



THE ARCHITECT AS FACILITATOR OF NATURE- INCLUSIVE AND REGENERATIVE DESIGN PROCESSES

Liam Verduin, 5447291 - 07.II.2022

Research Plan

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Argumentations of choice of
the studio

The reason for choosing the studio AE was because I want to master the techniques behind the architecture and be able to apply them correctly. Besides being able to give meaning to space, an architect must also be able to accomplish this. Within a technically focused studio, I thrive to master this skill. To proverbially explain this process, I always take the example of baking a delicious cake. To do this well you must first know all the right ingredients and then be able to put them to good use. But besides the technology behind architecture, AE is also concerned with the changing climate. Then not just in the sense of how the earth is warming, but precisely how that translates into the engineering of buildings. Smart design interventions can drastically reduce a building's energy demand. This principle is essential within the process of designing a high-performance building of the future.

Keywords

local resources, nature-inclusive,
renewable materials,
regenerative, self-sufficiency, oak,
winery



Illustration I: Aerial photo of Maastricht quarry. (n.d.). Google Earth.

*"The science and study of wine and winemaking is called **oenology**"*

*"The protected bird species found in the Maastricht quarry is called the **oehoe**"*

*"In the Netherlands, **œ**" is used within student groups as an informal greeting via textmessages, to indicate an inebriated state of being"*

*"If one tastes a good wine, one says: **oe!**"*

A quarry that has caused the primordial biodiversity to decline, that has caused land (ab)use to leave its marks/ scars. A quarry that has had an impact on both nature and culture, which has ensured that it is currently very difficult to restore this area to its former glory.

The Maastricht quarry is the result of our mass consumption of resources and materials. A direct example in how resource depletion manifests itself in an urban context. Which also directly affected the native environment with its associated biodiversity, but also created new ecological values in its place. Therefore, this location fits in perfectly with the current discussion about the depletion of the earth, coupled with changing climate conditions. Because of this reason, this quarry is the design site of this research. It will show what is left behind after the

large-scale extraction of raw materials, but also what should be done differently next in order not to further exacerbate resource scarcity.

This research firstly focuses on how this resource depletion can be countered within future construction processes, by looking ahead to how a particular material can be used within the different "layers" of a building.

Secondly, it investigates how the use of local materials as a possible solution can contribute to enrich its local biodiversity, by correctly applying nature-inclusive design interventions, for example.

Finally, this research will apply and incorporate the results in a design brief in the context of the aforementioned Maastricht quarry.



Illustration 2: View from viewpoint Maastricht quarry (2022). Picture from author

"Ces arbres qu'il plante et à l'ombre desquels il ne s'assoira pas, il les aime pour eux-mêmes et pour ses enfants, et pour les enfants de ses enfants, sur qui s'étendront leurs rameaux."
(Hyacinthe Loyson, 1866, p. 77)

"These trees he plants and in whose shade he will not sit, he loves for himself and for his children and for his children's children, over whom their branches will spread."

This quote, from 1866, refers (without perhaps intending to) almost directly to a form of sustainability. Namely, leaving the earth in a better condition compared to how it was found. However, if we are to believe the (intended) definition of sustainability from more than a hundred years later, it refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations, 1987, p.40). In this, there is sudden discourse about leaving it alone not "worse" than how it was found. Gladly, this study foresees an outcome, as in the first description from 1866, where the earth is left in a better condition.

To be able to do this not only in a general sense, but also specifically within the built environment, the focus is on building materials. How can we use them in the best possible way?

And how can we apply the materials we use primarily from a local context? And how can we regenerate renewable materials again so as not to leave a footprint for future generations?

The best concept that addresses the relationship between buildings and time is the concept of "Shearing Layers". This concept layers sees buildings as a series of components that evolve in different time scales. Steward Brand's shearing layers model distinguishes six distinct layers of a building according to its lifetime; site, skin, structure, services, space plan and stuff (Brand, 1994). (1) The site is the geographical environment, which is eternal in lifespan. (2) The structure is the load-bearing elements, such as the foundation and skeleton. This layer lasts thirty to three hundred years, according to the model. (3) The skin is the external surface, such as cladding and windows lasts twenty years, as this layer reacts to the elements. (4) The services will succumb after seven to 15 years due to abrasion and technical ageing. This includes a building's circulation, such as the heating system, wiring and plumbing. (5) The space plan, which may change every three years, includes walls, floors and ceilings. And finally (6) the stuff like lamps, chairs, equipment, signage and paintings. This last layer is subject to constant change in this one. Of course, each layer depends on the material being applied. The proper application and processing of these different layers/materials will be explored in this study.

