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Creative management: a framework for designing multifunctional play biotopes - lessons from a Scandinavian landscape laboratory

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Abstract
Most children grow up in urbanised settings with a low possibility to experience biodiversity and nature. However, experiencing nature and other species increases children's wellbeing, health, learning abilities and their understanding of nature values. Play biotopes is one solution for supporting a co-existence between children and different species in nature-based play settings. Play biotopes are based on ecological theories, where structures in the morphology of landscapes at different scales and the content of flora and fauna can support children's interplay with a part of the landscape. However, traditional landscape management is not adapted to support the dynamic nature of play biotopes, especially when considering multiple scales. This makes it interesting to explore more dynamic management concepts arching over multiple scales. Accordingly, we here explore creative management as a scale-based framework for design by management to further develop the concept of play biotopes. Using examples from a landscape laboratory in southern Sweden, we propose that a creative management framework combining the scales of landscape, biotope, place, and object together with play connectivity can support the creation and management of multifunctional play biotopes.

Keywords Urban biodiversity · Children's environment · Temperate zone · Design by management · Multiple scales

Introduction

Most children today live in an urbanised setting in which the possibility to experience biodiversity is low (UNICEF 2012), yet, experiencing nature and other species increases children's health, wellbeing, learning abilities and the understanding of nature values (Chawla 2015, 2020). Present urban green areas are often solely managed for one purpose, such as aesthetically pleasing short mown lawns and trees in parks or natural remnants left for free development and nature conservation. Seldom is an urban green area managed to fit multifunctional purposes – such as simultaneously supporting children's play and biodiversity. However, we argue here that it is possible to increase both nature experiences for children *and* biodiversity through more differentiated management. We further argue that management is part of the *design* of urban green spaces for play and species prerequisites and that this type of management can be conceptualised as *creative management*. To illustrate our arguments, we frame this in the concept of so-called *play biotopes* and exemplify its implementation within a landscape laboratory in southern Sweden. The case studies presented are mainly revealing a central European perspective as for vegetation – but the framework of creative management is likely applicable in many other different contexts.

Play biotopes have been put forward as a solution that supports a co-existence between children and other species in nature-based play settings (Fjørtoft 2012; Ito et al. 2016). Inspired from landscape ecological concepts, Fjørtoft (2012) presented play biotopes as a scale-related concept including *biotope*, *habitat* and *niche* (see Fig. 1). Within ecology, a biotope is a distinguishable division of the physical landscape with a specific assemblage (community) of different

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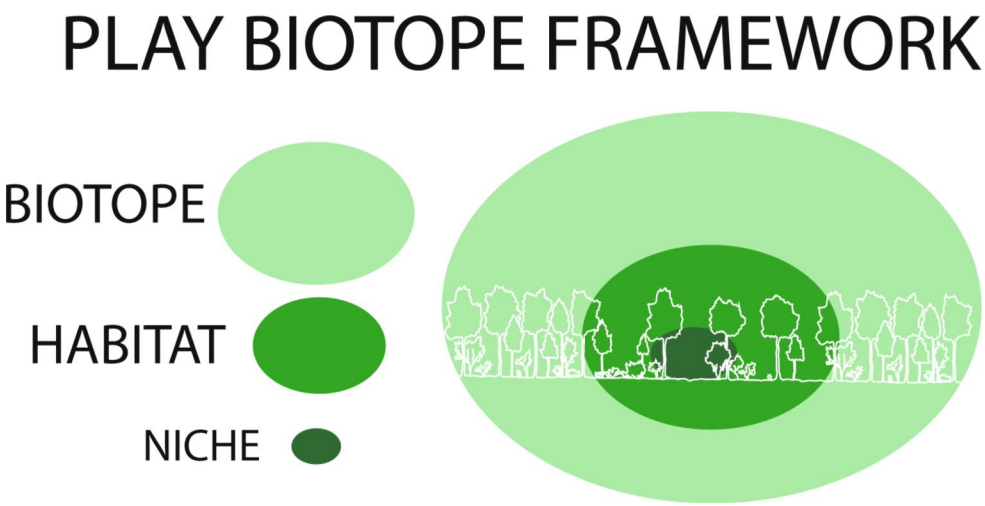

