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LANDSCAPE ARCHITECTURE FOR URBAN WILDLIFE

A design proposal for a courtyard in Eriksberg, Uppsala

inspired by the needs of the species house sparrow and European robin

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ABSTRACT

With the urban population growing worldwide, there is a risk of people losing contact with nature. For many people, cities are the place where nature can be experienced, and therefore, urban areas can play an important role in reconnecting people with nature. Watching urban wildlife and small birds in particular is an activity appreciated by many people which can contribute to a stronger contact with nature. However, biodiversity is decreasing throughout the world, and urbanisation can cause fragmentation aggravating habitat conditions for urban wildlife. This master's thesis deals with the question in which way landscape architects can contribute to increasing urban biodiversity by designing places for urban wildlife. It aims to create a design proposal for a residential courtyard that combines creating habitats for bird species and a courtyard that offers functions and recreation for the residents. The design is based on the method Animal-Aided Design. The design proposal of this thesis is inspired by the needs of the species European robin and house sparrow, and combines the needs of these species with the needs of the residents. In order to successfully design habitats, all needs during the life cycle of the chosen species must be fulfilled on the site. This thesis shows that it is possible to design places for both urban wildlife and people. It can be stated that most needs of the chosen bird species are compatible with needs of the residents. For instance, design elements such as tall trees, fruit trees and berry shrubs, native plants and plant diversity are appreciated by both residents and birds. Moreover, multifunctional design solutions such as a boules court with a stone dust ground cover and pergolas with integrated bird houses can be used for different activities by the residents while also fulfilling needs of the birds regarding feather care and nesting spots. However, there are difficulties when designing for both birds and people. While people generally wish for a place to be visually open, birds depend on dense vegetation consisting of a variety of dense shrubs. Nevertheless, the thesis shows that such conflicts can be overcome by designing a place with varying attributes regarding choice of vegetation in different parts of the site. The discussion chapter deals with chances and difficulties when designing for urban wildlife as well as aspects that can influence the outcome of this approach. The importance of including the residents in the design phase is highlighted. Furthermore, the method Animal-Aided Design and its applicability to landscape architecture projects are discussed.

SAMMANFATTNING

Andelen av världens befolkning som lever i storstadsregioner växer, vilket medför en risk att människor förlorar kontakten med naturen. Städer kan dock spela en avgörande roll i att få människor att återanknyta till naturen. Att observera djur i städer är en aktivitet som uppskattas av många och som kan tänkas bidra till att skapa bättre kontakt med den naturliga omvärlden. Den biologiska mångfalden minskar dock i hela världen. Detta examensarbete behandlar frågan hur landskapsarkitekter kan bidra till ökad biologisk mångfald genom att gestalta platser för stadslevande djur. Arbetet syftar till att gestalta en bostadsgård som kombinerar gestaltningen av habitat för två fågelarter och en gård som erbjuder funktioner och rekreation för de boende. Gestaltningen är baserad på metoden Animal-Aided Design (AAD). Gestaltningsförslaget som presenteras i arbetet kombinerar behoven av de två arterna rödhake och gråsparv med behov och önskemål av de boende.

SYFTE OCH FRÅGESTÄLLNINGAR

Syftet med detta examensarbete är att skapa ett gestaltningsförslag för en bostadsgård som kombinerar skapandet av habitat för två fågelarter med skapandet av en gård som erbjuder olika funktioner och rekreation till de boende. Gestaltningen inspireras av djurens behov i enlighet med metoden AAD. Frågeställningar är: *Hur kan en gestaltning av en bostadsgård i stadsdelen Eriksberg i Uppsala som baseras på behoven av arterna rödhake och gråsparv se ut?* och *Hur kan de boendes behov tillgodoses samtidigt?*

METOD

För att svara på uppsatsens frågeställningar arbetades ett gestaltningsförslag fram som baserades på metoden AAD i kombination med slutsatser från förstudien. Tolkningen av bakgrundslitteraturen ledde fram till beslut rörande både val av arter och val av plats samt till förutsättningar för gestaltningsförslaget. Dessutom genomfördes platsbesök av referensobjekt som bidrog med inspiration till gestaltningen. AAD är ett sätt att kombinera landskapsarkitektur med främjandet av det urbana djurlivet. Målet är att skapa habitat för utvalda arter som en del av gestaltningen av offentliga platser. För att framgångsrikt gestalta habitat måste alla behov under ett djurs livscykel tillgodoses på platsen. Ett viktigt hjälpmedel för landskapsarkitekter är artprofiler som sammanställer allmän information om arten, deras betydelse för människor och kritiska faktorer som måste uppfyllas i gestaltningsförslaget för att arten ska kunna leva på platsen.

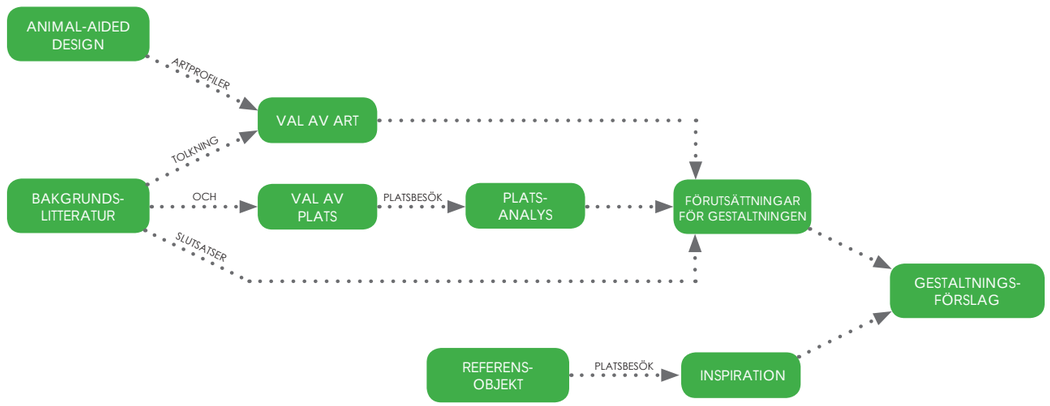

Figure 1. Illustration som visar metoden och processen som ledde fram till gestaltningsförslaget.

URBANA DJUR

Stadslevande djur påverkas av de specifika förhållanden i urbana områden. Det finns både arter som trivs i städer och andra som inte klarar urbana förhållanden.

Klassificering av vilda djur

Vilda djur delas ofta in i olika kategorier beroende på deras förmåga att hantera förändringar som orsakas av urbaniseringen. Kategorierna sträcker sig från djur som är beroende av urbana resurser till arter som inte förekommer i städer på grund av specifika ekologiska nischer.

Mänsklig påverkan

Människor har en stark påverkan på olika ekosystem vilket vanligen leder till ändrade habitatförhållanden. Mänsklig påverkan på stadslevande djur berör faktorer som byggande av gatunät, kontaminering av jord, luftföroreningar, buller och artificiell belysning.

Livsförhållanden

Urbana djur lever under förhållanden som skiljer sig från deras naturliga habitat. Det finns dock många platser i städer som kan fungera bra som habitat, såsom trädgårdar, parker, kyrkogårdar och industriområden. Däremot är habitat i städer ofta fragmenterade vilket skapar problem för många djur att förflytta sig mellan lämpliga platser.

MÄNNISKORS BEHOV

Människor värdesätter gröna platser med stora träd i sina bostadsområden. Överlag använder få människor sin bostadsgård vilket kan bero på att människor känner sig iakttagna av de andra boende. När människor befinner sig på sin bostadsgård är det därför viktigt för de flesta att ha någonting att göra, till exempel aktiviteter som trädgårdsarbete och läsning. Även fast många boende inte använder sin bostadsgård aktivt kan den uppskattas genom att titta på gården. En bostadsgård bör erbjuda olika upplevelsemöjligheter som både möjliggör social kontakt, möten, aktiviteter och att kunna vara själv. Visuellt öppna platser utan tät vegetation ökar känslan av trygghet. Bostadsgårdens kvalitet är särskilt viktig för barn och äldre eftersom dessa grupper spenderar mycket tid i sin närmiljö.

RELATIONEN MELLAN URBANA DJUR OCH MÄNNISKOR

Inställningar gentemot urbana djur skiljer sig åt mellan olika människor, och är dessutom beroende av djurarter. Gentemot vissa djur, såsom råttor dominerar negativa attityder medan andra djur, exempelvis små fåglar uppskattas av de flesta människor. Att observera stadslevande djur är ett sätt att återanknyta till naturen. För många människor är det dessutom en anledning att spendera tid utomhus. Utbildning av allmänheten är viktig för att öka medvetenheten kring urbana djur och urban biodiversitet.

Människor och fåglar

Fåglar är vanligt förekommande i städer och kan därför enkelt bli observerade av människor. Små fåglar gillas av allmänheten, och fågelskådning är en aktivitet som både uppskattas av många människor och bidrar till ökat välbefinnande.

URBANA DJUR OCH LANDSKAPSARKITEKTUR

Landskapsarkitekter har möjlighet att genom medveten planering och gestaltning bidra till skapande och förbättring av urbana habitat. Landskapsarkitektur för urbana djur omfattar åtgärder som rör såväl planeringsstrategier i stor skala som gestaltningar i liten skala.

Planering för urbana djur i stor skala

För att främja det urbana djurlivet bör djur och deras behov inkluderas i tidiga planeringsskeden. Förutom skyddet av befintliga habitat gäller det även återuppbyggnad av försämrade habitat. I storskalig planering läggs stor vikt på att koppla ihop habitat och skapa gröna korridorer.

Gestaltning för urbana djur i liten skala

Vegetationen är av central betydelse vid gestaltning för urbana djur. Faktorer som hög mångfald bland växtarterna, förekomst av inhemska växter, existens av många lager i vegetationsstrukturen och växter i olika successionsstadier är gynnsamma för djur då de underlättar födosökande och att hitta skydd.

Planering och gestaltning för fåglar

Förutom de allmänna åtgärderna för att främja det urbana djurlivet finns det en del specifika aspekter som gynnar fågellivet i städerna. Fåglar är särskilt beroende av förekomsten av buskar vilka används för både häckning och födosökande, och planteringen av en mångfald av inhemska buskar bör prioriteras.

Exempel – bostadsområde *Fröschmatt* i Bern, Schweiz

Fröschmatt är ett bostadsområde i Bern, Schweiz som omgestaltades med målet att öka den biologiska mångfalden i området och skapa habitat för olika djur på bostadsgården. Djur som förekommer i närliggande grönområden valdes ut och gestaltningsprocessen genomfördes i nära samarbete med de boende och ekologer. Involveringen av de boende i gestaltningsfasen och skötseln av bostadsgården ledde till en hög acceptans av gestaltningen.

FÖRUTSÄTTNINGAR FÖR GESTALTNINGEN

Förutsättningar för gestaltningen gäller fåglarnas behov baserad på artprofilerna för rödhake och gråsparv samt bakgrundslitteraturen, de boendes behov baserad på tolkningar av bakgrundslitteraturen och platsspecifika förutsättningar baserad på en analys av bostadsområdet i Eriksberg.

Koncept

För att uppnå en sammanhållen gestaltning används konceptet *Wild garden* som ämnar att integrera typiska trädgårdsstrukturer som fruktlund och grönsaksland med naturliga och oordnade planteringar.

REFERENSOBJEKT

Platsbesök och analyser av bostadsgårdarna *Fröschmatt*, *Hardegg* och *Diessbachgut* i Bern, Schweiz leder till element som bidrar med inspiration för gestaltningsförslaget.

GESTALTNINGSPROCESS

Kapitlet beskriver gestaltningsprocessen från de första enstaka idéerna till en sammanhållen gestaltning.

GESTALTNINGSFÖRSLAG

Gestaltningen av bostadsgården i Eriksberg tillgodoser alla behov av arterna rödhake och gråsparv under hela livscykeln. Vegetationen består av främst inhemska arter som erbjuder skydd och mat till fåglarna samt upplevelser till de boende i form av blomning, höstfärger eller ätbara bär. Med hjälp av stora solitärbuskar och flerstammiga träd skapas rumslighet samtidigt som gården behåller en visuellt öppen karaktär. Det finns flera rum som fyller olika funktioner.

SLOPING MEADOW/SLUTTANDE ÄNG

Skapar ett avstånd mellan privata uteplatser och bostadsgården. I den höga vegetationen kan rödhaken bygga bo samtidigt som de boende kan njuta av blomningen.

GARDEN/KOLONILOTTER

Här kan de boende odla egna grönsaker. Fåglarna kan hitta mat i form av exempelvis insekter.

BOULES COURT/BOULE

Markbeläggningen är stenmjöl som uppfyller gråsparvens behov av platser för sandbad. Det är även ett område där de boende kan spela boule.

ORCHARD/FRUKTLUND

Fruktträd och bärbuskar erbjuder mat till både fåglarna och de boende. Flyttbara bord och bänkar möjliggör för de boende att välja plats efter egna önskemål.

WESTERN PERENNIAL GARDEN/VÄSTRA PERENNTRÄDGÅRD

Bland perenner kan fåglarna hitta mat och blomningen är en upplevelse för de boende.

SOUTHERN PERENNIAL GARDEN/SÖDRA PERENNTRÄDGÅRD

Denna del är vildare och inte tillgänglig för de boende. Perenner kombineras med buskar som erbjuder skydd för fåglarna.

PLAY/LEK

Berg i dagen är en del av leken. Här finns död ved att klättra på, Salix-buskar att leka bland och en vattenpump som barn kan skapa vattenpölar med som används som badplats av fåglarna.

DISKUSSION

Möjligheter och svårigheter vid gestaltning för både fåglar och människor diskuteras, bland annat gällande kombinationen av motsatta behov såsom den mänskliga önskan om visuellt öppna platser och fåglarnas behov av tät vegetation. Dessutom diskuteras användbarheten av metoden AAD och artprofilerna för landskapsarkitekter, både allmänt och i en svensk kontext.

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INTRODUCTION

Biodiversity loss is a global issue; the Millennium Ecosystem Assessment report (2005) on ecosystems and human well-being finds that, overall, population sizes of many species decrease, and the current extinction rate is about 1000 times higher than natural background rates. Moreover, due to a combination of higher extinction rates of endemic species, and an introduction of exotic species, species distribution becomes more and more alike in different regions of the world. This biodiversity loss also affects human well-being as it can result in poorer supply of ecosystem services (Millennium Ecosystem Assessment 2005, pp. 3-5). Biodiversity is essential to functioning ecosystems that both provide people with important ecosystem services (for example, pollination, cleaning water and air), and contribute to decreasing negative effects of climate change (European Commission 2013, p. 5).

With more and more people living in cities worldwide there is a risk of people losing contact with nature; for the urban population, green spaces in cities are often the only areas where contact with nature can be established on a regular basis (Fuller et al. 2007, p. 390). In Sweden, for instance, 85% of the population lives in towns (Statistiska centralbyrån 2015). This urbanisation is accompanied by fragmentation of green structures (Goddard, Dougill & Benton 2010, p. 90, Hough 2004, p. 133). Fragmentation of green spaces and habitats, caused by transforming land into urban and artificial areas with hard surfaces, as well as building enormous transport networks, is a severe problem in European countries (European Commission 2013, p. 5). The current growth and densification of urban areas almost always leads to a decrease of green areas and nature close to dwellings (Boverket 2007, pp. 9, 12, 28). This fragmentation, caused by densification, leads to animals having difficulties moving between the remaining green spaces (Boverket 2007, pp. 42-43). In this context, green spaces in urban areas can play a fundamental role in protecting biodiversity (Goddard, Dougill & Benton 2010, p. 90). However, in Swedish towns, the amount and expanse of green areas have decreased since the 1970s (Boverket 2007, p. 28). When new residential areas are being built, there is a high risk that focus lies on building as many houses as possible, leaving small areas for courtyards and recreation (Boverket 2007, p. 13). Despite this, courtyards are important parts of the urban green, and can, if well designed, increase quality of life for the residents as well (Boverket 2007, p. 70). Furthermore, green spaces that are inhabited by a lot of different species both contribute to an increase of urban biodiversity and help people to get a better understanding of nature (Boverket 2007, pp. 9, 21) which in turn can make the residents feel rooted in their neighbourhood (Boverket 2007, p. 23). Moreover, spending time in nature has positive effects on people's health (Boverket 2007, p. 17).

Destroyed habitats, more competition between species, and higher amounts of impermeable land cover, resulting in difficulties for certain species to move between habitat patches, are some of the negative effects on urban wildlife, caused by urbanisation, that can be countervailed by planning strategies for urban wildlife integrated in urban planning (Hess et al. 2014, p. 272). One design strategy aiming at creating habitats for animal species, and combining this effort with designing places for people, is called *Animal-Aided Design* (Hauck & Weisser 2015). Based on this method, a design proposal for a courtyard, in the residential area Eriksberg in Uppsala, Sweden, inspired by the needs of two bird species is presented in this thesis.

1. AIM AND RESEARCH QUESTIONS

This thesis deals with the question in which way landscape architects can contribute to increasing urban biodiversity. The purpose is to create a design proposal for a residential courtyard that combines creating habitats for bird species with a courtyard that offers functions and recreation for the residents. The design is inspired by the needs of the animals in accordance with the method Animal-Aided Design.

Research questions are: *How can a design of a residential courtyard in the district of Eriksberg in Uppsala, Sweden that is based on the needs of the species European robin and house sparrow look like?* and *How can the needs of the residents be met at the same time?*

2. METHOD

In order to answer the research questions how a design of a residential courtyard based on the needs of the species European robin and house sparrow can look like and how the needs of the residents can be met at the same time, a design proposal based on the method Animal-Aided Design (AAD) was created. This method is described in the following chapter.

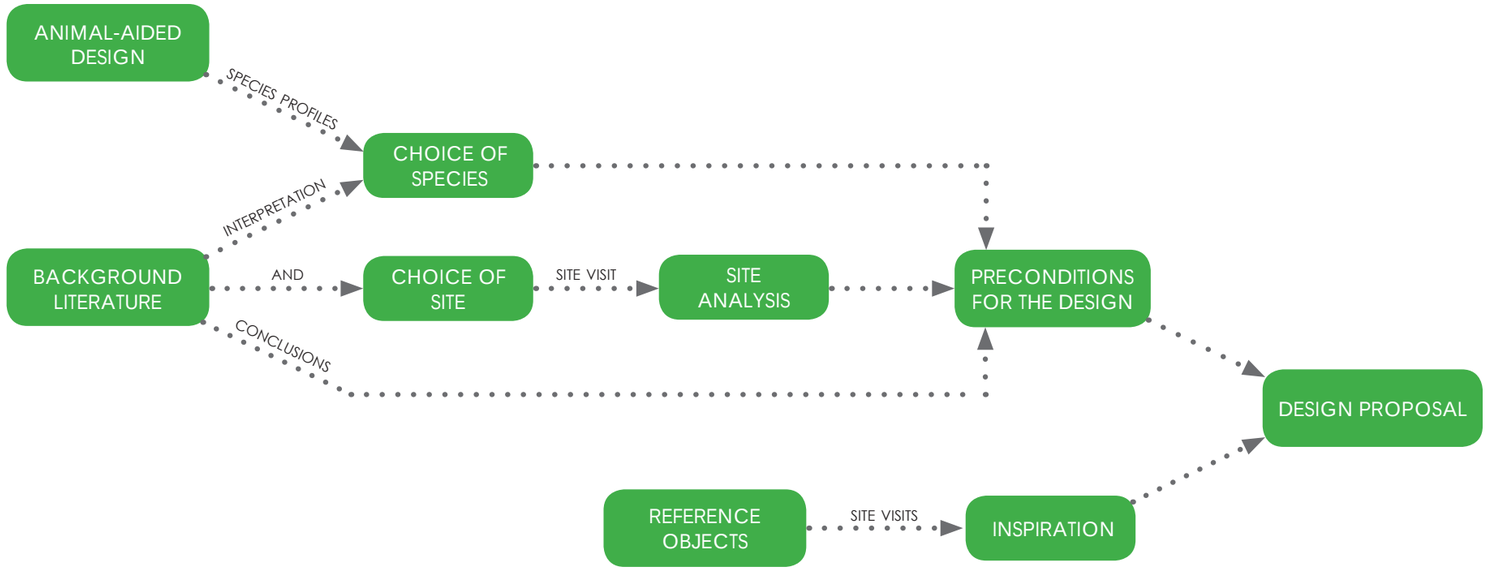


Figure 2. Illustration showing the method and process leading to the design proposal of this thesis.

2.1 ANIMAL-AIDED DESIGN

The concept of Animal-Aided Design (AAD) was developed as part of a research project led by landscape architect Dr Thomas E. Hauck (University of Kassel) and Professor Wolfgang W. Weisser (Chair for Terrestrial Ecology, Technical University of Munich). Eggermont et al. (2015) mention AAD as a type of nature-based solution. Nature-based solutions range from protection and conservation of existing ecosystems to creation of new ecosystems, all solutions having the aim of both being resilient to future changes of the environment and offering ecosystem services and benefits to people. According to the authors, AAD is a method trying to connect biodiversity conservation strategies with landscape architecture (Eggermont et al. 2015, pp. 243-245).

According to Hauck and Weisser (2015) merely planning for green areas like parks is not enough if planners want to ensure that different animals can live in cities even in the future. Instead, the actual needs of animal species must be considered in the planning phase (Hauck & Weisser 2015, p. 5). Hauck and Weisser state that sometimes landscape architects create pictures or reproductions of nature and landscape associated with different types of biotopes and certain animal species. Nevertheless, the actual needs of these species are considered insufficiently leaving the occurrence of these animals to chance. Furthermore, some biotopes suffer from negative associations, and are not perceived as suitable for landscape design. That can lead to the landscape architect excluding species associated with this type of biotope even though their needs could be met in a different way (Hauck & Weisser 2015, p. 9).

Hauck and Weisser describe AAD as a method that integrates the occurrence of animal species in the design process (Hauck & Weisser 2015, p. 4). The aim is to create habitats for one or several animal species, and by that also improve the design of public space for people (Hauck & Weisser 2015, p. 28). According to this method the first question planners and landscape architects should ask themselves, in the beginning of a design process, is which animal(s) should be present on the site. This question is equal to all other necessary questions and decisions when starting a design process. The needs of the chosen animal species are, in this method, thought of as an inspiration for the design. The two scientists believe that AAD is especially suitable for projects in urban areas, both on a small and large scale, and that this method can help to create a better, more attractive environment for humans as well (Hauck & Weisser 2015, p. 4). Thanks to AAD, people living in cities are able to experience nature and animals in urban areas close to them (Bischer et al. 2018, p. 8). Instead of the common planning praxis of creating areas for animals elsewhere as a substitution when building or redesigning a site, measures within AAD are taken on the site, thus, considering the animal species and populations in fact living on the site (Bischer et al. 2018, pp. 9-10). However, AAD does not work with potentially dangerous animals or animals that are extremely sensitive to disruptions (Hauck & Weisser 2015, p. 28).

According to Hauck and Weisser the basic requirement for designing with AAD is knowledge about the life cycle of a species and their needs during all phases from birth to reproduction. These needs can vary during different phases of life, usually they include a place for raising the young, food resources, a place for mating and protection from predators. Even other species (plants and/or animals) that the chosen species depends on, for instance, because they are food resources, must be included in AAD (Hauck & Weisser 2015, pp. 18-19).

