Regenerative Housing

REGENERATIVE DESIGN PRINCIPLES
FOR POST-WAR BUILDING
DENSIFICATION

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Research Plan

ADVANCED HOUSING DESIGN

Research Plan A3A010
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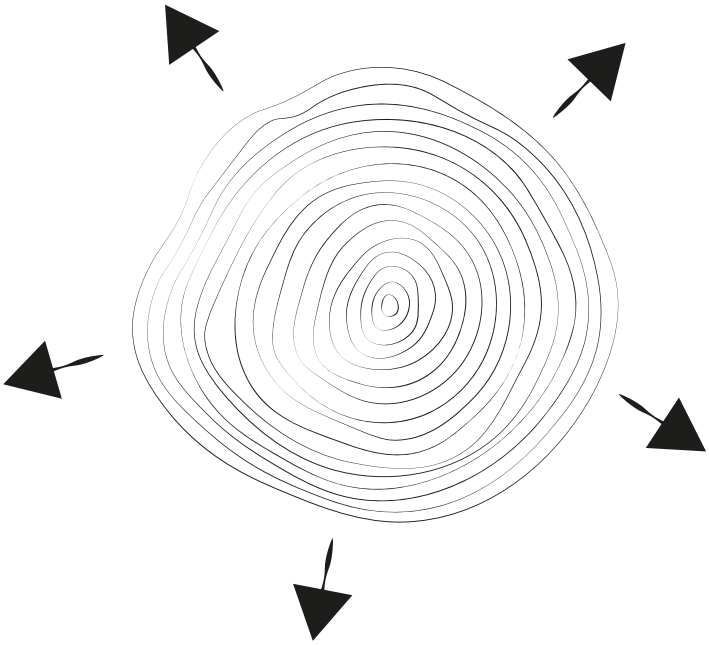

‘The periphery is like the cambium of a tree, it is the only living layer that thereby determines the shape of its growth.’

Floris Alkemade - 2016

CONTENT

Introduction

The introduction provides the context and background of this research, answering various questions across different scales. Starting at the national scale, the question of why construction is necessary in the Netherlands is addressed. Next, the focus is narrowed down, answering the question of where construction should take place. Finally, at the neighborhood scale, the problem statement of this research is introduced. This introduction, traversing different scales, culminates in the development of a research question and supporting sub-questions.

DUTCH 'HOUSING' CRISIS

The Netherlands is currently facing a significant housing crisis that is expected to worsen in the coming years. This crisis is caused by several factors, including the changing family composition, urbanization and the continued influx of immigrants on the demand side and rising construction costs, less issuance of permits and scarcity of space on the supply side. As a result, there is a growing demand for affordable and sustainable housing. In response, the Dutch government has set a target of building 917,193 new homes between 2022 and 2030 (1)

However, this housing crisis differs from previous crises in several ways. Firstly, due to the continued urbanization of society, many of the new homes will need to be built within the existing urban fabric. This presents unique challenges, such as space constraints and the need to balance the demands of different stakeholders. Additionally, there is now greater awareness of the importance of environmental issues and societal goals, which means that new housing developments must be designed with sustainability and diversity in mind. From starters, students, young and older couples, families, seniors, migrants, and the local population, many are currently living in inadequate housing or poor living conditions, while existing neighborhoods close to the city center are becoming exhausted in their static monocultural structures.

ROTTERDAMS PERIPHERY

The Dutch government's goal is to build nearly 1,000,000 homes by 2030, and with increasing urbanization, much of that will have to be realized in cities. Our city centers have traditionally been the natural focal point of a continuously growing number of surrounding expansion areas. This development puts increasing pressure on these cen-

Image 1: Striking Starters on the Housing Market (ANP)

ters and often leads to painful segregation between advantaged and disadvantaged residents, with the disadvantaged part of the population experiencing significantly less livability in these cities (2). This is no different in Rotterdam, where the difference in perceived livability between the richest and poorest neighborhoods of Rotterdam has even increased. In 2008, this difference was 0.6 points, while in 2021 it had increased to 0.9 points (3). Livability is about "the degree to which the environment meets the demands and wishes that are placed on it by people." The difference between the neighborhoods on the north side of the Maas River and the southern garden cities is clearly visible (Image 1). Furthermore, the map on streetscape index (green/paved ratio) shows almost the opposite. So the solution lies deeper than just greening the city