Fig. 1 Schematic representation of the play biotope framework

species. Habitats are closely interlinked to biotopes but represent the specific abiotic and biotic resources in an area needed for a specific species. A specific niche represents a place or setting suitable for a specific species' need or use. An oak woodland is thus a biotope that works as a habitat for a specific species given its resources, where this usage can be seen as its niche. A niche as such is a two-sided concept including both the use of a habitat and the effect such use has on the system itself. Applying the ecology concept to a children's play-environment makes an oak woodland where children could play a play biotope, where the configuration and structure of the woodland enable the play, i.e., a play-habitat, while a play-niche represents specific play activities within this habitat. A play biotope as such can hold different kinds of *affordances*, i.e., opportunities for children to take meaningful action and facilitate their various activities, making stones *jumpable*, shrubs possible to hide in and trees *climbable* (Heft 1988).

Play biotopes can thus support managers and planners in understanding how specific biotopes in the city can be more multifunctional, as it gives a framework for understanding both the synergies and dis-synergies of biodiversity and children's play. However, the management of more multifunctional biodiverse urban green spaces faces many challenges, and traditional park management, forestry and nature conservation are often not fully adapted to this, focusing mainly on maximising single functions and seldom considering more than one or two main scales while doing so (e.g., Wiström et al. 2023). On an operational level, multiple scales are seldom included in management; instead, the management often focuses *mainly* on the biotope (e.g., nature conservation), stand level (e.g., forestry) or individual trees, as within arboriculture (Fallding 2000; Lämås et al. 2023; Östberg et al. 2018). Therefore, we here argue for the need to search and explore practical management frameworks that work over multiple scales. Additionally, in most cases, when designing and planning for green spaces in the city, the inherent dynamics of vegetation related to community´s succession and disturbance regimes, such as children´s wear and tear, are neglected (Gustavsson 2004; van Dooren and Nielsen 2019). Traditional design approaches, based on a main illustrated masterplan that is implemented and upkept through standard park maintenance, thus become less suitable when working with more dynamic and nature-based designs (Gustavsson 2004) such as play biotopes. One suggested way forward in relation to these challenges is to elaborate on *management as design* at different scales through the framework of "creative management" (Tregay 1983; Ruff 1987; Koningen 2004; Wiström et al. 2023).

Creative management

The fact that nature and vegetation is highly dynamic, depending on various natural processes, is formative to children´s play outdoors (Mårtensson 2004). Therefore, when designing with nature, as when creating play biotopes, design cannot be separated from management. The original design can only set the start for the forthcoming development of plants (Tregay 1983; Koningen 2004; Gustavsson et al. 2005; Wiström et al. 2023); hence, management becomes design placed in a time continuum. A community of trees and shrubs, irrespective if planted or naturally regenerated, can, depending on the thinning and pruning, develop into stands with radically different structures and species compositions (Tregay 1983; Rydberg and Falck 1998). Given this wide variety of possibilities, a large degree of creativity and design-based thinking becomes essential to management (Tregay 1983; Koningen 2004).

Common to such creative management is a high level of *place specificity*, where the management is adapted to the local context, focusing on specific *places* (Wiström et al.

2023). Places are here seen as distinct areas compared to their surrounding space in the range of about 10 to 2000 m^2. Sites of this size can be experienced as a *place* and thus attributed experiential values and meaning. The actions taken within these specific places are, however, always taken in relation to the larger landscape, as well as in relation to a smaller scale of individual objects. It is a way of activating a landscape with relatively small resources, as it is possible to combine with more standardised management or conservation approaches for the overall landscape matrix (Lerner 2014; Duinker et al. 2017; Wiström et al. 2023).