Taking into account the needs of the chosen animal species makes sure that there is an actual chance that these animals can be present on the site in the future (Hauck & Weisser 2015, pp. 4, 18). The aim of this method is to create habitats for viable populations (Hauck & Weisser 2015, pp. 5, 18). To achieve that goal, it is essential to fulfil all needs of the animal species during all phases of life. Part of the method AAD are descriptions of critical factors that must be fulfilled for different species. These descriptions are minimum requirements and help landscape architects to design sites in a way that allows the chosen animal species to live in this location. Examples of critical factors are certain plant species on which the animal species depends or a temperature range within the chosen animal can survive (Hauck & Weisser 2015, p. 20).

An important component of AAD are the so-called species profiles (*Artenportraits*) in which the needs of different animal species are compiled. The first part of these profiles delivers general information about the species. More precisely, the first part includes:

- general characteristics such as appearance, geographical extension, demand for space, behaviour and predators,
- the importance of the species for humans, for example, birdsong, interesting behaviour, if the species can be useful in terms of biological pest control, but also if there are any possible conflicts between the species and humans as well as if the species is endangered,
- the life cycle with information about the different phases of life.

The second part consists of specific planning tools:

- critical factors for all phases of life that should be fulfilled in the design,
- design modules,
- further helpful information regarding specific requirements, for instance, plant lists for food resources.

(Hauck & Weisser 2015, p. 25).

According to AAD, the life cycle of the target species must be made visible on the illustrative site plan showing all parts of the design fulfilling the needs of the species during different phases of life. If there are needs that can only be fulfilled outside the site area these should also be indicated, and landscape architects must show that the animals are able to reach those places (Hauck & Weisser 2015, p. 20).

The authors argue that people and animals living side by side and sharing the same space is no contradiction. Thanks to AAD, people also have access to more ecosystem services (Hauck & Weisser 2015, p. 28).

2.2 LITERATURE REVIEW

Literature on urban wildlife, needs of people, relations between people and urban wildlife, and landscape architecture for urban wildlife was studied. Then, preconditions for the design regarding needs of both residents and urban wildlife, the two bird species in particular, were determined by drawing conclusions from the studied literature and the species profiles of European robin and house sparrow.

2.3 DESIGN

Both the critical factors in different phases of life, listed on the species profiles, and the needs of the residents were used as a guideline throughout the sketching process. The needs of the birds and the residents were then implemented in design solutions. Whenever possible, it was tried to connect the needs of the bird species with the needs of the residents, creating design solutions that suit both animals and people. In this way, an area designed to fulfil a critical factor could, at the same time, be used for activities by the residents. A concept for the design proposal was decided upon in order to facilitate decision-making regarding certain design solutions, and to, consequentially, achieve a unified design. The design process leading to the final design proposal of this thesis is described in chapter 9.

2.4 SITE VISITS OF REFERENCE OBJECTS

To acquire inspiration for the design of the courtyard in Eriksberg three courtyards (*Fröschmatt*, *Hardegg* and *Diessbachgut*) situated in the city of Bern, Switzerland were visited on Wednesday 20 March 2019. The weather was sunny, but windy and the temperature was about 10 °C. In order to structure the site visits, questions inspired by background literature and own experiences as a landscape architecture student were used as a guideline (see appendix).

The courtyard in the residential area of *Fröschmatt* was chosen as it is designed as part of a pilot project of the City of Bern with the aim of supporting urban biodiversity (Schellenberger et al. 2014, p. 5). The site visit took place between 14:45 and 15:55.

The courtyard *Hardegg* was found via a search on the homepage of the Swiss Federation of Landscape Architects (BSLA) listing Swiss landscape architecture projects. Since a large area of this courtyard consists of meadows, it was chosen to find inspiration especially for design solutions that integrate natural landscapes with functions of a courtyard. This courtyard was visited from 11:30 till 12:15.

The choice of the courtyard *Diessbachgut* was based on an evaluation of several courtyards and residential areas in Bern, undertaken by professionals such as landscape architects, architects and planners; the courtyard *Diessbachgut* received an overall positive evaluation, especially regarding nature aspects (Stadtgrün Bern 2017, pp. 60-63). The site visit took place from 16:35 to 17:00.

Sketches, photographs and notes were taken during the visits with focus on design solutions, especially the design of different types of plantations as well as placement and size of different functional areas.

2.5 CHOICE OF SITE

The site of the following design proposal is a residential neighbourhood in the district Eriksberg in Uppsala, Sweden. Eriksberg is situated about 3 kilometres from central Uppsala and is surrounded by green areas: Ekebydalen in the North, Stadsskogen in the East and Hågadalen in the West.

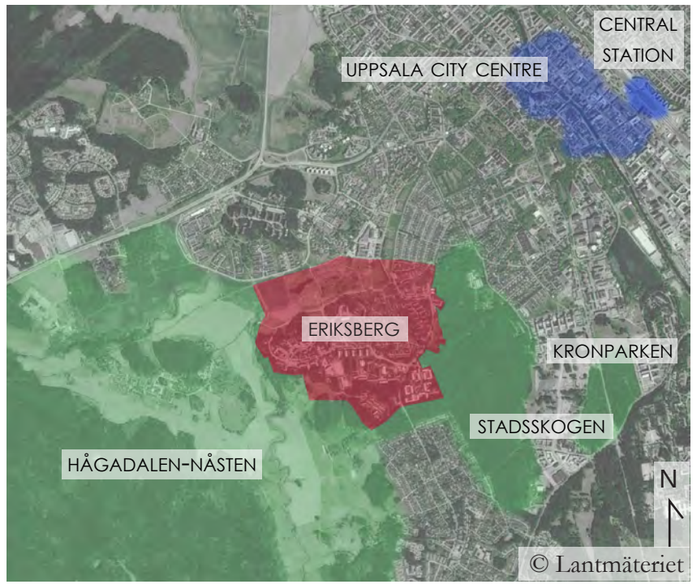
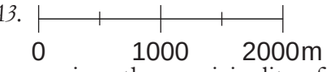


Figure 3. Orthophoto showing the residential area Eriksberg (red area) in relation to central Uppsala (blue area) and nearby nature reserves (green areas). Ortofoto © Lantmäteriet (2019)
Scale 1:50000/A3.



The site was chosen since the municipality of Uppsala has plans to develop this area, and densification is going to take place (Uppsala kommun 2017). As it is a recent project, site plans and other documents are easily accessible. These documents are the basis for the design proposal of this thesis. The master plan for the future development of Eriksberg, published by the municipality of Uppsala, includes the building of approximately 2400 new homes as well as shops, preschools, schools and other facilities. Even squares and parks shall be developed. Nonetheless, Uppsala municipality writes that new houses will be built on existing green areas as well (Uppsala kommun 2017, p. 4). This being said, residential courtyards can be assumed to play an important role both as accessible green areas for residents in future Eriksberg and for animals living in or close to this area.

The design proposal of this thesis concentrates on the residential area north of Marmorvägen (see figure 4, blue area on the map).

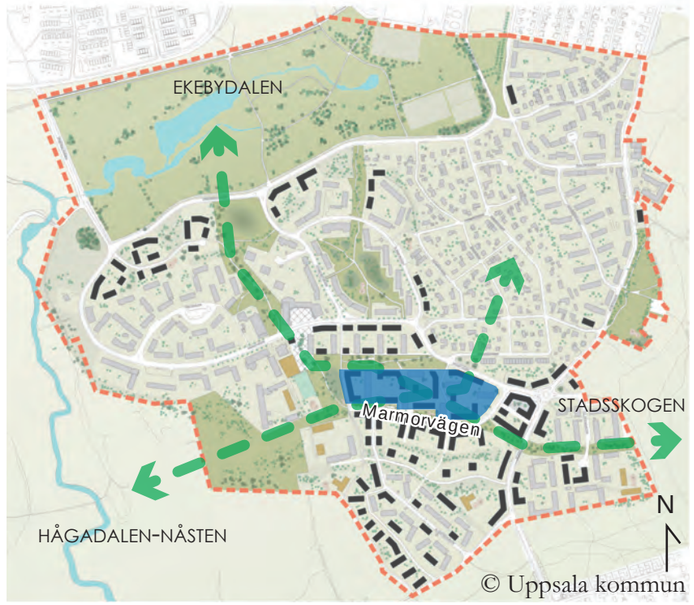


Figure 4. The map shows the residential area of Eriksberg within the red border, and the location of the site of the design proposal (blue area). The site includes the residential neighbourhood north of Marmorvägen. The green arrows show the green areas in the surroundings that can be linked with the help of the courtyards. Grey houses are the existing buildings, the black ones are suggested new buildings within the future development of Eriksberg according to the masterplan of Uppsala municipality.
Schematisk illustrationsplan © Uppsala kommun (2017, p. 39)
Scale 1:15000/A3.

0 300 600m

This area consists of several courtyards; along with an overall design of the whole area, one of these courtyards will be designed in detail (see figure 5). The existing houses on the site are 5 seven-storey buildings and 1 eight-storey building. According to the master plan, nine buildings will be added to these. Densification will take place partly on existing parking places, but also on areas of the existing courtyard (Uppsala kommun 2017, p. 39).

The choice of site was inspired by the example of *Fröschmatt* described in chapter 6.4, important factors being that there are green areas close to the site, and that the design has a potential of connecting these areas. The chosen area is situated quite central in Eriksberg and has a potential of linking the north-eastern area of single-family homes with Hågadalen as well as planned green paths with each other. The courtyard that will be designed in detail was chosen as it has a distinct shape with clear borders, and therefore appeared convenient to work with.

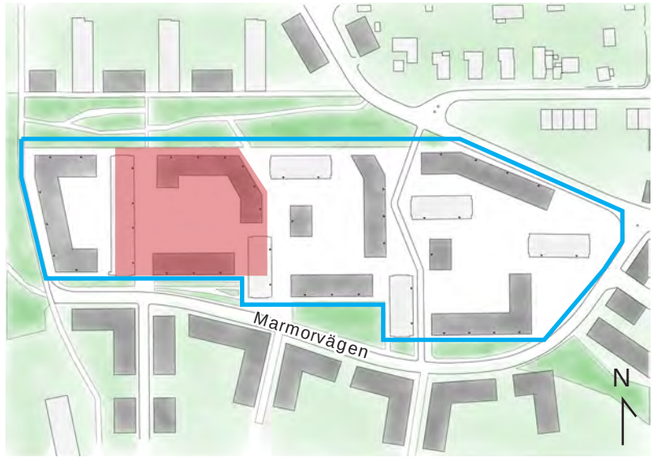


Figure 5. The map shows the residential area north of Marmorvägen within the blue border, and the courtyard that is designed in detail within the light red area. Light grey houses are existing buildings, dark grey houses are planned residential buildings according to the masterplan of Uppsala municipality on the development of Eriksberg.
Scale 1:4000/A3.

0 100 400m

2.6 SITE VISITS AND SITE ANALYSIS

The planned development of Eriksberg and related plans by Uppsala municipality were the starting point for the analysis of the site. In addition to that, two site visits of the chosen area took place on 20 February 2019 and 22 April 2019. The first visit focused on the whole residential area north of Marmorvägen to get an understanding of the area, as well as to find out which functional areas and what kind of plant material can be found on the site. The second visit, on the other hand, was concentrated on the courtyard that was chosen to be designed in detail with the aim of investigating elements and vegetation in order to decide if and how these might be integrated in the design proposal.

2.7 CHOICE OF SPECIES

Inspired by the project *Fröschmatt* and its approach of choosing local species as target species for the residential courtyard, species that can be integrated in the design proposal of this thesis should occur in the residential area Eriksberg and/or close to it (for example, in Stadsskogen, Ekebydalen and Hågadalen) to increase the chances of the species colonising the site. To date, 15 species profiles have been published as part of the Animal-Aided Design project including nine bird species, two bat species, two butterfly species, one lizard species and one bee species (Hauck & Weisser 2015, pp. 32-54, Bischer et al. 2018, pp. 22-41). In order to decide which species to integrate in the design, a search for all 15 species was conducted on The Swedish Species Information Centre *Artdatabanken* and The Swedish Species Observation System *Artportalen*. *Artdatabanken* was used to find out if the species occur in Sweden at all. On *Artportalen* the search was limited to the municipality of Uppsala and the years 2010-2019. This search showed that five of the species either do not usually occur in Sweden or, if they do, only in southern Sweden. For the other ten species findings were reported in Uppsala municipality. However, some of those species were not found in the Eriksberg area. Species for which

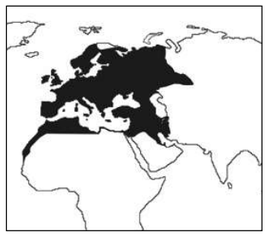
findings were reported in Eriksberg and/or in the nearby green areas are great spotted woodpecker (*Dendrocopos major*), European robin (*Erithacus rubecula*), house sparrow (*Passer domesticus*), common redstart (*Phoenicurus phoenicurus*), grey wagtail (*Motacilla cinerea*), grey heron (*Ardea cinerea*), black redstart (*Phoenicurus ochruros*) and purple emperor (*Apatura iris*). Grey wagtail and grey heron are two bird species strongly tied to water (Bischer et al. 2018, pp. 28-31) making it difficult to include them in the design of a courtyard in Eriksberg. Moreover, only a few individuals of black redstart and purple emperor were found in Eriksberg and nearby green spaces leading to an exclusion of these species. Great spotted woodpecker needs large territories up to 20 hectares, and can cause noise nuisance due to its drumming on trees (Hauck & Weisser 2015, p. 32) which is why a courtyard is not assumed to be an ideal habitat for this species. The common redstart was excluded since the species profile for this bird (Bischer et al. 2018, pp. 22-23) was not as detailed as the ones for European robin and house sparrow, for instance, plant lists, which were regarded as an important help for the design proposal of this thesis, were missing. Hence, species that are integrated in the following design proposal are European robin (*Erithacus rubecula*) and house sparrow (*Passer domesticus*). It is easy to observe these birds as neither European robins nor house sparrows are very shy around humans; in fact, they profit from human activities when foraging (Hauck & Weisser 2015, pp. 39, 44). Thus, it is assumed that properly designed residential courtyards can function as habitats for these species. Below translations of the species profiles for these two species can be found.

Figure 6. European robin (Erithacus rubecula) by Francis C. Franklin (CC-BY-SA-3.0)

Figure 7. House Sparrow (m), Breeding Plumage by Becky Matsubara (CC BY 2.0)

EUROPEAN ROBIN
Erithacus rubecula

SHORT CHARACTERISTIC



FAMILY

Old World flycatchers (*Muscicapidae*)

DESCRIPTION

Distinctive small (length 14 cm) singing bird with a roundish shape; olive brown on top, light underneath, red-rust coloured breast, pointy beak typical for insectivorous birds, males and females look the same; juvenile birds: light brown, spotted, no red in the beginning. Relatively big eyes, crepuscular and diurnal. Very loud, striking song alternating between rippling elements and warbling in different tone pitches, ends with low fading tones

DISTRIBUTION

Main occurrence in Europe (approx. 75% of the population). The area of occurrence covers the boreal, temperate, Mediterranean zones of the Western Palearctic within the following limits:
Longitude: from islands in the eastern Atlantic Ocean (approx. 20° W) to West Siberia (approx. 85°E)
Latitude: North of the Arctic circle (approx. 65°N, in Northern Scandinavia even up to > 69°N) to Mediterranean countries (approx. 35°N)
Altitudinal zones: from coast (0 m above sea level) to tree line (2200 m above sea level)

HABITAT REQUIREMENTS

— tied to forest or forest edge structures with a humid micro-climate
— breeding success strongly depends on the structure of the ground vegetation: on the one hand, secure nesting areas with dense ground vegetation are needed, on the other hand, there is a need for open areas for foraging
— prefers to be close to bodies of water (if breeding areas are dry) and humid habitats
— usually populations in anthropogenic spaces (parks, cemeteries etc.) are less dense than in natural habitats. Outside the breeding season even in less dense vegetation structures. In winter, more often in gardens and parks

BEHAVIOUR

— diurnal, crepuscular and nocturnal

OVERWINTERING

— in northern areas and areas of high altitude migrating bird. Wintering grounds are in Western Europe, the Mediterranean area or in North Africa. In Germany partial migrant, i.e. only a part of the population migrates to southern and southwestern regions, mostly females and juvenile birds

NATURAL THREATS

— cats, martens and others, nest predators are hedgehogs, rats etc.

IMPORTANCE FOR PEOPLE

PERCEPTION

Song
— primarily from shortly before and after sunset, when defending territory even during the day. At night when there is moonlight and bright artificial light

Observation
— courtship display
— hunting
— bathing and sunbathing
— bird feeding in winter (bird feeders)

BENEFITS & CONFLICTS

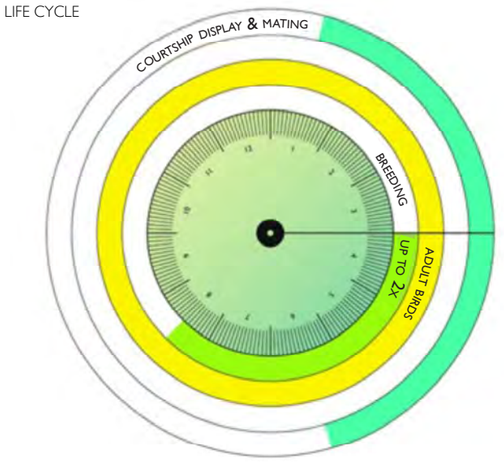
— removing leaves and herbaceous layer (no food source due to lack of humification)
— cats
— disturbance during breeding and raising the young

THREAT & LEGAL STATUS

— like all European birds protected according to the Conservation of Wild Birds Directive
— populations widely stable

AUDIO SAMPLE

LIFE CYCLE



CRITICAL LOCATIONAL FACTORS IN DIFFERENT PHASES OF LIFE

BREEDING

— nests:
- (1) ground nests: in holes and scrapes; beneath grass and roots; on slopes and scarps
  (2) higher nests: close to the ground; in tree cavities, wall alcoves, climbing plants, low hanging half open birdhouses
  (3) special nests: tipped over flower pots, letter boxes, rubber boots etc.
- nesting material: moss, dry culms and leaves, plant stems and roots, feathers and hair

— food for nestlings:
- hardly chitinised invertebrates, often solely caterpillars

— threats:
- nest predators (above all cats in gardens), other disturbances

ADULT BIRDS

— roost in dense shrubs
— diet:
- shrubs with fruit and berries
- arthropods and their larvae in herbaceous layer with a lot of leaf litter
- felting ground cover (above all due to grasses) is disadvantageous
- dense shrub layer serving as a cover when foraging

— threats:
- nest predators, other predators, other disturbances

— feather care:
- shallow, wide water for bathing, not next to cover for predators, good accessibility to a sheltered area in case of the need to escape. Nearby sitting perches to dry

OVERWINTERING *

— roost:
- sheltered areas in dense shrubs or at and in buildings

— diet:
- feeding grounds: artificial bird feeders or natural (open snow- and frost-free areas)

COURTSHIP DISPLAY & MATING

— protected songposts (> 4 m high)
— size of territory: 0,2 – 1 ha (depending on food resources)

* additional comment:
In Sweden, the European robin is a migrating bird, thus critical factors for overwintering are not relevant to the design proposal of this thesis.

Box 1. Translation of species profile European robin

PLANT LIST

English name	Scientific name
wild strawberry	*Fragaria vesca*
European blueberry	*Vaccinium myrtillus*
February daphne	*Daphne mezereum*
red elderberry	*Sambucus racemosa*
elder	*Sambucus nigra*
alder buckthorn	*Rhammus fragula*
spindle	*Evonymus europaeus*
bird cherry	*Prunus padus*
redcurrant	*Ribes rubrum*
mountain currant	*Ribis alpinum*
blackcurrant	*Ribis nigrum*
raspberry	*Rubus idaeus*
blackberry	*Rubus fruticosus*
common ivy	*Hedera helix*
rowan	*Juniperus communis*
common yew	*Taxus baccata*
common grape vine	*Vitis vinifera*
-	*Evonymus latinfolia*
buckthorn	*Rahmnud cathartica*
common dogwood	*Cornus sanguinea*
common juniper	*Juniperus communis*
common sea buckthorn	*Hippophae rhamnoides*
guilder-rose	*Viburnum opulus*
Laurustinus	*Viburnum tinus*
evergreen oak	*Quercus ilex*
bird cherry	*Padus avinum*
wild privet	*Ligustrum vulgare*
Boston ivy	*Parthenocissus tricuspidata*
snowberry	*Symphoricarpos rivularis*
common cotoneaster	*Cortoneaster integerrimus*
wild madder	*Rubia peregrina*
scarlet firethorn	*Pyracantha coccinea*
mastic tree	*Pistacia lentiscus*

PROFILE

BREEDING

Nests: The European robin is classified as a ground-breeding bird; however, it is relatively flexible when choosing nesting sites. The birds breed in ground nests, e.g. burrows and scrapes, beneath tufts of grass, among roots and beneath twigs, on flat ground as well as on slopes and scarps. Moreover, they nest close to the ground, e.g. in cavities, holes in walls, climbing plants and low hanging birdhouses. In addition to that, they use unusual structures as nesting sites, e.g. various gardening tools such as tipped over flower pots, letter boxes, rubber boots and even empty tin cans. The nests are bowl-shaped with walls built by the birds and sometimes even a roof. Nesting materials are dry moss and leaves, fine blades of grass and roots as well as hair and feathers.

Breeding: Starting in April 4 to 7 yellowish eggs speckled with a reddish-brown colour are laid. These are incubated by the female alone for 14 days. With special calls the male entices the female away from the nest for short breaks in order to feed it. During the first days after hatching the chicks are taken care of by the female alone, then even the male participates. Approximately two weeks after hatching the juveniles leave the nest. Usually there are two broods per year. Sometimes two broods overlap, in which case the male feeds the fledged young while the female incubates the other clutch of eggs.

Diet: The juveniles are mainly fed with insects, in the beginning mostly caterpillars and other (soft) larvae, later even with more chitinised prey.

Disturbances: Disturbances when building the nest, during breeding and raising the young can lead to abandoning the nests or broods. The brood is at risk by nest predators like hedgehogs and rats.

JUVENILE BIRDS

After leaving the nest, the juvenile birds are fed by their parents for another three weeks. Mostly, they stay on the ground or close to the ground. In this phase, they are very vulnerable to predators, especially cats and martens.

ADULT BIRDS

Roosts: Adult birds need dense shrubs for roosts.

Feather care: The European robin likes to bathe. Bathing spots should be shallow, wide and easily accessible, though not too close to a cover where predators can hide, but close enough so that the birds themselves can quickly hide. Close to the bathing spots there should be perches for drying and sunbathing.

Diet: Adult birds mainly feed on invertebrates living on the ground and in the soil. Therefore, they are dependent on ground with a lot of leaf litter or ground cover in which intense humification leads to the production of a rich invertebrate fauna. So, the ground should not, in contrast to the nesting site, be covered by felting grasses. Instead there should be open areas where hunting can easily take place, e.g. under evergreen shrubs. Surrounding dense shrubs serve as a cover from predators like cats and martens and to camouflage. In addition to insects living on the ground even flying insects are hunted. In late summer and autumn, the birds also feed on fruit and berries.

