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Through the Eyes of Forest Visitors—Perception and Scenic Preferences of Munich's Urban Proximate Woodlands

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Abstract: With the increasing individualization of society, perceptions and attitudes towards nature and forest management is changing. Knowledge about motives for visiting woodlands as well as the aesthetic perception of forests can support forest management and communication strategies. In Central Europe, multifunctional, close-to-nature silviculture aims to convert the still dominating conifer monocultures towards mixed, structured forests to establish forests that are better adapted to the changing climate, thus enhancing the value for nature conservation and increasing their ability to provide ecosystem services. Reflecting these management objectives, we examined the perception and scenic preferences of the resulting forest stands in Munich´s urban proximate woodlands. We applied both surveys with choice experiments using visualizations of different forest stands and conducted Photovoice walks. In the choice experiments, most interviewees preferred the visualizations of mixed forests. Deadwood was appreciated in mixed stands. Knowledge about the positive effects of deadwood influenced this choice. With the Photovoice walks, it could be shown that many forest types and even monocultures were perceived to be very attractive, such as tall Norway spruce (*Picea abies*) stands. In addition, small details such as single trees, colorful leaves, or small vegetation features contributed to a positive perception of the forest.

Keywords: forest perception; forest preferences; outdoor recreation; multifunctional forestry; urban forestry; survey; choice experiment; photos; Photovoice; Munich

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1. Introduction

1.1. Forest Perception and Preferences in the Context of Ecosystem Services and Valuing Nature

Forests in urban and peri-urban areas deliver numerous ecosystem services (ES). One of the most important ES in urbanized areas is the provision of recreation opportunities for enjoying nature and the experience of nature [1–4].

Climate change will be a challenge for managing urban forests and urban proximate woodlands. Comprehensive adaptation measures to respond to the rapidly changing environmental conditions will be necessary, and their role has increased massively to mitigate the negative impacts of climate change [5]. Their importance as recreational areas to provide opportunities for citizens to leave overheated built-up areas of cities will also increase [3,6].

IPBES has examined nature's contributions and the multiple values for people. Pressure on biodiversity is increasing as a result of multiplying, diversifying, and interacting threats. These ultimately derive from the growing societal and economic demands on nature. In a world increasingly affected by climate change, comprehensive adaptation measures to respond to the rapidly changing environmental conditions will be necessary [7]. Besides protecting and restoring biodiversity, multiple benefit management and inclusive

approaches through a holistic, integrated, consultative, and adaptive approach can maximize co-benefits in both conserving biodiversity, mitigating climate change, and enhancing good quality of life [8].

The predicted strong population growth in urban regions and migration to powerful economic urbanized centers implicates much more demand for recreation in urban proximate woodlands [9]. With increasing individualization and changing lifestyles based on different cultural backgrounds and socialization, economic possibilities, personal views, opinions, mentality and values, habits and the demands of forest visitors, demand for recreation opportunities, and perceptions and attitudes towards nature and forest management is changing and diversifying [3].

The IPBES highlights assessment typology with key concepts, their interrelationships to better understand the diverse values of nature, value types, and dimensions. The concept of ES is seen as an important theoretical framework linking between ecosystems, their goods, and services. Their contribution to human well-being has been globally assessed in the Millennium Ecosystem Assessment [10]. The concept of ES stresses the essential relevance of ecosystem structures and processes for human wellbeing, sociocultural values, as well as for mental and physical well-being [11]. Numerous studies attempt to assess and account sociocultural benefits also in economic terms. Recreation activities such as walking or cycling have a positive effect on health [12]. For example, in England, access to quality green space such as forests is estimated to save around £2.1 billion in health care costs for the National Health Service (NHS), and even savings of up to £1.44 billion (in health care costs) could be achieved with a 1% reduction in sedentary behavior [13].

Despite such efforts, challenges remain concerning the definition and measurement of sociocultural ES assigning values, as they are also determined by how important those services are to people and are created by people through their interactions with places individually [14,15].

Linking the recommendation of the IPBES to holistic, adaptive approaches to best maintain and maximize co-benefits in both conserving biodiversity and mitigating climate change, and enhancing good quality of life, the evaluation and application of value indicators of such management is vital.

From the perspective of a land manager, such approaches can provide valuable insights for visitor management, providing recreational infrastructure, targeted information, and adapted forest management strategies to secure the provision of multiple ecosystems and benefits, avoid conflicts, as well as increase the acceptance of forest management [16,17].

For measuring sociocultural values of such strategies and their successful integration of recreation into multifunctional forest management concepts, besides "hard data", providing visitor numbers and types of recreation activity, approaches outlined by Dickinson and Hobbs [15] that provide insights about motives for visiting the aesthetic perception of forests, are vital to evaluate and further develop adequate management strategies and concepts to minimize conflicts [18,19].

In the past, quite a large number of empirical studies on landscape preferences have been conducted. Yang et al. provide an overview and development of the respective research in their review [20]. Many of the user- or visitor-based approaches make use of choice experiments. However, comparatively few have a focus on the perception of forests and forest stands. Most published empirical studies and theories on forest preferences were conducted in Northern Europe or North America with respective forest types and silvicultural methods such as using clear-cutting and retaining seed trees like Scots Pine (*Pinus sylvestris*) in Finland [21–23]. The studies document an increasing preference for naturalness and mixed forest structures [24]. Similar tendencies have been reported from China [25–27]. In the North American context, Gobster et al. [28] postulate preferences for forests that tend towards them remaining natural as possible, which also correlates with high biodiversity.

For Central Europe, studies in the 1960s and 1970s showed preferences for coniferous forests [29,30], but preferences in Central Europe have changed. In more recent studies

from the turn of the millennium, forest visitors particularly value uneven-aged, tiered stands formed by various deciduous and coniferous tree species. A proportion of very thick, large, and bizarrely shaped (supposedly) old trees are important [31,32].

Studies from Scandinavia come to similar conclusions [21–23,33], but there are also studies in which tidier, lighter forest types are preferred [22]. Some other studies contradict the aforementioned studies, claiming the importance of good recreational infrastructure and well-maintained forests, especially for urban woodlands and urban forests [34]. These studies suggest that lighter, tidier, and well-kept structures may be preferred in urban recreational areas. For example, the respondents in this study preferred the less densely forested areas in an urban park that only had a comparatively low level of biological diversity with a high visual penetrability of forests as formulated by Kaplan and Kaplan [35] in their "Information Process Theory" as a basic prerequisite for gaining high preference. However, one should be careful as some studies refer to "Urban Forests" in a broader sense also comprising wooded urban parks or urban green infrastructure and not to forests in a stricter sense. Most studies are conducted in summertime and seasonality aspects are missing.

Research on sociocultural aspects linked to forest and greenspace use has been conducted to some extent, however mainly on a more conceptual level, e.g., using household surveys or data analyses (e.g., reviewed studies in [20]). For countries with a high proportion of people who have a migration background, such as Great Britain, The Netherlands, and USA, some studies have been conducted to analyze the perceptions and desires of different societal groups and persons with a migration background or belonging to different ethnic groups [36–39]. For Central Europe, only a few examples could be found in the literature, such as the study by Jay and Schraml [40], which analyzed the forest use and perception of persons with a Russian-German and Turkish migration background.

The aim of the investigations in the greater Munich area was to examine whether the tendency towards a preference for particularly near-natural stands described in the literature applies to urban proximate forests and woodlands in Central Europe with its multifunctional management approaches. Moreover, small-scale, individual tree-related management silviculture strategies approaches are widespread in Central Europe and might be much less noticeable to forest visitors. Older studies conducted in these forests [30,41,42] help to draw comparisons with the new findings.