These disadvantaged residents of the city often live in neglected post-war suburbs, which, due to their spacious layout, should now be the domain of renewal. It is precisely the periphery of Rotterdam that can provide a solution to the various issues. If we consider the current state of the Rotterdam post-war residential areas as a first layer on which we can build, many possibilities arise. The absorption capacity of these neighborhoods is very high. Whether it concerns the housing shortage, segregation of society, or various climate and sustainability issues, a large part of these problems can be solved in the existing post-war neighborhoods, making these areas significantly more important and increasing their living quality.

Image 2: Rotterdam's Periphery (4.)

MONOCULTURE IN GROOT IJSSELMONDE

The ongoing urbanization in the Netherlands not only leads to growing pressure on the housing market, but also puts biodiversity at risk and changing the ecosystems in urban areas. The Groot-IJsselmonde area is no exception. There is not only a homogeneity in housing typologies, but also a monoculture in the green structures that have been designed based on the social principles of the garden city (see Figure 2). As a result, this human-designed (egocentric) greenery contributes little to biodiversity and important ecosystem services such as water retention, air purification, and pollination.

Due to these various challenges, there is currently a struggle for the use of scarce space in the Netherlands. Promoting ecosystem services can contribute to multiple land uses and efficient use of space. Thus, there can be a synergy between different ecosystem services, a nature-inclusive design of the Netherlands also contributes to multiple land uses and efficient use of space. By approaching the various challenges integrally, the monoculture of housing and greenery will only be greatly enriched as these neighborhoods can increasingly fulfill multiple functions.

Image 3: Monoculture in IJsselmonde

RESEARCH QUESTION

To address the ecosystem issues just mentioned, without losing sight of the social aspects of a neighborhood, regenerative design is a good angle. Therefore, the following research question was formulated:

Wich regenerative design principles for the renovation and densification of a post-war building contribute to the densification of biodiversity within the ecologies of the urban fabric?

This research question will be answered through the following sub-questions:

What is the current state of the biodiversity in the urban fabric (Groot-IJsselmonde)?

How can an intervention in the built environment affect the biodiversity in the urban fabric?

Which regenerative design principles can be applied during the densification and renovation of a post-war building?

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Personal Interest & Motivation

Design Brief

Problem Statement

Theoretical Framework

The built environment has a significant impact on climate change, with nearly 40% of human-caused CO2 emissions resulting from the construction and operation of buildings (5). Regenerative design aims to make buildings part of the solution to climate change, rather than part of the problem. This is urgent because the Intergovernmental Panel on Climate Change (IPCC) warns that we have only 12 years to reduce carbon dioxide emissions (6). Buildings that are currently being designed, constructed or in the design phase must be adapted as soon as possible to provide regenerative solutions. This means that buildings must not only be built and operated without fossil fuels, but must also be net carbon positive, meaning they should absorb more carbon dioxide than they emit.

Regenerative design aims to create a situation where the built environment contributes to the well-being of people and natural ecosystems. This implies that there should be no one-way flow of energy, materials and living matter from nature to humanity. Instead, a partnership between humans and nature must be created to strengthen both parties. The main goal of this text is to present the key principles of regenerative design and explore its integration in practice from the perspective of architects, engineers, and urban planners.

SUSTAINABLE VS REGENERATIVE

Regenerative design is an approach that emphasizes creating new relationships to enhance the health of human and natural ecosystems. This involves utilizing appropriate construction and technology solutions, requiring in-depth knowledge of multiple disciplines and the involvement of various specialists and suitable tools to develop and frame approaches and solutions. Current responses to climate change and biodiversity issues are insufficient given the urgency and scale of predicted impacts. Current objectives typically focus on reducing negative impacts or at best achieving "neutral" operational energy use. However, newly built and renovated buildings must go beyond reducing environmental impacts and have positive environmental benefits. A holistic approach is needed that considers carbon, resource use, waste, and water. Regenerative design methods aim to not only reduce the causes of climate change and ecosystem degradation but also to reverse them (Figure 1).