Hunting: The birds catch their prey either directly on the ground (hopping) or starting from a perch (1 – 6 m high). When hunting the European robin is not very shy since it likes hunting invertebrates that were startled (e.g. by humans) or exposed (e.g. because of digging of soil). Therefore, they seem utterly unafraid and tame.

OVERWINTERING

In Germany, the European robin is predominantly a resident bird. Because of large losses due to lack of food, snow- and frost-free areas where the birds can forage even in winter are important for resident birds. These areas are among other things heaps of deadwood, twigs and compost heaps. In winter, the European robin often visits bird feeders.

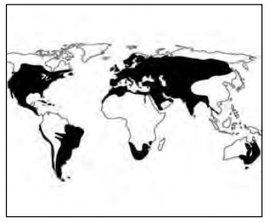
COURTSHIP DISPLAY & MATING

Claiming territory: Already in late summer non-migrating European robins start to claim territories by singing and defend feeding territories for the winter. Home range fidelity is relatively high for European robins, higher for males than females. Already in winter females are attracted by song. Once a female enters the territory it will get chased away several times by the male before getting accepted as a potential mate. The actual courtship display starts in February/March depending on weather conditions. Basically, it consists of ritualised singing of the male in front of the female and the female "hunting" the male. By its behaviour (posture, quiet singing) the female tries to get the male to mate with her. The female shows a similar behaviour to young birds begging for food.

For marking their territory and courtship display the birds need a favourable songpost that is usually high, often in treetops. The European robin also sings at night by bright moonlight as well as under artificial light, especially in big cities.

HOUSE SPARROW
Passer domesticus

SHORT CHARACTERISTIC



FAMILY
Sparrows (*Passeridae*)

DESCRIPTION
males grey underneath, predominantly brown on top, black throat, grey crown, brown on the sides of the head, grey-white cheeks; females and juvenile birds are rather unimpressive, bright plain underneath, grey-beige-brown patterned on top

DISTRIBUTION
occurs almost all over the world, up to approx. 2000 m

HABITAT REQUIREMENTS
— originally in tree savannahs and steppes
— today the house sparrow lives where there is enough food, crevices/burrows or trees/shrubs
— synanthropic species in cities and villages (formerly in consequence of cattle breeding and grain warehouses)
— lives in colonies of 5 – 10 and even more breeding pairs
— breeds in buildings (cavity nesters)

BEHAVIOUR
— resident bird, i.e. stays in the area for the whole year, extremely high fidelity for a place, nests are being reused. Range during breeding season approx. 50 m, outside the breeding season usually not more than 500 m
— diurnal
— foraging in flocks

NATURAL THREATS
— cats, barn owl, Eurasian sparrowhawk, carrion crow, Eurasian magpie, in cities also common kestrel, sometimes marten and squirrel

IMPORTANCE FOR PEOPLE

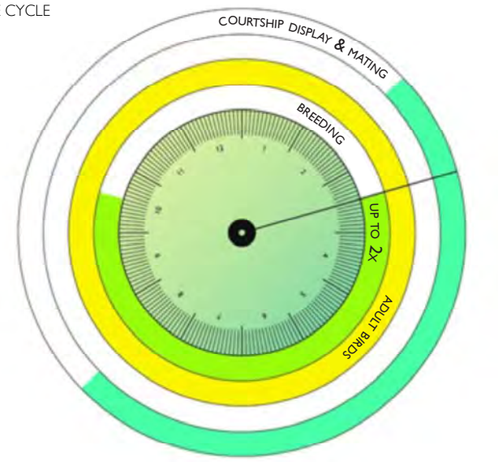
PERCEPTION
— roost communities/nesting colonies
— song, courtship display and mating
— defending territory
— collecting nesting material
— juvenile birds begging for food
— juvenile birds leaving the nest
— dust bathing
— bathing in water
— foraging
— flocks in winter

BENEFITS & CONFLICTS
— disturbance during breeding season due to building restoration
— dropped nesting material (refuse)
— soiling from bird droppings
— noise nuisance from sparrows
— nuisance from "cheeky" sparrows that are searching for food near people, e.g. in cafés, near benches, waste bins

THREAT & LEGAL STATUS
— like all European birds protected according to the Conservation of Wild Birds Directive
— since 2008 on pre-endangered species list (*Vorwarnliste* – lists species that are not endangered yet, but that potentially can become endangered within the next years)
— population setbacks in the last decades (approx. 1/3 in the last 50 years) because of: loss of food sources: seeds (horses are no longer used in farming, no more keeping of small domestic animals; intensification of livestock farming in stables; optimised grain harvest; intensified maintenance of green areas, gardens etc.)
— lack of food especially in winter
— loss of breeding areas (renovations of pre-war buildings; energy-efficient new buildings)

AUDIO SAMPLE

LIFE CYCLE



CRITICAL LOCATIONAL FACTORS IN DIFFERENT PHASES OF LIFE

BREEDING

— nests:
- colonies with 5-10 nesting sites with a minimum distance of 50 cm each
- at a height of 3-10m in holes, especially in crevices in buildings, rarely in cavities and birdhouses; breeding success is higher in holes/crevices in buildings. Shape: spherical in holes. Seldom open-nesting (in trees, shrubs or climbing plants), recently even found in steel constructions and advertising signs
- entrance hole of nesting site approx. 35 mm (if opening is bigger other species breeding in buildings will compete with sparrows), also horizontally oval 35x60 mm or vertical slits 35 mm long
- base area of the nest approx. 20x20 cm to 15x40 cm, inner height of 15 to 20 cm
- nesting material: hay, plant fibre, hair, moss, feathers (also twines, plastic: danger for juvenile birds!); to some extent leaves with essential oils as a defence against parasites (e.g. lavender, rosemary)

— diet:
- in the beginning, they *solely* feed on animals, especially insects, later the vegetarian part increases until fledging
- food source must be in immediate environment of the breeding site (<50 m)

— threats:
- very high mortality among juvenile birds (on average only approx. 20% chance of survival), therefore, protection of nests and fledglings against predators is very important for a successful development of the population

ADULT BIRDS

— roost:
- sheltered places, resting and roosting sites in immediate environment of breeding site, in dense shrubs (hedges, climbing plants etc.)

— diet:
- seeds of many plants (grasses, cereal crops)
- fruit and berries
- small invertebrates, especially insects on the ground and on plants, animal food accounts for max. 30% of the diet
- also waste and crumbs

— feather care
- dust bathing on surface areas of sand and dust free from vegetation (roadsides, gravel roads, sandpits) to fight parasites
- sunny bathing spots with shallow water (puddles, water spilling over the edge of fountain etc.)

OVERWINTERING

— roost:
- sheltered areas close to and in buildings (possibly communal roosting)

— diet:
- seeds of perennial plants, berries, waste
- bird feeders

PLANT LIST

I. PLANT FOOD SOURCES

English name	Scientific name
trees	
rowan	*Sorbus aucuparia*
bird cherry	*Prunus padus*
silver birch	*Betula pendula*
aspen	*Populus tremula*
goat willow	*Salix caprea*
shrubs	
dog rose	*Rosa canina*
blackthorn	*Prunus spinosa*
common hawthorn	*Crataegus monogyna*
elder	*Sambucus nigra*
shadbush	*Amelanchier sp.*
wild privet	*Ligustrum vulgare*
Cornelian cherry	*Cornus mas*
perennial plants	
coneflowers	*Rudbeckia sp.*
globe thistles/eryngo	*Echinops sp./ Eryngium sp.*
common sunflower	*Helianthus annuus*
mullein	*Verbascum sp.*
centaury	*Centaurea sp.*
poppy	*Papaver sp.*
evening primrose	*Oenothera sp.*
spring flowering plants	
crocus	*Crocus sp.*
primrose	*Primula vulgaris*
squill	*Scilla sp.*
narrow-leaved lungwort	*Pulmonaria angustifolia*
holewort	*Corydalis cava*
wild herbs and grasses	
lamb's quarters	*Chenopodium album*
common knotgrass and lady's thumb	*Polygonum aviculare und persicaria*
chickweed	*Stellaria Media*
common dandelion	*Taraxacum officinale*
common and annual nettle	*Urtica dioica und urens*
great burnet	*Sanguisorba officinalis*
meadow clary	*Salvia pratensis*
different grasses	*Digitaria, Setaria, Echinochloa, Poa*

English name	Scientific name
other plants	
lamb's quarters	*Chenopodium album*
plantains	*Plantago spec*
common and annual nettle	*Urtica dioica und urens*
common knotgrass	*Polygonum aviculare*
lady's thumb	*Polygonum persicaria*
chickweed	*Stellaria media*
red-root and mat amaranth	*Amaranthus retroflexus und blitoides*
common mugwort	*Artemisia vulgaris*
common evening-primrose	*Oenothera biennis*
common dandelion	*Taraxacum officinale*
different species of grass	*z.B. Digitaria, Setaria, Echinochloa und Poa spec*
different species of cereal crops	

II. PLANTS PROVIDING SHELTER

English name	Scientific name
shrubs	
dog rose	*Rosa canina*
Diels' cotoneaster	*Cotoneaster dielsianus*
blackthorn	*Prunus spinosa*
common hawthorn	*Crataegus monogyna*
common barberry	*Berberis vulgaris*
trimmed hedges	
wild privet	*Ligustrum vulgare*
European hornbeam	*Carpinus betulus*
Cornelian cherry	*Cornus mas*
field maple	*Acer campestre*
facade greening - if densely grown	
Russian-vine	*Polygonum auberti*
old man's beard	*Clematis vitalba*
winter jasmine	*Jasminum nudiflorum*
-	*Hedera helix*
common ivy	*Hedera helix*
Italian woodbine	*Lonicera caprifolium*

PROFILE

BREEDING

Nests: House sparrows are cavity breeders. Above all they breed in crevices in buildings, more rarely in tree cavities and birdhouses or open-nesting in trees, shrubs or climbing plants at a height of 3 – 10 m. Broods in holes and crevices in buildings are more successful because of the more protected location. The nests are spherical and consist of hay, plant fibre, hair, moss, feathers, leaves etc. Often the nest is padded with feathers. Artificial elements such as twines and pieces of plastic are also used. Pieces of plastic can be a threat to nestlings, they can strangle themselves (twines) or fungal infestation can occur due to missing circulation of air (plastic). Sometimes leaves of plants that contain essential oils (lavender, rosemary etc.) are used as a defence against parasites. To humans the nest appears very messy, often nesting sites can be recognised by material hanging out of the nest.

House sparrows breed in colonies. Thus, at least 5-10 nesting sites at intervals of approx. 50 cm should be available.

Breeding: Starting in March (in Southern Germany a little later), the female lays 3-6 eggs that are white to blueish and spotted with brown. Both the female and male incubate the eggs for 11 to 14 days. After hatching the juveniles stay in the nest for about 12-18 days. The parents protect the juvenile birds against effects of the weather with their wings/feathers on the belly for one week. All in all, the juvenile birds are fed for about three weeks in the nest. After leaving the nest the fledglings are fed for about 14 days, then they are independent, usually around the beginning of June. At the same time the female starts breeding again. Depending on weather conditions and food supply house sparrows breed 1-4 times between March and August. During breeding season house sparrows have got a range of activity of only 50 m (in towns) or 400 m (in the countryside).

Diet: At first, the nestlings are fed almost exclusively with animals such as insect larvae, aphids, spiders and other insects; later, when the juvenile birds are growing, the percentage of plant food increases, but stays under 50%.

Disturbances: During breeding and raising the young house sparrows are very sensitive to disturbances (e.g. façade refurbishments and other renovations of buildings).

JUVENILE BIRDS

About 14 days after they have left the nest, the juvenile birds can sustain themselves, but like adult birds they have got a very high site fidelity. Generally, the dispersal range is under 10 km.

ADULT BIRDS

Diet: Adult house sparrows feed mainly on seeds. Food includes cereals (oat, wheat, rye etc.), but also seeds of other species of the grass family (e.g. *Poa, Echinochloa, Digitaria*) and ruderal species (e.g. goosefoot, common knotgrass, common and annual nettle, chickweed, amaranth, common mugwort, common evening-primrose). Moreover, adult house sparrows feed on fruit, invertebrates and garbage. The percentage of animal food is max. 30 %. Food sources should be within max. 50 m from the breeding site.

Foraging: House sparrows forage in flocks. Their range of activity (outside breeding season) is about 200 m (in towns) to 600 m (in the countryside). They search for seeds while hopping on the ground. When feeding they are dependent on structures that function as protection (plants providing shelter, dense hedges and shrubs) so they can take cover quickly when in danger.

Roosts: House sparrows need sheltered sites, roosting end resting sites in dense shrubs, hedges, climbing plants.

Feather care: House sparrows like to bathe, especially dust bathing. The presence of areas for dust bathing seems to be of greater importance (compared to bathing in water). These areas should be dry or fast drying and free of vegetation. In urban areas, possible dust bathing sites are gravel roads, outdoor riding rings or sandpits in a sunny location. Even the edge of areas with mulch, where the bark mulch dries quickly, is suitable. Bathing spots should be shallow, wide and easily accessible, though not too close to a cover where predators can hide, but close enough so that the birds themselves can quickly hide. Close to the bathing spots there should be perches for drying and sunbathing.

OVERWINTERING

House sparrows are resident birds. On rare occasions, they migrate medium distances (up to several hundreds of kilometres) in flocks.

CLAIMING TERRITORY, COURTSHIP DISPLAY & MATING

House sparrows are very social birds and they defend only the immediate environment of their respective breeding site. The black throat of the male plays an important role as a sign of dominance when defending their territory and during courtship display. When a male has found a suitable nesting site, he starts to collect nesting material. At the same time, he performs a courtship display (song) to attract a female. After mating both the male and the female continue to build the nest. House sparrows typically mate for life.

3. URBAN WILDLIFE

This chapter provides an overview of living conditions of urban wildlife. Wildlife species are often categorised according to their ability of coping with changes caused by urbanisation. Different classification systems for urban wildlife are described in the first part of this chapter. In addition to that, the chapter highlights aspects of human impact on wildlife habitats, and conditions characteristic of urban areas affecting life and behaviour of animals living in cities.

3.1 WILDLIFE CLASSIFICATION

Many animal species have got problems adapting to new urban habitats, but there are also species that thrive in cities and can take advantage of the special conditions in an urban environment (Hough 2004, p. 134). These animals are often generalist species, omnivores and species breeding several times during breeding season (Rodewald & Gehrt 2014, p. 117).

The common wildlife classification system includes three categories: *urban exploiters, urban adapters* and *urban avoiders* (Blair 1996, McKinney 2002). According to this classification, *urban exploiters* are able to take advantage of changes caused by urbanisation, and their population densities are highest in urban areas; *urban avoiders*, on the other hand, are sensitive to such changes, and, therefore, occur in natural areas (Blair 1996, p. 507). *Urban adapters* are species usually occurring in suburban areas, and can use urban as well as natural resources (McKinney 2002, p. 887).

As an alternative to this three-category system, Riley and Gehrt (2014) suggest a new classification system for urban wildlife as they argue that the classic system is too coarse (Riley & Gehrt in Rodewald & Gehrt 2014, p. 132). In their new classification system, categories are not strict, meaning that one species or even different individuals of the same species can belong to different categories depending on the situation. The categories of their suggested classification system are *urban dependents*, *urban exploiters*, *urban tolerant* and *urban avoiders*. *Urban dependents* are species that depend on people for food resources. These species are most common in urban centres. Examples are mice, rats, pigeons and house sparrows. *Urban exploiters* include species that can exploit resources in urban areas without being dependent on them. Usually they are generalist species, and populations can be greater in urban areas than rural ones. They prefer urban areas with green spaces and residential areas. Typical species include red fox, stone marten and peregrine falcon. Species that, in general, do not exploit resources in urban areas to reach higher populations, but still may use these resources and live in parts of urban areas, belong to the *Urban tolerant* category. They occur mostly in residential districts with

low density of people or in residential areas situated close to natural landscapes. Examples are several bat and songbird species. *Urban avoiders* are species that due to specific ecological niches do not usually occur in urban and suburban areas, or if they do, only temporarily and close to open spaces. Example species are grey wolf and species that are tied to specific habitats. A fifth category ("urban impossibles") includes animal species that never occur in urban areas since they are tied to specific natural habitats, and very sensitive to disturbances. The authors mention mountain gorilla and snow leopard as example species for this category (Riley & Gehrt in Rodewald & Gehrt 2014, pp. 133-134).

However, as the classic three-category system is common in literature on the subject, its terms are used in some of the following chapters.

3.2 HUMAN INFLUENCE

According to Adams and Lindsey (2011), human influence on urban wildlife covers aspects like whether species occur in certain places or not, and population density. The authors state that urban ecosystems are the result of humans affecting both biotic and abiotic structures (Adams & Lindsey 2011, pp. 116, 118). People do not only modify traditional abiotic factors, for example, when moving or compacting soil during construction, but also create abiotic factors, for instance, construction of roads and buildings (Schwarz, Herrmann & McHale 2014, pp. 55-56). Human influence on ecosystems can be dramatic, and usually leads to a destabilisation affecting other animals that either have to adapt to the new circumstances or find another habitat (Adams & Lindsey 2011, p. 121). Living conditions for urban wildlife are affected by factors such as heat, emissions, noise and artificial lighting (Schwarz, Herrmann & McHale 2014, p. 58). The availability of sunlight, for instance, influences the growth of plants, and, in turn, resources for wildlife (Schwarz, Herrmann & McHale 2014, p. 59). Soil contamination also endangers wildlife survival when contaminating materials enter the food chain (Schwarz, Herrmann & McHale 2014, p. 62). Urban noise can mask the songs of songbirds which can lead to either songbirds leaving the area for another environment with less noise or adapting the time of their song or its acoustic (Ryan & Partan 2014, p. 161). Moreover, increasing areas of impermeable ground cover contribute to disconnections of habitat patches (Hess et al. 2014, p. 241).

3.3 LIVING CONDITIONS

The disappearance or degraded conditions of habitats due to urbanisation lead to more competition between *urban avoiders* and *urban adapters* or *urban exploiters,* the latter being at an advantage, resulting in declining numbers of *urban avoiders* (Hess et al. 2014, p. 241). Furthermore, species that normally would not get in contact with each other outside of urban areas, can happen to live close to each other in urban spaces which can lead to competition and diseases (McIntyre 2014, p. 110). Non-native, invasive species often thrive in urban areas as a result of changed habitat structures, warmer temperatures and sometimes better opportunities for foraging thanks to access to waste (Clucas & Marzluff 2011, p. 137).

However, Hough (2004, p. 143) claims that due to industrialisation of agriculture, cities are now ecologically more complex than rural environments. Ryan and Partan (2014) describe urban areas as fragments of habitat spaces separated from each other by other areas that are not suitable for animal species, and that animals have to transit. Potential habitat fragments are residential courtyards, parks and other greenery. While these habitat areas provide a lot of resources such as food, shelter and prey, the unsuitable areas in between provide only a few (Ryan & Partan 2014, p. 150). Possible urban habitats, that can be created or improved for increasing biodiversity, include private gardens, cemeteries, city parks as well as active and abandoned industrial sites (Hough 2004, pp. 146-154).

Animals living in urban areas often start breeding earlier than those of the same species living in the countryside (Rodewald & Gehrt 2014, p. 130). According to Ryan and Partan (2014) anthropogenic food sources provided in urban areas influence the behaviour of urban wildlife. Home ranges decrease, and less time has to be spent on foraging. Since most wildlife animals perceive humans as potentially dangerous, animals living in urban settlements may spent more time avoiding humans at the expense of time spent on foraging or parental behaviour. The authors also state that animals can be active at different times of the day than they are in natural environments to avoid humans. Nevertheless, urban wildlife species are usually less cautious among people than species living in rural environments indicating that they adapt and get used to human presence (Ryan & Partan 2014, pp. 154-157).

Man-made structures are often used by *urban adapters*, especially birds, for shelter and nesting; birds may build their nests on such structures, and even use artificial objects as nesting materials (Ryan & Partan 2014, pp. 151-152). However, buildings in cities can be threats for some species such as migrating birds, that might collide with them, on the other hand, there are bird and bat species that profit from high buildings (Adams & Lindsey 2011, pp. 121-122). Even bridges can be of importance for bats and birds as roosting and nesting sites (Adams & Lindsey 2011, p. 125). Crossing roads in urban areas is dangerous to terrestrial species (Rodewald & Gehrt 2014, p. 124), especially amphibians and reptiles (Adams & Lindsey 2011, pp. 124-125).

4. NEEDS OF PEOPLE

In consideration of the subject of this thesis – designing a residential courtyard inspired by the needs of two bird species – the following chapter deals with needs and wishes residents can have regarding the outdoor spaces in their neighbourhood. Preferences concerning aesthetics and functions as well as factors that contribute to a positive perception of residential areas are identified.

To a large extent, this chapter is based on the book *Stadsrum – människorum* by Berglund and Jergeby (1998). The authors investigate how people experience and use the outdoor environment in Swedish towns, and point out what people appreciate in the district or neighbourhood they live in.

In general, nature, green areas and tall trees are valued by residents. For many people the appreciation of their home will be higher if they can enjoy a view and have access to a private terrace from their flat (Berglund & Jergeby 1998, p. 13). According to Berglund's and Jergeby's research, a view over nature and green spaces is highly valued by most people. Moreover, being able to see other people from one's window is appreciated by a lot of residents. The authors stress that residents can appreciate their courtyard just by looking at it, and without actually spending time on it. In fact, very few residents spend time on their courtyard. A reason for that might be that people feel watched by their neighbours with buildings placed around the courtyard. In addition, this feeling of being watched makes it important for people spending time on their courtyard to have something to do, for instance, reading a book or gardening (Berglund & Jergeby 1998, pp. 16-17). Still, these activities occur rarely, and residents are most likely to spend time on the courtyard carrying out collective activities or spending time with their children (Berglund & Jergeby 1998, p. 41). Many people wish for a balcony or a private terrace, and these are the places where adult residents spend most of their time. If balconies and private terraces are missing the courtyard seems to gain importance for the residents (Berglund & Jergeby 1998, pp. 16-18).

According to Berglund and Jergeby, adult people spend time outside either because they have to, for instance, to run an errand, or because they want to experience their environment (Berglund & Jergeby 1998, p. 13). Aesthetic qualities are the most important factors when choosing where to spend time outdoors. Moreover, it is important that it is easy to get to the place, and to find a place for seating (Berglund & Jergeby 1998, pp. 20-21). Many people also want to engage in social interaction when spending time outside by choice (Berglund & Jergeby 1998, pp. 13, 21). Others want to have a chance to be on their own (Berglund & Jergeby 1998, p. 21). Short meetings with their neighbours, and knowing them casually is the type of social interaction most working people wish for, and that can

increase a feeling of affiliation and safety in the neighbourhood. People who have more free time also wish for places where they can meet people, and maintain closer contact to others; these places are often tied to certain activities making it possible for people with similar interests to meet (Berglund & Jergeby 1998, pp. 57-59).