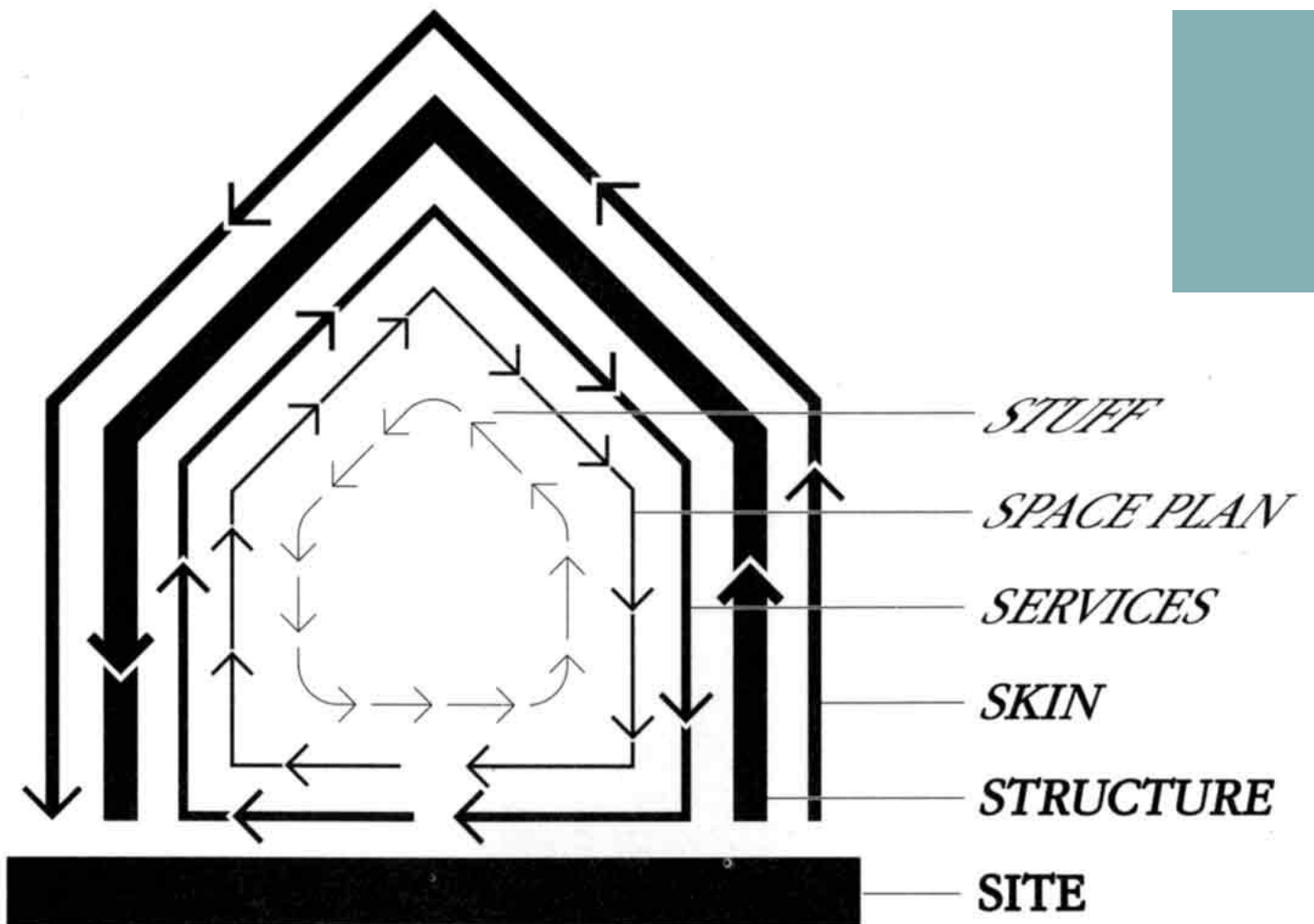


Illustration 3: Shearing layers concept by Steward Brand. (1994).

SHEARING LAYERS OF CHANGE. Because of the different rates of change of its components, a building is always tearing itself apart.



Illustration 4: View from viewpoint Maastricht quarry (2022). Picture from author



Illustration 5: View on old ENCI factory, Maastricht quarry. (2022). Picture from author

Problem analysis

- a. Environment
- b. Context
- c. Thematic Focus

The problem raised is a two-sided issue. Where one deals with the rapid decline in biodiversity, and the other with the use of materials/resources. Two-sided because it is caused over different scales. First, it looks at it from a global perspective, after which it zooms in.

a. Environment

Nature plays a vital role in providing food and nutrition, energy, medicines and genetic resources and a variety of materials that are fundamental to human physical well-being and cultural preservation. Nature, through its ecological and evolutionary processes, maintains the quality of air as well as fresh water and soil on which humanity depends. It also distributes fresh water, regulates the climate, provides pollination and pest control, and mitigates the effects of natural disasters (IPBES et al., 2019, p. XIV). But all this beauty is being disrupted. The vast majority of ecosystem and biodiversity indicators today show rapid decline due to various human causes that have drastically degraded nature across most of the world. On average, about 25% of animal and plant species are endangered, meaning that about one million species are already threatened with extinction, many of them within a few decades (IPBES et al.,