The concept of regenerative design was first introduced by American landscape architect John T. Lyle in his book "Regenerative Design for Sustainable Development" (9), although the term had

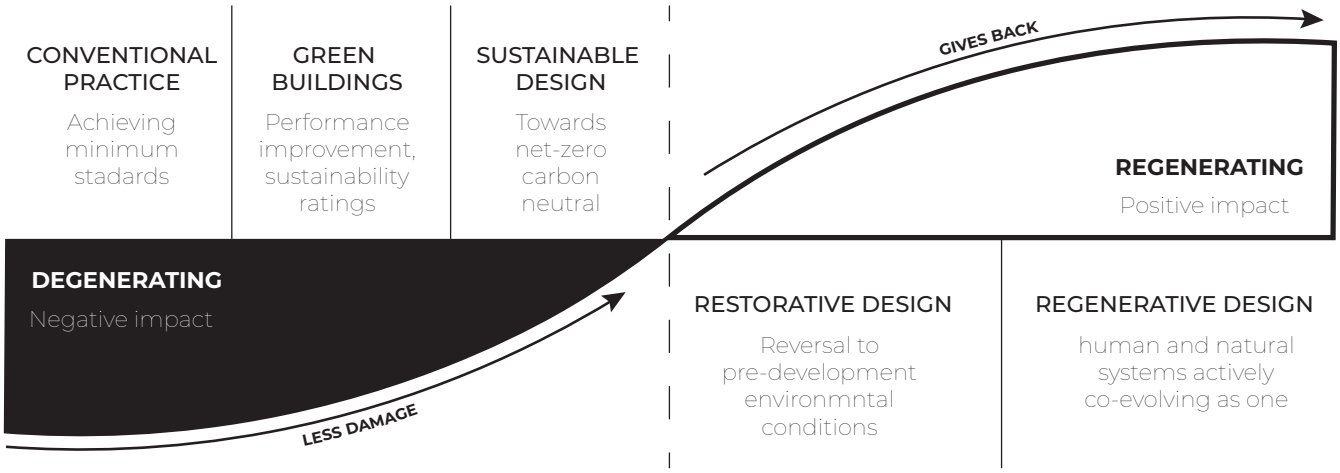

Image 4: Regenerative Design (13)

been previously formulated by Robert Rodale in relation to agriculture (10). Regenerative design has emerged as a significant approach within sustainability, with scholars such as Bill Reed and Raymond J. Cole exploring definitions and applications (11)-(19). Nowadays, a group called Regenesis has developed their own theory and methodology of regenerative development that moves beyond the biophysical and contracts with the entire social-ecological system to grow its potential (12). Regenesis' work is guided by three approaches: Living Systems Thinking, permaculture, and developmental change processes. The aim of regenerative design and development, according to Regenesis, is the "reconnection of human aspirations and activities with the evolution of natural systems – essentially co-evolution" (13).

It is crucial to understand that regenerative work is not separate from sustainability. According to Bill Reed, the concept of sustainability is impossible without regeneration. The question is how to shift our thinking and being to be participatory and co-creative, thus co-evolutionary (13). If what we create does not have the capacity to evolve itself, entropy means that it will eventually deteriorate. Not only the project or living system we are working with needs the capacity to evolve, but it is also necessary to continually regenerate ourselves in relation to evolutionary processes. For planners, designers, and developers, working from the Regenesis perspective has challenging implications, the most difficult of which is to accept that "it's not about the building," as was the case with the Brattleboro Food Co-op. The initial design intervention can become a catalyst for the regeneration of the community and ecosystem, even if no building is eventually constructed (13).

