TU Delft

Reflection
12 Mai 2022

The Nature-Inclusive Redesign

The possibilities of nature-inclusive redesign in Dutch urban monumental buildings

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The studio

The choice for the studio Heritage & Architecture: Vacant Heritage stems from the subject of the studio, which fits well with my personal fascination with monumental buildings. Monumental buildings tell a story and possess many cultural, social, architectural, technical and environmental values. A large number of these buildings are not or hardly used. I see it as a challenge to make such buildings part of society and let visitors experience these values. I also find it interesting to discover the history of a building or location which makes the case more and more interesting. I'm curious about the traditional building methods, such as the purpose of certain elements, the materials used and how details are constructed. I also like to discover the possibilities of redesign in an existing case, instead of starting with an empty canvas, where much more is possible.

The subject

The subject of my graduation project is Nature-inclusive redesign of monumental buildings in an urban context. Over the last century, biodiversity has come under increasing pressure. This is also the case in the urban context. The preservation of biodiversity is important. It forms the basis of our food chain, maintains the quality of the soil, filters the air and keeps the ecosystem in balance (Wageningen University & Research, n.d.). In addition, biodiversity enriches the living environment. Research shows that part of this biodiversity is largely dependent on the buildings and vegetation in the city and to help this biodiversity we need to build as nature-inclusive as possible.

There is a wide range of nature-inclusive options that can be applied to make a building and its environment more nature-inclusive (Arcadis, 2018; Gemeente Amsterdam, 2018). The application of nature-inclusive aspects in the design of new buildings are easy to implement, and relatively inexpensive through minor adjustments, because of the blank canvas (Helling, 2020). However, the aspects are more difficult to integrate into existing buildings. Especially in monumental buildings, where multiple constraints have to be considered. Monumental buildings possess values that must not be substantially affected. The adaptations must be structurally and spatially possible. In addition, there is an existing plot and building shape (form, height, and orientation). It also depends on the presence of certain building elements and the facade materialisation. The above shows that implementing nature-inclusive options in new buildings is easy. On the contrary, for monumental buildings it is currently unclear if and if possible what should be considered in order to make this group more nature-inclusive.

But it is precisely making monumental buildings more nature-inclusive that is important. These buildings have a higher age, frequently leak a lot of heat to the outside and often possess many holes and cracks, in which fauna has gladly taken up residence over the years. By redesigning these buildings, fauna is disturbed, heat leaks are reduced and holes and gaps are closed, eliminating animal habitats. By making these buildings nature-inclusive, the animals can also be brought back into these buildings. Also, making the monumental building and its surroundings nature-inclusive increases its ecological value and thus contributes to its preservation. In addition, it greatly enhances the quality of the living environment for both humans and animals.

Research based design

The research seeks answers to the following question: ''How can Dutch monumental buildings in an urban context be redesigned to be more nature-inclusive?'' This research is validated with a design of the monumental Koudenhorn building in the urban context of Haarlem. From this follows the

following design question: ''How can the monumental building Koudenhorn in the urban context of Haarlem be redesigned to be more nature-inclusive while retaining its heritage value?''.

The monumental Koudenhorn building stands in the urban context of Haarlem. It is a building with a story and many values. On the building and the plot even a limited amount of nature-inclusiveness can be found at the moment, which makes this a good case for my graduation project (see figure 1).

Figuur 1: Existing situation courtyard

To make the building more nature-inclusive, a start was made with establishing a number of design criteria. The first is to look at the potential of the building without the need for major interventions. Also, the aim is to apply the nature-inclusive possibilities on the facade instead of the plot. The reason for this is that the nature-inclusive possibilities will be more sustainable and likewise the sustainability of the building will be increased. Thirdly, a nature-inclusive potential should not detract from the heritage value of the building with the reason to preserve and where possible enhance this value. Fourth, its application should not be at the expense of the functionality of the building for both people and animals. In addition, nuisance caused by the application of the possibilities must be avoided as much as possible. Lastly, the nature-inclusive intervention must be proportionate to the added ecological value. How these criteria were expressed will be discussed later.

To answer the research question, a start was made with creating a theoretical basis. This revealed the benefits of a nature-inclusive building for its human and animal users (see figure 2). This provided a scientific basis for making design decisions. As a result, a lot of greenery was used in the building itself. For instance, all the porticoes were eventually equipped with a green walls and indoor gardens were installed in the community centre and the main entrance. In the adjacent building, a botanical café-restaurant was designed, where one can eat and drink amidst the greenery. Here you will find a large indoor garden, in which certain species of birds and butterflies fly around freely (see figure 3). In addition, I wanted to improve the connection from the various functions to the nature-inclusive

environment. By making use of a porticoes, the positioning of the residences and the realisation of maisonettes, almost all residences are oriented towards two sides and connected to the nature-inclusive courtyard and surrounding (see figure 4). By realising balcony roof dormers, roof terraces, balconies, balcony windows and openable windows, among other things, the connection with nature has been strengthened (see figure 4).