So far, published studies applying human-centered approaches to assess landscape and forest perceptions are quite scarce. They only tend to use single approaches, such as interviews or choice experiments. Hence, the guiding research questions for our work were:

- How are forests and forest landscapes perceived?
- What is perceived as attractive or is disliked using qualitative, user-driven approaches?
- How do the findings compare with choice experiments?

In our paper, we present findings from several studies conducted in the Greater Munich Metropolitan area. Study areas were the "Forstenrieder Park", a large forested area to the south of Munich, the "Ebersberger Forst" to the east of Munich, and in the World Forest/Weltwald near Freising, around 30 km north of Munich.

1.2. Theoretical Reflections on Landscape and Forest Perception

In order to understand people's aesthetic sensibilities, perception, and valuing of the forests and lay a theoretical foundation to embed our work, we first looked at theoretical considerations on landscape perception. Being aware of the international literature, being rooted in the German discussion on landscape perception, we took the respective German literature on landscape aesthetics [43,44] as a starting point for our reflections.

Following the definition of landscape perception according to Nohl [43], the perception of a forest therefore is not only based on physical existing elements, but also aspects such as experiences, previous knowledge about forests, attitudes, expectations, memories, desires, and needs. The current state of mind, previous experiences, knowledge (e.g., lay person,

someone having a professional background, e.g., in forestry), origin (first-time or regular visitor, familiar with landscape types or not), as well as personal or collective values are important for forming the perception of a landscape or forest. Humans therefore might perceive the same landscape in a completely different way. Next, the situational influences such as seasonality, weather, the viewing point and angles from which to look at a landscape are important. The conducted activity (e.g., cycling, walking, birdwatching) plays a role in experiencing landscapes, the mood and the visitor's own feelings as well being alone or being accompanied by others. Depending on the situation, that the same forest can be perceived and valued in a completely different way by any one individual. The same person can experience the same landscape differently depending on mood or judge different during the course of life, for example, a forest can be experienced in a totally different way when being there as a child or as an adult [43,45].

According to Hoisl et al. [31] regarding the perception of a landscape, the authors distinguish between three different "layers of meaning or knowledge" (so-called levels): the perceptual layer of meaning, the symptomatic layer of meaning, and the symbolic layer of meaning. On the first level, the perceptual level, the perception of the landscape components takes place, but already some interpretations and feelings about such components belong to this layer. For example, an old large oak tree can be perceived as sublime and enchanted. On the second level, the symptomatic layer of meaning, for example, the oak could be a hint to historic land use such as a wood pasture for pig fattening or the ecology of the area, a bottomland hardwood forest. On the symbolic level, landscape elements also connect elements beyond the physical features linked to the imaginations triggered in the viewer, such as feeling at home or feeling free.

For the satisfaction of desires and needs of humans, certain landscape types and landscape features and structures are more suitable than others. Particularly noteworthy are impressions that provide a certain amount of diversity, suggest naturalness and individuality, or the uniqueness of a landscape but also interests, ideas, and knowledge thereof and ecological, functional, or historical connections play an important role for the evaluation of any landscape [31].

User-dependent procedural approaches attempt to develop and evaluate the impression that people have, resulting from their viewing and the interpretation of the perceived elements [46]. The human being is therefore at the center of the research approaches. The research mainly uses social science methods such as surveys or behavioral analyses in which mainly laypersons judge and evaluate forests and landscapes. Another form is the analysis of interactions between humans and the forest.

In the international English literature, in work and studies on landscape or forest perceptions, references or theoretical foundations are made on the basis of the work of Kaplan and Kaplan [35] in order to support, contradict, or supplement their postulated theories and findings. Despite dating back more than 30 years, nowadays, the work is still considered state-of-the art and key literature for understanding and reflecting landscape preferences.

The concept by Bourassa [47] integrates many existing theories including the ones provided from Kaplan and Kaplan [35] to better explain and cover the facets, why certain landscapes or forest types are preferred, whilst others are disliked. Bourassa postulates three strategies.

The first law postulates genetically fixed preferences for certain landscape types. These are referred to as the "prospect-and-Refuge Theory" by Appleton [48], the «Savannah Theory» by Orians [49] or a more sophisticated concept based on numerous studies by Kaplan and Kaplan [35], the «Information Process Theory». Particularly good living conditions and thus, particularly valued, would therefore be landscapes with views and cover for hunting opportunities, protection and shelter from enemies, and providing enough water. Accordingly, most preferred landscapes would be park-like with groups of trees, and open grasslands, containing rivers and lakes, but also cliffs and caves providing shelter and refuge [50]. Landscapes are structured and readable with a number of landscape

elements providing some stimuli but should not overwhelm viewers with too many or unstructured features.

The second level is "Cultural Laws" [47]. It is assumed that landscape preferences are primarily acquired through human socialization, social rules and norms, learning, reflecting, collective experience, and shared knowledge [47]. Values and norms for »beauty« are formed in this way. Often, preferences shaped by this "Law" do not have universal validity. They might only be shared by small groups, some societies or in one cultural background.

As a third level, the personal development of each individual is also important and called "Personal Strategies" [47]. Every person can develop their own landscape preferences and dislikes. They are only valid for one individual. They evolve by imprinting, habituation, but are also due to traumatic experiences [47,50].

The most important human sense for perceiving landscapes and forests is sight, the second most important one, hearing [44,51]. Studies [32,52,53] show that an important and highly valued feature of the forest is "silence", meaning the absence of the noise of civilization, e.g., from car traffic. According to Newman et al. [53], the noises of civilization can significantly reduce the experience of nature. In addition to seeing and hearing, the sense of smell, taste, and touch should also be mentioned. Even if other sensory stimuli might contribute little to perception, they should not be completely neglected for the analysis of landscape preferences or their impact on human well-being [31,43,44]. A notable example was a study from Japan on the positive effect of resin smell in the forest [54].

Two methodological directions are described for capturing the quality of the landscape in order to assess landscape preferences. These are expert-based and user-dependent methods [46].

2. Materials and Methods

2.1. Methodological Approach

The methodological approach and methods used can be found in Figure 1. To get an overview, we conducted literature reviews at several points until summer 2021 collecting scientific papers from Web of Science, Scopus, and Google Scholar databases using search terms "landscape" and "forest" each in connection with one of the term "aesthetics", "perception", "preferences", "recreation" (resulting in ten combinations of terms) and the respective term combinations in the German language. It was considered important to use more than one database since search algorithms may vary across databases and potentially include some more practitioner-oriented literature gathered through Google Scholar. Resulting publications were then selected while using the PRISMA method [55]. In screening the abstracts of the articles for relevance [55], we then continued searching for additional work using a snowballing approach with author names and references in the found papers. Around 450 papers were collected and extracted this way.

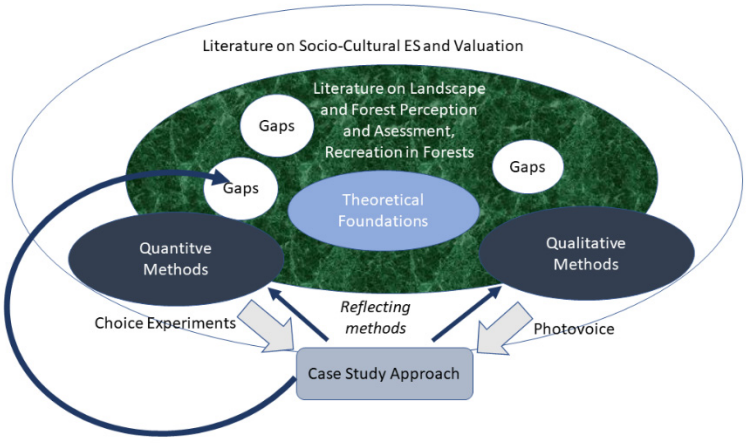

Figure 1. Methodological approach and methods used.