SYSTEM THINKING

System thinking is a crucial aspect of regenerative design in architecture, as it allows designers to understand the interconnections between various elements and systems within a building or a community. By adopting a systemic approach, designers can create buildings and spaces that promote environmental, social, and economic sustainability and enhance the health of human and natural ecosystems. This is particularly important in the face of climate change and biodiversity loss, as regenerative design aims to not only reduce negative impacts but also to reverse them.

According to scholar Bill Reed, regenerative design requires a shift in thinking from a me-

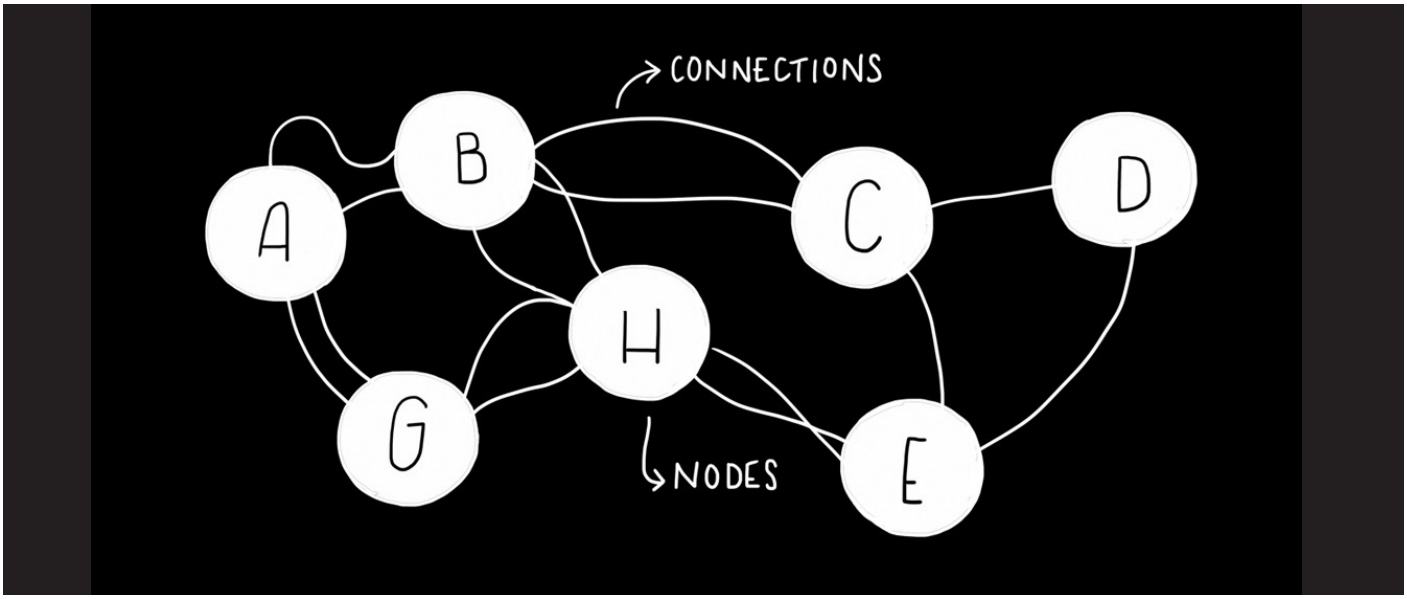

Image 5: System Thinking

chanistic to a living systems approach, which sees buildings and communities as dynamic systems that are interconnected with their environment and evolve over time (14). This requires designers to consider the context, relationships, and patterns of a building or community, and to work with the natural systems and processes that sustain life. By doing so, designers can create buildings and spaces that contribute positively to their surroundings, rather than depleting or harming them.

BIODIVERSITY IN THE CITY

Urban biodiversity is an increasingly important area of focus in cities worldwide. It is well established that urbanization poses significant threats to biodiversity, with urban development often leading to habitat loss and fragmentation, as well as increased pollution, invasive species, and disrupted ecological processes. However, recent research has highlighted the potential for urban areas to provide important habitats for a wide range of species and promote biodiversity conservation.