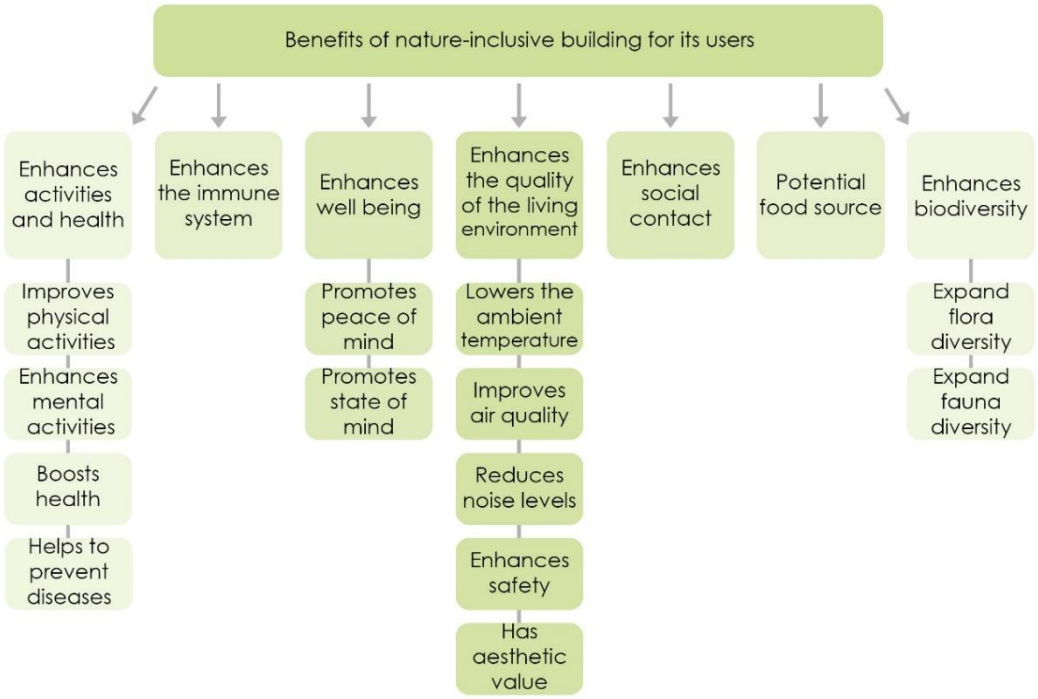


Figure 2: Diagram of the benefits of nature-inclusive building for its users

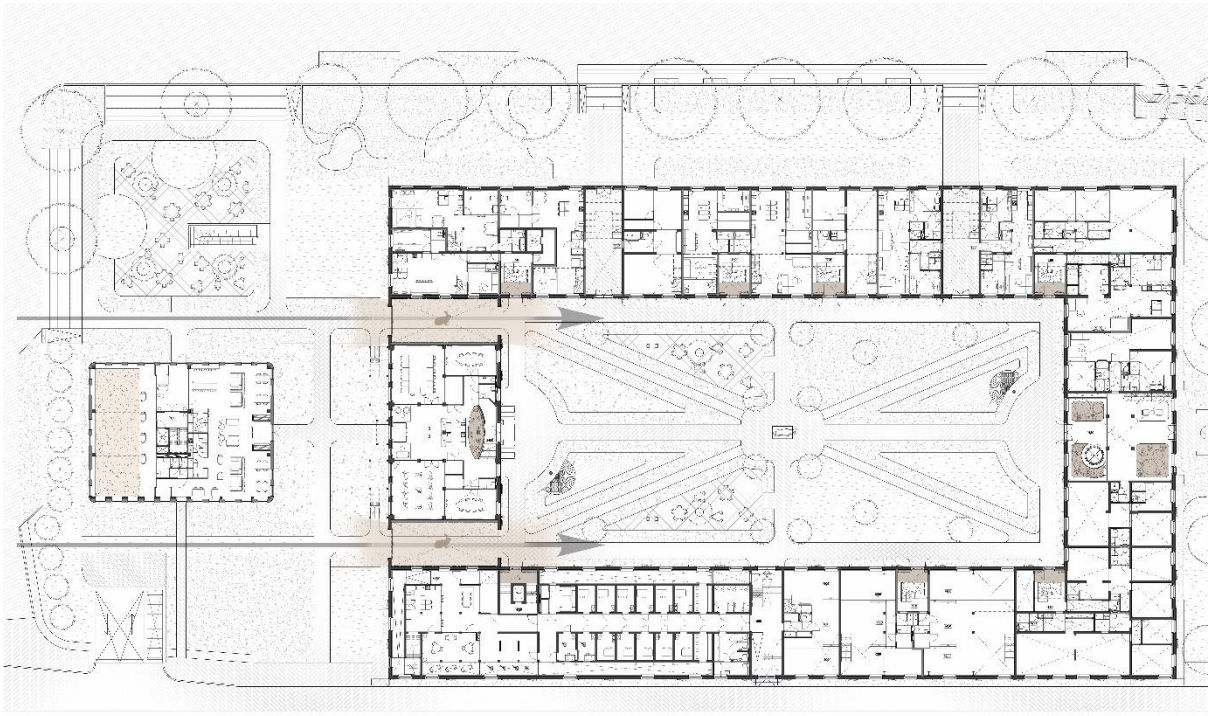


Figure 3: Ecological interventions in the building

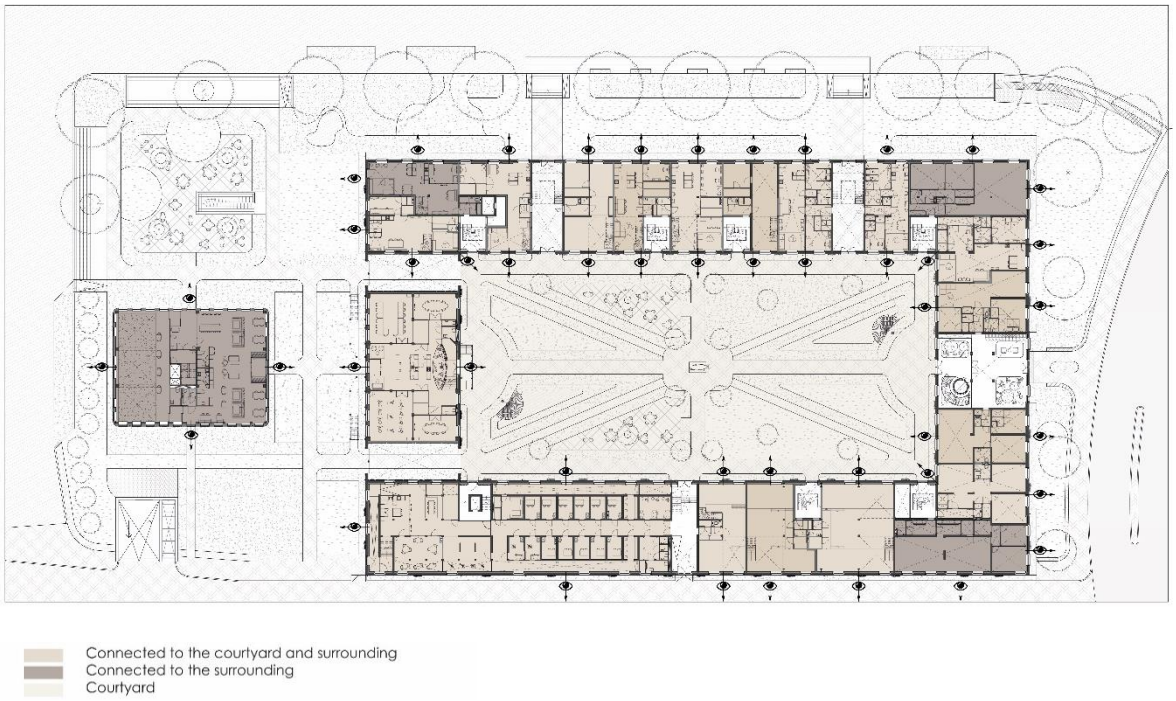


Figure 4: The connection of the interior spaces with the nature-inclusive courtyard and surrounding

Figure 5: Facade courtyard North

The research question is answered with a toolbox and three decision trees split into the categories: flora, water, and fauna. The decision trees provide insight into which nature-inclusive options could be applied to a case study and which aspects would need to be modified to enable application. To fill in the decision trees, certain case study analyses have to be carried out. The decision trees were filled in for the monumental part of the Koudenhorn building. This showed which nature-inclusive possibilities are applicable and on which specific elements. Ultimately 17 of these possibilities were applied in the design. These include green roofs, roof gardens, a brown roof, facade greenery, trees, shrubs & hedges, (flowery) planting, natural pavement, branches & tree trunks, a blue roof, natural ponds, ecological puddle, floatlands, all kind of fauna residencies, the connection of ecological structures, preventing window casualties and preventing annoying light (see figure 6). The toolbox