For our studies, we opted for the user-dependent approaches. We followed a case study approach as a flexible way for in-depth investigations at small scales that balance breadth and depth [56]. A combination of different qualitative and more quantitative approaches is seen to be the most useful in research dealing with human-nature relations [57].

Choice experiments, e.g., using a set of photos and ranking the pictures as the sole method for assessing landscape preferences are not considered sufficient in the literature [58]. To minimize the disadvantages and the limitations of different methodological approaches, combining more quantitative and more qualitative approaches can help to better determine and understand the perception and preferences for landscapes and forests. Especially the basic assumption of qualitative research approaches is that an important aspect and quality criterion is the proximity of researchers to the human being. Thus, research is supposed to be conducted as close as possible to the natural environment of the human being [59].

We chose three different forest areas in the Munich metropolitan area (Figure 2). In 2014, Munich had 1.487 million inhabitants. It is Germany´s third largest city and the most densely populated urban area in Germany [60]. Being among the top 10 most powerful economic regions in Europe [61], the Munich metropolitan area faces rapid population growth [60]. With its close vicinity to the Alps, numerous attractive green spaces in the city, nearby lakes and forests, the high recreation value is also considered to be an important driver for the rapid population growth [62].

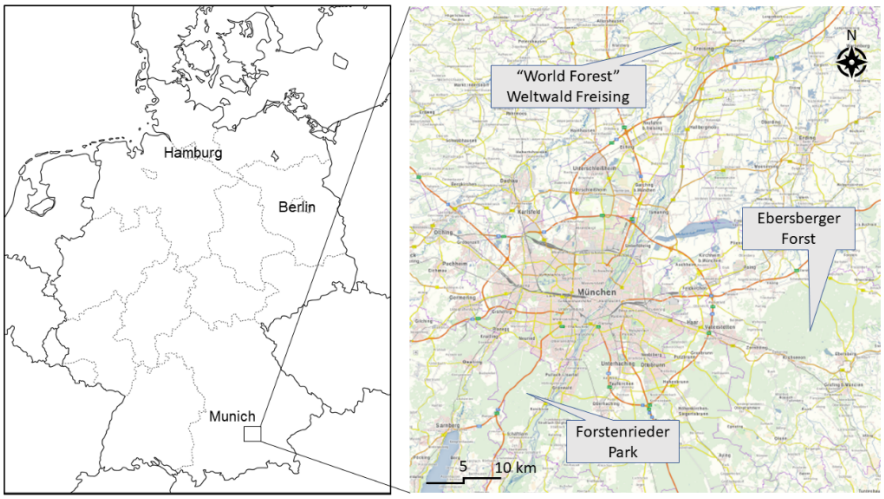

Figure 2. Map of the Study Area and selected forests in the Munich Metropolitan Area; Map Source and Geospatial Data: Bayerische Vermessungsverwaltung No. 2207-12734.

2.2. Description of the Chosen Forests Serving as Study Areas

The Forstenrieder Park together with other forests of neighboring communities form a 43 km^2 continuous forest area located to the South of Munich belonging to the state or other public bodies. It is mostly situated on the rather flat Munich gravel plain originating from the late Pleistocene glacial periods [63].

The name "Park" indicates its origin as a gated hunting area for the nobility in the past. Today, 2000 hectares have been dedicated as a game reserve with opportunities to watch deer. In the 19th century, this pasture woodland comprising oak (*Quercus robur, Quercus petrea*), beech (*Fagus sylvatica*), and other broadleaves native to the region were afforested systematically and schematically formed by a rectangular grid of forest roads using conifers, mainly Norway Spruce (*Picea abies*). After several gales, storm damages, and decimation by bark beetle (*Ips typographus*), since the early 1990s, the state forest management tries to establish mixed, structured forest stands of conifers and broadleaved tree species using methods such as establishing the next forest generation by shelterwood strategies, natural regeneration or planting broadleaves on larger empty areas resulting from calamities.

Transforming the stands will take many decades, even centuries. Therefore, forest stands currently present all phases of the transformation from pure conifer stands up to structured mixed forests. With a trail network of 43 km [63], connection to cycle routes and parking lots, and with suburban railway and metro line stations within walking distance of a few minutes, the forest is easily accessible by the general public.

The Ebersberger Forst is situated 25 km east of Munich and covers a total area of 90 km^2 [64]. While the west of the forest is located on the flat Munich gravel plain, it stretches up onto the terminal moraine range of hills to the east. Connection to cycle routes, parking lots, and public transportation in nearby villages and towns provides access to the forest. A large network of over 200 km of trails for hiking, horse riding, and cycling provide ample recreation opportunities. A forest interpretation trail, a game sanctuary, restaurants, a viewing tower, as well as ancient monuments provide additional points of interests.

Similar to the Forstenrieder Park, this forest originates from a hunting area for the nobility and forests were degraded at the end of the 18th century. In the early 19th century, the area was systematically afforested with Norway Spruce (*Picea abies*) and Scots Pine (*Pinus sylvestris*). In the 19th century, already severe damages by beetle and Black Arches (*Lymantria monacha*) were reported [64]. Forest types and management strategies are similar to the ones in the Forstenrieder Park.

The "World Forest" or "Weltwald" (in German) is a state-owned forest 30 km north of Munich. It has a size of 100 ha. The nearest town is Freising, around 4 km away to the east of the forest. Situated on tertiary Danube-Isar hilly landscape forming the northwestern end of the Munich gravel plain, it is part of a larger forest complex called the "Kranzberger Forst". The forest was established on the ground of a former village called Oberberghausen. At the end of the 19th century, the farm property had been acquired by the state and reforested also using a variety of "exotic trees" and willows (*Salix*) also for experiment purposes. The Church of St. Clemens, surrounded by a small cemetery, is the last witness to the former village [65].

Some years later, with mixed and discouraging results especially related to cultivating the willow, the forest was managed for timber production with Norway spruce (*Picea abies*) with a shift to mixed structured stands in the past three decades. With a still noticeable amount of exotic trees dating back to the reforestation in the 19th century, it was decided to host an arboretum for both the public and the life sciences faculties when the Weihenstephan university campus was further developed. Systematic planting of exotic trees started in 1987. By 2016, more than 300 different tree and shrub species had been planted in the forest matrix formed by spruces and beeches (*Fagus sylvatica*). In addition to the main routes leading through the forest, several thematic educational trails for the different tree species from different regions of the world provide access to the forest. Numerous activities, guided tours, and outdoor art exhibitions are provided to create an attractive space for visiting and recreation [65].

2.3. Overview on Methods Used

An approach using interviews with forest visitors inside the different forests in Munich and Freising was employed. Besides a set of overall questions on activities, some overall demographic data and general questions on forest preferences, choice experiments with different ranking methods of photo impressions were applied for the analysis of forest preferences including short open-ended statements as to why a picture or visualization was chosen. In addition to more quantitative approaches using ranking or selecting sets of images for preferred impressions, qualitative approaches to assessing forest images were implemented, as the choice of images or photos as well as the way of photographing or visualizing forests can influence interviewees. Besides applying such classic instruments, Photovoice forest walks were carried out in the World Forest.

In recent years, the Photovoice method has received increasing attention as a qualitative research method. A camera is handed out to a person asked to take photos of what they consider relevant in the context of the respective investigation. Then, in an interview, the persons explain the relevance of the images for them. This gives researchers a much deeper insight into the respective point of view than would be possible with structured

or semi-structured interviews, since the subjects use the images to define the individual aspects of the investigation [66–68]. In addition, Photovoice can be easily combined with other research methods of qualitative social research [69]. Photovoice is originally a technique of participatory research and uses the immediacy of visual impressions to capture experiences, knowledge, and subjective perceptions of subjects [70,71].

