H.F. and M.J. Project administration, H.F. Supervision, M.J. and A.B.N. Validation, H.F., M.J., and A.B.N. Visualization, H.F. Writing—Original Draft, H.F. Writing—Review and Editing, H.F., M.J. and A.B.N.

Funding: This research was funded by the European Commission, 7th Framework Program Grant GREEN SURGE collaborative project, FP7-ENV.2013.6.2-5-60356 and by the Movium Partnerskap project 91 12.

Conflicts of Interest: The authors declare no conflicts of interest.

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