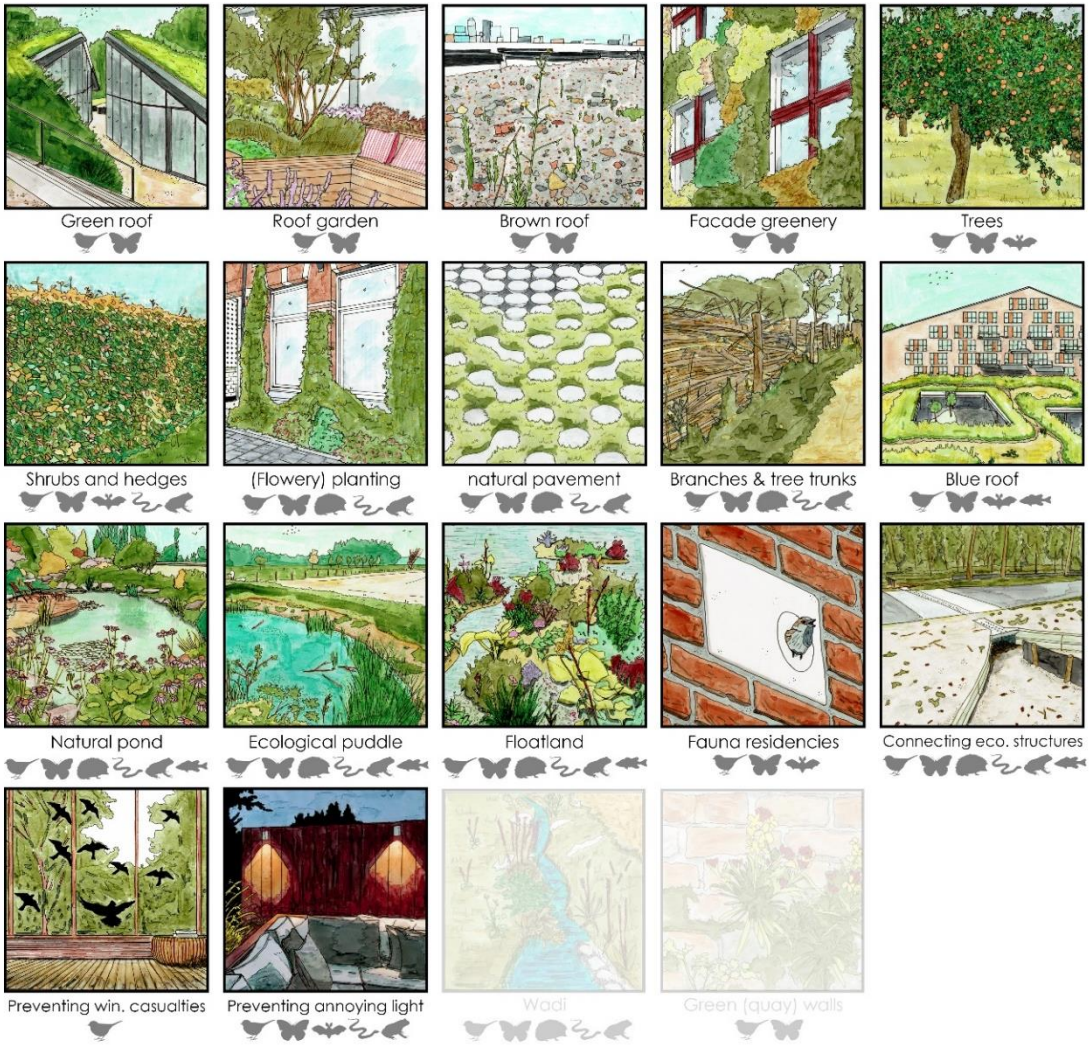


Figure 6; The used nature-inclusive possibilities

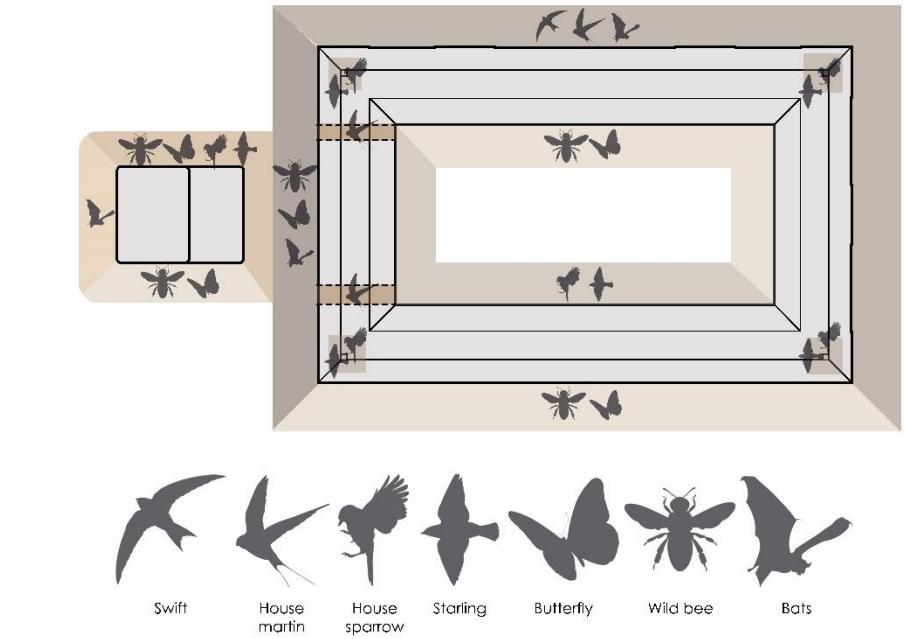


Figure 7: The fauna zones

includes a clear description of what the nature-inclusive option entails, the additional points of

interest and an optional design. This toolbox was then used to integrate the application into the redesign of the Koudenhorn building.

The described possibilities from the toolbox are focused on a number of bird, mammal and insect species that are highly dependent on the Dutch urban environment. Further research has been conducted on the species that live in or on buildings. The individual specific requirements of the