In his book "Darwin in the City", Menno Schilthuizen explores the evolution of urban biodiversity, highlighting the unique challenges and opportunities that cities present for species adaptation and evolution. Schilthuizen argues that urban areas can act as "evolutionary hotspots," where species are exposed to novel environmental conditions and selective pressures, leading to rapid adaptation and evolution. This can result in the emergence of new species and the evolution of unique urban-adapted traits. (20)

Building on this, the book "Making Urban Nature" examines the ways in which cities can be designed and managed to promote biodiversity conservation. The book highlights the importance of green spaces in cities, such as parks, gardens, and green roofs, as important habitats for a wide range of species, from insects and birds to mammals and reptiles. It also explores the role of citizen science and community engagement in promoting urban biodiversity and highlights the importance of considering social equity in urban biodiversity conservation efforts. (21)

Overall, these books demonstrate the potential for cities to play a critical role in biodiversity conservation and suggest that urban areas can act as important refuges and habitats for a wide range of species. However, achieving this requires careful planning and management, as well as a recognition of the social and ecological complexity of urban environments. By incorporating biodiversity conservation into urban planning and design, cities can help to ensure that they remain vibrant, resilient, and diverse ecosystems for both humans and other species.

Image 6: Vertical Forest, Milan

Methodology

Regenerative desing and densify the ecologie of the plac can play an important role in increasing the physical and social resilience of a post-war urban neighborhood in need of densification. This research focuses on how this can be achieved and includes the following sub-questions:

What is the current state of biodiversity and ecologies in the urban fabric (Groot-IJsselmonde)?

How do neighborhood renovation and densification interventions affect the biodiversity and ecology of the urban fabric?

Which regenerative design principles can be applied during the densification and renovation of a post-war building?

LITERATURE STUDY

A literature review can contribute to the research by providing a theoretical framework. By reviewing relevant scientific articles and policy documents, an understanding of the concepts of regenerative design principles and biodiversity can be gained. In this way the literature should really function as the foundation of the research, by reading a lot of literature you can place yourself in the rich array of opinions and discussions on this topic.

In addition, a literature review can help identify knowledge gaps and research questions that remain unanswered. It can also help determine the relevant variables to examine and to understand the context in which the research takes place.

Finally, a literature review can help validate findings obtained from other research methods, such as field research and case studies. By comparing the results of the study with what is known in the literature, the reliability of the findings can be increased.

LOCATION ANALYSIS

Locational research, such as the use of geographic information systems (GIS), can help map the current state of the neighborhood. By collecting and analyzing data on the presence of green space and water, and their use by residents, a better understanding of the current ecosystem services available in the neighborhood and their impact on the physical and social resilience of the neighborhood can be gained. As a result, recommendations can be made for improving available ecosystem services and neighborhood resilience.

Field research, where researchers actually visit the area, can help verify the findings from the site surveys and literature review. This will look at the quality of green space and water, and the social function of these areas for residents. This provides a deeper understanding of the current situation in the neighborhood and helps identify residents' needs and desires. This can lead to recommendations for improving the current ecosystem services and resilience of the neighborhood that better reflect residents' needs and desires.

In the case of regenerative building design, field research can also help identify suitable sites for nature-inclusive building projects. For example, by surveying different areas of the neighborhood, one can look at which areas are suitable for green roofs, green facades, or wadis. This can lead to targeted recommendations for nature-inclusive construction that better fit the needs of the neighborhood and the ecosystem services available.

CASESTUDIES

Case studies are a crucial aspect of understanding the effectiveness of regenerative design principles in practice. They provide real-world examples of how regenerative design can be applied on a building level and the positive impacts it can have on both the environment and the people who inhabit those buildings. By examining case studies, designers and architects can learn from the successes and failures of others, leading to more informed decision-making and the development of more effective regenerative design solutions.

DIAGRAM

Systems thinking is not just about designing something in the built environment. I want to extend it into the process of this research as well. That is why the diagram about methodology (image 7) also consists of verscillende nodes (questions, tools, answers) connected to each other: It is not a linear process but almost a natural process.