Berglund and Jergeby state that outdoor spaces should fulfil the needs of a variety of people, and list several factors that can be helpful to encourage social contact. First, a place should offer different experiences that invite people to spend time there, and explore the place. There should also be a possibility to engage in activities, for instance, gardening. As a consequence of this, spending time outside becomes more meaningful and meetings between those who participate in activities and those who pass by are made possible. Moreover, it is important that people have a good overview of the area and other people. Visually open spaces without tall shrubs and very dense vegetation increase the feeling of safety, and allow people to both see others and to be seen by others. Furthermore, the authors point out that an outdoor place should offer spots for different groups of people to feel welcome on the site. According to their research people want spaces to allow for meetings, but, at the same time, also for keeping a distance if that is what one desires (Berglund & Jergeby 1998, pp. 72-73).

Children usually choose where to spend their time outdoors according to where they can meet other children (Berglund & Jergeby 1998, p. 13). It was also found that people think of courtyards mainly as places for children (Berglund & Jergeby 1998, p. 17). Open spaces for children to play are important to people, but the adults' perception of those spaces regarding safety determines whether children are allowed to explore their outdoor environment on their own (Berglund & Jergeby 1998, p. 13). Here, an important aspect is the view from one's flat over the courtyard and its entrances giving parents the possibility to watch their children while they are playing outside (Berglund & Jergeby 1998, p. 19). Still, Berglund and Jergeby argue that children need places to play without adults constantly watching them. In such places, children can express themselves, and get in contact with other children (Berglund & Jergeby 1998, p. 62).

A feeling of safety stands in correlation with a feeling of responsibility for one's courtyard (Berglund & Jergeby 1998, p. 20). If the maintenance of courtyards and other green areas close to dwellings is undertaken by local groups or residents a sense of belonging can be established (Boverket 2007, pp. 68-69). By taking care of the courtyard, and adding details to it residents can give the courtyard a personal touch. Maintenance work also creates opportunities for the residents to meet (Berglund & Jergeby 1998, p. 18). Furthermore, responsibility for maintenance has a positive impact on social control (Berglund & Jergeby 1998, p. 20). If people feel responsible for a green space its quality will be better (Douglas & Ravetz 2011, p. 262).

The quality of open spaces close to dwellings is especially important to children and elderly people since these groups spend most of their time in their neighbourhood and town district. The elderly value places where it is possible for them to see, meet or talk to other people (Berglund & Jergeby 1998, pp. 44-45).

Berglund and Jergeby mention several components and factors that can increase the quality of courtyards. A large-scale courtyard, for instance, can be divided into several smaller yards that are connected with each other. In this way, every smaller courtyard "belongs" to a certain number of residents. Furthermore, plantations and built structures can be used to divide a courtyard into multiple outdoor rooms offering both sun and shade as well as protection from wind. The authors suggest that public paths might be situated close to courtyards, though not crossing them, allowing for contact between these two outdoor areas (Berglund & Jergeby 1998, pp. 64-65).

An evaluation of several residential areas in the city of Bern, Switzerland, based on a walk with 60 professionals (landscape architects, architects, planners etc.) visiting private and semi-private spaces in different urban residential districts, to find out which factors in outdoor spaces contribute to a higher quality of life and of the residential areas, shows that the courtyards designed with the help of the residents are perceived as more positive than those designed without participation of the residents (Stadtgrün Bern 2018, pp. 122-123). Another factor positively perceived courtyards have in common is that they have some formal frame and maintenance, but still allow for development and changes in usage (Stadtgrün Bern 2018, pp. 132-133). The participants of the walk mention that a possibility for the residents to express that a space is their courtyard, for example, by adding a personal touch, and by that being able to somewhat change the appearance of the courtyard, is important to the quality of a residential area (Stadtgrün Bern 2018, pp. 144-145). Another factor raising the quality of an outdoor area, in the opinion of the participants, is the existence of soft edges between private and semi-private spaces, for instance, between private terraces and the courtyard. The view of the residents, however, differs in some cases, regarding hard edges as something positive because in that case people living on the ground floor cannot annex the courtyard, and the courtyard appears more as a common space for all residents (Stadtgrün Bern 2018, pp. 152-153). Moreover, the presence of natural elements such as wildflower meadows, wild hedges, edges between biotopes, ruderal species and native tree species, is a factor that strongly improves the rating of the residential outdoor spaces (Stadtgrün Bern 2018, pp. 136-137).

5. RELATION BETWEEN URBAN WILDLIFE AND PEOPLE

As stated earlier in this thesis, people have a strong impact on urban wildlife. In this chapter, relations between people and urban wildlife are investigated with a focus on attitudes towards different species, and the importance of animals for people in urban areas. The second part of the chapter particularly focuses on the importance of birds for people, and on the influence people can have on bird habitats.

Current biodiversity loss is predominantly caused by human actions, such as transformation of natural habitats, overexploitation of resources, introduction of invasive species, climate change and a growing population that consumes more ecosystem services (Millennium Ecosystem Assessment 2005, p. 8). Since biodiversity plays a major role in functioning of ecosystems, and thereby determining which ecosystem services can be provided, biodiversity has a strong influence on human well-being (Millennium Ecosystem Assessment 2005, p. 1). Moreover, people's physical and psychological health benefits from both active and passive experience of urban green areas; for instance, stress can be reduced (Tzoulas & Greening 2011, p. 265).

Douglas and Ravetz (2011) state that attitudes towards natural areas with wild vegetation and wildlife differ strongly among people. While some have positive feelings about such areas, for others they might cause fear or simply appear unattractive (Douglas & Ravetz 2011, p. 248). Jacobson et al. (2014, p. 2018) claim that communicating with and informing the public about urban wildlife contributes to the education of people about wildlife, and helps to manifest a greater tolerance for animals in urban areas.

A questionnaire study conducted by Bjerke and Østdahl (2004) in Trondheim, Norway shows that attitudes towards urban wildlife differ among groups of species. While small birds, squirrels, butterflies and hedgehogs receive high preference ratings, most people dislike rats, mosquitoes and mice (Bjerke & Østdahl 2004, pp. 117-118). Even Clucas and Marzluff (2011, p. 137) find that towards some animals such as rodents, pigeons and cockroaches negative attitudes predominate. Conflicts between people and wildlife can occur regarding health issues (for example, communicable diseases), safety and aesthetics (for example, bird droppings) (Hough 2004, p. 136).

Though the building of cities contributed to a human disconnection from nature, urban areas also have a high potential of reconnecting people with nature; one way of supporting this reconnection is watching urban wildlife (McCleery, Moorman & Peterson 2014, pp. 6-7). Observing birds and wild mammals is mentioned by many people in Bjerke's and Østdahl's study (2004) as important reasons for going for walks outside (42% and 34% respectively) (Bjerke & Østdahl 2004, p. 121). The ability to recognise different species of plants and animals can also increase the feeling of being rooted in one's neighbourhood or district (Boverket 2007, p. 23).

5.1 HUMANS AND BIRDS

Since bird population in urban areas is high, birds are those animals living in cities that can be easily seen by people (Clucas & Marzluff 2011, p. 139). As mentioned above, small birds are the group of urban animals that people like the most with preference ratings positively correlating with respondents' age (Bjerke & Østdahl 2004, pp. 117-118). According to Bjerke and Østdahl (2004, p. 122) bird song might be a crucial factor supporting the overall positive attitudes towards small birds as it signalises summer.

Concerning animal-related activities, Bjerke's and Østdahl's study (2004) shows that birdwatching outside one's home is the second most frequent activity that people carry out, watching TV-programs about nature being the most frequent one. Almost half of the respondents state that watching birds is an important reason to go for walks in the outdoors. Both the activities and the motive for outdoor walks are positively correlated with the age of the respondents (Bjerke & Østdahl 2004, pp. 120-122). Since older people often spend more time in their residential area, the authors suggest that experiencing wildlife should be made possible in the near surroundings of where people live (Bjerke & Østdahl 2004, p. 126). Clucas and Marzluff (2011) point out that watching birds has a positive effect on human well-being. Moreover, birds contribute to reduce insect pests (Clucas & Marzluff 2011, p. 141).

Negative effects birds can have on humans include damaging properties (for example, damage to vegetable and fruit gardens, bird droppings), building nests in unwanted places, and noise on properties (Clucas & Marzluff 2011, pp. 139, 141). On the other hand, pets such as cats and dogs moving freely in the outdoors affect birds negatively through disturbance and predation (Savard, Clergeau & Mennechez 2000, p. 138).

House sparrows are used to people, getting close to them in outdoor cafés for example, and viewing these birds offers people a possibility of experiencing nature (Clucas & Marzluff 2011, p. 144). However, Savard, Clergeau and Mennechez (2000, p. 134) claim that the appreciation of house sparrows usually only applies to low densities of the species while high densities of house sparrow populations can be seen as disturbing by some people. Shaw, Chamberlain and Evans (2008) argue that the recent population decline of house sparrows in many European countries is linked to changes of habitats caused by people. For instance, a higher amount of paving, and a loss of vegetated areas and native shrubs in many urban gardens makes it more difficult for the birds to find cover and food resources. With less plants that can provide shelter predation risk is higher. Moreover, new buildings usually do not provide roof cavities that are used for nesting by house sparrows. These factors can negatively affect survival and reproduction of the birds (Shaw, Chamberlain & Evans 2008). Considering that human actions can impair the living conditions of animal species, it can be assumed that a reverse development is possible. The next chapter deals with possibilities landscape architects have got to improve or create habitats for urban wildlife.

6. URBAN WILDLIFE AND LANDSCAPE ARCHITECTURE

This chapter points out measures that can be undertaken to support urban wildlife both on a large and local scale. Descriptions of planning strategies concerning urban areas as a whole, and factors that are essential for successful design for urban wildlife on a small scale are followed by a presentation of particular design methods aiming at improving habitats for birds. Moreover, an example of a landscape architecture project with the objective of designing a courtyard that enhances biodiversity, and attracts certain animal species is described.

Niemelä et al. (2011) argue that it is important to include ecosystem services into city planning. By doing that, the dependence of human lives on ecosystem services and natural resources can also be made clear to the public (Niemelä et al. 2011, p. 2). Savard, Clergeau and Mennechez (2000) claim that, since the term biodiversity is very general, the overall aim of increasing urban biodiversity should be concretised defining which organisms should be supported, and at which scale measures are taken. By doing that, achievable goals are set (Savard, Clergeau & Mennechez 2000, p. 135). Although even common species are part of a city's environment, measures to support these species are rare, whereas protection of endangered species is widespread in policy (Hough 2004, p. 137). Environmental impact assessments of urban design projects are often conducted in late stages after the design phase; if species that have to be protected by law are found on the project site this usually leads to a conflict between conservation and design (Hauck & Weisser 2017, p. 2). To avoid such conflicts, the biodiversity on a certain site should be included in the planning process from the beginning (Hauck & Weisser 2015, p. 8).

Overall, natural areas and green spaces with functioning ecosystems should be connected to build a green infrastructure providing ecosystem services and protecting biodiversity (European Commission 2013, pp. 7-9). To achieve this, Hauck and Weisser (2015, p. 8) argue that merely protecting existing habitats is not enough, but new ones have to be created. This action can help to reconnect fragmented habitats (European Commission 2013, p. 11).

6.1 PLANNING FOR URBAN WILDLIFE ON A LARGE SCALE

Hess et al. (2014) argue that conservation measures for urban wildlife should be a part of early planning processes, regarding rules and regulations for future development, rather than raising those questions in advanced stages in an attempt to change already made decisions concerning development and design of a site. The authors' focus lies primarily on protecting existing habitats. Measures that can be undertaken in regional planning are establishing conservation goals and guidelines for future development without harming conservation areas. Creating conservation zones in which site development is inhibited or restricted as well as collecting information about wildlife and natural resources on a site resulting in distinct requirements for its development are other suggestions (Hess et al. 2014, pp. 256-259).

Hough (2004) identifies three types of design strategies for protecting urban habitats for wildlife. The first one considers existing habitats, and aims at protecting and planning for species that live there now. Important outdoor spaces for wildlife existing in urban areas should be integrated in urban planning and connected with the overall green structure. The purpose of the second strategy is to rebuild habitats that have been impaired. The third strategy is about identifying habitats that are important, and therefore should be protected in the future (Hough 2004, p. 143).

Hess et al. (2014) state that conserving habitats of *urban avoiders* that need large habitat areas and the possibility of moving between habitat patches requires planning on a large scale considering whole cities or urban areas. This large-scale planning complements actions on a local or neighbourhood scale, and also contributes to the creation of connections between these different small-scale projects (Hess et al. 2014, p. 240). Several habitat patches may be needed to meet all requirements of a species during their life cycle, and through large-scale planning the connection of these habitats can be ensured (Hess et al. 2014, p. 255).

Goddard, Dougill and Benton (2010) stress the importance of spatial relationship between different habitat patches. Avoiding isolation of habitat patches, and instead working for connecting them with each other in an urban area, supports urban biodiversity (Goddard, Dougill & Benton 2010, pp. 93-94). Size is a factor that even Hough (2004) states as critical for habitat quality, along with shape, complexity and productivity. According to the author these factors determine whether animals can survive under the pressure found in urban areas. Restricted access for people to wildlife habitats has a positive effect on animal populations (Hough 2004, p. 146). When developing a site, for instance, building residential houses in an area, parts of the area can be conserved for protection of urban wildlife and natural resources, but this strategy is insufficient since developed places in the surroundings can still affect nature and wildlife negatively (Hostetler & Reed 2014, p. 284). The type of environment bordering habitat patches, whether the neighbouring area is a high- or low-density urban area, influences whether certain species are likely to be found in these habitats (Hess et al. 2014, p. 241). In addition to that, natural landscapes surrounding urban settlements influence which species occur in urban areas (Savard, Clergeau & Mennechez 2000, p. 136).

Hess et al. (2014) stress that green infrastructure in urban areas both serves as a habitat, and connects habitat patches, but also provides benefits to humans such as spaces for recreation and better health. Although these benefits might be contrary to wildlife conservation efforts, they also play an important role in convincing the public of the need of creating and taking care of green infrastructure (Hess et al. 2014, pp. 261-262).

Hostetler and Reed (2014) list strategies for wildlife conservation during different development phases of a site (design, construction and postconstruction). The authors state that already in the design phase biodiversity issues have to be considered together with other design decisions. The first step is an inventory to find out about wildlife populations living on the site that is to be developed, and whether there are areas meeting the requirements of these animal species during different times of their lives and the year, i.e. if there are spaces for breeding, possibility of movement between places as well as places for overwintering. An evaluation of the ways in which the concerned animals, both those living on the site the whole year and those living there for a limited time of the

year, can continue to inhabit the site, follows the first step. Then, in order to possibly conserve these parts, areas with little human disturbance and high native plant diversity should be identified since they provide best conditions for functioning habitats for urban wildlife. An evaluation of the nearby areas is also part of the design phase aiming at finding habitats outside the development site, and possible ways of connecting those (Hostetler & Reed 2014, p. 286). Moreover, placing a conserved habitat area on the site in such a way that it connects to habitats bordering the development site provides larger habitat patches and increases the chance of wildlife occurring in the area. According to the authors, houses should be placed in clusters. This makes sure that larger areas of habitat can be conserved reducing habitat edges which negatively impact several species. However, conserving large green areas is not possible in all site developments, and the authors stress that even small patches play an important role for biodiversity providing habitats for smaller animals. During construction, compaction of soil, and damages to trees caused by heavy machines and shortage of water are a danger to ecosystem functions (Hostetler & Reed 2014, pp. 288-290). Finally, plans for maintenance of the site, and informing and engaging residents are ways to ensure that efforts undertaken to support urban wildlife can continue (Hostetler & Reed 2014, p. 294)

6.2 DESIGNING FOR URBAN WILDLIFE ON A LOCAL SCALE

The vegetation in a place determines the overall biodiversity of that area (Cilliers & Siebert 2011, p. 148), and the quality of a habitat depends on the amount and structure of vegetation as well as diversity of plant species (Hough 2004, p. 133). Moorman (2014) states four principles that determine in which way urban wildlife uses habitat patches. The first factor considers which plant species a plant community consists of. Depending on the plant community and its composition resources such as food and shelter differ in type and availability at different times of the year influencing which animal species can live in these habitat patches. The greater the diversity is among plants, the more diverse food resources and cover will be available throughout the year (Moorman 2014, p. 304). In this context, Hough (2004, p. 131) claims that, in general, spaces with a high diversity of plant species also host a higher number of wildlife species. The second factor Moorman (2014, p. 304) lists is the importance of the plant community mainly consisting of a diversity of native plant species. Besides the fact that there are non-native species that already are invasive, there is even a general risk of exotic species becoming invasive in the future, therefore, using native plants instead of exotic species when designing spaces for urban wildlife also helps to reduce the amount of invasive plants (Moorman 2014, p. 308). Even Hostetler and Reed (2014, p. 293) stress the importance of using native plants in urban developments since they provide food and shelter for wildlife. This is specified by Hough (2004) arguing that whereas plantations in urban open spaces often consist of few and exotic tree species, insects, which in turn are food for other animals, depend on native species. Native trees host a higher number of insect species than exotic ones (Hough 2004, p. 157). Vegetation structure is the third critical factor Moorman (2014) describes stating that the more complex the vertical vegetation structure, i.e. the more different layers of vegetation (tree layer, shrub layer and ground cover) present, the higher diversity among animal species. It is, however, important that shading of layers beneath the tree layer is not too strong in order for lower vegetation to be able to grow and offer resources to wildlife. Vegetation structure with only one or two layers, for example lawn areas, results in poor living conditions for urban wildlife (Moorman 2014, p. 305). This is supported by Hostetler and Reed (2014) who argue that lawn does not provide any resources for wildlife, and therefore should be reduced. Dead trees, on the other hand, are important habitats, and efforts should be taken to conserve these when building on a site (Hostetler & Reed 2014, p. 293). Nevertheless, standing dead trees are often removed in urban settlements due to safety reasons, aesthetics or because of lack of knowledge about the values for biodiversity they offer (Moorman 2014, p. 308). The succession of the plant community is the fourth and last factor stated by Moorman (2014). There are specialist species tied to certain stages in plant succession. Since areas of early and late successional stages are rare in urban spaces generalist species able to cope with different stages of succession are more common in urban environments (Moorman 2014, p. 305).

Designing for urban wildlife involves a risk of creating ecological sinks. A place might provide some resources, for instance food, attracting certain animals to inhabit the area, but in fact, populations are harmed due to anthropogenic hazards such as road kill or lack of other resources resulting in high mortality (Hostetler & Reed 2014, p. 288).

Planning and design strategies for including birds and their needs in landscape architecture are explained in the next chapter, followed by a detailed description of a landscape architecture project aiming at enhancing biodiversity in a residential area in Bern, Switzerland.

6.3 PLANNING AND DESIGNING FOR BIRDS

Savard, Clergeau and Mennechez (2000) list several large- and small-scale measures to increase bird populations and bird diversity in urban areas. Starting on a large scale, a first step is to identify and protect bird habitats in the surroundings of the city. The authors also mention the importance of a green belt surrounding the town, and green corridors connecting habitats and green spaces outside and inside the urban area. Measures that can be undertaken within the city include increasing vegetation regarding the overall amount, species diversity as well as diversity of structure. If there are parks that attract certain bird species, attributes of those parks should be promoted. Concerning choice of plants, the authors stress the importance of conifers and fruit trees for both shelter and food resources. Plantation of shrubs is also of importance since shrubs are used for both nesting and foraging by many different bird species. Furthermore, bird feeders, bird houses and bathing spots should be available as well as nesting structures for cavity or cliff breeding birds. Buildings can be designed in a way that such nesting sites can be provided. Even actions to motivate private homeowners to adapt the maintenance of their properties in order for these to become more suitable for birds including restricted use of pesticides, and keeping pets indoors should be undertaken (Savard, Clergeau & Mennechez 2000, p. 138).

Cerra and Crain (2016, p. 1830) list five design strategies for improving bird habitats in residential areas: "a) link sites to overall landscape networks; b) build vegetative structure into projects; c) provide microrefugia; d) optimize forage resource availability; and e) enhance plant diversity". Linking a site to a green network can be done both on a large and small scale by planning for greenery that either fills gaps, or functions as stepping stones between existing green spaces. Planning for a higher amount of vegetation cover in tree, shrub and groundcover layers improves diversity of plant structure (Cerra & Crain 2016, p. 1836-1837). Providing microrefugia means increasing the number of shrubs on a site to offer birds protection from predators, and improving the availability of food resources implies plantation of a variety of plants offering food for bird species during all times of the year these species can be found on the site (Cerra & Crain 2016, p. 1839). According to the authors, when increasing plant diversity, the designer should keep in mind that sites are also designed for people, and therefore, try to combine plant diversity with visual organisation making it easier for people to interpret the site (Cerra & Crain 2016, pp. 1841-1842).

Paker et al. (2014) examine the relation between vegetation and bird species diversity. They find that indigenous bird species prefer to forage on native tree species, whereas non-native bird species choose non-native tree species for foraging to a greater extent. According to the authors, green spaces should be designed in a way that attracts indigenous bird species, i.e. planting native plant species, since that can have a positive effect on people's knowledge on native birds as well as on conservation efforts trying to reduce invasive species. In line with the other mentioned authors, Paker et al. also stress the importance of shrubs for foraging and shelter. They highlight that the more different shrub species there are, the higher bird species diversity is as well. The authors suggest planning for a mixture of open spaces and dense vegetation as such a design appeals to most bird species. The presence of people and dogs seems to have a negative effect on the number of bird species found in different gardens; therefore, limiting access for people and dogs to some areas, and planning for several paths to keep a distance from shrubs should be considered when designing a site (Paker et al. 2014, pp. 190-192). The most crucial factor for survival of birds in an urban setting is protection against predators (Hauck & Weisser 2015, p. 19).

6.4 RESIDENTIAL AREA *FRÖSCHMATT* IN BERN, SWITZERLAND

Fröschmatt is a small residential area situated about 5 kilometres west of the city centre of Bern, Switzerland. The courtyard is surrounded by three residential buildings originating from the 1950s; two of these houses were renovated in 2012/2013, and after completion new tenants moved in (Schellenberger et al. 2014, p. 7). Along with the renovation of the buildings, the courtyard, that until then was hardly used by the residents, and showed no biodiversity values, was redesigned (Schellenberger et al. 2014, pp. 7-8). The redesigning of the courtyard *Fröschmatt* took place as part of a pilot project of the City of Bern with the aim of increasing biodiversity and showing that this kind of design does not exclude the usage of the courtyard by the residents (Schellenberger et al. 2014, p. 5). The final report (2014) shows that the project was successful in demonstrating a possible way of conducting a participative design process aiming at increasing urban biodiversity. Furthermore, it is pointed out that an active usage of the courtyard by the residents does not conflict with the aims of higher biodiversity. Residents are very accepting and dedicated to working for a biodiverse residential environment. Additionally, the final report shows that the costs for such a biodiversity-friendly design are lower than for a conventional design (Schellenberger et al. 2014, pp. 5-6). For instance, costs for maintenance and for design solutions in comparison to conventional design solutions including hardscapes and playground equipment are lower (Schellenberger et al. 2014, p. 42).