Figuur 8: Impression courtyard zone

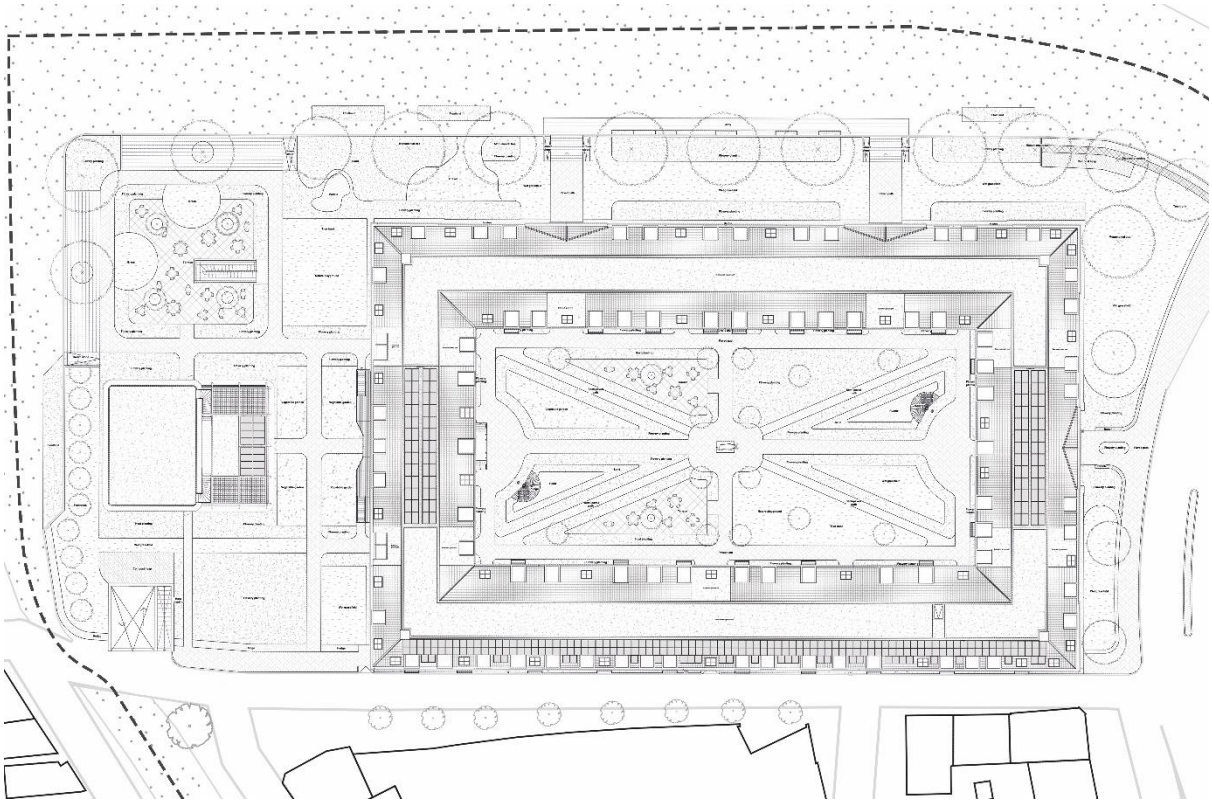


Figure 9: The nature-inclusive building and plot

Figure 10: The nature-inclusive building and plot

species were used in the redesign to create the ideal habitat for these species in the different zones on the plot (see figure 8 & 9).

The analyses also revealed what nature-inclusive problems the plot possesses. By understanding this, these problems could be addressed in the redesign. For example, the problem analysis revealed the lack of nature-inclusiveness on the lot and the building, which has changed with the application of the nature-inclusive opportunities described earlier. In addition, the ecological tree structure is interrupted at the Northern and Western plot boundaries. In the redesign, trees were planted at this position. A continuous green structure is completely lacking and this nature-inclusive redesign is a good first step. Other locations may link up in the future. In addition, the courtyard appeared difficult to reach for the non-flying fauna. This is because these areas are enclosed by the building. In the redesign, the Western courtyard has disappeared and made way for a nature-inclusive park. The Eastern courtyard is linked to the existing ecological structure by creating two gates in the Western wing that act as fauna passages (see figure 3). It was also found that there are busy roads and paths on the lot and adjacent to the lot that pose a hazard to wildlife. In the redesign, this problem has been solved by removing the busy road on the lot and impeding the access to the adjacent road by installing a guidance screen. The lot is currently separated from the ecological water structure by +/- 2 meter high quay walls. To improve this connection, stairs and vegetated ramps have been installed in the quay walls and floatlands and a jetty have been placed in the water. Also the bicycle shed, car parking and a wall form fauna blocking elements on the lot. The bicycle shed and car parking were moved to an underground basement and the wall was removed. The roof windows of the monumental building and some of the windows in the addition, seem to form a passageway or are highly reflective, causing window casualties. Some of the roof windows have been removed and those that remain have been fitted with a rod arrangement. Again, some of the windows in the addition

were removed and some replaced to avoid the problem. Lastly, there was the disturbing light emission from a number of lamps on the lot. These lamps have been replaced by other fixtures and equipped with less bright light in a yellow-orange non-intrusive color. All this shows the influence of the research on the design (see figure 9).

Research process

In order to answer the central research question, a number of subquestions were first addressed. The first sub-question concerns the benefits of nature-inclusive buildings for their human and animal users. This was done by means of literature research in books, scientific articles, reports, web articles and websites. Because there was a lot of information to be found on this subject, I was able to come up with a proper scientific basis. In my opinion, this sub-question provides a good rationale for the choice of nature-inclusive building. The advantages given can be used as arguments in the redesign. Next, a residential building by landscape architects Buro Harro at the Groenmarkt in Amsterdam served as a case study to provide insight into nature-inclusive building. In retrospect, this case study may have been of little added value to the research and would have been discarded in the future.

In the second question, a literature search provided insight into which animal species the nature-inclusive options are aimed at and the reason behind this. However, less literature was available on this subject and the sources used were difficult to understand, which took up a lot of time. Then, following my tutor's suggestions, I investigated in more detail the above mentioned animal species that like to live in or on buildings. This was done with the aim of being able to focus on these in the design. Afterwards, I am satisfied with the result of this sub-question.