Following the approach by Heyman [72], Photovice walks were conducted in the Freising World Forest in two studies with volunteers. In one study, persons who had lived in the region for a significant time and being German were asked to participate. A study with a similar setup focused on persons with a migration background. Participants taking the walk in the forest were given the task of taking pictures of things and impressions that they particularly like or disliked when strolling through the forest. They were accompanied by a "silent" researcher to ensure that all person took the same route and felt safe. At the end of the walk, everyone was asked to talk about the photos, explaining why they had taken them and why they represented something positive or negative.

Table 1 provides an overview of the study areas and applied methods as well as of the chosen approaches to evaluate scenic qualities of the forests.

Table 1. Overview of sites and interview approaches.

Interview Site	Season	Applied Methods	Number Participants
At frequented entry places of the Forstenrieder Park Forest Three locations at frequented entry places, 9 interview days covering a weekday weekends, interviews between 9–17	Winter without snow cover	Passers-by were asked to participate. After the interview was finished, the next person approaching was contacted. Ranking of 16 images based on the Q-Sort method [73]. From a set of 16 images, four images are selected that are like or less appreciated. The best is then selected from the pre-selection of good pictures. For the less esteemed images, the worst image is selected. The images can then be evaluated accordingly, either according to how often they were divided into certain levels or given a scale value with an allocation of values between −2 and +2. Participants were asked to give brief statements why best and worst image was chosen.	302 (out of 402 asked)
Inside Ebersberger Forst, three interview sites, 11 interview days, weekdays and weekends, time between 9–17	Autumn	Interview approach similar to Forstenrieder Park; Photos from different forest types in early autumn found in this woodland were used for a picture survey. Respondents could only pick one best and one worst image, and were asked to briefly describe their choice. How often an image was selected as the best or worst image as well as the reasons given were evaluated	320 (out of 351 asked)
Inside World Forest/Weltwald Freising	Spring	Photovoice walks with persons living over a long time in the area. Recruitment of participants following sampling strategies recruiting a good cross-section of society for the study following [74,75]. Persons were selected both from persons known by a circle of acquaintances (especially for recruiting persons visiting the forest less often) and contacted on the parking lot at the entrance to the forest	26 participants, German, living in the region for a long time
Inside Weltwald Freising	late summer	See above, Photovoice with persons that migrated to Germany, who were asked to participate using contact persons in the circle of acquaintances	14 participants, originating from Canada, China, Croatia, France/Spain, Luxemburg, Norway, Peru, Poland, Syria, Tunisia/Saudi Arabia, Turkey, Ukraine USA

3. Results

3.1. Overall Demands and Wishes for the Forests

In the surveys employed in the Forstenrieder Park and the Ebersberger Forst, the respondents valued the forest's closeness to nature, its "wilderness", the recreational opportunities, and the accessibility of the forest (especially on foot, by bicycle, and by public transport). The majority of those surveyed wanted "pure nature". This included, among other things, a rather sparse supply of recreational facilities. Respondents were mostly very satisfied with the forests and the amenities found. Compared to the previous studies in the greater Munich area forests [30,33,34], the majority of those surveyed in the most recent study described the infrastructure, e.g., benches, as sufficient. In addition, around a third of those surveyed had no complaints or points of criticism. Negatives mentioned were conflicts with other user groups and races of civilization such as rubbish or noise. Especially road traffic and aircraft noise were perceived as disturbing, in particular for the World Forest as it is situated close to the approach lane of the heavily frequented Munich Airport. Disturbing traces originating from forest management such as timber harvested were only rarely mentioned.

When collecting demographic data on the two survey approaches, regarding the age of the interviewees, older age groups (from 46–55 years) and more persons with a high educational background visited the forest much more often than other groups. For young people, especially those with a migration background, if forests were visited, sporting activities were an important reason for going there, as was socializing.

3.2. Assessing Forest Landscapes Using Photos and Drawn Images

In order to obtain assessment data from a large number of respondents and to test the perception of forest landscapes resulting from different management practices, different sets of forest visualizations and photos considering the different forest types in the vicinity of Munich and seasonality were used. This was done by applying different methods for choosing, selecting, ranking, and valuing the shown impressions from the forests.

Since few studies analyze forest images in the winter, typical forest images of the local spruce stands were made as part of the investigations in the Forstenrieder Park. Most of them present themselves in different stages of transition to mixed stands that are better adapted to climate change. Impressions without snow cover and beeches (*Fagus sylvatica*) without leaves or with dried leaves were visualized. The aim was to find out whether stands with many leafless beeches might perform less well than studies of beeches with leaves.

When evaluating 16 forest images with different stands (Figure 3) and forced Q-Sort [73] ranking (Figure 4), the old-growth spruce stand of the same age was valued least. The picture of an unequal-aged, layered mixed stand of deciduous and coniferous wood with a small proportion of dead wood was particularly preferred (Figure 5). However, the statements made by those surveyed made it clear that a mixture of different stocks along the route covered in the forest is perceived as especially attractive. Even those forest pictures that came off the worst in the ranking (Figure 6) were not considered "really bad" by the participants in their feedback. The ranking and the strong gradation are more likely to be due to the fact that the task consisted of having to commit to a ranking. Studies with comparative approaches to evaluation methods, where school grades [52] were also asked for, show that forest pictures judged to be less attractive also received good school grades.

Figure 3. Set of forest images used for ranking in the Forstenrieder Park, visualization by Anna Ritter.

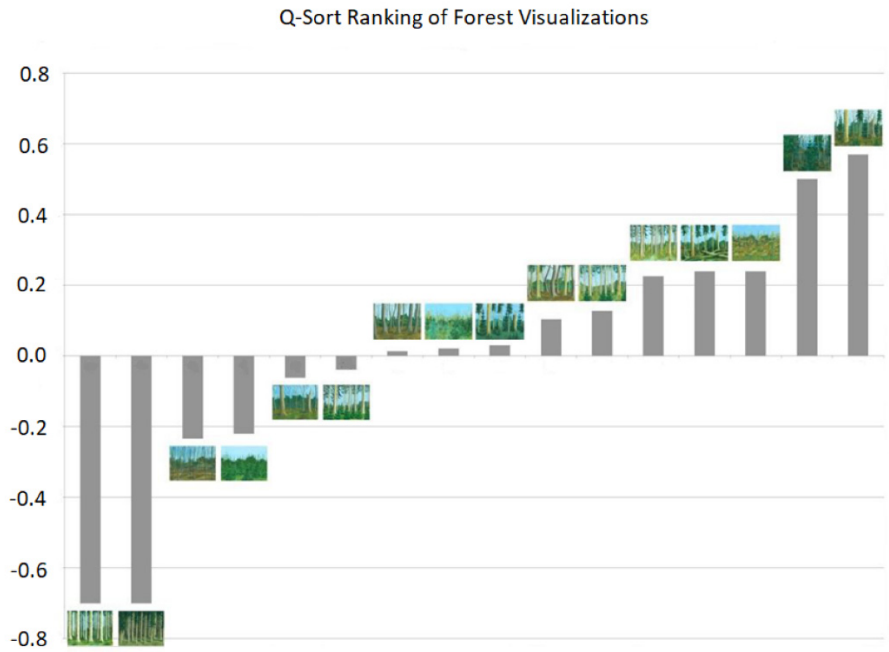

Figure 4. Results of Q-Sort Ranking from the Forstenrieder Park Study. Maximum numbers on the scale would have been −2.0 (every participant would have chosen the image as the worst one) and +2.0 (every participant would have chosen it as the best one).

Figure 5. Most preferred impression from the Forestenrieder Park Study, visualization by Anna Ritter.

Figure 6. Least preferred impression from the Forestenrieder Park Study, visualization by Anna Ritter.