The courtyard *Fröschmatt* qualifies for this kind of project since it is situated close (less than 1 kilometre) to several species-rich green areas, and thus has the potential of linking green spaces, and becoming part of a green structure (Schellenberger et al. 2014, pp. 8-9). In the appendix on biodiversity to the final report a strategy for deciding whether a residential area is suitable for a biodiverse design is described. To make this decision three questions have to be asked. The first question is whether there are nature values within 100 metres of the residential area. These nature values can be habitats such as

old native trees, free-growing shrubs, meadows or ruderal areas, and natural structures, for instance, garden ponds or dry-stone walls. The second question is whether the design of the outdoor area can help support more than two species of national priority, and more than four species typically occurring in the neighbourhood (within 100 metres). Connectivity is the subject of the last question asking whether the residential area is located in between one or several ecologically important areas. If all of these questions can be answered positively planning for a biodiverse design is worthwhile. Even if the last question cannot be answered with a yes, planning for biodiversity can still be suitable as long as it can be assumed that animals will move between the natural areas in the environment and the biodiversity-friendly designed outdoor space (Witschi 2014, p. 9).

Target species, that the courtyard is designed to attract, are local species rather than very rare ones since they are chosen according to which species occur in the surroundings (Schellenberger et al. 2014, p. 9). Local species and species of national priority are chosen to reach the aim of increased biodiversity; species that attract the senses, so-called flagship species, are chosen to offer natural experiences (Witschi 2014, p. 11). Animals offering sensory experiences to the residents help to create experiences of nature, and therefore, some parts of the courtyard, for instance, fruit trees and berry shrubs as well as bird houses, are especially designed to support this kind of experiences (Schellenberger et al. 2014, p. 13). Flagship species are considered to be attractive, and can play a role in making people support wildlife conservation (Savard, Clergeau & Mennechez 2000, p. 134). The project *Fröschmatt* shows that natural experiences in one's residential area raise acceptance and understanding of the importance of biodiversity (Schellenberger et al. 2014, p. 13). It could be observed that children integrate natural elements found on the courtyard *Fröschmatt* such as berry shrubs, flowers, piles of stones as well as rocks and sand into their play, thereby experiencing nature (Schellenberger et al. 2014, p. 29). Target species are both animal and plant species, and are divided into first and second priority; there are 9 first priority species being those species that are included in the planning process from the start because they occur in the surroundings, and the courtyard is important for connecting habitat patches or because their needs can be easily integrated in the design, the 9 second priority species are species among which the residents can choose several to additionally integrate in the design (Witschi 2014, pp. 11-15). According to the needs of the target species, several structures that are either compulsory or optional design elements are listed (Witschi 2014, pp. 11, 17-18).

The aim of increasing biodiversity and attracting target species is concretised by several strategies, for instance, at least 50% of the outdoor area must consist of green surfaces (other than lawn and garden areas), no more than 15% of the ground cover on the courtyard is impermeable, it is forbidden to grow invasive plants in the garden and on the balconies, there should be green facades where possible, and cats are not allowed on the courtyard (Schellenberger et al. 2014, p. 12).

During the planning and design phase of the project biologists and ecologists were actively participating in decision-making; residents were also involved in these phases to increase identification with their courtyard as well as understanding of urban biodiversity and needs for special maintenance of the outdoor area (Schellenberger et al. 2014, p. 5). In a first step of the participatory process, all tenants had the chance to answer a questionnaire regarding their preferred usage of the courtyard. This was followed by four workshops dealing with preferred usages and actual design issues within the framework of the overall aim of increasing biodiversity as well as target species and their needs in particular. Participants also decided that the responsibility for the maintenance of the courtyard will be taken by a group of residents for one year at a time, supervision by a professional gardener was assured. It could be observed that new tenants were more open to the ideas than older ones, which can indicate that long-time residents might be more sceptical to changes in their environment in general, but could also depend on socioeconomic differences with the new residents having a higher socioeconomic status, and a resulting gap between residents (Schellenberger et al. 2014, pp. 21-23). Overall, involving the residents in the design phase seems to have contributed to a feeling of identification with the courtyard illustrated by residents quickly starting to make use of their courtyard (Schellenberger et al. 2014, p. 34). Moreover, the participatory process contributed to residents socialising (Schellenberger et al. 2014, p. 41).

Before moving in, new tenants had to agree to the biodiverse design by signing a charter (Schellenberger et al. 2014, p. 24). Besides new residents being informed about the project before moving in, there was also a poster at the property explaining the project to people, and media as well as the district organisation were informed about the project (Schellenberger et al. 2014, p. 20).

The design and construction phase of the project is followed by three controls of success conducted one, three and seven years after completion (Schellenberger et al. 2014, p. 27). The first control, conducted one year after the renovation, shows that six of the target species of first priority live on the courtyard (Stadtgrün Bern 2018, p. 78).

The evaluation of courtyards in Bern, mentioned in chapter 4 and published by the City of Bern in 2018, shows that the courtyard in *Fröschmatt* is overall valuated very positively by the participants, except for the fact that the connection between the buildings and the courtyard is considered to be insufficient. Since people living in ground-floor flats only have access to balconies, instead of private terraces, a gradual transition from private rooms to the exterior area cannot be achieved (Stadtgrün Bern 2018, pp. 38-41).

7. PRECONDITIONS FOR THE DESIGN

Preconditions for the design proposal of this thesis regard both the needs of the chosen animal species and the needs of the residents as well as site-specific preconditions. In this chapter, these preconditions are summarised followed by a description of the design concept of the design proposal of this thesis.

7.1 NEEDS OF THE BIRD SPECIES

Based on the critical factors listed in the species profiles for European robin and house sparrow, elements that are crucial for their survival and possibility of reproduction, and therefore must be located on the courtyard of the design proposal are summarised in the following list:

European robin house sparrow

Parts with dense ground vegetation for nesting	X	
Slopes	X	
Tree cavities for nesting	X	X
Crevices for nesting close to the ground, holes in walls	X	
Crevices (spherical holes inside) in buildings for nesting, 3-10 metres high		X
Climbing plants for nesting	X	
Low hanging half open birdhouses for nesting	X	
Birdhouses for nesting		X
Special nests, e.g. tipped over flower pots, letter boxes, rubber boots	X	
Nesting material (moss, dry culms and leaves, plant stems, roots)	X	
Nesting material (hay, plant fibre, moss, leaves with essential oils)		X
5-10 nesting sites 50 centimetres from each other		X
Food resources for nestlings: caterpillars	X	
Food resources for nestlings: insects		X

European robin house sparrow

Food source within 50 metres from the nest		X
Protection against predators (especially cats)	X	X
Parts with open ground for foraging (no grass)	X	
Dense shrubs	X	X
Dense hedges, climbing plants		X
Shrubs with fruit and berries	X	X
Seeds of different plants according to plant list		X
Herbaceous layer with a lot of leaf litter to find arthropods and their larvae	X	
Evergreen shrubs to find food underneath	X	
Shallow, wide bathing spot	X	X
Sitting perches close to bathing spot	X	
Areas with sandy ground, no vegetation for dust bathing		X
Bird feeders in winter		X
Songposts (> 4 metres high) – tall trees	X	
Sheltered areas in or close to buildings		X

Figure 8. List of elements and factors that have to be located/fulfilled on the courtyard as well as which species they apply to based on the species profiles for European robin and house sparrow.

Several aspects considering needs of urban wildlife in general and birds in particular as well as specific design decisions emerge from studying background literature on urban wildlife and the role landscape architecture can play in designing for animals living in urban areas. These aspects and elements are:

- Support of plant diversity
- Usage of native plants
- Ensuring vegetation structure (trees, shrubs, ground cover)
- Considering succession - preserving old trees
- Increasing number of shrubs and shrub species diversity
- Usage of conifers and evergreen plants
- Usage of fruit trees
- Trying to link green areas, providing stepping stones
- Providing a mixture of open spaces and dense vegetation
- Planning for some areas to be inaccessible to people

Figure 9. List of aspects that are important for landscape architects to consider when designing for urban wildlife.

7.2 NEEDS OF THE RESIDENTS

Interpretation of the background literature on people's needs regarding residential areas and courtyards results in the following list of aspects and elements that can be regarded as parts contributing to a positive perception of a courtyard by residents:

- Tall trees
- Natural elements (e.g. wildflowers, ruderal species)
- Something to look at, view over green areas/ nature
- Being able to watch one's children
- Area for playing
- Private garden/terrace
- Possibility of carrying out activities
- Possibility of engaging in social interaction
- Possibility of being on one's own
- Several outdoor "rooms"
- Visual openness
- Possibility of adding a personal touch
- Possibility of development and change in use

Figure 10. List of aspects that are appreciated by residents.

7.3 SITE-SPECIFIC PRECONDITIONS

Site-specific preconditions for the design proposal are based on an analysis of the proposed development of the residential neighbourhood in Eriksberg as well as site visits of the area.

Functions that can be found on the courtyards today are several seating areas, a playground, an outdoor gym and a grill for having a barbecue. There are a lot of old and tall trees (20 metres or higher); Scots pine (*Pinus sylvestris*), being a characteristic tree species for the entire neighbourhood, and silver birch (*Betula pendula*) are the dominating species. As mentioned above, tall trees are appreciated by people, and are also important for birds since they can be used as songposts.

Figure 11. Tall Pinus sylvestris trees are characteristic for Eriksberg.

Overall, the majority of vegetation consists of native species. However, lawn is the main vegetation ground cover. Exposed bedrock is a characteristic feature of the district of Eriksberg and can be found in the area of the design proposal as well.

Figure 12. Exposed bedrock on the courtyard in Eriksberg.

Today, large parts of the site consist of two parking places. According to the master plan (Uppsala kommun 2017) these parking areas will disappear since some of the new houses are planned to be built on parts of the parking places. This holds the opportunity of improvement of the courtyards. Nevertheless, densification also results in a decrease of the number of tall and old trees as many of these trees must be cut down due to the construction of new buildings. Existing bird houses and bird feeders indicate appreciation of birds by at least some of the residents which can be assumed to be favourable for this type of design project.

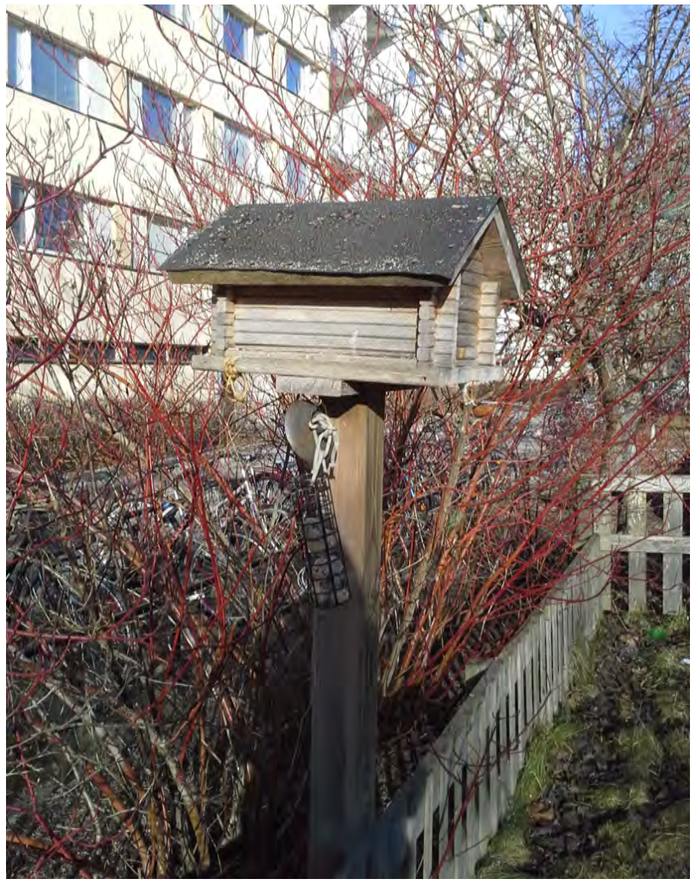


Figure 13. Bird feeders and bird houses indicate an interest for birds among residents.

In summary, the following guidelines based on the analysis of the site are to be integrated in the design proposal:

Creating areas for different functions (e.g. seating, play, other activities)

Preservation of existing old and tall trees

Change of vegetation ground cover from lawn to meadow or perennial plants

Integrating exposed bedrock in the design

Figure 14. List of aspects that are to be integrated in the design based on site-specific preconditions.

7.4 CONCEPT

The concept of the design proposal of this thesis is called *Wild Garden*, and aims to combine garden structures with natural plantations. It arises from the thought that birds often can be found in private gardens. A wild garden includes certain structures associated with a typical garden such as a vegetable garden, fruit trees and berry shrubs, but without being an orderly place. Instead of lawn and exotic species, green spaces with meadows and native plants allowed to grow freely and giving the impression of plants growing like they would in nature, are dominating. Moreover, natural materials are used for different elements.

8. REFERENCE OBJECTS

Three landscape architecture reference objects situated in Bern, Switzerland provide inspiration for the design proposal of this thesis. Descriptions of the three courtyards are complemented by analytical site plans and pictures taken during site visits. The last part of this chapter concludes important design aspects regarding, for instance, vegetation and choice of material inspiring the design of the courtyard in Eriksberg presented in chapter 10.

8.1 FRÖSCHMATT

During the site visit of the courtyard in *Fröschmatt* bird song could be heard, and children were playing. The courtyard seems private, it is surrounded by three- and four-storey residential buildings on all sides providing shelter from wind.

Although most of the vegetation on the courtyard is not fully grown, the courtyard seems very green. Besides one area with lawn all other ground vegetation consists of meadows, perennials or ruderal species. There are four old, tall trees (about 18 metres high) adding character and history to the place. The other trees on the courtyard are about 3 to 5 metres high. Most of the vegetation consists of different species of shrubs of different heights (from about 1 to 5 metres). There is a great diversity of plant species, most of them being native species. Since there are only free-growing shrubs on the courtyard and no other hedges than those bordering the courtyard on the entrance side of the buildings the plantations have got a wild and "messy" character. Paths bordering these plantations show clearly where to walk.

The fact that all paths are stone dust paths adds a soft garden feeling to the courtyard. Moreover, there is no impermeable layer other than the concrete paving in front of the entrances of the building and on one area next to another building. Natural materials are used for built structures such as wood for fences, benches and a shed as well as natural stones for dry-stone walls.

Different areas on the courtyard allow for different activities. There is an area for gardening, an area with herb plantations, a meadow with fruit trees, a fireplace and a seating area underneath a roof. The old, tall trees create a "room" being used for relaxation with a hammock stretched between trees. Furthermore, there is a table tennis table, a lawn area used for playing football and a play area with a water pump, a sandpit, a little play house, old car tyres and dead wood that can be used for climbing. The play area is located centrally on the courtyard surrounded by shrub plantations and a dry-stone wall. Elements such as dead wood, shrub plantations and the dry-stone wall support biodiversity, and, at the same time, invite children to integrate them into their play.

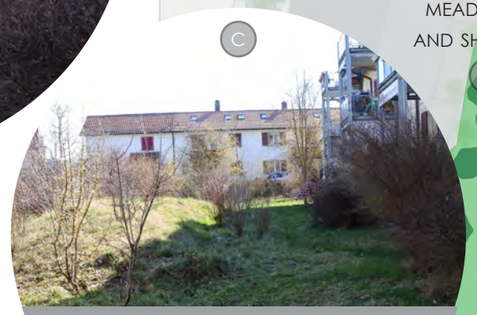
The whole courtyard is easy to overlook with dense shrubs situated at certain points, but otherwise being visually open making it possible for adults to watch children they are responsible of. During the site visit three children were playing on the courtyard moving between the play area and other parts of the courtyard while also communicating with an adult and another child on their respective balconies.

There is a lack of seating on the courtyard with only two stationary benches next to one residential building. These benches are placed in a way making it impossible to overlook the courtyard. All other primary seating is limited to portable picnic tables and a portable bench. During the site visit the picnic tables were placed under a roof indicating that they are not being used at the moment. This type of seating makes it hard for people who physically cannot move these elements to find a seat. The dry-stone wall at the play area can also be used for seating.

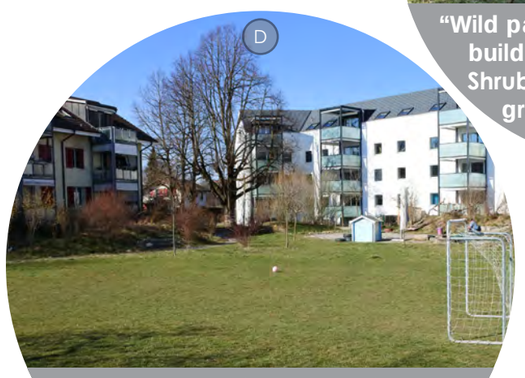
There is a shed with tools and gardening items indicating that residents take active part in gardening and building elements for the courtyard. The atmosphere on the courtyard is personal indicated by a private rabbit hutch, a hammock and toys lying around. The transition from private to semi-private space, however, is quite hard since there are no terraces and only balconies making it difficult to create a soft transition.

Herb plantations and rabbit hutch showing that residents can use the courtyard in different ways.

Shrubs behind the western building grow freely creating a natural border between private balconies and the courtyard.



"Wild part" between the western building and the courtyard. Shrubs and flowering plants grow freely, access is limited.



Lawn area used for playing football. Fruit trees and old linden trees in the background adding character to the place.

Figure 15. Illustrative site plan Fröschmatt and analysis. Scale 1:2000/A1.

Entrance to the play area. Organically shaped stone dust paths lead the way.

Dead wood in the play area can be integrated in children's play and used for climbing.

Water pump and dry stone wall in the play area.

Free-growing shrubs bordered by stone dust paths showing clearly where to walk.

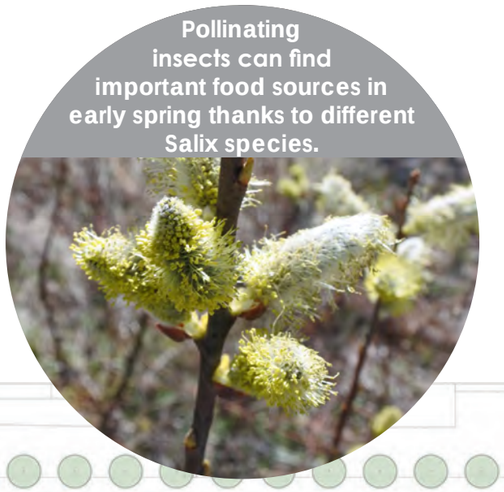
Fire place, garden area and seating underneath a roof in the southern part of the courtyard.

8.2 HARDEGG

The courtyard *Hardegg* is large, and seems quite public since it is only bordered by 1 six-storey residential building in the North, all other buildings, also six storeys high, are placed separately across the courtyard. This placement of the buildings hinders the creation of distinct outdoor rooms. During the site visit three people could be observed sitting and spending their lunch break on the courtyard indicating that it might be perceived as a public or semi-public place. The courtyard is visually open with vegetation consisting of some trees (about 8 to 10 metres high) and predominantly shrubs of different heights (up to about 4 to 5 metres). There are many solitary shrubs (about 2 to 5 metres high), but also smaller shrubs that are often placed in groups. Plant diversity is high, different *Salix* species support pollinating insects, and berry shrubs offer food to birds. The ground cover is a meadow stretching over the whole courtyard only divided by areas with rolled asphalt in front of the entrances of the buildings, and circular concrete slabs creating small paths across the courtyard. The vegetation is of the same type on the whole courtyard, thus, uniting the large area. South of the buildings there is a stream with a natural character. Free growing shrubs together with meadow vegetation create a wild and rural character of the greenery. Small paths show clearly that people are invited to walk through the planted greenery. This wild vegetation stands in sharp contrast to the "hard" and "edgy" buildings. This contrast is further underscored by the hard edges between private terraces made of concrete and the green courtyard.

Primary seating is concentrated to areas in front of the building entrances, but there are several round play areas with concrete walls that can be used as secondary seating. Two outdoor tables and a couple of chairs placed in two different spots on the courtyard indicate that at least some people use the courtyard as a place for relaxation and social interactions, other than that the level of personal touch is low.

Circular concrete slabs create paths across the courtyard showing that people can walk through plantation areas.



Pollinating insects can find important food sources in early spring thanks to different Salix species.

The round play areas offer secondary seating.

Figure 16. Illustrative site plan Hardegg and analysis. Scale 1:1500/A1.

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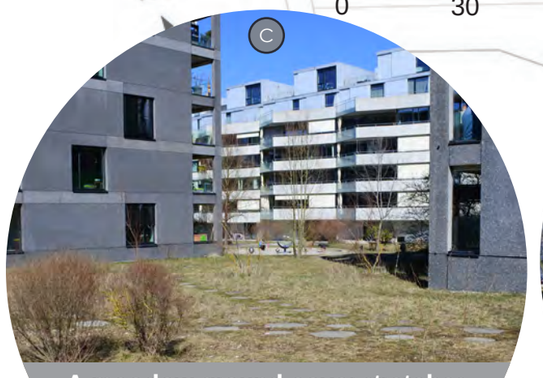


A meadow ground cover stretches over the whole courtyard. There is a strong contrast between "soft" vegetation and "hard" buildings.

The courtyard is visually open thanks to plantations of solitary shrubs with gaps between plants. Free-growing shrubs and meadow vegetation create a wild character.

The circular concrete slabs turn into concrete blocks making it possible to cross the stream at several points.

The stream in the southern part of the courtyard has a natural character.

8.3 DIESSBACHGUT

The courtyard *Diessbachgut* is fully surrounded by six-storey residential houses and partly closed by gates. Consequently, it is shielded from the surrounding streets and traffic noise. Indeed, the courtyard is very quiet and due to the surrounding buildings and gates it is also perceived as a private place for the residents. Toys, a tree house, a swing hanging from a tree, and strings of pennants as well as hammocks suspended between trees indicate that both adult and young residents use the courtyard.

In contrast to the other visited courtyards this one is much older with tall, full-grown trees and shrubs. The vegetation is dense overall with many different species and types of vegetation: grass, moss, climbing plants on trees and fences, shrubs up to 5 metres high and trees of about 20 metres height. Some of the plants are evergreen providing greenery throughout the year. Even parts of dead trees can be found. The dense vegetation involves a risk of the courtyard being perceived as somewhat unsafe in the dark. On the other hand, the residents do not have to cross the courtyard to reach their entrances since these are located towards the surrounding streets. Thanks to the vegetation several rooms are created making it possible for residents to find a place to be on their own. Moreover, there is a play area with a sandpit, a grill and a pond, however, with a fence around it making it impossible to reach the water. Seating is limited, and many residents might experience the courtyard by merely looking at it from their windows.