Subsequently, by means of literature and observation research in books, scientific articles, reports, internet articles and websites, an overview was made of the nature-inclusive possibilities that exist. I am pleased with the large number of nature-inclusive options that were examined in the toolbox. In the end, there were 20 of them, some of which were further subdivided. This has a positive effect on its operation of the toolbox. Many of the possibilities were already known to me. I had hoped for more new applications in advance. However, it is good to have an overview of the possibilities that are available. Each possibility was visualised with a hand sketch that works well in the research to make the research visually attractive. After that, a lot of information was collected to give an explanation of each possibility and a description of what needs to be considered when applying it to a monumental building. At this point, I realised that the research work was very time-consuming and that I would not be able to follow my preconceived plan of making a principle detail of everything. Therefore, I was only able to do this for the important ones. In retrospect, I think this is a pity, because it could have significantly increased the quality of the toolbox.

At the time of writing my research plan, I was only going to design the toolbox. Later, my research supervisor gave me the idea to make a decision tree. This was a good idea to increase the application of the toolbox. However, developing the decision tree turned out to be a complicated task. Because of the many forms it can take and the great variety of points of interest in the application to monumental buildings. This is why I finally decided to split up the nature-inclusive possibilities into the categories: flora, water and fauna and to subdivide them into different building and plot parts (roof, facade, windows etc.). This resulted in three different decision trees. I was then able to further specify these and, in my opinion, developed useful decision trees.

Due to lack of time, I never got around to addressing the fourth sub-question. Here I had planned to investigate which vegetation species are suitable for nature-inclusive options. In retrospect, I do not consider this a limitation of the final result.

In the final sub-question, the designed decision trees are tested in the monumental Koudenhorn building. For this purpose, a number of analyses were carried out, after which the decision trees could be filled in. As mentioned before, the decision trees turned out to be too generic. After adjusting them and specifically filling in the elements, the decision trees turned out to be useful and a list of applicable nature-inclusive possibilities followed for the various elements. In the planning I intended to test the decision trees on two other case studies. In the end I did not manage to do so. This may limit the validation of the decision trees. It is possible that they could have been further refined by testing them on several case studies. Possibly, the decision trees can be tested in the case studies of other students.

My tutor drew my attention to a lecture by the BNA on nature-inclusive building. This lecture proved very inspiring for my design and also for the finalisation of my research. Finally, the central research question is answered by a summary of the research done and a description of the use of the toolbox and decision trees.

Further research

As a result of my research, a lot of follow-up research is needed. First of all, the toolbox can be expanded with nature-inclusive possibilities that will appear in the future. In addition, this research focuses on the possibilities for the building façade and the plot. Also the possibilities for inside the building can be investigated. This research focuses on birds, mammals and insects (bees and butterflies), but the possibilities for other animal and/or plant groups can also be investigated. Possibly, it could be examined how the use of the decision trees can be promoted, such as digitalising the decision trees and the toolbox.

Design process

At the beginning of the year, a number of workshops were organised with the aim of getting a clearer picture of the functions that could be designed in the building. Analyses of the surroundings were made for this purpose. This quickly gave me an insight into what functions I might want to design in the building. I also enjoyed making the essential models and they gave me important insights on which I wanted to focus in my design proposal.

In the second period, I went to analyse the building and its surroundings with the other students who had chosen the same case study. It turned out to be a complicated large building. A large part of the analyses went well, but there were also a lot of trouble. This was due to the fact that some people in the group did not work for a long time and there was also a lack of available information. The documents we had received from the atelier Politiebouwmeester at the start of the project turned out to be far from accurate. Contact with architects who had worked on the building also yielded very little in retrospect. A visit to the Haarlem archives did provide us with a number of construction drawings. However, this only concerned some outdated cross-sections and floor plans of a part of the building. A second visit to the building was long delayed, so that we had to work with many assumptions in a number of analyses. After studying the analyses made, we succeeded in forming a design proposal. Afterwards, I had made too little time for this. This is because in the second period, my focus was mainly on the research and the design fell behind. I saw the research as a very

important basis for the design, so it was given priority. In the future, I should have achieved a better balance in this. At the P2 presentation, the research done and the design proposal were presented. Partly because of the above, I did not make it through this presentation. As feadback, I got to focus more on what the building is and the qualities of the building itself and the interventions related to the building. Also as the nature-inclusive possibilities and problems on the plot. In retrospect, I thought this was very justified feadback, because I missed it myself. After working hard on the parts I mentioned earlier and with personal guidance, which helped me a lot, I succeeded with the retake presentation.

After the retake presentation, I was busy drawing up a number of starting points for the design, such as determining the target group, the programme of requirements and a personal vision. I noticed during this period that this acted as a good guide for me. By setting up a digital model, I was able to quickly create many possible floor plans. This also gave me a much better understanding of how the building was exactly put together. In the weeks that followed, the design progressed steadily in all kinds of areas. During the coaching sessions, my attention was drawn to many inspiring projects. This was very stimulating for my own project. The various supervisors also gave me a number of points of attention, which allowed me to improve the design. This period flew by. The P3 presentation came too quickly for me, but it also forced me to make a statement about all kinds of aspects, which I develop further in the final period. The presentation itself went well. As important feedback, I received a number of points for attention in the design and to focus more on the heritage quality that I use and how I improve it. I was also told to incorporate nature inclusiveness as a red thread in my design. This is what I want to focus on in the final period.

The last period flew by. During this period, the consultations helped me a lot. Like the climate consultant and the many technical consults, which made the design in the technical field undergo great progress. Unfortunately, I did not get to work on a number of remarks during this period and I want to incorporate them in the fifth period.

During this graduation period, I have tried to stick to my research plan and schedule. This has been largely successful so far and has also given me something to hold on to.

