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# AR3A010 Research Plan

NATURE INCLUSIVE DESIGN IN HIGH-DENSITY URBAN  
DEVELOPMENT IN SLOTERDIJK CENTRUM

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## Introduction

Diversity in plant and animal species is declining worldwide. This is caused by human activities, land use change and urban densification (European Parliament, 2020). Well aware of this global trend, the municipality of Amsterdam, which is facing population growth and rapid urbanisation, has the ambition to densify within city borders instead of expanding the urban area, to protect surrounding natural areas and biodiversity (Gemeente Amsterdam, 2020). However, even though the biodiversity is declining nationwide in the Netherlands, particularly in urban areas the biodiversity seems to have increased (AT5, 2019). But this does not mean that new development, designed by architects and planners, should neglect the need for the integration of natural elements in the urban framework to support the biodiversity. The municipality of Amsterdam developed a green vision for 2050 in which they state that “greenery is essential to create a pleasant city” (Gemeente Amsterdam, 2020). Greenery contributes amongst others to the mitigation of the effects of urban heat-island and peak precipitation.

For the future development of both public space and architecture in Amsterdam, nature inclusive design will be the norm. This means that in the design process, architectural and spatial interventions are incorporated to accommodate flora and fauna. Tenders for new projects will have to score a certain amount of points in a point-system based on nature inclusive interventions (Gemeente Amsterdam, 2019). Nature inclusive design is not just beneficial for the natural environment, the flora and fauna also provide ecosystem services that humans benefit from. For example: plants convert CO<sub>2</sub> to oxygen and clean the air by capturing particulate matter, insects pollinate plants and secure plant survival, birds and mammals eat plague insects and rodents, etc. Every organism has a role within the ecosystem. Furthermore, a green environment is beneficial for physical and mental health, concentration and productivity (WHO Europe, 2016).

The objective of this research is to investigate the architectural possibilities to incorporate plant and animal species in (the design of) a densely populated urban development, to see how both the needs for humans and animals can be met. With nature inclusive design as a focus, the building should function as a habitat and steppingstone within the larger scale ecosystem. The main research question will be:

How does the integration of nature inclusive design interventions into the building envelope support local biodiversity in an urban environment?

To find the answer to this question, the research is based on the following sub research questions:

1. *What is nature inclusive design?*

In this case, nature inclusive design is the main focus of the graduation studio project. So to start, it is important to understand what nature inclusive design is and why it is necessary to incorporate nature in future designs. To further investigate how nature inclusive design will influence the design of a building in the design phase of the graduation studio, the research investigates the state of the art of two types of nature inclusive development: on the one hand nature inclusive design of high rise buildings and on the other hand nature inclusive design in the Netherlands specifically. The criteria for the selection of projects will be handled in the Methodology part of this Research Plan. The part of the research concerning nature inclusive design will result in an overview of the precedents in a matrix, in inspiration gained from precedents, do's and don'ts, and it provides a way to relate the design intentions and the final project to the state of the art.

2. *What technical or architectural design interventions are there to integrate plant and animal species into a building?*

This sub research question consists of two parts: (1) interventions to integrate plants into a building and (2) interventions to integrate animals into a building. For the integration of plants into the building, the research investigates options to place plants on the façade or on the roof of a building, the variety of techniques that are available to do so, and what the benefits are for nature and humans. For the integration of animals into the building, the investigation of architectural design interventions will focus on housing of animals, since other aspects of the life of the animals are mostly related to plants.

3. *What is the local biodiversity in Sloterdijk Centrum?*

The final project will be in Sloterdijk Centrum area in Amsterdam. Informed by the more general (Dutch) urban ecology (Vink, et al., 2017) the third sub research question focuses on site specific plant and animal species. To create a habitat (on or in the building) the research investigates the local biodiversity that it has to connect to. For the specific location, there are several Red List species that will be included in the research, but also other species can be included, based on their presence in the area.

4. *What are the habitats to be created with the techniques and interventions to fit in with the surrounding ecosystem and support the local biodiversity?*

The last sub research question functions as a summary and conclusion of the second and third sub research questions. In this chapter, the research comes together: the answer to the previous sub research question will result in an inventory of target species and other species that are (frequently) sighted in the area. Those species can be used to make a selection in architectural interventions, which will result in a toolbox for the final design in Sloterdijk Centrum.