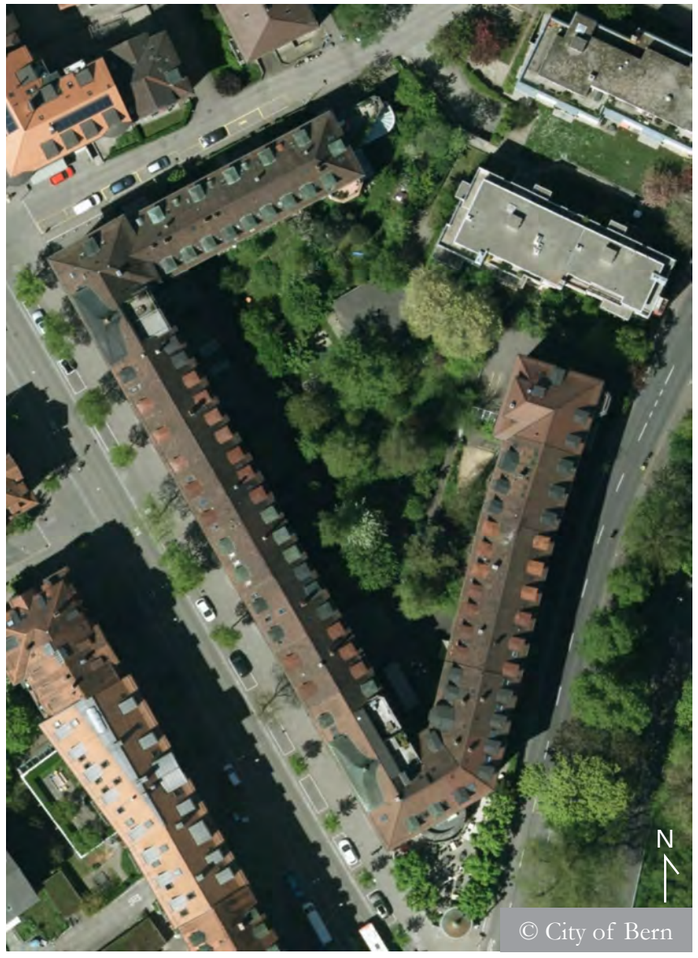


Figure 17. Orthophoto of the courtyard Diessbachgut showing the high amount of greenery. Scale 1:1000/A3.


Parts of dead trees contributing to an increase of biodiversity can be found. A fire place and hammock indicate that residents use the courtyard.


Vegetation is dense with paths traversing shrub plantations creating small outdoor rooms.


Climbing plants such as Hedera helix grow on tall trees creating a wild and natural character.


There are many old, tall trees on the courtyard adding to the green atmosphere.

8.4 CONCLUSIONS AND INSPIRATION FOR DESIGN PROPOSAL

Since all courtyards were visited on a weekday in spring during working hours it is difficult to draw conclusions regarding activities on the courtyards. A few people could be observed, but it is possible that usage of the courtyards differs between weekdays and weekends as well as between different seasons of the year. Moreover, even though some of the vegetation was in bloom, most plants were bare-branched and the courtyards will look different in summer with meadow vegetation and ruderal species in bloom. However, the site visits were inspirational regarding, for instance, ideas on how to design natural plantations, plantations with shrubs as the predominant vegetation type while still ensuring visual openness, and regarding choice of material.

Wherever possible, vegetation groundcover should be used and complemented with paths of stone dust to reduce impermeable ground cover to a minimum. This is both positive for infiltration of rain water and the overall atmosphere of the courtyard. Differing strongly from the outside and the surrounding buildings a green courtyard provides a calm and peaceful feeling for the residents. One way of designing natural plantations with plants growing freely and in a way they might in nature, is to construct paths bordering or entering these plantations showing clearly that people are welcome to walk there. Paths that border or even enter natural plantations show that the place is designed to be used, and make it possible for visitors or residents to experience their environment at close hand. In addition to that, informing the residents about the importance of certain types of plantations and their maintenance for biodiversity, as in the example of the courtyard *Fröschmatt*, is crucial to make people take responsibility for their courtyard and understand the thoughts behind the design of it.

In accordance with the design concept of this thesis, *Wild Garden,* several elements of the studied courtyards can be inspiring for the design of the courtyard in Eriksberg. Using natural materials such as wood, natural stone and stone dust for built structures and paving supports a feeling of being in a garden. Organically shaped paths and irregularly shaped natural stones increase the desired natural feeling. Fruit trees and berry shrubs as well as a place for growing vegetables are typical garden elements that are also found on the courtyard of *Fröschmatt*. Picnic tables and other portable tables and chairs make it possible for residents to choose a seat where they prefer, but these seating possibilities should be complemented with stationary seating making it possible for everyone to find a seat during all times of the year. A visually open courtyard can be achieved by placing tall solitary shrubs, smaller shrubs and trees in a way that ensures that there are gaps between plants. Free-growing tall solitary shrubs are especially important since they can create rooms around them without obscuring too much of the view across the courtyard. Furthermore, evergreen plants help to create a green outdoor area during all seasons. Climbing plants growing on structures and trees, as in the example of the courtyard *Diessbachgut*, are suggestive of a wild and natural feeling implying that plants may grow the way they even would in nature. Play areas can become an integrated part of the courtyard when using natural materials such as *Salix* shrubs and dead wood rather than prefabricated playground equipment.

The size of a courtyard and its different "rooms" has got a strong impact on how it is used. While the courtyard *Hardegg* is large and open and therefore seems quite public, *Fröschmatt* is of a smaller size, surrounded by buildings, and clearly a private space for the residents. The site of the design proposal for Eriksberg consists of several minor courtyards defined by surrounding buildings. These courtyards can be further divided into smaller "rooms" and areas for different activities using vegetation or built structures.

In summary, the following elements and strategies that are to be incorporated in the design proposal of this thesis result from the site visits:

- Areas for different activities
- Low amount of impermeable ground cover - designing with ground vegetation and stone paths instead
- Paths bordering or entering natural plantations
- Organically shaped paths
- Natural materials (e.g. wood, stone dust, natural stones)
- Irregularly shaped natural stones
- Tall solitary shrubs
- Evergreen plants
- Climbing plants
- Fruit trees and berry shrubs
- Garden area
- Both portable and stationary seating
- Play area with natural materials instead of prefabricated equipment

Figure 18. List of elements that are to be integrated in the design proposal inspired by the site visits.

NEEDS OF THE BIRDS

- Parts with dense ground vegetation for nesting
- Slopes
- Tree cavities for nesting
- Crevices for nesting close to the ground, holes in walls
- Crevices (spherical holes inside) in buildings for nesting, 3-10 metres high
- Climbing plants for nesting
- Low hanging half open birdhouses for nesting
- Birdhouses for nesting
- Special nests, e.g. tipped over flower pots, letter boxes, rubber boots
- Nesting material (moss, dry culms and leaves, plant stems, roots)
- Nesting material (hay, plant fibre, moss, leaves with essential oils)
- 5-10 nesting sites 50 centimetres from each other
- Food resources for nestlings: caterpillars
- Food resources for nestlings: insects
- Food source within 50 metres from the nest
- Protection against predators (especially cats)
- Parts with open ground for foraging (no grass)
- Dense shrubs
- Dense hedges, climbing plants
- Shrubs with fruit and berries
- Seeds of different plants according to plant list
- Herbaceous layer with a lot of leaf litter to find arthropods and their larvae
- Evergreen shrubs to find food underneath
- Shallow, wide bathing spot
- Sitting perches close to bathing spot
- Areas with sandy ground, no vegetation for dust bathing
- Bird feeders in winter
- Songposts (> 4 metres high) – tall trees
- Sheltered areas in or close to buildings

- Support of plant diversity
- Usage of native plants
- Ensuring vegetation structure (trees, shrubs, ground cover)
- Considering succession - preserving old trees
- Increasing number of shrubs and shrub species diversity
- Usage of conifers and evergreen plants
- Usage of fruit trees
- Trying to link green areas, providing stepping stones
- Providing a mixture of open spaces and dense vegetation
- Planning for some areas to be inaccessible to people

+

NEEDS OF THE RESIDENTS

- Tall trees
- Natural elements (e.g. wildflowers, ruderal species)
- Something to look at, view over green areas/ nature
- Being able to watch one's children
- Area for playing
- Private garden/terrace
- Possibility of carrying out activities
- Possibility of engaging in social interaction
- Possibility of being on one's own
- Several outdoor "rooms"
- Visual openness
- Possibility of adding a personal touch
- Possibility of development and change in use

+

SITE-SPECIFIC PRECONDITIONS

- Creating areas for different functions (e.g. seating, play, other activities)
- Preservation of existing old and tall trees
- Change of vegetation ground cover from lawn to meadow or perennial plants
- Integrating exposed bedrock in the design

+

REFERENCE OBJECTS

- Areas for different activities
- Low amount of impermeable ground cover - designing with ground vegetation and stone paths instead
- Paths bordering or entering natural plantations
- Organically shaped paths
- Natural materials (e.g. wood, stone dust, natural stones)
- Irregularly shaped natural stones
- Tall solitary shrubs
- Evergreen plants
- Climbing plants
- Fruit trees and berry shrubs
- Garden area
- Both portable and stationary seating
- Play area with natural materials instead of prefabricated equipment

PROGRAM

The courtyard of this design proposal is a place where both birds and residents can thrive. Fulfilling the needs of the bird species European robin and house sparrow, gives the residents the opportunity of connecting to nature in their immediate environment, watching the birds and listening to their song. The needs of the birds and the residents are combined in a green courtyard with a variety of predominantly native plant species providing food and shelter for the birds as well as sensory experiences to the residents in terms of blossom, edible fruit and fall foliage. Several areas for different functions offer the possibility of various usages of the courtyard.

DESIGN PROPOSAL

Figure 19. Illustration of the work flow leading to the design proposal. All preconditions summarised in chapter 7 together with the elements and strategies inspired by the reference objects lead to the program of the design proposal.

9. DESIGN PROCESS

This chapter gives an overview over the design process leading to the final design proposal including choices that were made during the creative process.

The initial thought when starting the design process was to incorporate the whole residential area north of Marmorvägen in the design proposal. Therefore, the whole area was analysed regarding movement and possible walking paths as well as locations of potential green connections.

Figure 20. A first analysis of possible green connections showed that these should be located both in a north-south direction close to buildings as well as crossing the courtyards. The thought about green connections was that they should provide shelter along the way, and therefore consist of dense shrubs, which meant that remaining areas could be more open and used for different functions. The green connections alongside the buildings remained important during the design process, while crossing green connections were expanded to cover the whole courtyard area.

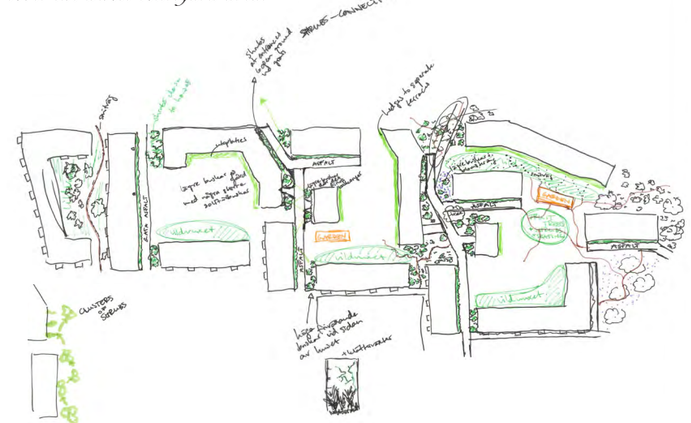


Figure 21. Sketches illustrating different types of green connections including trimmed hedges, clusters of shrubs, climbing plants.

During the analysis, it became apparent that the area can be divided into four courtyards leading to the idea of designing each courtyard with a focus on different functions (see figures 22 and 23). Due to the size of the whole area, this turned out to be unmanageable within the framework of this thesis.

Moreover, each courtyard is large enough to accommodate a multitude of functions. That is why, one courtyard was chosen to be designed in detail. However, in order to show a possible solution on how to accomplish green connections between the site area and green spaces nearby, a simplified overall design of the whole area was created.

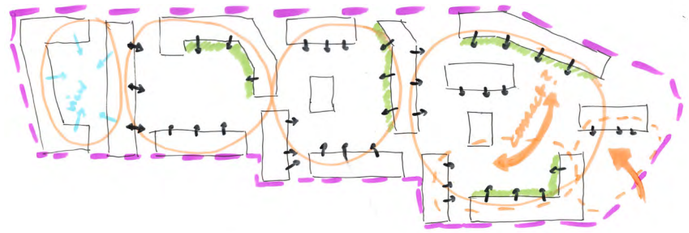


Figure 22. Division of the residential area into four courtyards. The two courtyards to the left have distinct borders, whereas the two courtyards to the right lack this feature, with buildings placed in the courtyard area. This finding led to the decision to design the courtyard situated second from the left in detail.

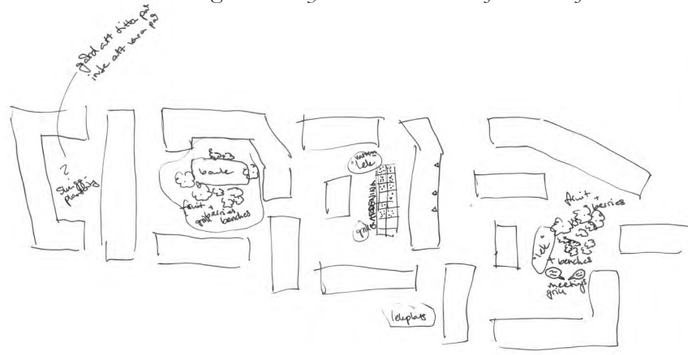


Figure 23. Sketch illustrating the idea of designing each courtyard with a focus on different functions.

The early sketching process concentrated on translating the critical factors listed on the species profiles into specific elements and design ideas with a focus on combining the needs of the birds with the needs of the residents aiming at creating design solutions that both fulfil the critical factors and offer experiences to the residents. This resulted in a number of rather small-scale design ideas illustrated by the following sketches:

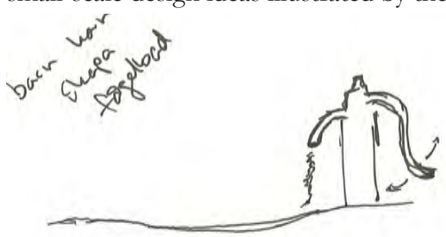


Figure 24. Sketch of a water pump that can be playground equipment. Children can create shallow bathing areas for European robins and house sparrows.

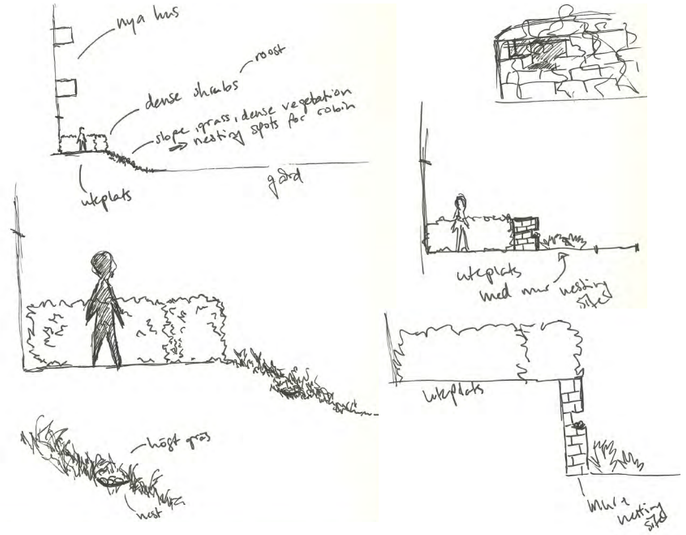


Figure 25. Sketches illustrating different ideas regarding the design of private terraces in combination with nesting sites for European robin. One idea included dense shrubs or hedges that can function as a boundary for private terraces and as a shelter for birds. A slope beneath the terraces with high grass/dense vegetation can offer areas where European robins can build nests on the ground. Another idea was to build walls with alcoves as a boundary between private terraces and the courtyard instead of dense hedges or even to build elevated terraces. The alcoves in the walls can function as nesting sites for robins. In the end, to achieve a more soft edge between private terraces and the courtyard, the idea with a vegetated slope beneath the terraces was chosen.

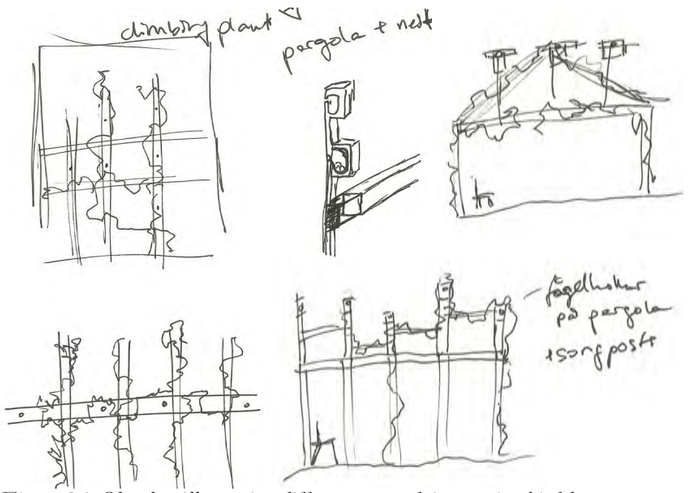


Figure 26. Sketches illustrating different ways of integrating bird houses for house sparrow in pergolas. The difficulty was that nesting sites for house sparrows must be at a height of at least three metres. Therefore, bird houses had to be placed on top of the pergola.

Figure 27. Sketch illustrating the orchard. Since berry shrubs supply food for the birds as well as for the residents it was decided early in the process to integrate such plants in the design. The idea was developed further to even include fruit trees and create an orchard.

Other early ideas included an area for playing boules that can function as a dust bathing spot for house sparrows, and including existing tall trees in the design as they are important songposts for birds, but also enhance the quality of a courtyard for the residents.

Many of these early ideas are included in the finished design. However, the challenge was to connect these loose ideas with each other in order to achieve a combined design. Therefore, the design concept *Wild garden* was defined. This concept was helpful in creating an atmosphere to work towards to. Moreover, relying on the concept facilitated decisions regarding, for instance, which functions and plants to include in the design. Another important factor helping to get a better understanding of how to combine the different ideas were the site visits of the reference objects described in chapter 8. These visits were valuable as they provided ideas on what a biodiversity-friendly design can look like and how vegetation, shrubs in particular, can be used to create outdoor rooms while keeping a visually open character.

Inspired by the site visits, and in order to break the trend of creating separate design solutions, during the next sketching phase critical factors of the species profiles were left aside to fully concentrate on possible ways of organising different functions and placement of vegetation on the courtyard (see figure 30). Then, this design was compared to the critical factors and elements that have to be found on the courtyard in order for the birds to be able to inhabit the site showing that the majority of elements was incorporated in the design (see figure 31).

Figure 28. Sketch illustrating a placement of tall shrubs next to a building facade inspired by the site visits. Placing dense plantations next to facades is an idea that can be seen in the final design proposal.

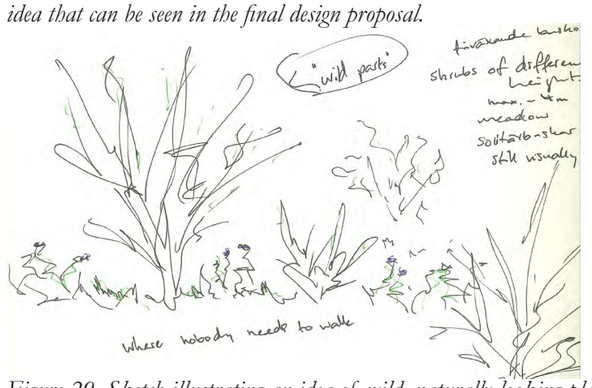


Figure 29. Sketch illustrating an idea of wild, naturally looking plantations. The site visits helped create an idea of designing such plantations in areas where residents do not have to walk. The southern perennial garden in the final design proposal is such an area.

Figure 30. Sketch of the courtyard inspired by the site visits. Areas with different functions are crystallising. Placement of vegetation with dense shrubs next to facades and solitary shrubs in other parts is inspired by the site visits.

Figure 31. Sketch showing that critical factors of the species profiles are fulfilled in the design.

The last phase of the sketching process was mainly concentrated on making decisions regarding the exact placement of functions, and choice of plants based on the plant lists of the species profiles. In order to choose which of the plants listed on the plant lists to integrate in the design, plants were divided into different categories:

- Plants that do not grow in Sweden – cannot be included in the design
- Existing plants on the courtyard – are included in the design if in good condition
- First priority plants: plants that are important for both bird species – all of these species are included in the design
- Second priority plants: plants that are important for one bird species, and provide sensory experiences to people in terms of blossom, berries, fall foliage and so on – many of these species that also match the concept of the design proposal are included in the design.

10. DESIGN PROPOSAL

The result of this thesis is a design proposal presented on the following pages.

SHRUBS FOR RENT FOR FEATHERED FRIEND

The design of the courtyard aims at attracting the bird species European robin and house sparrow. All critical locational factors of these species are fulfilled making it possible for the birds to inhabit the site. Watching the birds and listening to their song strongly contributes to the experience of the courtyard by the residents.
Several areas for a multitude of functions make it possible to use the courtyard in different ways ranging from activities like gardening to relaxing under a tree canopy.

Impermeable ground cover is reduced to a minimum as large areas with vegetation in combination with stone dust paths are the predominant elements of the courtyard. Wildflower meadow and perennial plants are the two types of vegetation ground cover used on the courtyard. The flowering plants attract pollinating insects and thus support biodiversity.

Except for trimmed hedges by the entrances all shrubs are free-growing enhancing a natural feeling of the vegetation. While dense plantations are concentrated to areas next to facades, the courtyard is visually open with tall solitary shrubs and multi-stem trees dominating.

NESTING SITES
holes in facade serving as nesting sites at a height of 3-10 metres

ROOST
hedges close to buildings are sheltered areas

FEATHER CARE
stone dust paths and boules court function as dust bathing spots

HIGHER NESTS
in tree cavities and low hanging half open bird houses

FOOD
open ground for hunting insects

FEATHER CARE
bathing spot with shallow water, Salix shrubs provide shelter

FOOD
leaf litter on the ground so that birds can find arthropods and larvae to feed on

FOOD
seeds of perennial plants and berries

ROOST AND COVER
in immediate environment of breeding site, dense shrubs, hedges, climbing plants

NESTING COLONIES
12 nesting sites integrated in every pergola

GROUND NESTS
beneath grass on sloping meadow

SPECIAL NESTS
flower pots, rubber boots etc. in garden area

FOOD
seeds of grasses

FOOD
berry shrubs

SONGPOSTS
all trees and tall shrubs (over 4 metres high)

HIGHER NESTS
in wall alcoves

HIGHER NESTS
in climbing plants

ROOST AND COVER
dense shrubs

NESTING MATERIAL
leaves, plant stems, roots, plant fibre

THREATS
no cats allowed on the courtyard as a protection against nest predators

FOOD FOR NESTLINGS
insects and plants

FOOD
food source within 50 metres of breeding site, almost the whole courtyard can be used for feeding

FOOD
small invertebrates on the ground and on plants

FOOD
bird feeders

FOOD FOR NESTLINGS
caterpillars on plants on the courtyard

SIZE OF TERRITORY
this courtyard is double the minimum size of territory; surrounding courtyards and parks provide important additional space for more birds

N

0 5 20m

Illustrative site plan. Scale 1:200/A1.

2019-06-25
Tina Lendi-Ziese

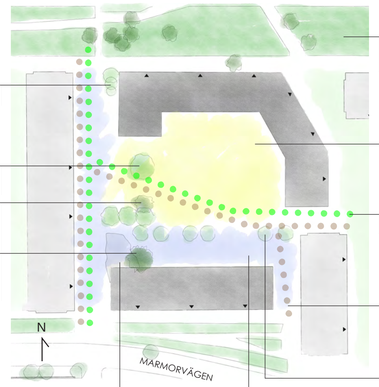
ANALYSIS

There are three Sorbus aucuparia trees, one of them being in good condition. This tree will be spared as it is an important food source for both European robin and house sparrow.