Nature-inclusive redesign and the educational programme

The Heritage & Architecture studio Vacant Heritage considers sustainable development as a goal for the time ahead. It wants to improve the connection between reuse and building development, while preserving the heritage value of the built environment. It sees the preservation and use of vacant built heritage as a good alternative to meet the high market demand for functional space. Making built heritage sustainable and functional are important factors for its preservation. (Heritage & Architecture, 2021)

My graduation subject of nature-inclusive redesign examines how a monumental building can be reused and/or redeveloped in a more nature-inclusive way while retaining its value to meet current functional demands. Making a building more nature-inclusive is an important aspect in making a building sustainable. In addition, nature-inclusiveness also improves the spatial quality of a building, because it lowers the ambient temperature, improves air quality, reduces noise levels, promotes safety and has an aesthetic value.

Furthermore, nature inclusiveness is not only in the Netherlands but also internationally an emerging theme in architecture. At the moment, there are only a few nature-inclusive buildings in the Netherlands, but this number is rising steadily. There are also strong indications that in the future

large-scale tenders in the Netherlands will be granted partly on the basis of a nature-inclusive points system. Besides improving the spatial quality of a building, nature-inclusive construction also has a positive influence on its human and animal users. For example, it promotes activities, health, the immune system, well-being and social contacts. For this reason, an increase in knowledge about nature inclusiveness is important for architecture.

Nature inclusiveness takes place on different scale levels. From green & water structures on the urban level, to designing a building and its plot down to the finest detail. This makes it a theme that fits in well with the Master of Architecture, Urbanism & Building Sciences, as it deals with these different levels of scale.

Nature-inclusive redesign and the social, professional and scientific relevance

The collective research results of the S.B.T. research line resulted in the research book: Spatial Building Typology on Dutch Police Real Estate. This will be the second volume in the S.B.T. book series. This book is a broadening of the existing literature and provides insights into how and why the spatial aspects of the specific building type, Dutch police real estate affect redesign. This research provides the Dutch police with an insight into how their buildings could be redeveloped. (Heritage & Architecture, 2021)

The individual study clearly lists a wide variety of nature-inclusive possibilities. In addition, this study analyses the applicability of these possibilities to Dutch monumental buildings in an urban context and offers a method to make this group of buildings more nature-inclusive. The study of this specific group is an extension of the existing literature.

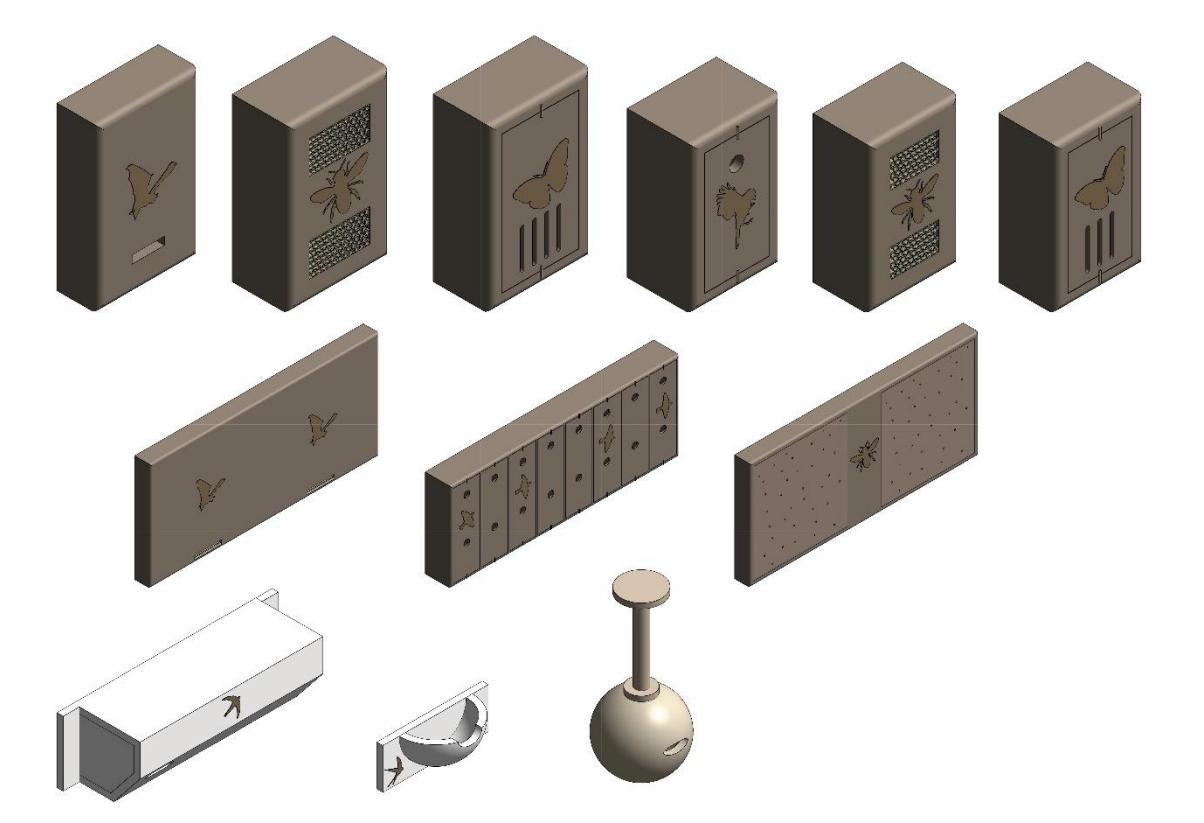
The group of Dutch urban monumental buildings involved is large, because it involves three different types of built monuments: national monuments, municipal monuments and provincial monuments. In August 2021, there were 61,809 national monuments in the Netherlands, these are mainly residential houses and residential complexes (Rijksdienst voor het Cultureel Erfgoed, 2021). The number of municipal monuments was estimated at 55,801 (in 2015) and the number of provincial monuments at 811 (in 2019) (Rijksdienst voor het Cultureel Erfgoed, 2020). A large proportion of these monuments are located in an urban environment. This shows that the survey is carried out for a relevant number of buildings. The research can also be used for non-monumental buildings in a Dutch urban environment.