## Theoretical Framework

The key terms of this research are formulated and explained in the table below.

BIODIVERSITY	<p><i>"The variety of life on Earth in all its forms. It comprises the number of species, their genetic variation and the interaction of these lifeforms within complex ecosystems."</i> (European Parliament, 2020)</p> <p>For this research the concept biodiversity focuses on several plant and animal species that are threatened in the specific urban area because of densification of the urban context, which increases the pressure on green space. The goal of the municipality is to sustain or bring back these species in the urban context. The variety of plants and animals that comes with the nature inclusive design to facilitate the threatened species and other species present in the area will also contribute to the biodiversity in the project.</p> <p>To sustain this local biodiversity it is important to incorporate only plant and animal species that find their origin in the Netherlands or similar climatic conditions.</p>
HABITAT	<p><i>"It can either mean 'the area and resources used by a particular species' or 'an assemblage of animals and plants together with their abiotic environment'."</i> (EEA, 2018)</p> <p>This research will focus on certain animal species and their needs, relating to the first definition. However, to create a habitat for one specific species the design will incorporate other species that occupy the same area and make use of the same resources. So the design for the needs of one specific animal species, will result in a habitat where multiple species, both plant and animal species, can live together.</p>
NATURE INCLUSIVE DESIGN	<p><i>"A well-executed nature inclusive design is capable of creating a strong bond between a building and the surrounding natural environment, without having to compromise on architectural quality."</i> (Bouwnatuurinclusief.nl, n.d.)</p> <p>Nature inclusive design in architecture started making strides since the 70's (Van Stiphout, 2019). Many architects have incorporated some form of greenery into their designs since then and people have added on nature inclusive elements such as nesting places to their house to support biodiversity. But the intention of this research is to find a way to integrate the natural elements into the project from the beginning, to investigate nature inclusive design and prevent greenwashing of the project.</p>
DENSITY	<p>Density is defined by the Floor Space Ratio (FSR) or dwellings per measured area.</p> <p>Although the desired density for the final project is not yet decided, the building to be developed in the design phase will be a mixed-use building complex with a residential tower of at least 30 meters high in a neighbourhood where in the next twenty years a density of at least 150 dwellings per hectare is desired, following the ambitions of the municipality (Gemeente Amsterdam, n.d.<sup>b</sup>). This means that the final project will contain approximately 200 dwellings.</p>

## Methods

The research falls under a combination of domains: phenomenology (how we perceive our environment), praxeology (how we use our environment) and ecology (how we relate to our environment), not just from the point of view of humans but from the point of view of flora and fauna. To be able to create a built environment that benefits both humans and nature, it is necessary to understand what resources and conditions the flora and fauna need to survive; next to research that is more common in architecture, research into human aspects such as dwelling sizes, demography, energy consumption and production, use of space, etc.

The figures below give an overview of the methods used in the research.