The tall existing Betula pendula adds character to the courtyard and can play a central role in its future design.

There are two Pinus sylvestris trees in good condition. However, one of them is located very close to a new building and it will be difficult to spare the tree.

Exposed bedrock is a characteristic feature that can be found in many places in Eriksberg. Therefore, it will be spared and integrated in the design of the courtyard.



North of the courtyard there is a park with many tall Pinus sylvestris trees that are characteristic for the area of Eriksberg.

A large area of the courtyard is sunny. Here, residents can meet and spend their afternoons.

The courtyard is part of a bigger green structure and plays a role in connecting surrounding courtyards and parks.

Residents can cross the courtyard, but the paths are not part of the main path network.

Some of the nine existing Tilia cordata trees will be spared to emphasise continuity.

Due to the buildings the southern part of the courtyard is shady.

Analysis of the courtyard based on the master plan of Uppsala municipality. Scale 1:1000/A1.
Light grey houses are existing buildings, dark grey houses are planned residential buildings.

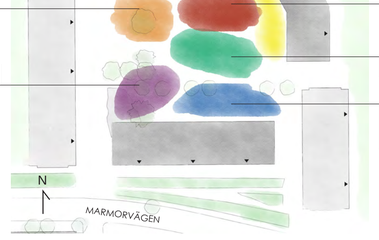
0 25 50m

ZONING

The sloping meadow is situated between the courtyard and private terraces in the sun.

Around the tall Betula pendula a place for activity and recreation is created, the boules court is situated here.

The exposed bedrock is integrated in the play area.



The garden area is situated in the sunny part of the courtyard to guarantee good conditions for growing vegetables.

Even the orchard is located in the sunny area offering a meeting place for the residents.

In the shady part plantations with shrubs and perennial plants dominate.

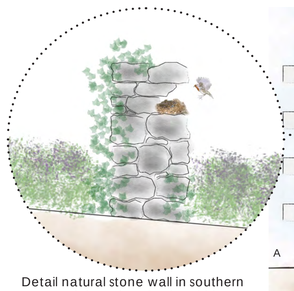
Plan showing different areas of the future courtyard as a result of the analysis. Scale 1:1000/A1.
Light grey houses are existing buildings, dark grey houses are planned residential buildings.

0 25 50m

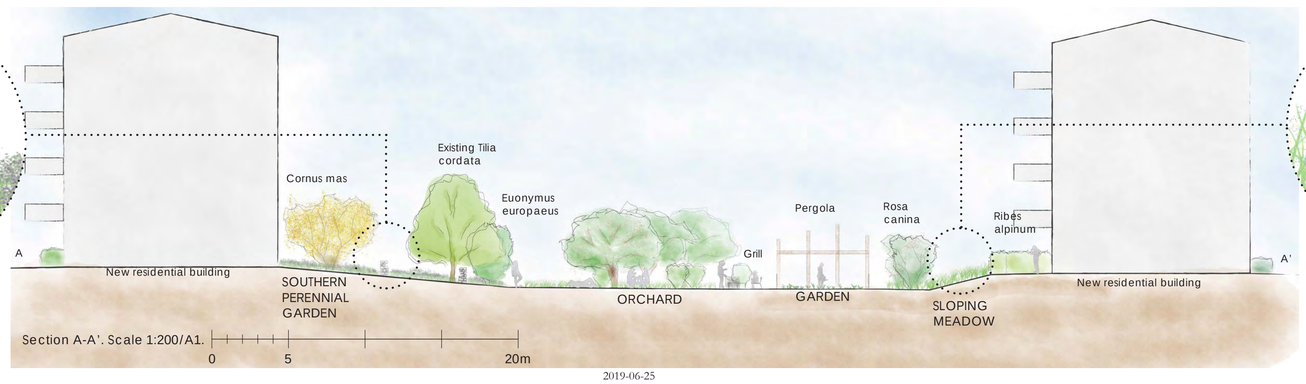
PERENNIAL GARDENS

The vegetation ground cover in these areas consists of a mixture of perennial plants such as globe thistles, primrose and coneflowers. Birds can feed either directly on their seeds or on insects that can be found on the plants. Trees and solitary shrubs provide shelter for birds, while the space is kept visually open.

A path made of natural stones leads through the western perennial garden making it possible to experience the flowers and their scent at close hand. The southern perennial garden, however, is not accessible to the residents. Here, trees and solitary shrubs are planted a little denser. Still, gaps between plants enable residents to catch a glimpse of the area when walking by. Together with natural stone walls, overgrown with common ivy, that offer nesting sites to European robin, this area has a wild and natural feeling to it.

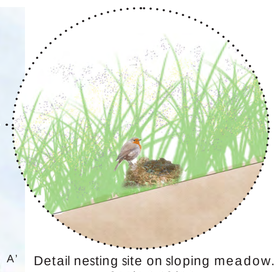


Detail natural stone wall in southern perennial garden. Scale 1:20/A1.
Alcoves in the walls are possible nesting sites for European robin.



Section A-A'. Scale 1:200/A1.

0 5 20m



Detail nesting site on sloping meadow. Scale 1:10/A1.
High grass offers optimal breeding conditions for ground nesting European robin.

ORCHARD

In the orchard residents can relax in the midst of fruit trees and berry shrubs. In spring, the white blossom of sour cherry and apple trees is an eye-catcher. During the summer months, the trees offer light shade, and in late summer, the residents can enjoy apples, cherries, blackcurrant, redcurrant and raspberries.

Paths of natural stones lead into the orchard, portable picnic tables and benches make it possible to choose a seat wherever one prefers. The orchard is both a place for being on one's own, reading a book in the shade of a tree and for having neighbourhood garden parties.

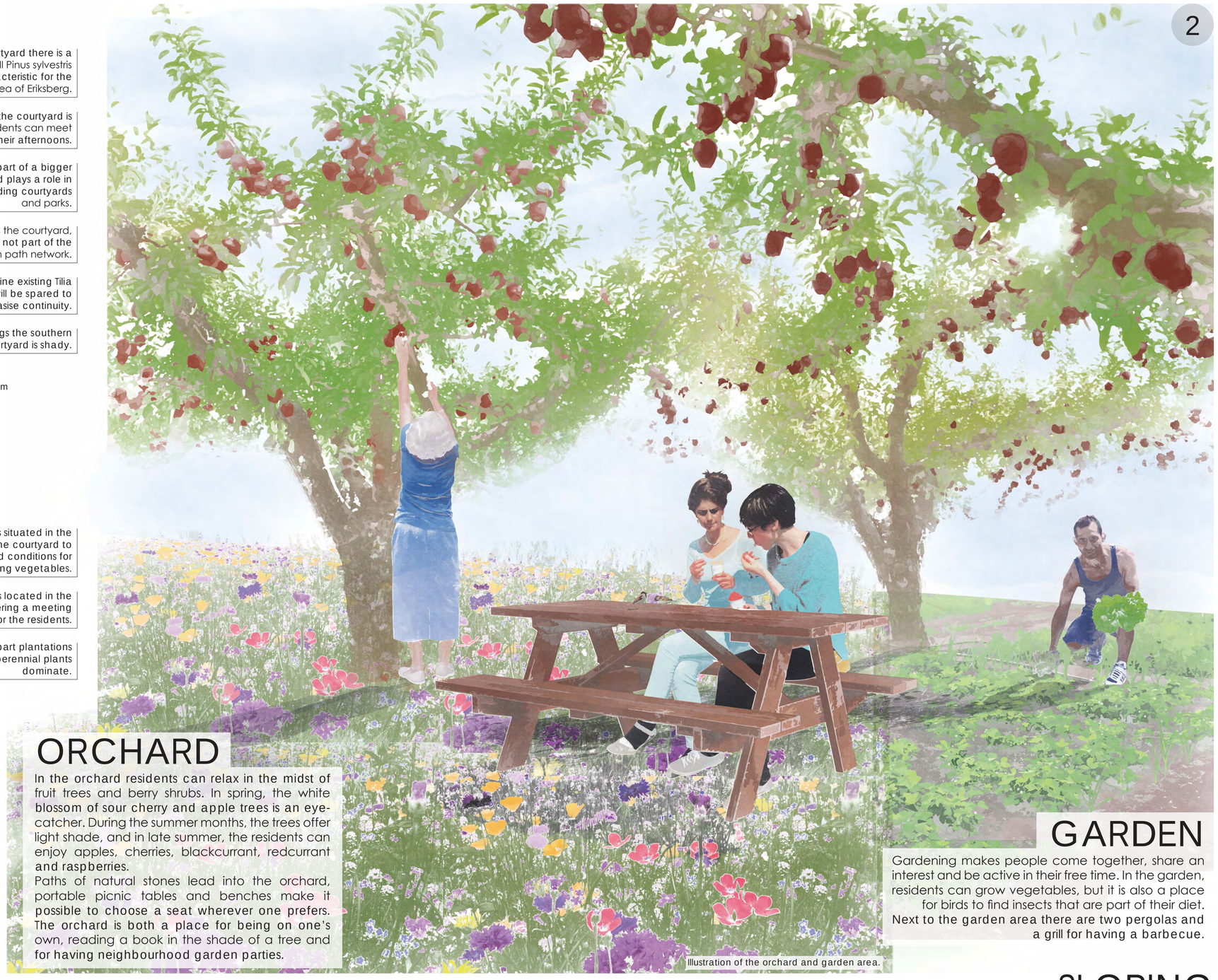


Illustration of the orchard and garden area.

GARDEN

Gardening makes people come together, share an interest and be active in their free time. In the garden, residents can grow vegetables, but it is also a place for birds to find insects that are part of their diet. Next to the garden area there are two pergolas and a grill for having a barbecue.

SLOPING MEADOW

The sloping meadow creates a distance between private terraces and the courtyard. Here, European robins can nest beneath the high grass without being disturbed. The wildflower meadow consisting of native plants is also important for pollinating insects, and its blossom is appreciated by the residents.

2019-06-25
Tina Lendi-Ziese

GREEN CONNECTIONS

The whole residential area can be divided into four courtyards, the courtyard situated second to the left is the object of the detailed design proposal.

Possible paths that people might use to move across the courtyards and green connections overlap partially.

This residential area consists of detached houses. There are a lot of small gardens that offer resources such as food and shelter to urban wildlife.

The courtyards can play a role in connecting the northern and southern park areas and the neighbourhood with detached houses. These green connections help the birds to move between different green areas.

Stadsskogen is a nature reserve located close to the residential area. It is an important green space for both wildlife and people. Here, many old and tall pine trees grow. The area is also used for recreational purposes.

Analysis of the residential area based on the masterplan of Uppsala municipality. Scale 1:3000/A1.
White houses are existing buildings, grey houses are planned residential buildings.

0 75 300m

Groups of shrubs and trees provide dense vegetation without appearing insecure as these plantations are concentrated next to facades.

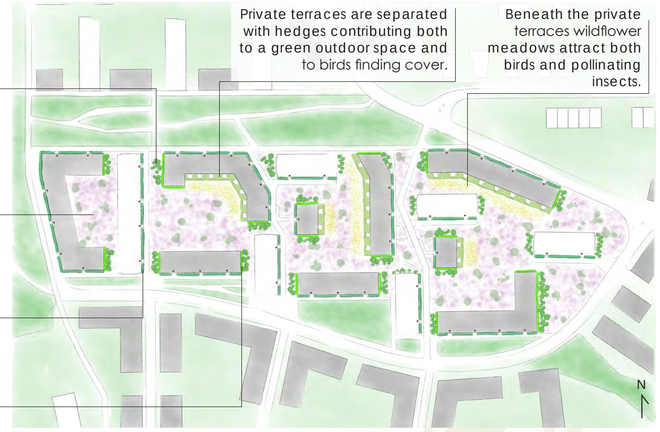
The predominant vegetation ground cover on the courtyards consists of perennial plants. Solitary shrubs and multi-stem trees are important stepping stones for birds and other animals moving between different parts of the area.

Contiguous trimmed hedges by the entrances provide shelter for birds.

Climbing plants cover the facades of the new residential buildings forming the vertical part of the green infrastructure.

Private terraces are separated with hedges contributing both to a green outdoor space and to birds finding cover.

Beneath the private terraces wildflower meadows attract both birds and pollinating insects.



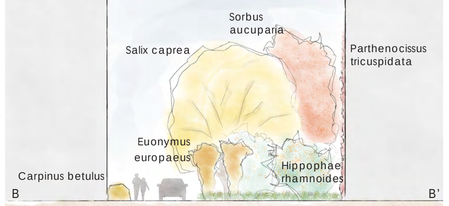
Plan showing a design of green connections with hedges, free-growing shrubs, meadow and perennial areas. Scale 1:12000/A1.
White houses are existing buildings, grey houses are planned residential buildings.

0 50 200m

VEGETATION

All vegetation offers shelter and/or food to either European robin or house sparrow or both species. At the same time, new plants contribute to the experience of the residents by offering enjoyable blossom and/or edible fruit. In addition to that, many of the chosen plants attract pollinating insects. Perennial plants and wildflower meadows replace lawn as ground cover in order to support biodiversity.

Next to the facades groups of trees and shrubs together with a vegetation ground cover of perennial plants form dense plantations offering shelter and food to European robin and house sparrow. Climbing plants offer additional shelter and nesting opportunities.
Fall foliage in different colours and berries are enjoyable for the residents as well.

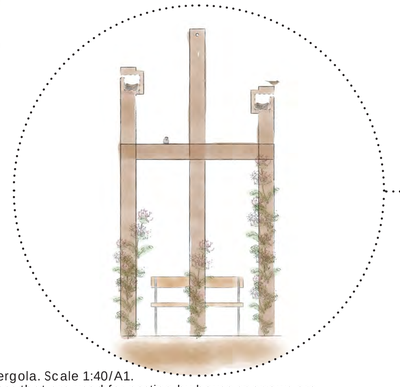


Section B-B'.
Scale 1:200/A1.

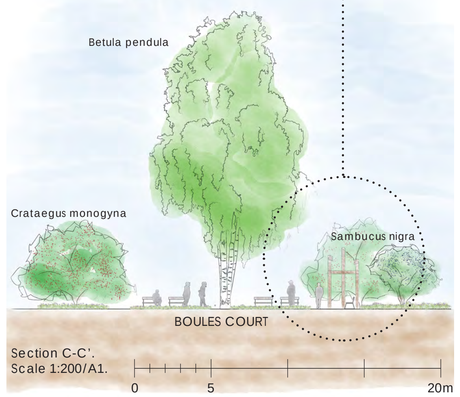
0 5 20m

PLAY

Natural materials such as dead tree trunks, exposed bedrock and Salix shrubs invite children to experience their outdoor environment and become creative in their play. When using the water pump, children can create puddles functioning as bathing spots for European robin and house sparrow.



Detail pergola. Scale 1:40/A1.
Bird houses that are used for nesting by house sparrows are integrated in the pergola.



Section C-C'.
Scale 1:200/A1.

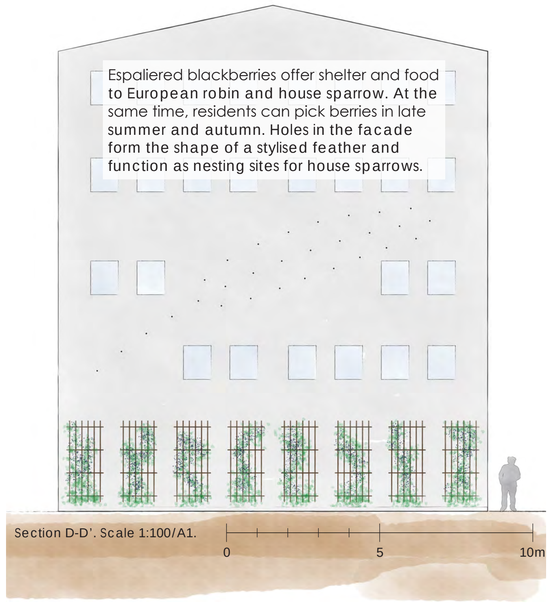
0 5 20m

BOULES COURT

Next to the tall Betula pendula residents can play boules or simply enjoy sitting underneath the airy tree crown. The boules court can also be used by house sparrows for dust bathing.

Illustration of the play area.

Espaliered blackberries offer shelter and food to European robin and house sparrow. At the same time, residents can pick berries in late summer and autumn. Holes in the facade form the shape of a stylised feather and function as nesting sites for house sparrows.



Section D-D'. Scale 1:100/A1.

0 5 10m

PLANT LIST

SCIENTIFIC NAME	ENGLISH NAME	IMPORTANCE FOR BIRDS according to plant lists on species profiles	IMPORTANCE FOR HUMANS	COMMENTS
TREES				
Betula pendula	silver birch	house sparrow (food)	tall existing tree in Eriksberg, yellow fall foliage	o Existing tree in Eriksberg
Hippophae rhamnoides	common sea buckthorn	European robin	edible orange-red berries in late summer	o Berries used for jelly, syrup, liqueur
Malus domestica	apple tree	not listed on species profiles, but crevices are possible nesting sites	white flowers in spring, apples	o Planted in the orchard
Pinus sylvestris	Scots pine	not listed on species profiles, but crevices are possible nesting sites, tall trees can function as songposts	tall existing tree in Eriksberg, evergreen	o Existing, characteristic tree in Eriksberg
Prunus cerasus	sour cherry	not listed on species profiles, but crevices are possible nesting sites	white flowers in spring, cherries	o Planted in the orchard
Prunus padus	bird cherry	European robin house sparrow (food)	big white flowers in May	o Multi-stem trees
Salix caprea	goat willow	house sparrow (food)	catkins in April-May	o Important for bees, bumblebees, butterflies, caterpillars
Sambucus nigra	elder	European robin house sparrow (food)	cream-white flowers in June-July, edible black berries in August	o Flowers and berries used for syrup, jam o Typical plant in gardens
Sorbus aucuparia	rowan	European robin house sparrow (food)	white flowers in May-June, edible red berries and red-orange-yellow fall foliage	o Berries used for jelly o Berries even in winter o Existing trees in Eriksberg
Tilia cordata	small-leaved lime	not listed on species profiles, but crevices are possible nesting sites, tall trees can function as songposts	tall existing trees in Eriksberg, yellow fall foliage	o Existing trees in Eriksberg
SHRUBS				
Amelanchier sp.	shadbush	house sparrow (food)	white flowers in May-June, yellow fall foliage	o Can be affected by mildew
Carpinus betulus	European hornbeam	house sparrow (shelter) as trimmed hedge	dry leaves in winter (sight)	o Trimmed hedge
Cornus mas	Cornelian cherry	house sparrow (food and shelter)	yellow flowers in early spring, edible red berries in early autumn, purple-yellow fall foliage	
Crataegus monogyna	common hawthorn	house sparrow (food and shelter)	white flowers in June	o Solitary plant
Euonymus europaeus	spindle	European robin	light red capsular fruit with orange seeds in late summer, red fall foliage	o Spectacular fruit
Ligustrum vulgare	wild privet	European robin house sparrow (food and shelter)	yellow-white flowers in June-July, keeps green leaves until December	o Trimmed hedge
Ribes alpinum	mountain currant	European robin	red berries	o Borders private terraces
Ribes nigrum	blackcurrant	European robin	edible black berries in July-August	o Typical plant in gardens
Ribes rubrum	redcurrant	European robin	edible red berries in July-August	o Typical plant in gardens
Rosa canina	dog rose	house sparrow (food and shelter)	light red, pink or white flowers in June-July, red rose hips	

Rubus fruticosus	blackberry	European robin	blackberries in August-October	o Can be espaliered next to a wall o Typical plant in gardens
Rubus idaeus	raspberry	European robin	raspberries in July-August	o Typical plant in gardens
Symphoricarpos rivularis	snowberry	European robin	white berries in autumn	o Tolerates shade o Berries even in winter
CLIMBING PLANTS				
Clematis vitalba	old man's beard	house sparrow (shelter)	white flowers in July-October, silky appendages of fruit	o Plant for pergola
Hedera helix	common ivy	European robin	evergreen	o Plant for shady spots
Lonicera caprifolium	Italian woodbine	house sparrow (shelter)	white-pink flowers in May-June, orange-red berries	o Plant for pergola
Parthenocissus tricuspidata	Boston ivy	European robin	orange-red fall foliage	o Suitable for green facades
PERENNIAL PLANTS				
Centaurea sp.	centaury	house sparrow (food)	red-purple or blue flowers in June-August	
Corydalis cava	holewort	house sparrow (food)	pink-red or white flowers in April-June	
Echinops sp.	globe thistles	house sparrow (food)	blue flowers in August-September	o Important for pollinating insects
Eryngium sp.	eryngo	house sparrow (food)	blue, purple or silver-grey flowers in July-August	
Fragaria vesca	wild strawberry	European robin	wild strawberries in July-August	
Helianthus annuus	common sunflower	house sparrow (food)	yellow flowers in August-September	
Oenothera sp.	evening primrose	house sparrow (food)	yellow flowers in July-September	
Papaver sp.	poppy	house sparrow (food)	red flowers in June-August	
Primula vulgaris	primrose	house sparrow (food)	light yellow flowers in April-May	
Pulmonaria angustifolia	narrow-leaved lungwort	house sparrow (food)	blue flowers in May	
Rudbeckia sp.	coneflowers	house sparrow (food)	yellow-orange flowers in July-September	
Salvia pratensis	meadow clary	house sparrow (food)	light blue-purple flowers in June-August	o Important for bumblebees
Sanguisorba officinalis	great burnet	house sparrow (food)	dark red flowers in August-September	
Verbascum sp.	mullein	house sparrow (food)	yellow flowers in July-September	
BULBS				
Crocus sp.	crocus	house sparrow (food)	flowers (different colours) in March-April or September-October	
Scilla sp.	squill	house sparrow (food)	blue flowers in April-May	

Table 1. Plant list of plants used in the design of the courtyard in Eriksberg.
Dark green rows include plants that are important for both bird species, light green rows include plants that are important to one of the bird species. All chosen plants offer experiences to the residents as well, for example, blossom, edible fruit or fall foliage. Four tree species (white rows) are included in the design although they are not listed on the species profiles. Pinus sylvestris and Tilia cordata are included in the design since they are existing tree species on the site. Malus domestica and Prunus cerasus are planted in the orchard. All of these tree species can offer nesting sites (crevices), and can function as songposts.

11. DISCUSSION

The aim of this thesis was to create a design proposal for a residential courtyard that combines creating habitats for bird species with a courtyard that offers functions and recreation for the residents. The design was inspired by the needs of the birds in accordance with the method Animal-Aided Design. To achieve this aim, research questions concerning how a design of a residential courtyard in the district of Eriksberg in Uppsala, Sweden that is based on the needs of the species European robin and house sparrow can look like, and how the needs of the residents can be met at the same time were asked.