From the set of photographs used in the Ebersberger Forst (Figure 7), by 31.3%, the photo of an old deciduous forest (LW_alt) was selected most frequently as the preferred forest image (Figure 8). It was considered to be a "particularly inviting" forest. Respondents explained their choice as following: the variety of colors, a "powerful" and "warm" atmosphere and the seasonality of the year can be experienced in a very good way in the shown forest type. The beech (*Fagus sylvatica*)-dominated forest with leaves covering the ground was considered to be more open, bright, warm and friendly, with the forest looking natural, and this type of forest was found to be most suitable for relaxing and taking walks. The aspect that only deciduous trees, mainly beeches, can be seen in the picture was the decisive factor for many in naming this picture as their favorite.

Figure 7. Set of pictures used for the interviews in Ebersberger Forst, photos taken by Julia Fäth. Abbreviations of the images; LW_alt, old broadleaved tree stand; NW_LN, old conifer stand with younger broadleaved trees beneath; MW, mixed forest stand in terms of species, sizes and age; NW alt, old conifer stand; Toth, old broadleaved tree stand with deadwood; LW_mi, middle aged broadleaved tree stand; LW_L, old broadleaved tree stand with initial broadleaves regeneration; NW_L, old conifer stand with initial broadleaves regeneration; LW_d, old, scattered broadleaved tree stand with several stages of regeneration; NW_d, stand with old, scattered conifers with several stages of broadleaves regeneration; NW_N, old conifer stand with young conifer regeneration; NW_mi, middle aged conifer stand.

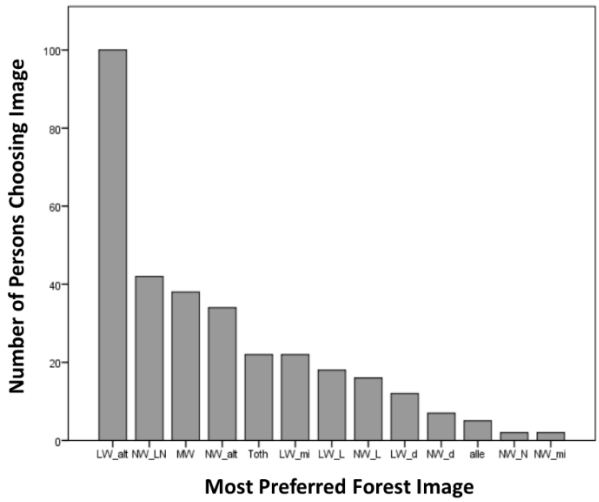

Figure 8. Diagram showing the numbers of selected most preferred pictures from the study in Ebersberger Forst. Abbreviations of the images; LW_alt, old broadleaved tree stand; NW_LN, old conifer stand with younger broadleaved trees beneath; MW, mixed forest stand in terms of species, sizes and age; NW alt, old conifer stand; Toth, old broadleaved tree stand with deadwood; LW_mi, middle aged broadleaved tree stand; LW_L, old broadleaved tree stand with initial broadleaves regeneration; NW_L, old conifer stand with initial broadleaves regeneration; LW_d, old, scattered broadleaved tree stand with several stages of regeneration; NW_d, stand with old, scattered conifers with several stages of broadleaves regeneration; NW_N, old conifer stand with young conifer regenertion; NW_mi, middle aged conifer stand; alle, persons insisted to select all pictures as their preferred ones.

On the other hand, 13.1% preferred the coniferous forest with deciduous and coniferous trees in the shelter (NW_LN). The main reason given was that it was a mixed forest, in which

both coniferous and deciduous trees were present, as well as trees of different ages and sizes. The existing moss and the different colors were described by many visitors as being particularly beautiful. Of respondents, 11.9% found the mixed forest (MW) to be the preferred forest image because it appeared particularly natural due to the different tree species and tree heights; the variety and balance of the colors were also emphasized by many visitors and, according to one forest visitor, "it corresponds best to the goal of multifunctional, close to nature forest management goals". The forest stand with deadwood was chosen by 6.9% of the participants. Because of the wood left behind, the forest appears to be particularly natural, and as one of the interviewees remarked, "not man-made". The aspects of wild, restless, and disorderly were judged particularly interesting by this group. The middle-sized deciduous forest (LW_mi) was also chosen by 6.9% of the respondents as the best forest picture, since the autumn colors are particularly recognizable in this image. The blaze of color was described as particularly beautiful and bright. Of respondents, 5.6% named the deciduous forest with foliage in the undergrowth (LW_L) as their favorite. They rated the different heights and colors of the trees as positive, and especially, the large number of beeches. Everything (small, large, young, old) was present in this stand that makes a good mixed forest.

Of the interviewees, 58.4% disliked most the forest image of the middle-aged coniferous forest (NW_mi, Figure 9). The trees were considered to be too thin, unnatural, and monotonous. Furthermore, the forest stand was described as dead, with too many bare branches, dark, sick, naked, sad, not maintained, or even scary. The study participants complained about an absence of broadleaved trees and stated that only commercial aspects appear to be considered here.

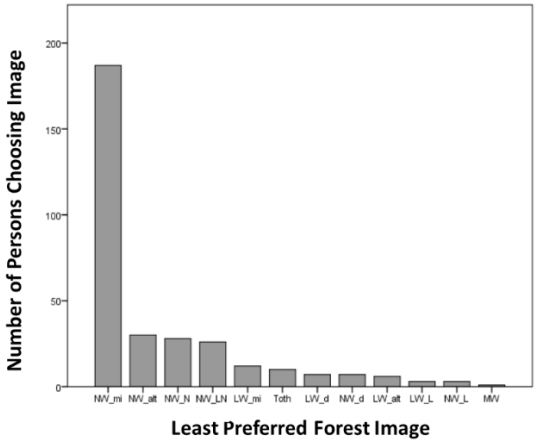

Figure 9. Diagram showing the number of selected least preferred pictures from the study in Ebersberger Forst. Abbreviations of the images; NW_mi, middle aged conifer stand; NW alt, old conifer stand; NW_N, old conifer stand with young conifer regeneration; NW_LN, old conifer stand with younger broadleaved trees beneath; LW_mi, middle aged broadleaved tree stand; Toth, old broadleaved tree stand with deadwood; LW_d, old, scattered broadleaved tree stand with several stages of regeneration; NW_d, stand with old, scattered conifers with several stages of broadleaves regeneration; LW_alt, old broadleaved tree stand; LW_L, old broadleaved tree stand with initial broadleaves regeneration; NW_L, old conifer stand with initial broadleaves regeneration; MW, mixed forest stand in terms of species, sizes and age.

Of respondents, 9.4% chose the old coniferous forest (NW_alt) as their least favorite forest image for the same reasons as for the medium-sized coniferous forest: the forest was too monotonous. The coniferous forest with conifers in the undergrowth (NW_N) was rated as the least popular forest image by 8.8%. The forest was too overgrown, monotonous, and too dense. The forest looked too uniform according to the respondents, too gloomy, and not alive enough. In addition, it was criticized that the ground could not be seen and it was therefore not possible to walk through the stand. Furthermore, 8.1% of the visitors could not name a picture that they liked the least as they considered all images beautiful.

3.3. Results from Photovoice

Almost all persons participating in the Photovoice study perceived the walk in the forest (Figure 10) as very positive and, particularly those people living for a long time in the region, took much fewer negative than positive pictures (Figures 11 and 12).