As the core of creative management is relatively small and specific areas in the landscape, this makes it suitable for processes of co-creation and supportive of people forming emotional bonds with the place, so-called place attachment (Manzo and Devine-Wright 2021). For example, co-creation between landowners, users, municipals and nature conservationists have been used within the creative management framework for teaching landscape students how *nature and culture reserves* can be strengthened concerning its readability, authenticity, biodiversity and experience through place-specific management operations (Gustavsson et al. 2019). In the landscape laboratory of Sletten Holstebro (Denmark), co-creation with the inhabitants has been successfully developed using specific co-management zones for edges between housing and surrounding planted woodlands (Fors et al. 2019). As such, creative management and co-creation are applicable both when working with existing nature and when creating new nature-like environments. However, the involvement of children´s perspectives in such creative and co-creative management has not been explored in depth. In the following, we synthesise, discuss and exemplify some of our practical experience and knowledge of using the creative management framework for co-creating multifunctional and biodiverse play biotopes in the Alnarp landscape laboratory (Sweden) in case-studies involving children 3–7 years old (Hladikova and Sestak 2017; Gabriel 2021; Herngren and Ågren 2021; Mårtensson et al. 2021). These studies included observations of children´s play in order to document their use and preferences in the landscape laboratory and to identify specific structures, objects and characteristics, which could provide affordances from potential play biotopes. Further, in a selection of settings, management interventions were made in collaboration with experts and children, followed by additional observations, in order to learn about their effects and the dynamic interface between children and nature.

Alnarp Landscape Laboratory

One cannot move the landscape to a laboratory; thus, one must move the laboratory thinking to a landscape (Nielsen 2011). Guided by this idea, and the will to test new ideas on a scale of 1 to 1 regarding how to create rich multifunctional landscapes, the Swedish University of Agriculture sciences (SLU) has since the 1980s created Europe's first landscape laboratory at SLU's Alnarp campus (Gustavsson 2002). It has been followed by several other landscape laboratories and projects inspired by its thinking, especially within Scandinavia but also other parts of Europe (Szanto et al. 2016). The Alnarp campus is located between villages that belong to the suburban landscape context of the cities Malmö and Lund. The campus covers about 100 ha, with roughly one third each allocated to traditional field trails, late 1800s park with old woodland remnants and buildings including offices, housing and one kindergarten. The surrounding landscape is strongly anthropogenic and dominated by agriculture and urbanisation, making the Alnarp campus and its landscape laboratory one of few woodlands in the surroundings and thus, an important recreational asset.

The landscape laboratory is located in the temperate vegetation zone with a mean annual precipitation of 535 mm and a mean annual temperature of 7.7 °C. It was established on former fertile agricultural land, with a limestone bedrock and a deep loamy glacial till overlaid by fine sand. To aid the understanding of its ecological context, a much-simplified summary of the local successional stages and vegetation dynamics is given below based on Ellenberg (1988) and Sjöman et al. (2015). If the agricultural soils of Alnarp would be left, for free development, it would according to traditional climax concepts first be rapidly colonized by annual and biannual agricultural weeds followed by perennial herbaceous species and grasses. The duration of this grassy stage, that could last for decades is depending on multiple factors, among other, the species pool and browsing pressure in the landscape effects the time needed for pioneer shrub and tree species to take over the dominance. Over time, secondary tree species would become more dominating and then upkept in dominance mainly by gap-driven disturbances. Depending on the hydrological conditions, the climax vegetation type would be beech (*Fagus*) forest on mesic sites, mixed oak (*Quercus*) forests if partly more dry or moist and if wet, ash (*Fraxinus*) and alder (*Alnus*) dominated forests. In the case of the landscape laboratory, the weedy and grassy stages have been by-passed by dense planting and weeding, also meaning the woodlands, although young can be dominated by secondary tree species. Still, natural regeneration is occurring at different parts and rates of the laboratory depending on species composition and management, including unplanted parts resembling early successional stages typical for the region.

The layout of the landscape laboratory includes all of the above mentioned main forest types, and uses several complexity/diversity gradients for the main landscape elements

of woodland stands, edges, water and open areas. This means that stands of only one species, a few species and many species can be found in the area as well water-streams and ponds ranging from the simplest of form (straight ditch) to the highly complex (meandering stream valley). This diversity in form and species is paired with a management trying to display several different options instead of a single optimal one.