It can be assumed that nowadays the aim of increasing biodiversity is widely accepted within many professional fields. However, this widely accepted aim is also a broad one including a multitude of aspects. In this context, Savard, Clergeau and Mennechez (2000, p. 135) suggest that organisms that are to be supported, and measures that are to be taken should be defined, thus, concretising the aim of increasing biodiversity. In line with this, the method Animal-Aided Design (AAD) can be used by landscape architects to create habitats for one or several defined animal species (Hauck & Weisser 2015, p. 28). This thesis shows that the method AAD can be used as a guideline for designing a residential courtyard with the aim of integrating habitats for two bird species on the site. Furthermore, it proves that it is possible to combine the creation of such habitats with a design of a functional place for people. The design proposal of this thesis fulfils all factors crucial for survival of the species European robin and house sparrow, and includes aspects and elements based on background literature that have a positive impact on the perception of a courtyard by the residents. Thus, it provides an answer to the research questions of how a design based on the needs of the species European robin and house sparrow can look like and how the needs of the residents can be met at the same time.

AAD is a new method and to date there are no built examples of landscape architecture projects that use this approach. Therefore, evaluation of whether target species colonise the site designed by using this method is lacking. However, the example of the residential area *Fröschmatt,* shows that it is possible to design with the aim of attracting animal species, evaluation of this project showing that 6 out of 9 first priority target species occur on the courtyard one year after completion (Stadtgrün Bern 2018, p. 78). Even though this project is not designed with the method AAD, certain attributes are alike such as the definition of target species and specific elements associated with these target species that must be implemented in the design (Witschi 2014, pp. 11-15, 17-18). Similarly, species profiles within AAD point out critical factors that have to be fulfilled in order to create habitats that allow for target species to live on the site (Hauck & Weisser 2015, p. 25).

These species profiles are the central means when designing with AAD offering helpful information for landscape architects condensed into a concise format making it possible to get a general idea of the studied species and their needs. The critical factors leave room for creativity of landscape architects in terms of how to implement these factors into specific design solutions. While this can be seen as a positive aspect overall, landscape architects might also face difficulties as recommendations sometimes can be hard to interpret. For example, both species profiles for European robin and house sparrow state that bathing spots should not be situated too close to cover that can be used by predators as a hiding spot, but still close enough to cover for the birds to quickly find shelter if needed (Hauck & Weisser 2015, pp. 37, 39, 47). Interpreting what is close enough, but not too close can prove difficult for designers without deeper knowledge of the species concerned. Moreover, according to AAD, all critical factors on the species profiles have to be fulfilled in order to create functioning habitats (Hauck & Weisser 2015). However, the species profile for European robin, for instance, lists three different possible nesting sites as critical factors, and the question if the needs regarding all of these nesting sites have to be met on the courtyard arises, or if merely planning for one of the possible nesting sites could be sufficient and contribute to a functioning habitat. A cooperation with ecologists can be thought of as a possible solution to such problems, and can help landscape architects make adequate design decisions. On the other hand, species profiles also provide distinct advices, especially the plant lists are worth mentioning in this context, being a valuable aid in deciding on which plant species to incorporate in the design.

Since AAD is a method developed in Germany, species profiles describe species common to this part of Europe. This fact in combination with the low number of 15 published species profiles results in a limited choice of species when applying this method in other countries of Europe or the world. The choice of species to integrate in the design proposal of this thesis was limited as many of the species for which species profiles are available do not occur in Sweden. Moreover, living conditions and behaviour of species can differ depending on which country or area they live in, for instance, regarding overwintering, which means that some critical factors might not be applicable to the design when using this method outside of Germany. For example, in the case of the design proposal of this thesis, critical factors concerning overwintering of European robin could be left aside since this species is no resident bird in Sweden as it is in Germany, but a migrating bird instead. Even the plant lists on the species profiles include plants that do not occur in Sweden resulting in a lower number of possible choices of plants to integrate in the design. At the same time, there might be other plants native to Sweden, and important for the target species, that are not listed on the profiles. Consequently, species profiles should be developed or modified in collaboration with landscape architects and ecologists, depending on conditions and circumstances characteristic of the country they are to be used in. The species profiles developed so far within AAD can be used as an important framework for such work.

The risk of creating ecological sinks, if only some resources are provided while others are lacking (Hostetler & Reed 2014, p. 288), has to be considered when designing for urban wildlife. The ambition of AAD, however, is to meet the needs of the target species during all phases of life, i.e. providing essential resources during breeding season, for juvenile as well as adult birds and during winter (Hauck & Weisser 2015, p. 18). It can be assumed that by doing this, the risk of creating ecological sinks can be strongly reduced.

Eriksberg being the site of the design proposal of this thesis is in line with the opinion of several authors regarding the importance of spatial relationships between habitats and the need of linking green areas with each other (Hough 2004, p. 143, Goddard, Dougill & Benton 2010, pp. 93-94, Hess et al. 2014, p. 240). Designing habitats on courtyards is a possible way of enhancing biodiversity (Ryan & Partan 2014, p. 150, Hough 2004, pp. 146-154) and connecting existing habitat patches, and due to the location of Eriksberg close to several green areas and nature reserves this residential neighbourhood has the potential of becoming part of a bigger green infrastructure.

Designing for both birds and people involves certain difficulties. A feeling of safety is important, and therefore people wish for visually open spaces without dense vegetation (Berglund & Jergeby 1998, p. 73). On the other hand, many authors (Savard, Clergeau & Mennechez 2000, p. 138, Cerra & Crain 2016, p. 1839, Paker et al. 2014, p. 191) stress the importance of dense shrubs needed by birds for foraging and cover. In the design proposal of this thesis, this conflict is tried to be solved by placing plantations with dense vegetation close to facades, while otherwise using tall solitary shrubs that can create rooms around them, but ensure a visually open character

of the courtyard. Such planning for a mixture of open spaces and dense vegetation is also in line with the suggestion of Paker et al. (2014, pp. 190-192) who claim that such a design appeals to most bird species.

Planning for trees and shrubs to be situated close to facades, and for climbing plants to cover facades requires collaboration with architects as, for example, placement of windows can be affected. Since vegetation is such an important factor for creating habitats for birds, it should be possible for landscape architects to have an impact on architectural decisions. Moreover, even architecture plays an import role in designing habitats for many birds. For instance, as shown in the design proposal of this thesis, constructed holes in facades are important nesting sites for house sparrows. Therefore, landscape architects and architects working together can help achieve the goal of designing habitats for animals and places for people.

Bird feeders providing house sparrows with food during winter are a critical factor that should be integrated in a design of a habitat for this species (Hauck & Weisser 2015, p. 45). However, on courtyards in urban areas, feeding birds might be forbidden due to the risk of rats colonising the site. Even if this was the case on the site of the design proposal of this thesis, it can be assumed that the birds would be able to find enough food when overwintering. Areas with meadow and perennial plants as vegetation ground cover dominate the courtyard, and these plants provide seeds which are an essential food source for house sparrows. Moreover, many shrubs and trees providing berries are an additional food source during winter.

When designing a place for both birds and people, there are also many aspects that are easy to integrate with each other as they are appreciated by both people and birds. For instance, people value tall trees (Berglund & Jergeby 1998, p. 13), and such trees can be used as songposts by European robin (Hauck & Weisser 2015, p. 37). Dust bathing spots that are essential for house sparrows can be incorporated in the design by planning for stone dust paths and a boules court that makes it possible for the residents to engage in an activity, something that is important for many people if they are to spend time on their courtyard (Berglund & Jergeby 1998, p. 17). In summary, the design proposal shows that designing a courtyard for both the chosen bird species and residents can be accomplished without great difficulties. Nevertheless, it is important to note that the compilation of the needs of the residents in this thesis are predominantly based on one reference (Berglund & Jergeby 1998) providing one possible way of describing the needs of people regarding their courtyards. Thus, and because different people have different needs regarding their residential area, it is not possible to provide a complete list of needs of the residents that should be incorporated in the design. It can even be argued that it is not desirable to satisfy all possible needs of different people by including them in a design. Since there is a risk of needs of different people being contradictory to each other, the attempt of designing a place that suits every single person tends to be an impossible effort. However, the aim for landscape architects should be to design places residents living in the area can enjoy. Therefore, involving residents in the design phase is important, especially since living in neighbourhoods designed to attract urban wildlife requires a willingness to compromise by the residents. In this context, Savard, Clergeau and Mennechez (2000, p. 138) mention restricted use of pesticides and the need of not keeping pets that are potential predators of urban wildlife outdoors. Even in the example of the residential area *Fröschmatt,* residents must not keep cats outside (Schellenberger et al. 2014, p. 12). As these restrictions can be a problem for some people, raising awareness and understanding of the importance of wildlife-friendly design is crucial. The example of *Fröschmatt* shows that involving the residents in both the design phase and in the maintenance of their courtyard increases acceptance of the design, and contributes to an identification with the courtyard (Schellenberger et al. 2014, pp. 5, 21-24, 34). The design proposal of this thesis is created without consideration of participation of the residents, but such participation can be strongly assumed to be essential for a successful realisation of this type of projects. Therefore, investigating different ways of involving residents in the design and maintenance of biodiversity-friendly designed courtyards can be a subject of future research.

Furthermore, it must also be observed that the species house sparrow is common in urban areas, and used to people, being a species classified as an *urban dependent* (Riley & Gehrt in Rodewald & Gehrt 2014, p. 133), which can positively affect the compatibility of its needs with the needs of the residents. Needs of other species might be harder to integrate in a design, and a courtyard is not a suitable habitat for all animal species. Therefore, when designing with AAD, target species should be chosen depending on whether their needs can be met on the site of the design proposal. By deciding on which species to include in a design, landscape architects can strongly influence the appearance of the site, and it can be assumed that there is a risk of the choice of species being affected by personal preferences. Therefore, using a method or framework for choosing target species, like in the example of the residential area *Fröschmatt* where local species were chosen (Schellenberger et al. 2014, p. 9), is recommended. Moreover, it can be argued that ecologists should take part in this decision-making since they have better knowledge of local fauna and potential positive as well as negative consequences on the ecosystem due to introducing certain species on a site.

Due to the chosen method AAD and the limited number of species profiles published to date, the chosen target species for the design proposal are rather common species. Nevertheless, such common species can provide an experience of nature as well. Species that offer sensory experiences to people contribute to creating experiences of nature (Schellenberger et al. 2014, p. 13), and European robin and house sparrow attract the senses sight and hearing. Both chosen species of the design proposal of this thesis are small birds; a fact which, since small birds are especially appreciated by people in general (Bjerke & Østdahl 2004, pp. 117-118), can be thought to contribute to a better acceptance of the biodiversity-friendly design of the courtyard with, for instance, dense shrubs and meadows instead of lawn areas.

Many authors stress the importance of native plant species to urban wildlife (Moorman 2014, p. 304, Hostetler & Reed 2014, p. 293), for example, insects that other animals feed on depend on native plants (Hough 2004, p. 157). Native bird species also prefer native tree species to forage on (Paker et al. 2014, pp. 190-191). Despite the facts that urban wildlife is dependent on native plant species, and that also people appreciate native trees (Stadtgrün Bern 2018, pp. 136-137), public plantations often consist of few and exotic tree species (Hough 2004, p. 157). It can be argued that the widespread usage of exotic plant species has a negative impact on biodiversity as many animals depend on native plants for foraging. Therefore, plant species used in the design proposal of this thesis are predominantly native. However, questions occur concerning which plants can

be regarded as being native. The aspect of using native plants, and their contribution to biodiversity can be a starting point for further research on the topic. For instance, an investigation of what the word native can mean in this context, and which attributes classify a plant species as a native species can be of interest.

McCleery, Moorman and Peterson (2014, pp. 6-7) claim that watching urban wildlife can reconnect people living in urban areas with nature, and Bjerke and Østdahl (2004, p. 121) find that this is even an important reason for many people to go for walks. Since older people and children spend most of their time in their residential area (Berglund & Jergeby 1998, p. 44) courtyards can have an essential role in making it possible for residents who cannot walk far distances to experience nature close to where they live. By designing such outdoor spaces in a way that attracts urban wildlife, landscape architects can contribute to lifting this experience of nature even further.

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FIGURE LIST

APPENDIX

CHECKLIST SITE VISITS

- What is the proportion between green areas and hardscape?
- What does the vegetation structure look like? Are there different layers of vegetation?
- Which type of vegetation (trees, shrubs, perennials, climbing plants) can be found on the courtyard?
- What is the proportion between the different types of vegetation?
- Is there a diversity of plant species?
- Are native species being used?
- How can "messy" plantations be designed without people thinking nobody takes care of the place?
- Which materials are used for hardscapes?
- Which materials are used for built structures?
- Are there different "rooms" on the courtyard?
- How big are the different "rooms"?
- Which functions can be found, and which activities can take place on the courtyard?
- How many metres of primary and secondary seating are there?
- Where are seating areas located in relation to vegetation?
- Is there a personal touch? Can residents influence the appearance of the courtyard?
- How is the transition from private space (terraces) to semi-private space (courtyard) designed? Are there soft or hard edges?
- Is it obvious to visitors that the courtyard is designed with the aim to be a habitat for different animal species? Is there any information about the project?
- Are connections to areas outside/close to the courtyard designed in a certain way?
- Tall trees?
- Natural elements (wildflowers, ruderal species…)?
- Something to look at (view over green areas/nature)?
- Being able to watch one's children?
- Area to play?
- Private garden/terrace?
- Something to do, activities?
- Possibility of social interaction?
- Possibility of being on one's own?
- Several "rooms"?
- Visually open?
- Possibility of adding a personal touch?
- Possibility of development and change in use?

CHECKLIST FRÖSCHMATT

- What is the proportion between green areas and hardscape?
  Mostly green – see site plan
- What does the vegetation structure look like? Are there different layers of vegetation?
  Layers of vegetation consist of grass, low perennial plants, shrubs from 1 m up to 5 m, trees 3-5 m, tall trees about 18 m high
- Which type of vegetation (trees, shrubs, perennials, climbing plants) can be found on the courtyard?
  Tall trees, fruit trees, shrubs – grouped and solitary, perennials, grass, dead trees
- What is the proportion between the different types of vegetation?
  60% shrubs, 30% trees, 10% perennials
- Is there a diversity of plant species?
  Yes, e.g. Salix caprea, Sorbus aucuparia, Malus, Rosa, Sambucus nigra, Tilia, Crataegus, Corylus avellana, Kolkwitzia amabilis
- Are native species being used?
  Yes, mostly.
- How can "messy" plantations be designed without people thinking nobody takes care of the place?
  Paths show clearly where to walk, plantations can be "messy" next to paths, "messy" plantations are also play areas.
- Which materials are used for hardscapes?
  Gravel (paths), concrete next to one building
- Which materials are used for built structures?
  Natural stones (dry stone walls), wood (benches, picnic tables, fence, shed, roof), iron (water pump)
- Are there different "rooms" on the courtyard?
  Yes, play area, lawn (with two football goals), area with herb plantations, area underneath tall trees (hammock), area underneath roof (picnic tables were placed there at time of visit), fruit tree area, gardening area
- How big are the different "rooms"?
  The whole courtyard seems quite small, play area is not very big, but the whole courtyard can be used for playing. During the visit children were playing on the courtyard moving between the play area and other parts. Size of the different rooms – see site plan as well
- Which functions can be found, and which activities can take place on the courtyard?
  See question 10 (different rooms), there is even a table tennis table (old?), fire place, play area – water pump, little play house, old car tyres, dead tree for climbing
- How many metres of primary and secondary seating are there?
  Primary seating: about 14 m (6 m bench, 8 m picnic tables), secondary seating: about 10 m (7 m stone stairs at play area, 3 m blocks of stone)
- Where are seating areas located in relation to vegetation?
  Shrubs on a little hill (1,5 m high) behind secondary seating at play area (about 1 m distance from seating), portable picnic tables
- Is there a personal touch? Can residents influence the appearance of the courtyard?
  Yes, there is a place for gardening, shed with tools/ gardening items, toys outside, rabbit hutch
- How is the transition from private space (terraces) to semi-private space (courtyard) designed? Are there soft or hard edges?
  Hard edges, only balconies, there was a rope-ladder hanging from one balcony.

- Is it obvious to visitors that the courtyard is designed with the aim to be a habitat for different animal species? Is there any information about the project?
  Wild atmosphere, but no further information
- Are connections to areas outside/close to the courtyard designed in a certain way?
  Hedges bordering towards streets

- Tall trees?
  4 (about 18 metres high)
- Natural elements (wildflowers, ruderal species…)?
  Yes, ruderal species, free-growing shrubs
- Something to look at (view over green areas/nature)?
  Green courtyard, easy to overlook
- Being able to watch one's children?
  Yes, easy to overlook
- Area to play?
  Yes, a play area with natural elements, lawn, the whole courtyard can be used to play
- Private garden/terrace?
  No
- Something to do, activities?
  Yes, different activities: gardening, relaxing, playing, fireplace
- Possibility of social interaction?
  Yes, gardening, residents are responsible for maintenance of the courtyard
- Possibility of being on one's own?
  Hard to say as there are only few areas for seating overall, privacy on balconies
- Several "rooms"?
  Yes
- Visually open?
  Yes
- Possibility of adding a personal touch?
  Yes
- Possibility of development and change in use?
  Partly, lawn can be used for different activities

CHECKLIST HARDEGG

- What is the proportion between green areas and hardscape?
  See site plan, very green, only small paths on grass/meadow area
- What does the vegetation structure look like? Are there different layers of vegetation?
  Ground vegetation (grass/meadow), low shrubs, shrubs (about 2,5-4 m high), trees (about 8-10 m high)
- Which type of vegetation (trees, shrubs, perennials, climbing plants) can be found on the courtyard?
  Trees, shrubs – solitary tall shrubs, smaller shrubs in groups, perennials
- What is the proportion between the different types of vegetation?
  70% shrubs, 30% trees
- Is there a diversity of plant species?
  Yes, a lot of different Salix species, Hippophae rhamnoides, Berberis, Alnus glutinosa, Crataegus, meadow
- Are native species being used?
  Yes, mostly
- How can "messy" plantations be designed without people thinking nobody takes care of the place?
  Would be interesting to see in summer when meadow is in bloom, there are free-growing shrubs, small paths (round concrete stones) make it possible to walk through and show that it is okay to walk there/use the place
- Which materials are used for hardscapes?
  Concrete (round stones – paths), gravel and rolled asphalt (in front of entrances of the buildings)
- Which materials are used for built structures?
  concrete
- Are there different "rooms" on the courtyard?
  Round activity areas at a lower level (play areas) distributed, stream, houses function as borders and help to create "rooms", visually open
- How big are the different "rooms"?
  see site plan

- Which functions can be found, and which activities can take place on the courtyard?
  Play in all round areas, walking along stream (possible to cross it at some points)
- How many metres of primary and secondary seating are there?
  About 33 m primary seating, secondary seating along all round activity areas
- Where are seating areas located in relation to vegetation?
  On areas in front of entrances, no planned seating close to vegetation, but there are two tables and chairs that people put out underneath a tree
- Is there a personal touch? Can residents influence the appearance of the courtyard?
  Not really, only on balconies and terraces
- How is the transition from private space (terraces) to semi-private space (courtyard) designed? Are there soft or hard edges?
  Hard edges, terraces have got concrete paving – hard edge against green ground cover, strong contrast between "hard" and edgy houses and the green "wild" courtyard
- Is it obvious to visitors that the courtyard is designed with the aim to be a habitat for different animal species? Is there any information about the project?
  Feels "wild", no further information
- Are connections to areas outside/close to the courtyard designed in a certain way?
  Open towards area outside (foot and bicycle path), soft edge towards the outside in the east

- Tall trees?
  Not yet
- Natural elements (wildflowers, ruderal species…)?
  Yes, meadow, free-growing shrubs, stream
- Something to look at (view over green areas/nature)
  Very green courtyard
- Being able to watch one's children?
  Visually open, but very large area making it impossible to watch children all the time
- Area to play?
  Yes, several designed play areas, stream, shrubs

- Private garden/terrace?
  Partly
- Something to do, activities?
  Play, walking
- Possibility of social interaction?
  Not really, design does not support social interaction
- Possibility of being on one's own?
  Yes
- Several "rooms"?
  Type of plantation is the same on the whole courtyard, but buildings create rooms, feels still very open
- Visually open?
  Yes
- Possibility of adding a personal touch?
  No
- Possibility of development and change in use?
  No

CHECKLIST DIESSBACHGUT

- What is the proportion between green areas and hardscape?
  65% greenery, 35% asphalt roads
- What does the vegetation structure look like? Are there different layers of vegetation?
  Ground vegetation (grass), low shrubs, shrubs (up to five metres high), trees (up to about 20 metres high), climbing plants, moss, different layers support a feeling of being in a forest
- Which type of vegetation (trees, shrubs, perennials, climbing plants) can be found on the courtyard?
  Tall old trees, shrubs, perennials, climbing plants, dead trees
- What is the proportion between the different types of vegetation?
  10% grass, 55% shrubs, 35% trees
- Is there a diversity of plant species?
  Yes, many different species, e.g. Betula pendula, Prunus, Ilex aquifolium, different Salix species (an old Salix caprea among others), Hedera helix
- Are native species being used?
  Mostly native, but even exotic species
- How can "messy" plantations be designed without people thinking nobody takes care of the place?
  Hedera helix climbing on trees and dead trees give a natural feeling, but for instance the lawn and hardscapes show that people use and take care of the place.
- Which materials are used for hardscapes?
  Asphalt and gravel
- Which materials are used for built structures?
  Natural stone
- Are there different "rooms" on the courtyard?
  A play area, water, rooms between plants, an old fountain used as plantation area with herb plants
- How big are the different "rooms"?
  Quite small rooms within vegetation
- Which functions can be found, and which activities can take place on the courtyard?
  Play (sandpit), grill, tree house
- How many metres of primary and secondary seating are there?
  About five metres primary seating, secondary seating around the old fountain (about 18 metres)
- Where are seating areas located in relation to vegetation?
  Secondary seating is facing vegetation, quite close at some points (distance about one to two metres)
- Is there a personal touch? Can residents influence the appearance of the courtyard?
  Yes, strings of pennants and swing in trees, tree house, toys lying around, two hammocks, private gardens
- How is the transition from private space (terraces) to semi-private space (courtyard) designed? Are there soft or hard edges?
  Although there are fences between terraces and courtyard the edges are quite soft since ivy grows on the fences and it is possible to see the terraces.
- Is it obvious to visitors that the courtyard is designed with the aim to be a habitat for different animal species? Is there any information about the project?
  Not relevant in this case
- Are connections to areas outside/close to the courtyard designed in a certain way?
  Closed courtyard
- Tall trees?
  Yes
- Natural elements (wildflowers, ruderal species…)?
  Yes, dead trees, ivy climbing on trees, free-growing shrubs
- Something to look at (view over green areas/nature)?
  very green courtyard
- Being able to watch one's children?
  Vegetation is very dense making it difficult to watch one's children, but play area is more open and therefore possible to see
- Area to play?
  Yes, a play area with sandpit, shrubs, tree house
- Private garden/terrace?
  Yes, there are private terraces and private gardens
- Something to do, activities?
  Play, relaxing, grill
- Possibility of social interaction?
  Strings of pennants in trees indicate that courtyard is used for social interaction
- Possibility of being on one's own?
  Yes
- Several "rooms"?
  Yes, rooms between plants/within dense vegetation
- Visually open?
  No
- Possibility of adding a personal touch?
  Yes
- Possibility of development and change in use?
  No