

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Ella Marie Wildenberg
Student number	4485491

Studio		
Name / Theme	Architectural Engineering	
Main mentor	Mauro Parravicini	Architecture
Second mentor	Nico Tillie	Urban Ecology
Argumentation of choice of the studio	I want to find a technical solution that can be applied in architecture to improve the biodiversity in dense urban areas	

Graduation project	
Title of the graduation project	Nature inclusive architecture in Sloterdijk Centrum "Humboldt"
Goal	
Location:	Sloterdijk, Amsterdam
The posed problem,	There is a need for more integral ecological design in architectural development to improve the quality of life for animal and plant species in the urban context. Specifically in Sloterdijk Centrum lies the opportunity to improve the biodiversity and connect larger natural areas of the Brettenscheg.
research questions and	How does the integration of nature inclusive design interventions into the building envelope support local biodiversity in an urban environment?
design assignment in which these result.	Create a building that functions properly for human use and dwelling, but that also contributes to the local natural environment; a design based on guidelines derived from ecological analysis and nature inclusive design research, and studies into timber construction, urban context and human needs.

Sub research questions

1. What is nature inclusive design?
2. What is the local biodiversity in Sloterdijk Centrum?
3. What technical and architectural design interventions are there to integrate plant and animal species into a building envelope?

Process

Method description

Research methods

Nature inclusive design

To investigate nature inclusive design the research analyses the state of the art and develops a definition that works for this project. The research also investigates the development of nature inclusive design in the Netherlands and precedents of nature inclusive design in high rise buildings. Concerning the last category, I have formulated criteria for the selection of projects:

1. The building has to be realized
2. The building should include interventions for both animals and plants
3. The building height should be at least 30 meters
4. It has to be a detached building
5. It has to be in an urban context

The research provides inspiration for the design and a state of the art that the design can be compared with at the end of the graduation project.

Local biodiversity

Informed by a more general (Dutch) urban ecology analysis, the answer to this sub research question focuses on site-specific animal species and their needs, to be able to connect the ecosystem on the building to the natural context. There are Red List species to take into account and other frequently sighted species in the area. The research makes inventory of these species, based on data from the municipality of Amsterdam and websites such as the ones from Bird Protection Netherlands and the Dutch Mammal Association.

Architectural interventions

This sub research question consists of two parts: interventions for animals and interventions for plants. The first part focuses on housing animals in a building envelope, because the rest of the facilities for animals are relying on plants. The architectural interventions for the integration of plants in the building envelope can be divided into two categories: roofs and facades. This part of the research uses online and literature study as a method. This results in an overview of the possibilities to integrate animals and plants into a building envelope.

Design methods

Defining parameters set by results of the research

The output of the research is input for the design. Parameters such as height of implementation of nest boxes, height of presence of flying fauna around buildings, orientation towards the sun and possible architectural interventions dictate the basic volumetric requirements of the project.

Volumetric study and housing typology analysis

Based on the comparison of reference projects to the site and analysis of Dutch housing floor plans, I defined the shape of the tower(s) and their composition. The desire to fit as many apartments as possible (because of densification ambitions) is disregarded, for the focus of the design is on the functioning of the nature inclusive design elements. The building will still be high-rise (over 30 meters) and respond to the dense urban environment that surrounds it.

Study of timber construction

Based on a volume and a building height, I studied structural possibilities. The basement will be a concrete container, that serves as waterproof base for the timber construction. Each tower has a core of CLT and several load bearing CLT walls for stability so the rest of the structure can be made up of columns and beams for flexible layout and increased adaptability to future changes of function.

Mountain landscape materialization

Since animals see the urban environment as a mountain landscape, the concept of the project is to make this more literal: to have a green valley on the inside and a rocky mountain side represented on the outside of the building. Materialization has to meet this aesthetic vision.

Taking into account the needs of the flora and fauna

Using the specific requirements for flora and fauna from the research, the more intricate details of the project are defined. Placement and detailing of nest boxes in facades, and joints of green facades and roofs are an example of this. Furthermore, landscape elements, landscape architectural plans and vegetation matrices are part of this project as well.

Literature and general practical preference

There are several publications on nature inclusive design and urban ecology, such as the *First Guide to Nature Inclusive Design* (Van Stiphout, 2019), *Stadsnatuur maken* (Vink, Vollaard & De Zwarte, 2017), and *Stadsvogels* (Kooijmans, 2009), that provide most of the general knowledge needed for the research. Furthermore there are publications specifically on natural roofs, such as *Handreiking Natuurdaken* (Green Deal Groene Daken, 2019), and the use of vegetation in or on a building, such as *The Living Building* (VHG, 2019). Websites about animals, such as the one of the Vogelbescherming and the Zoogdiervereniging, and nature inclusive design interventions, such as www.bouwnatuurinclusief.nl and www.checklistgroenbouwen.nl, are also very useful resources.

There are ambitions, visions and guidelines provided by the municipality of Amsterdam that set boundaries for the design, such as the *Groenvisie 2050* (Gemeente Amsterdam, 2020), *Natuurinclusief bouwen en ontwerpen in twintig ideeën* (Gemeente Amsterdam, 2018), and the *Puntensysteem voor natuurinclusief bouwen* (Gemeente Amsterdam, 2019).

For the study on timber construction I intend to consult the *Cross Laminated Timber Handleiding voor architecten en bouwkundigen* (INBO, 2021) and the building technology tutor.

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?
2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

Nature inclusive design is a relatively new phenomenon. It started in the last quarter of the twentieth century with an idea of Friedensreich Hundertwasser and the realized Hundertwasser House in Vienna, where there are organic shapes and vegetation on roofs and facades. Many architects nowadays integrate vegetation in their buildings in the form of green facades, planters on balconies or green roofs, and only now are municipalities including ambitions for urban green in their visions for the future. This also means that there is still a lot to discover in the field of nature inclusive architecture.

There are innovative solutions yet to be developed. However, my goal is not to create a new type of solution, which might be expected in the Architectural Engineering studio. I investigated the possibilities for nature inclusive design and applied them in a project in a dense urban context; a mixed-use building with a high dwelling density, a design based on local ecology and architectural and ecological research. This type of research can also be performed for other locations to investigate what types of animal and plant species are preferred in these other areas.

The research tries to find a basis knowledge of nature inclusive design in the Netherlands and for high-rise buildings. At the same time, it makes inventory of architectural design elements to design nature inclusive, and analyses the site-specific biodiversity in Sloterdijk Centrum. The research functions as inspiration in the architectural field of nature inclusive design and develops an inventory to use when designing nature inclusive in a dense urban context. The overview includes various architectural interventions, linked to the animal species in the area.

Even though the research focuses on ecology, the final result is an architectural project. The design phase will include investigating timber construction and technical solutions, for example to include green roofs and provide sun shading.

The final design in the graduation project is an example of how to design with a focus on nature, but still be able to meet the needs of humans and reach a high density as is desired by the municipality. Since the urban population will grow, and cities do not want to expand but densify, nature inclusive design will take further strides and develop further to accommodate both human life and flora and fauna in the cities of the future.