Creative management in the landscape laboratory

The initiation of creative management in the landscape laboratory started in 2002 (Hladikova and Sestak 2017) and has been ongoing ever since. This type of management focuses on place, objects and paths, but always in relation to the overall landscape and its different stands or biotopes. Central to this approach is place specificity – normally an area covering about 50 to 1000 m^2 and its relation to the landscape at multiple scales is in focus. Although the main aspects of creativity, seen by the visitors are place-specific interventions such as artfully pruned glades and trees, these management interventions are set within a larger framework. By deciding on how and when different stands should be thinned, an overall syntax is given to the landscape that often enhances the original design of different complexity ladders, e.g., a simple structure with straight paths in contrast to species-rich stands and the specific actions for that area. Part of the creativity is that not one optimum or standard management approach is applied; instead, some stands are thinned to promote pillared halls while others are formed as multi-layered stands. Additionally, some areas are left for free development, whereas in others dead wood is taken out or everything cut is left in piles or on the ground. This adds variation to the landscape at both the landscape and stand scale. Further, the overall variation of the landscape is enhanced by how the path system is laid out, making it possible to pass by beech forest, hybrid aspen, glade, water, dense edges, open edges, etc., in just a few hundred meters. Instead of constructing the paths from the start, as in most conventional landscape designs, they have instead been thinned out over time. This has given the possibility to include odd looking trees, spontaneous shrubs, small extra bends, etc., along the path. Moreover, a hierarchy exists in the path system with smaller and larger walks, which enables multiple options for movement. In relation to the overall landscape configuration given by the coarser management and path system, site-specific detailed management actions focusing on special places (e.g., glades) and objects (e.g., special trees) are added, accounting for only about 10% of the total area (Hladikova and Sestak 2017; Wiström et al. 2023), leaving approximately 90% of the landscape laboratory for more rational and conventional vegetation management approaches (e.g. forestry thinnings, haymaking, grass cutting, brushwood clearing and free development) on a landscape and stand level.

In the following sections, we will present and discuss some overall experiences and examples from applying the above-described creative management framework to children's play in the landscape laboratory.

Stand level management: creating a diverse hut forest

In urban situations, multifunctional forests that combines production, recreation and biodiversity are often of high interest. A model woodland trying to achieve this is the *Trolleholm model* planted in the landscape laboratory (Fig. 2a). Developed in 1994 (Gustavsson and Ingelög 1994), it departs from studies of reference landscape and forest stands at a regional estate (Trolleholm) together with interviews with its forest manager. Oak *Quercus robur* is supposed to act as the main crop tree together with a few other light tree species. The more shade tolerant hornbeam *Carpinus betulus*, linden *Tilia cordata* and birdcherry *Prunus padus* form a varied understory, shading the oak trunks and its epicormic branches, thus giving it a better timber quality (Henriksen 1988). However, when species are planted at the same time, this desired stratification does not develop by itself, especially when many species have similar initial growth rates as in many mixed oak stands (Richnau et al. 2012). Therefore, to support the oaks, large growing specimens of the understory species are coppiced. These shade tolerant species find their role in the understory, mainly as multi-stemmed and lower trees when they re-sprout from root-suckers or from the stump. Coppice over time and repeated thinnings give rise to a complex multi-layered stand with many multi-stemmed trees of different sizes below the oaks, together with some large and deep crowned shade tolerant trees (Fig. 2c). Such a structure is not only good for many birds (Fuller and Green 1998; Heyman and Gunnarsson 2011) but also attracts a certain kind of games and provides many affordances for building huts and dens. Furthermore, the big timber trunks create fascination among children with their size and bark but the play itself is mainly supported by the understory beneath the trunks and the spaces and structures that it provides. At the same time, the thinning of the tree canopy is what enables enough light to maintain a vital understory (Richnau et al. 2012). Additionally, by leaving dead wood from the thinning in different suitable sizes, the affordances of hut and dens have been enforced while simultaneously giving more substrate to saproxylic species (Hedblom and Söderström 2008; Jonsson et al. 2016).