In both study groups, photos of the forest were particularly colorful showing a larger number of tree species or leaf colors. The provided benches and the signposting were mostly perceived as positive. Notably, many participants photographed tall, large trees. They were considered particularly attractive and were associated with nature, wildness, and power. Even pure Norway spruce stands (*Picea abies*) and tall non-native Douglas firs (*Pseudotsuga menziesii*) were found in a comparatively large number of pictures, as the photographed trees were considered very impressive and "mighty" due to their size. While deadwood was valued by persons living for a long time in the region, the group of migrants perceived this largely negatively. According to the justifications of the participants given, a positive perception was primarily related to (actual or assumed) knowledge about the importance of deadwood in forest ecosystems. The same diverging perspective could be observed for the insect hotels and the areas in the forest were goat grazing is practiced to maintain meadows important for nature conservation and biodiversity. While the locals photographed both as positive, the migrants perceived both as negative elements in the forest. Goat grazing received little understanding by persons originating from Mediterranean countries and was mentioned several times as the main reason for forest destruction in their countries. While the small ponds in the forest were almost always photographed by the locals as a positive element in the forest, they were only photographed once by the migrant group.

Both local persons and those originating from other countries felt disturbed by vehicles in the forest, the noise, and the rubbish, even by small pieces of litter, traces of logging such as cut trees, and the color markings on trees selected to be harvested. A clear-cut area close to the small lake was perceived very negative and foresters were blamed for this. However, this was the result of a bark beetle (*Ips typoghraphus*) invasion and had to be removed for maintaining the safety of visitors and for sanitary reasons. In other sections, the fresh lanes on an active skid trail were also perceived as disruptive by the first group of participants. Interestingly, persons who passed the same spot a few weeks later during the Photovoice walk no longer commented on the skid trail, since the lanes were leveled and had overgrown due to the growth of vegetation in the spring.

Figure 10. Route of the Photovoice walk inside the World Forest/Weltwald with the locations of the pictures taken by the participants; Map Source and Geospatial Data: Bayerische Vermessungsverwaltung No. 2207-12734.

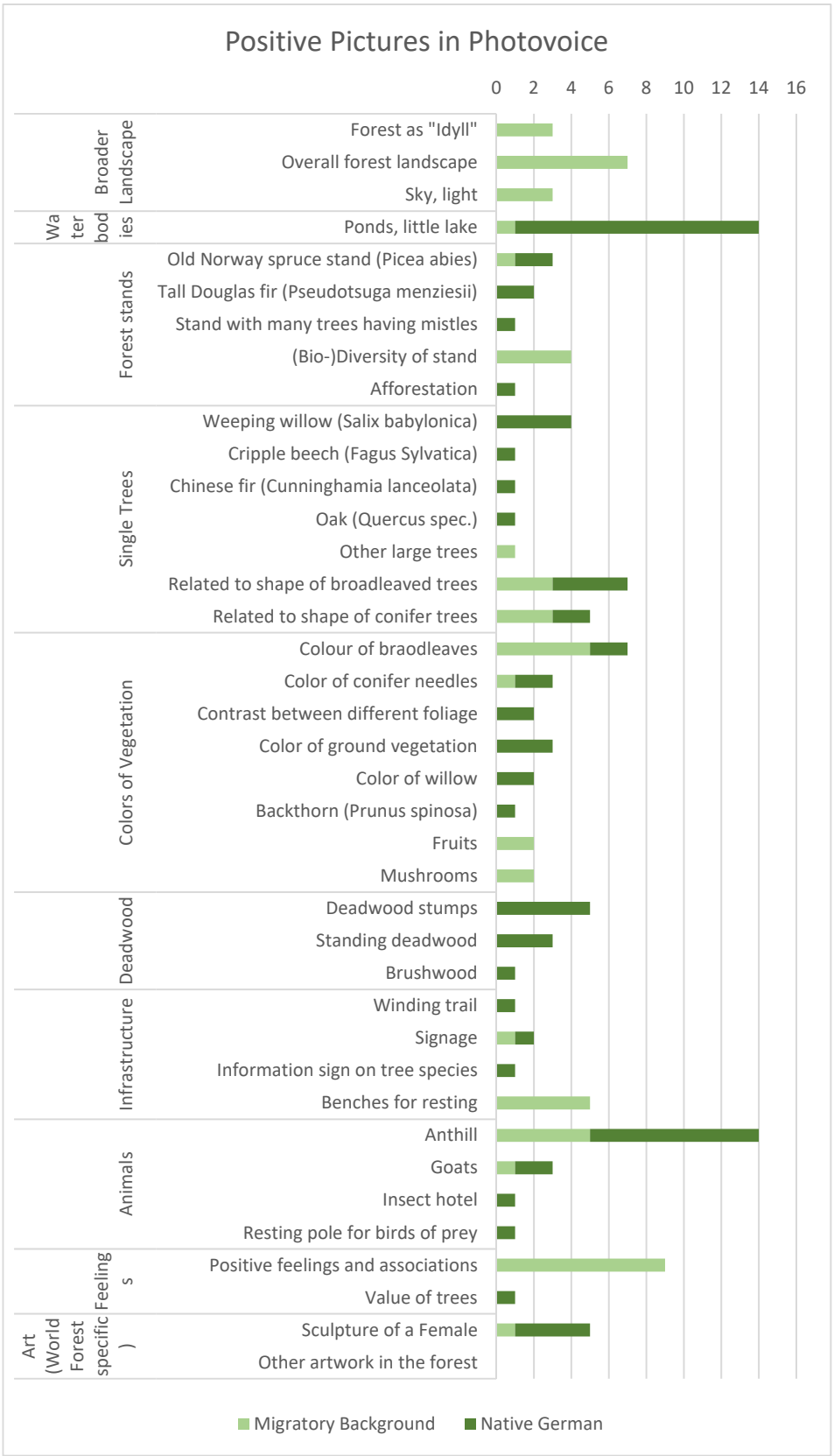

Figure 11. Picture contents chosen as positive in the Photovoice walk.