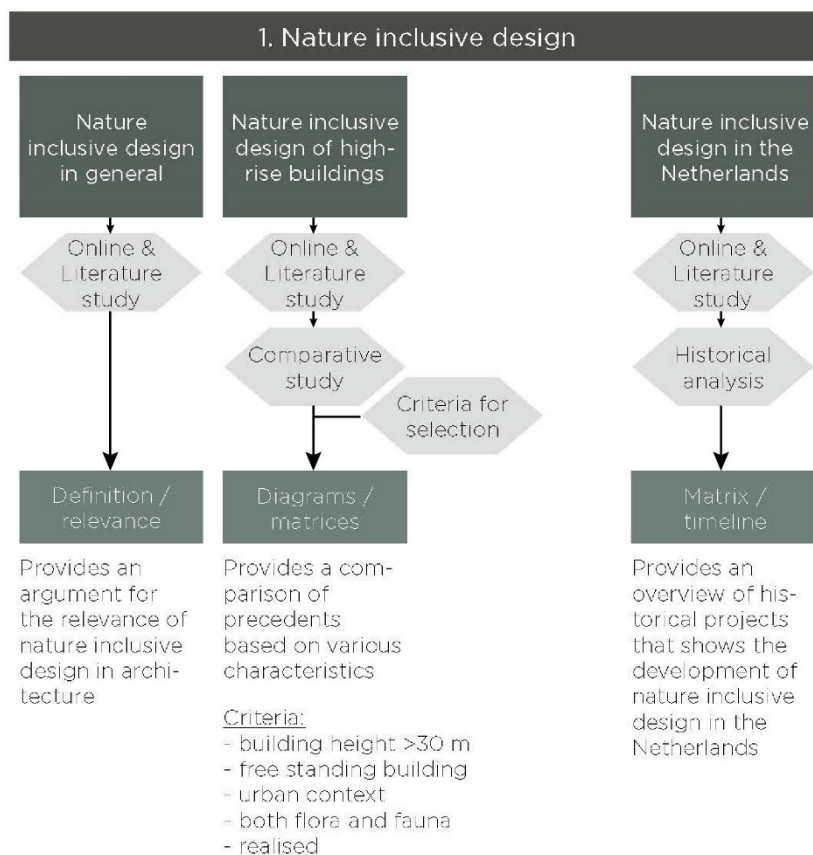


Figure 1 Methods to answer sub research question 1. What is nature inclusive design?

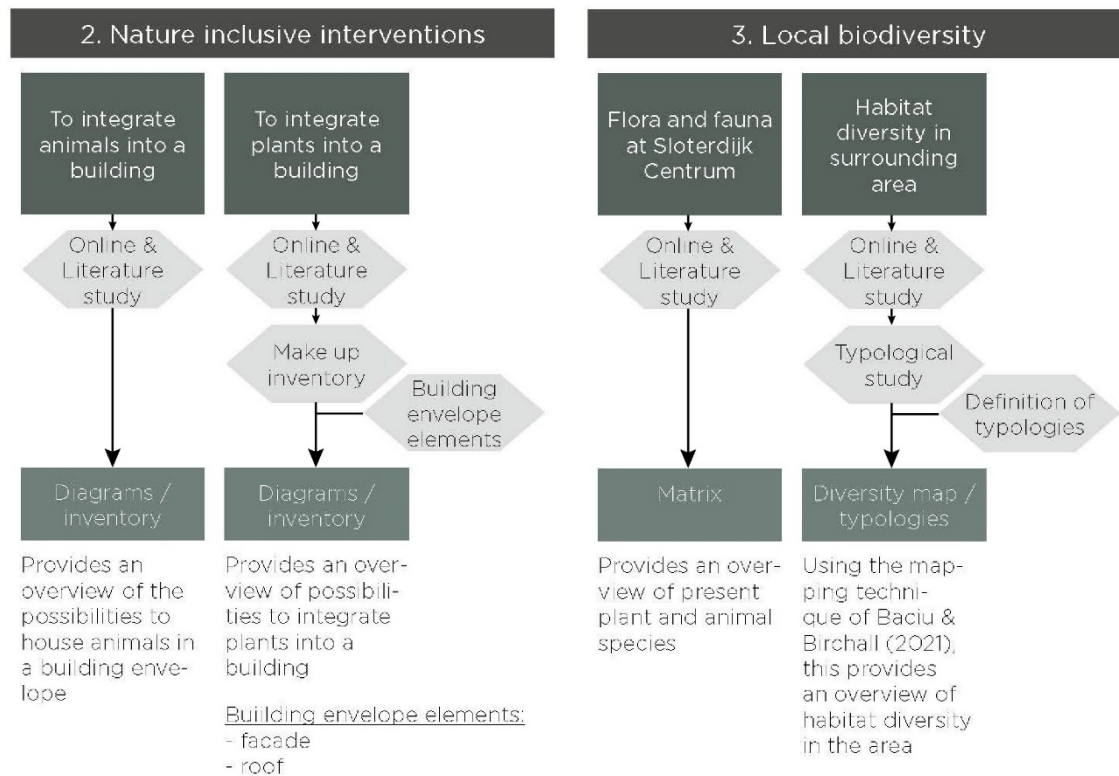


Figure 2 Methods to answer sub research questions 2. What technical or architectural design interventions are there to integrate plant and animal species into a building? and 3. What is the local biodiversity in Sloterdijk Centrum?

For the fourth sub research question, which can function both as a preliminary conclusion and a summary in the final research, the methods consist of an interaction of this sub research question with the previous ones. As mentioned before, the information gathered about plant and animal species will inform which architectural interventions are preferred in the final design. This will result in a toolbox and design intentions can be created based on this toolbox.