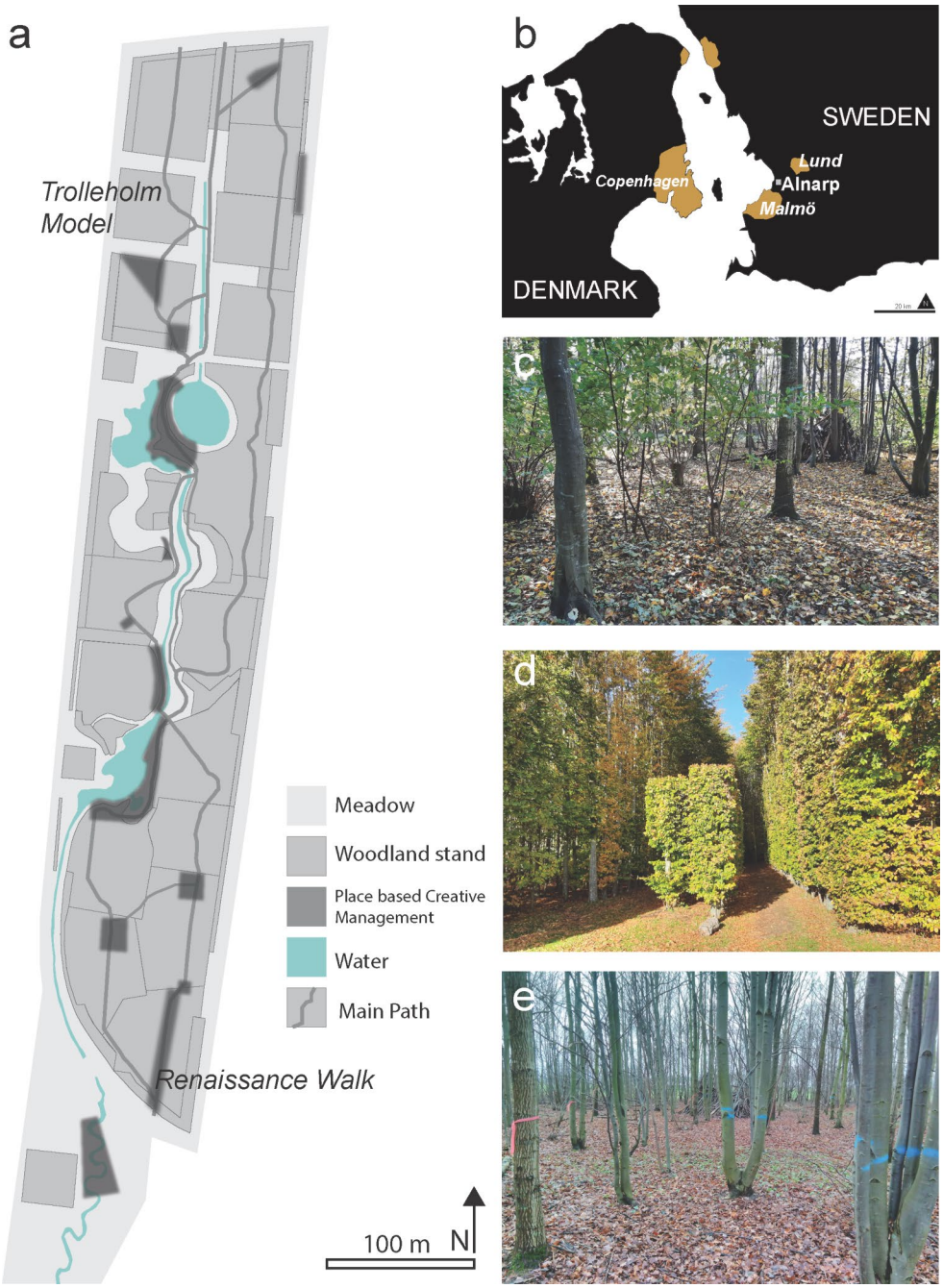

Fig. 2 (**a**) Map of the part of the landscape laboratory in Alnarp used in the study with the stands and places mentioned in text marked with italics in the plan. (**b**) Geographical context of Alnarp where black = country, brown = city, white = the Baltic sea. (**c**) Trolleholm Model. (**d**) Renaissance Walk. (**e**) Example of frame tree marking

Place-based management: creating a formal space for games

In the southern part of the laboratory, the beech species *Fagus sylvatica* dominates, resulting in a dark forest type. However, where there is darkness, the contrast of light becomes stronger. In 2002 and 2003, this notion was used to create a narrow walk with a formally cut beech hedge by pruning two of the planting rows on each side of the straight path, the so-called *renaissance walk* (Fig. 2a). The initial idea was that this action would give values to the young forest while waiting for the trees to mature into a classic pillared hall of beech (Hladikova and Sestak 2017). To enhance this concept further, a miniature-pillared hall was also created at the start of the walk by raising the stems of the small, young beech trees to about 2 m. This provided some distinct room, especially at younger children's eye-level. However, as the surrounding trees grew bigger, the *renaissance walk* (Fig. 2d) was increasingly shaded out. However, instead of letting this continue unabated, the rows closest to the cut hedges were thinned out in 2012, transforming the walk into a large beech hedge, which one