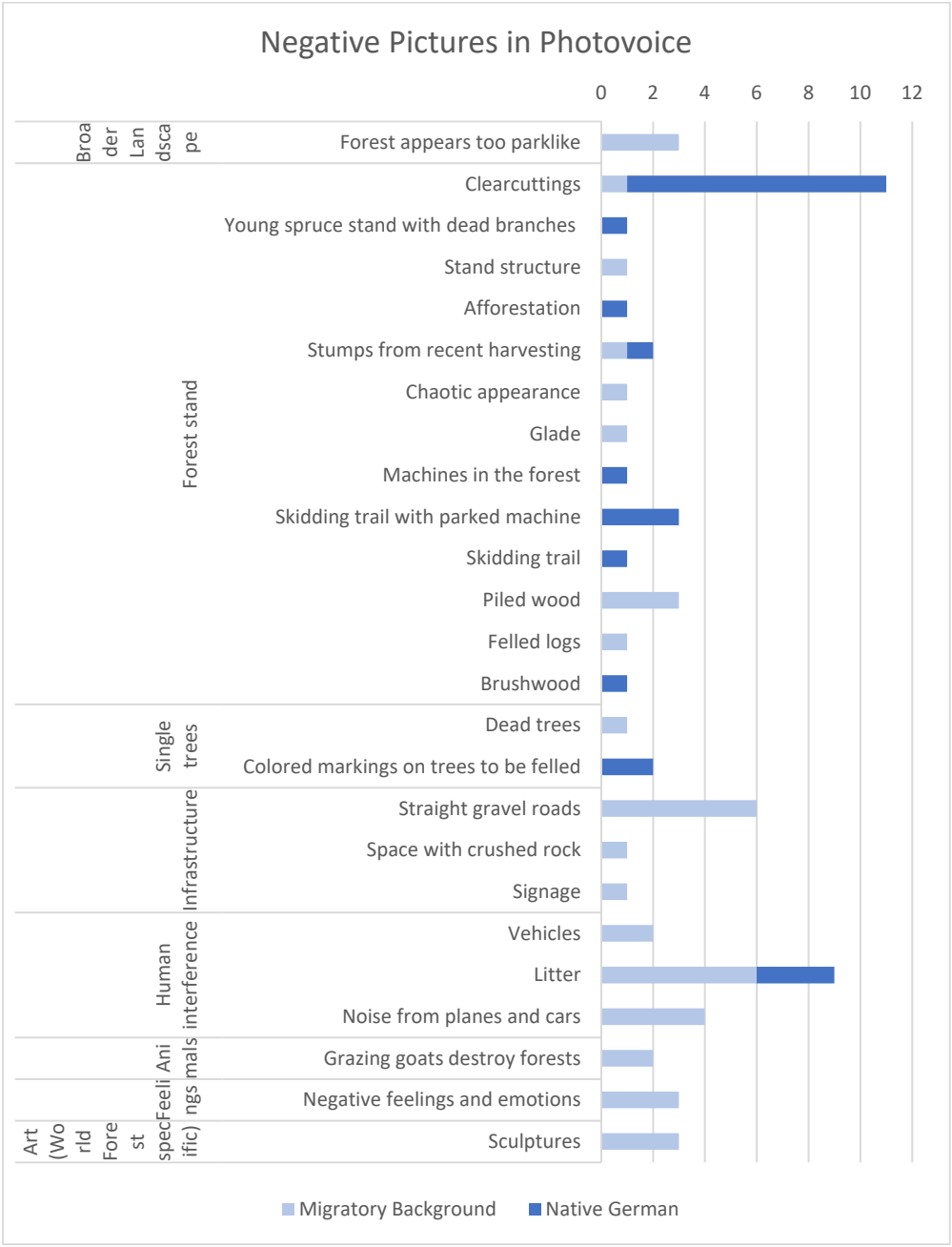

Figure 12. Picture contents chosen as negative in the Photovoice walk.

4. Discussion

4.1. Reflecting the Chosen Methods

The chosen approach covered around 300 interviewees each in the larger two surveys. This is a very small number compared to the very high visitor numbers in the forests and that were counted by a systematical approach in two forests in the Munich Metropolitan area [76]. Despite the systematical approach to collect information, e.g., selecting both weekdays and weekends, and interviews at different locations in the forest to cover a broad range of potential city dwellers and different forest visitors, the representativeness of the interviewees is minor to capture the broad range of actual forest visitors, especially capturing opinions of persons visiting the forest less frequently or recreating in other, more proximate, or more distant forests than the ones we chose for our surveys. Comparing the demographic data of our interviewees in the Forstenrieder Park and Ebersberger Forst with

census data from Munich, more elderly and persons with higher vocational backgrounds were participating in the surveys.

Especially weather can influence laypersons in their perception of landscapes [77]. Using photos, even when carefully taking photos on the same day in similar light conditions, the angles, directions, or colors of photos can be slightly different and resulting bias. With drawings or computer-generated impressions, e.g., using eye-tracking methods in controlled lab settings, e.g., in a study on urban green space in Shanghai, China [78] instead of photos, bias by shade and colors can be better controlled and reduce such factors influencing the participants in their assessment [22]. Nonetheless, Hull and Stewart [79] suspected that the different assessments of the environment and the photos are related to the mood of the respondents, since the assessment of the photos in their study did not take place in a more normal situation, e.g., while hiking through the forest. Despite the option to give an open-ended answer when explaining the chosen pictures, the approach heavily depended on the pre-selection and research design developed by the researchers, selecting images and forming questions. Participants have few opportunities for stating their own, personal preferences or for expressing what they dislike(d) about the forests.

The Photovoice method, therefore, represents an interesting possibility to collect more qualitative data. While the approach aims for in-depth understanding, its ability to cover the whole range of forest visitors is even more limited. A key challenge for using Photovoice is the high and often unpredictable time needed to conduct a study, and therefore, within a given time frame, the number of participants in such studies is very limited [67]. However, with a systematic choice of representatives for certain user groups, interesting insights and understandable ways of explaining perceptions can be given. An advantage of Photovoice is that the participants can, to a large extent, determine the investigation from their perspective. This allows the researcher to see things through the visitor´s eyes at least to some extent by looking at the photos and listening to the explanations. In addition, the situation of taking a walk through the forest is different compared to an interview situation going through a survey sheet even when choosing an interview site inside the forest. Later on, Photovoice allows the test persons to speak freely and reflect about the walk. In the literature, participants are more engaged and willing to provide insights if they can co-create the investigation to some extent, take responsibility, and take photos [66,67,71]. Bethmann and Wurster [80] state that open, qualitative research methods and a change of perspective can help pick people up "from where they are" and discover what their perspective is.

While Kong et al. [67] mentioned costs for taking and evaluating the images, it can be neglected for most approaches thanks to the omnipresence of tools such as smartphones, digital cameras, laptops, or tablet computers for showing images and recording interviews. However, Berbes-Blazquez [66] stated that photos are only snapshots and are not capable of depicting dynamic processes. In the presented work, the Photovoice walks were taken in the months of April and May for the German group and in late summer for persons having a migratory background. Potentially, interviewees might have taken other pictures and expressed other things at a different time of year or in a different weather condition. More similar investigations covering the full year and different weather conditions would be feasible for this reason. With some exceptions to dynamic aspects such as short-term logging activities, at least during the covered periods, the distribution of photos taken along the trail was quite even. From the overall distribution of the images, it can be concluded that the attention to the forest remained high throughout the walk. However, this might have been a result of the tasks given to the participants of taking photos and attention to the forest at least in several parts of the walk might have been lower in a normal recreational situation.

Some sections were different with a large number of negative images showing the clear cut at the small lake and the skid trail with parked machines. For the positive impressions, accumulations can be found for the small ponds and the meadow in the southeastern edge of the trail as well as reaching the tall conifer stands when walking towards them from

the mixed forest sections. Many pictures show single trees and were taken towards the canopy or showing the thick tree trunks. A large number of the images taken showed details such as colorful or nicely looking leaves, colors, single trees, fruits, or the anthill. Similarly, negative features were photographed such as litter on the ground or vehicles in the forest causing disturbance. Several participants wanted to describe non-visual effects of the forest such as noise, feelings, and emotions that they found challenging to visualize with a camera. Interestingly, only a minority of photos visualized the forest in a way that would be typically used for choice experiments to determine scenic preferences linked to the broader landscape or forest stand category.

4.2. Reflecting Studies Outcomes

In our studies, near-natural and ecologically valuable forests with only little infrastructure were preferred, even if forests were close to built-up areas and heavily frequented. Even in densely populated areas and next to built-up areas, it was said that forests should be something to contrast to the urban environment and provide "pure nature". While, visually, natural looking mixed forests were preferred; nonetheless, almost every forest type was well-suited for recreation and liked for many features. In our studies, a large share of respondents could not say something negative about the forests. Participants chose or took fewer negative images or put their negative statement into perspective, since they were asked to respond to the interviewers' questions regarding negative aspects or "had to" sort pictures according to the given tasks. Even monocultures or non-native tree species were accepted and appreciated. An important, but not decisive aspect for valuing the different scenic qualities of forests was knowledge and experiences, as well as an understanding of the relationships in the forest ecosystem. The latter was a key element in a special appreciation of "wild" forests containing deadwood. Thick, large, colorful, and bizarre-shaped trees were valued and enriched the forest experience, whereas the type of tree species was of secondary importance. Our findings are in line with and confirm theoretical (e.g., [81]) assumptions or expert-based approaches (such as [82]), as well as studies from Europe and North America [24,28].