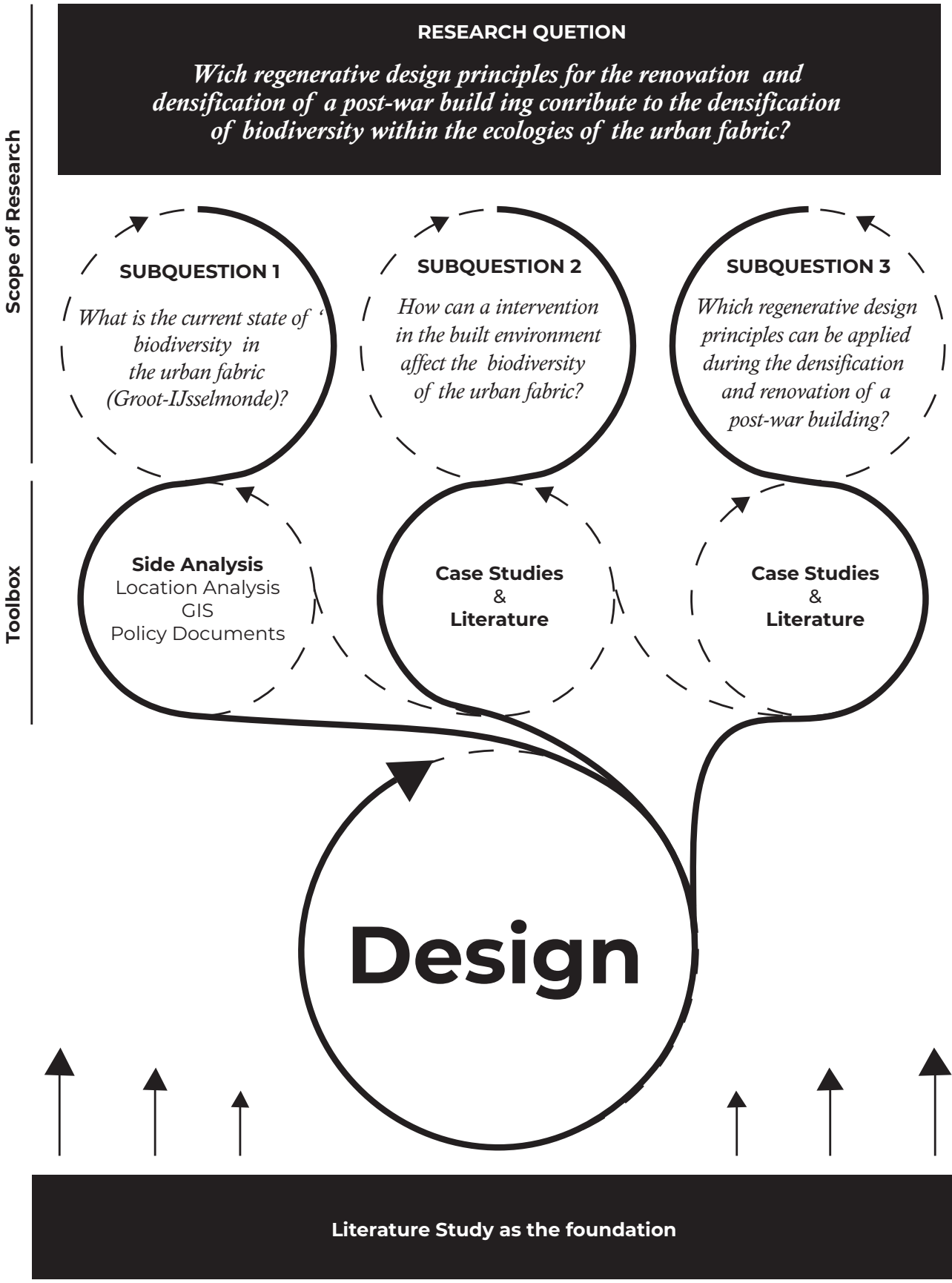

Image 7: Methodology

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