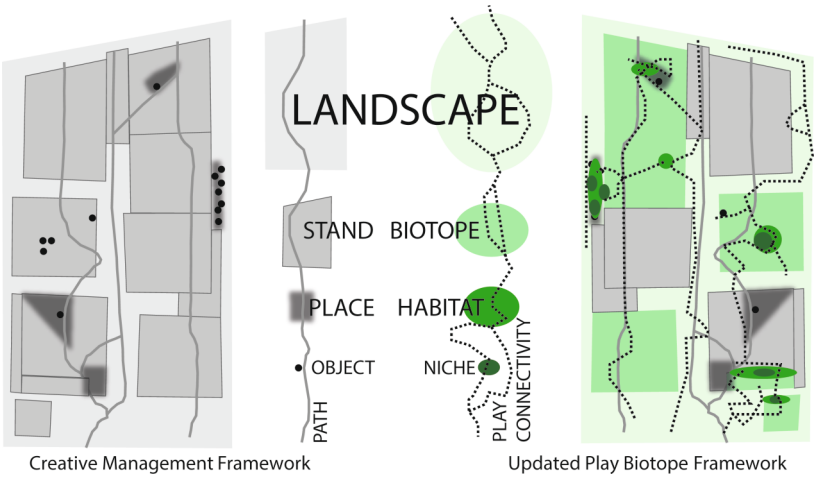

Fig. 3 Schematic overview of the creative management framework and how it can be related to an updated play biotope framework to aid managers. By adding the landscape scale and play connectivity to the play biotope concept, a more scale-based framework is created that links to the scales and framework of creative management

now walks alongside, while the surrounding trees have been trimmed into extremely high hedges (Fig. 2d). Traditional forestry thinning in the stand to the west of this formal room has given rise to a forest that one can see and walk through, whereas the east side has been left un-thinned, creating a dense and almost impermeable structure. This part stands out as the most formal and controlled part of the landscape laboratory with its geometric shapes and only one tree species. The linear features of the place, and contrast between open and more closed parts, invites mainly running games. Given that, other places were overall seen to promote more diverse affordances for play than the *renaissance walk*, it should be noted that a place-based approach suitable to support aesthetics and a sense of place for adults cannot directly be transformed to places for children's play, although they might overlap. While the *renaissance walk* mainly enforced running-related activities, it also showcased that different management can give complementary affordances for play. One simple application of this insight could be the use of variable density thinnings (Carey 2003) to increase the structural variation for biodiversity while simultaneously activating some areas for running-based games while more dense parts could support other play activities.

Object directed management: creating trees with character

Within silviculture and woodland conservation, there is an increased realisation that the individual management of valuable crop trees for high quality timber or habitat is a cost-effective way of management (Löf et al. 2016; Pommerening et al. 2021). Central to both cases is the selection of specific trees for biodiversity or high quality timber (Fig. 2e) and selective thinning to support these so-called *frame trees* (Pommerening et al. 2021). It has also been suggested that those frame-trees can also be selected to support aesthetics values (Pommerening et al. 2021). In the landscape laboratory, we have explored this thinking further to also include trees with possible affordances for children´s play, i.e., *play affordances*. Here at least two main types of frame trees for play have been observed as important: trees for hut building and trees for climbing. Both of these categories differ from high quality timber trees in that they give priority to trees with low branches and multiple stems. In contrast, many conservation values with an increased number of micro habitats and more sun exposure for bark (e.g., Gran and Götmark 2019; Asbeck et al. 2021) could probably be combined within *frame trees* for play and biodiversity. It would often also be possible to combine the selection of different frame trees for different functions within the same stand to promote a more multifunctional stand (Löf et al. 2016). However, it is also important to recognise that the normal smallest object for forestry is the tree, whereas for play and biodiversity, even smaller objects are central for play; indeed, loose natural material, as pointed out by, e.g., Fjørtoft and Sageie (2000), seems especially vital for play biotopes.