Both Germans and persons originating from other countries with other types of ecosystems appreciated Central European forests very much. Similar elements in the World Forest create value for everyone. Depending on the origin, some specific management practices such as grassing goats for nature conservation purposes needed explanation to be understandable. Visiting a forest stimulated respondents to link, resemble, or draw comparisons to and raised memories of forests and nature providing a sense of place linked to both the visited forest and the one from the country of origin. Less frequent forest visits could be linked to mobility aspects (accessibility, e.g., public transportation), lack of knowledge, and information about the forests or awareness about recreational offers and activities as well as less familiarity with forest recreational activities such as hiking or cycling [36,38].

On closer observation, the results concerning forest preferences show that people with a higher level of formal education and long-term familiarity with respective forest ecosystems generally perceived ecologically more valuable nature as more attractive. Thus, this positive assessment is strongly related to learning and knowledge. The Finnish preference study of forest types [23] showed that unmaintained forest stands tend to be rated more negatively and monocultures more positively in terms of visual impression. However, people who had a higher level of education were more likely to accept deadwood and undergrowth and perceived pure spruce stands as very negative [21]. Quite obviously, knowledge of ecological relationships influences the perception of whether a forest stand is perceived as attractive and correlates with findings by Gobster et al. [28] from North America. The group with a higher education was therefore more aware that pure monocultures are often viewed critically from a nature conservation point of view, which is clearly reflected in the reasons given when these people had to justify their selection of negative forest images, for example in image surveys. Mixed stands, on the other hand, combine

closeness to nature and biodiversity. The study by Qiu et al. [34] came to the controversial conclusion that while respondents recognize biodiversity, they do not automatically see it as particularly attractive. Picturesque, visibly cultivated landscapes were preferred to wild-looking images. However, it should be noted that in this study, more park-like structures were examined and open impressions were compared there with forest-like impressions. Hence, for this reason, one should be careful transferring findings linked to "Urban Forests" with related expectations more to a managed wooded park than to a real, larger, and less intensively managed woodlands.

Knowledge about forest management can also lead to a positive attitude towards forest management [83,84], with which our findings are in line to some extent. In a study conducted in mountain forests in Italy and Bosnia-Herzegovina, preferring standing and lying deadwood was mainly linked to the cultural background [85]. While close-to-nature-managed forest stands are perceived as positive, logging activities always cause visual disturbance for visitors to the forests and are noticed as negative. Despite the necessity to explain well and communicate the importance of wood harvesting, thereby trying to foster an understanding of the society for timber management, in heavily frequented areas, from an aesthetic standpoint, timber harvesting, wherever possible, should be as invisible, sensitive, and quickly done as possible and include a good cleaning up after logging. In many cases and when conducted with care, good practice or doing some minor restoration activities, vegetation will overgrow any such traces rapidly during the vegetation period.

Tyrväinen et al. [21] found that the preferences for a certain forest type depends not only on the level of education, but also on age, gender, frequency of forest visits, and forest activity. Thus, males, young people, and frequent and active forest visitors accepted ecological management options, abundant undergrowth, and deadwood more often than other groups. Another phenomenon from the study by Tyrväinen et al. [23] and Hauru et al. [86] was also found in our studies. In the Finnish study, for example, deadwood was viewed negatively, especially in coniferous forests, while it was hardly mentioned in mixed forests.

In the Forstenrieder Park, too, it was partly the case that deadwood in the mixed stand was hardly mentioned (or only in a positive sense as a habitat for insects), while visitors often made negative comments about deadwood in the pure deciduous forest, but also about deadwood in the pure spruce forest. The lower acceptance for deadwood in deciduous forest stands could also be related to the fact that deadwood is particularly noticeable in such forest areas in winter, the season in which the pictures were visualized.

In a study conducted both in North American and in a European context on bark beetle outbreaks with vast dying conifer stands and related impacts on scenic qualities using visualizations, visitors preferred healthy mature forest stands and disliked forests with substantial dead wood. Interestingly, the number of visitors shown in the animated visualizations influenced the expressed preferences [87].

While previous knowledge and frequent stays in nature could mean that recreational users behave in a more environmentally friendly and conscious manner when practicing sports [88], we could not find hints in our studies and a broader, evidence-based mixed-method approach would be required to verify such an assumption that is typically assessed in self-reported surveys. Variation between forest stands seem to contribute positively to recreational value, and in some cases, this may outweigh the contribution of variation within a stand according to Filyushkina et al. [89]. Taking a closer look at the results, and especially, at the Photovoice walks, it could be shown that changing stands and other forest types than the preferred mixed, uneven-aged stands are perceived to be very attractive for recreation and scenic enjoyment, such as tall spruce and Douglas fir stands. In particular, many participants photographed the old spruce stand because the size of the trees was perceived as attractive and, as well, the change between different stands was perceived in a positive way. "Mighty thick trees" drew attention and were very much appreciated, regardless of whether they were non-native trees or trees in an even-aged monoculture. With the Photovoice method, it could be shown that the view, direction, and attendance to a

forest changes between a broader look at the forest stand and attention to small details such as single trees, colorful leaves, or small vegetation features. To some extent, also non-visual aspects of forest perception could be captured this way.

4.3. Implication and Further Work

With our work, it can be shown that multiple benefit management is as well highly valued, and the respective management can increase provisioning sociocultural ES. While there is a link between high biodiversity and nature conservation, from the valuation by people, a closer look shows that managed, structured, diverse, and resilient forests can provide or create very high values for humans as well and might better cope with intense recreation in urban areas. Looking at demographic and cultural backgrounds, valuing forests are similar for most visitors, including persons having more familiarity with other types of landscapes. While the forest and many services are perceived as positive, the use of timber and related actions is perceived as negative. In the eyes of most visitors, forests should be "pure nature".

For unveiling the potentials of forests, accessibility, opportunities for experiencing forests, as well as information and learning opportunities can stimulate valuing forests, forest structures, and elements. Based on the knowledge of the elements and structures especially appreciated, forest managers can develop visitor management strategies to steer or develop attractive places away from valuable, sensitive areas to more robust forests.

Often, small features and elements are highly valued and lead to a high appreciation and were reported frequently in the Photovoice walks. Qualitative, user-directed approaches in field settings can help to better understand and identify such elements assigning values or link elements with aspects that are important to create a sense of place, positive feeling, and human wellbeing. With still many gaps existing, especially to assess and value sociocultural ES, applications of in-depth, user-centered approaches can contribute to further develop a better understanding how humans appreciate and value nature.

5. Conclusions

Using in-depth approaches attempting to take the view through the eyes of forest visitors, interesting insights to the perception of forests and landscapes can be collected. Such approaches contribute to a broader understanding of preferences and satisfaction with the forest recreational experience. Making use of approaches such as Photovoice allows the participants better to determine and direct the course of the investigation. Additional insights for understanding the perception of forests and landscapes can be captured. While overall theories of landscape perceptions and approaches such as choice experiments can explain preferences in general or give feedback to management practices, it can be shown that perception of a forest goes beyond the overall visual quality of a forest stand. Many more, sometimes small visual elements such as colorful leaves or ground vegetation contribute to positive, in some cases, negative experiences, such as little pieces of litter. Even forests that might seem less attractive when looking at outcomes of choice experiments or from a literature point of view, can be perceived very attractive for recreation and scenic enjoyment by actual visitors. Qualitative, user-centered approaches provide interesting possibilities and opportunities to better understand landscape perception as well nuances that contribute to a broader understanding of landscape perception.

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Research Involving Humans: The study presented involved humans. No personal data that could be assigned to an individual were collected and anonymity of participants were maintained throughout the entire research process. Data were collected in a way so that they cannot be linked or traced back to a person. Conducting and handling of the collected data and maintaining privacy of persons follows the legal basis of the EU, REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing GDPA Directive 95/46/EC (General Data Protection Regulation) and corresponding country-specific regulation for the Federal Republic of Germany.

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