This individual research is of practical relevance. The toolbox helps designers and owners of Dutch urban monumental buildings to make their buildings more nature-inclusive. The redesign of the monumental Koudenhorn building in the urban environment of Haarlem tests the results of the research. The further goal is to be socially relevant. Making these monuments more nature-inclusive helps nature and reduces the pressure on biodiversity. Human beings depend on this biodiversity because it forms the basis of our food chain, maintains the quality of the soil and filters the air (Wageningen University & Research, n.d.). In addition, research also contributes to solving other serious environmental problems that threaten man and nature. Moreover, it has a positive effect on the users of the city and the redeveloped estates, thereby enriching the urban built environment (Wageningen University & Research, 2018; Jenssen et al., 2014; Kabisch et al., 2018).

The ethical issues and dilemmas of a nature-inclusive redesign

During the nature-inclusive redesign of the monumental Koudenhorn building, a number of dilemmas arose. First, there was the question to what extent the building could be adapted without losing its heritage values. For this reason the design chose to keep the most representative North façade recognizable by not applying any façade greenery and green, brown or blue roof. However, in this façade fauna accommodations have been appropriately applied, such as the integrated bat nesting stones in the brick façade and the unobtrusive swallow boxes at the eaves. In the remaining facades, more nature-inclusive options have been applied. Also, on the exterior of the monumental entrances, no nature-inclusive interventions were made. The inside of the entrances has been changed considerably. Here walls and floors have been removed to create spatial passages. The nature-inclusive applications are applied symmetrically and balanced in the facades. In order to avoid losing the recognizability of the building. There was also the question of whether the highly valued roof edge should be modified to provide accommodations for fauna within or behind it. In the end it was decided not to make any changes here. Also there was the dilemma between usability and nature inclusiveness. For example, natural pavement is less integrally accessible and for this reason it was decided not to apply it everywhere. Also, when applying facade greenery, it was not allowed to drastically affect the view of the courtyard and the incidence of light. For this reason the facade greenery was placed at a distance from and between the facade openings. There was the question of removing the blocking bicycle shed and car parking next to the water. This would create more space for nature and connect the lot with the existing ecological structure. However, the need for parking remained and it was finally decided to construct an underground parking garage. The fauna accommodations were designed and positioned taking into account the specific housing needs of the fauna species. Also, the question remained to what extent the building had to be adapted to enable the application of the nature-inclusive possibilities that emerged from the research. An example of this is that the supporting structure of the bitumen roof on the monumental building was not strong enough for the application of an intensive green roof. This would have required substantial reinforcement of the structure. Ultimately, the decision was made to look at what the existing building currently has to offer and to adjust the nature-inclusive options accordingly. Partly for this reason, the facade greenery with a substructure was placed at 15 cm from the facade in order to prevent damage to the facade by the vegetation and moisture problems in the facade. In the fauna passages and in the new building, facade greenery in substrate attached to the facade was used. This was possible because the structure of the facades differs in this case and less moisture problems will occur here. As many nature-inclusive options as possible were applied to the facades. A set of fauna accommodations was designed that are integrated into the facades of the building and also serve as ornamentation (see figure 11). Additionally, there was the dilemma between nature inclusiveness and the potential nuisance this causes. Through clever design this could be countered. The fauna accommodations are not placed above windows and in the fauna passages the swallow's nest balls are hanging next to the walkway. The already existing niches in the West flank are provided with fauna accommodations. However, these niches are located above facade openings. By matching the species in this way, nuisance could be avoided. Finally, there was the question of whether adding a

nature-inclusive opportunity is proportional to the added ecological value. Because of the expected limited added value of a green quay walls this was not applied.



Figuur 11: Fauna accommodation façade monument

In practical application, the dilemma arises between costs, space and the added ecological value of the intervention. It is important that not only the potential added value is considered, but also all other benefits that nature-inclusiveness brings (see figure 2). In addition, research shows that nature-inclusive building is quite good for the business case. In addition, the application must take into account who is responsible for future maintenance and possible associated costs. It is advisable to think about this and make agreements early on. In addition, a nature-inclusive building could cause a nuisance, due to the mess, odor and noise it may cause. On the one hand, this problem can be partially eliminated by the proper design of nature-inclusive applications. On the other hand, the user of the building can be chosen in such a way that they will not be bothered by this. Another aspect is that regulations can hinder the application of nature-inclusive options, such as the building code and the welstand committee. This calls for a way of thinking that is changed, in which the interests of the ecology are put first and the cramped way of thinking is broadened.

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