Ways forward - landscape scale and play connectivity

The places studied in the landscape laboratory range from simple monocultures to the most diverse woodland planting as well as free growing spontaneous vegetation, all providing different types of play affordances. This diversity shows that there are possibilities to develop play biotopes using management both in situations with more natural vegetation as well as when restoring nature through planting. Thus, in cases where there are existing indigenous vegetation in an urban context, efforts could be directed toward keeping and developing it, ideally integrating play, biodiversity and sometimes also forestry. When such existing vegetation is missing, it becomes important to establish it anew, ideally ahead of urban development in order to allow time for it to develop and grow before its

integration into the urban fabric with schools and residential areas. This means that in forest-poor regions, the establishment of multiple use afforestation and restoration projects becomes vital (Nielsen and Jensen 2007), while in more forest-rich landscapes (Nielsen et al. 2017), initiatives such as those presented by Rydberg and Falck (1998), which use natural forest regeneration, should be a first-hand option. However, both existing and new vegetation benefit from place specific creative management that creates multifunctional landscapes for children´s play.

Common to such place-specific creative management is that it ranges from details of gardening to coarse forestry thinnings, and its uses and functions are related to the overall landscape configuration and our movement through it. Since different play biotopes give different play affordances and support different species, there is a need to expand the play biotope framework to also address how different play biotopes are interlinked to each other on a landscape scale (Fig. 3). In the same way that biodiversity is scale dependent (alpha, beta and gamma diversity) and needs a diversity of different habitats interlinked with each other (e.g., Whittaker 1972; Stein et al. 2014), a diversity of play affordances and their landscape configuration is what should be guiding the management, not the idea of one ideal play biotope or play setting. As such, extending the play biotope framework to address the combination and configuration of different play biotopes on a landscape scale, as within creative management, is central to further research and practice. Within the creative management framework, the path system is central to combining and working across scales as it sets the main lens for experiencing the different parts of the landscape. While adults generally use the path system and thus are guided by it in their use and experience of the landscape, children move more freely. Over-focusing on the path aspects thus might be unbeneficial for children's exploration and play. As such, the focus on paths should be further elaborated to include a more overall connectivity approach, where a better understanding of movement between different play biotopes and play-niches needs to be addressed in future research.

In addition to these larger scales and their interrelation, small scale management actions, even on a micro scale, are central to creative management and added play affordances, but it is easy to miss if one only focuses on management on the stand or biotope scale, as is common in traditional forestry, conservation and park management. Moreover, small-scale interventions focusing on details are also very suitable for co-creation with children where they can take an active part in landscape creation and management.

Children are active users of the landscape and modify it through their uses (play) to a much larger extent than adults, who typically visit for recreation. Branches are collected, trees are bended and broken (Gunnarsson and Gustavsson 1989), and as such, children's play is to some extent a bit like low intensity grazing, thus stressing the need to embrace the two-sided aspect of the niche concept. Children not only use the resource for play, but through the play also effect and interact with it. They also have another scale of space; thus, when thinking of place-based interventions of play, there is a need to adopt to this. One management solution is to support micro-places such as dens of shrubs but also to provide half-finished places that children themselves can modify actively through their play (e.g., Jansson 2015). This is a central aspect of adopting the creative management framework more towards play since, traditionally, it has focused on visual aspects of aesthetics, landscape readability and authenticity, which might not always directly support play affordances. Thus, a better understanding of the places and play biotopes that support different kinds of play are essential. Here a more detailed description and analysis of specific play settings in relation to its details, where species as well as landscape configuration and connectivity are central, is a research area in great need of further exploration.

Conclusion

Our studies in the Alnarp landscape laboratory have shown a wide range of different play interactions with the natural setting, and at different spatial scales. We propose that creative management together with play connectivity could be used as a scale-based framework for combining the landscape, biotope, place, and object scales, to support the creation and management of multifunctional play biotopes. However, additional studies need to confirm its implementation in other contexts, especially outside Sweden and Europe. Additionally, there is a need for more detailed studies on the place specific interaction between biodiversity, play, design and management.

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Data availability The background data that support the findings of this study are available from the authors upon reasonable request.

Declarations

Competing interests The authors have no relevant financial or non-financial interests to disclose. Marcus Hedblom declare that he is part of the Editorial Board of Urban Ecosystems.

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