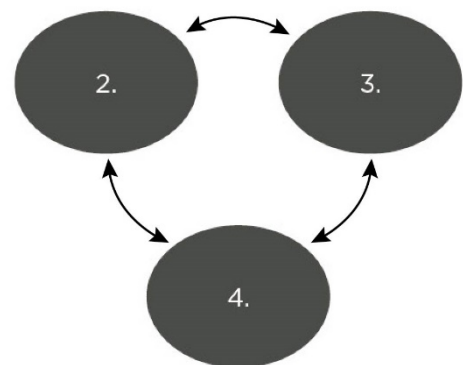


Figure 3 Interaction of information between the second, third and fourth sub research question

## Preliminary conclusions, choices and design strategies

How does the integration of nature inclusive design interventions into the building envelope support local biodiversity?

### Nature inclusive design

In the traditional way of building, animals such as birds and bats found places in our houses that they use for nesting, for example in cavity walls and under roof tiles. With the new way of building, where we strive to minimize the environmental impact of our houses, these spaces are filled with insulation materials, or other solutions in construction are found where these cavities or rest-spaces do not even exist. By the integration of nature inclusive design interventions such as nesting spaces in the facade, the building is suited to house birds better than the current way of building. Integrating the right greenery into the building envelope attracts insects and other small animals that function as food for the larger animals, but they also play a large role in the ecosystem services that we as humans benefit from.

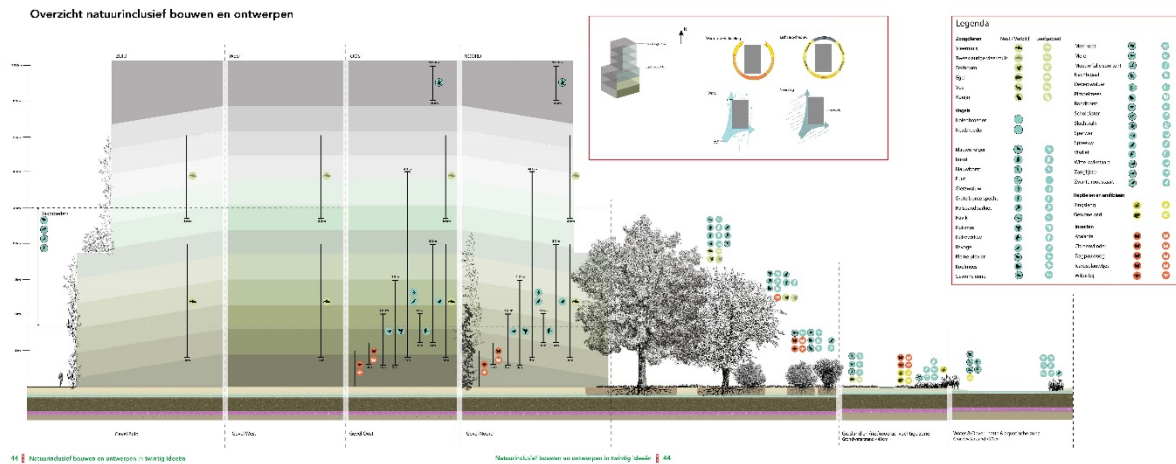
### Flora and fauna

In Sloterdijk Centrum, there are two Red List animal species (Nightingale and House Sparrow) and one Red List plant species (Southern Marsh-Orchid) that are protected according to the municipality (Gemeente Amsterdam, n.d.<sup>a</sup>). The idea is to focus on these species and what resources they need to survive in the area.

### Design related

To have a connection with the surrounding ground level natural environment (nature) and have a roof that is easily accessible for people and ground-bound animals, I first thought of a sloped green roof that connected with the ground floor. However, this design would require a very unpractical and complex building structure, especially when the roof is an intensive green roof with trees and shrubs. Also, example projects with sloped roofs mostly had only extensive vegetation on it, which is not the kind of vegetation I am envisioning for my project. Preferably, the final design includes a more diverse vegetation, both in species and in heights, that supports a wider range of animals.

In the *First Guide to Nature Inclusive Design* (Van Stiphout, 2019) and in *Handboek Natuurinclusief Bouwen en Ontwerpen* (Gemeente Amsterdam, 2018) the authors give an overview of the relation between animal species and the height and orientation of the building. This can be a guiding line in the selection of interventions for different parts of the building.





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