2019, p. XV). The harvest of raw timber has increased by 45% to about four billion cubic metres compared to 2017. In much of the tropical high biodiversity areas, thirty-two million hectares were lost between 2010 and 2015. 75% of the land area has changed significantly and more than 85% of wetlands have been lost. This human-induced process leads to loss of local biodiversity, including native species, ecosystem functions and nature's contributions to humans.

b. Context

For terrestrial and freshwater ecosystems, land-use changes have had the largest relative negative impact on nature since 1970 (IPBES et al., 2019, p. XVI). In particular, through overexploitation of animals, plants and other organisms. This occurred mainly through harvesting, logging, hunting and fishing. This is how this problem arose globally, and of course we also suffer from it at a national level today. The agricultural sector, in particular, has been to blame for this. Currently, the agricultural sector is already much in the news regarding nitrogen emissions (van der Scheer & Blacqui re, 2021), but the strong measures of farmland expansion make it the most widespread form of land-use change (Brink & CGN, 2015). Here,

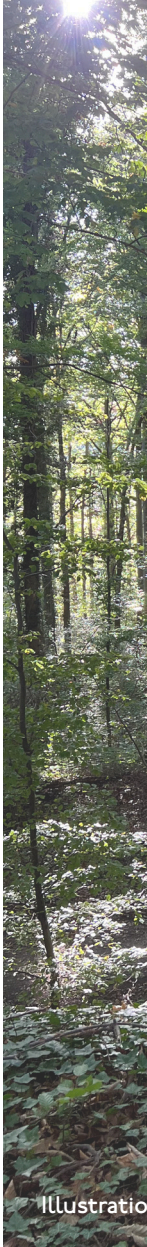
more than a third of the land area was converted for agriculture or animal farming. This expansion, together with a doubling of the urban area since 1992 and an unprecedented expansion of infrastructure associated with growing population and consumption, has largely come at the expense of forests and grasslands (Van Dyck et al., 2018, pp. 54-55). This naturally ensures that today it is very difficult to realise new building projects without directly invoking natural land. In this, we can talk about a real lack of potential and suitable building land. However, the construction sector itself also has a considerable impact on biodiversity. With the large amount of nitrogen emissions, coupled with the “over” extraction of building materials and resources, the construction sector’s share is considerable. As mentioned earlier, new construction often involves the loss of nature. In addition, construction activities cause ‘fragmentation’ of the landscape, which can also lead to a decline in biodiversity (PBL, 2022). In addition, it proves to be difficult to bring back the nature that has been lost in the same area on the same scale. But in addition, the resources that have been taken from the area cannot be restored to their former state.

c. Thematic Focus

At this point, we come to the second part of the problem formulation. Namely, the (wrong) handling of materials and resources. Industrialisation has brought

a high degree of technical development, especially in the field of building materials such as steel and concrete. Technical development combined with growing transport infrastructure and trade opportunities has meant that materials are no longer tied to local availability or regional traditions (Röstellund & Björlling, 2020, p. 2). This has led to many innovations and higher living standards in many parts of the world, but as a side effect it has also given the illusion of endless resources (Borden & Meredith, 2012, p. 2). The rationalised and centralised production process has since continued along that line, resulting in a further ‘disconnect’ between resources, communities and landscapes. The fact is, however, that we only have one planet with both finite and renewable resources that we over-consume. Contemporary material use and the logic of the construction industry are largely the result of a modernist approach to buildings, landscapes and professions. In his text “Towards a critical regionalism”, Kenneth Frampton writes about how the tabula rasa approach of modernist movements that sought a universal civilisation, a kind of “one size fits all” methodology, has contributed to a global phenomenon of placelessness, especially in the Western world (Frampton, 1983, pp. 16-29). This is to approach that same ‘disconnection’.

The best Dutch example of such resource depletion is visible in the Maastricht quarry. Such quarries disturb the land and



Illustratio



Figure 6: ENCI forest. (2022). Picture from author

Problem statement

The way we build now is about “extracting” materials in places where we don’t build. And building in the places where we don’t “extract” materials. In addition, no thought is given to how these materials can be regenerated in order to not only “extract” materials, but also to keep providing new building materials. Given the forested context, this would involve using and regenerating wood, with the most common tree species being European oak, beech and maple. Not only that, thoughts on the proper use of these materials within the different layers of a building and its production processes are neglected.

have affected the balance of the natural systems of the environment. In doing so, they change landforms, create disturbed drainage patterns, destroy soil systems and make habitats disappear. These sites have been damaged by industrial activities to the extent that they now need to be cleaned up and restored before they can be made suitable for new land use or a second life (Vosloo, 2018, p. 46-47). Paired with this, biodiversity has also declined significantly as a result. The materials for this modernisation, and especially for the applications of concrete, were extracted in such quarries in an unsustainable way, and often not applied in the local context.

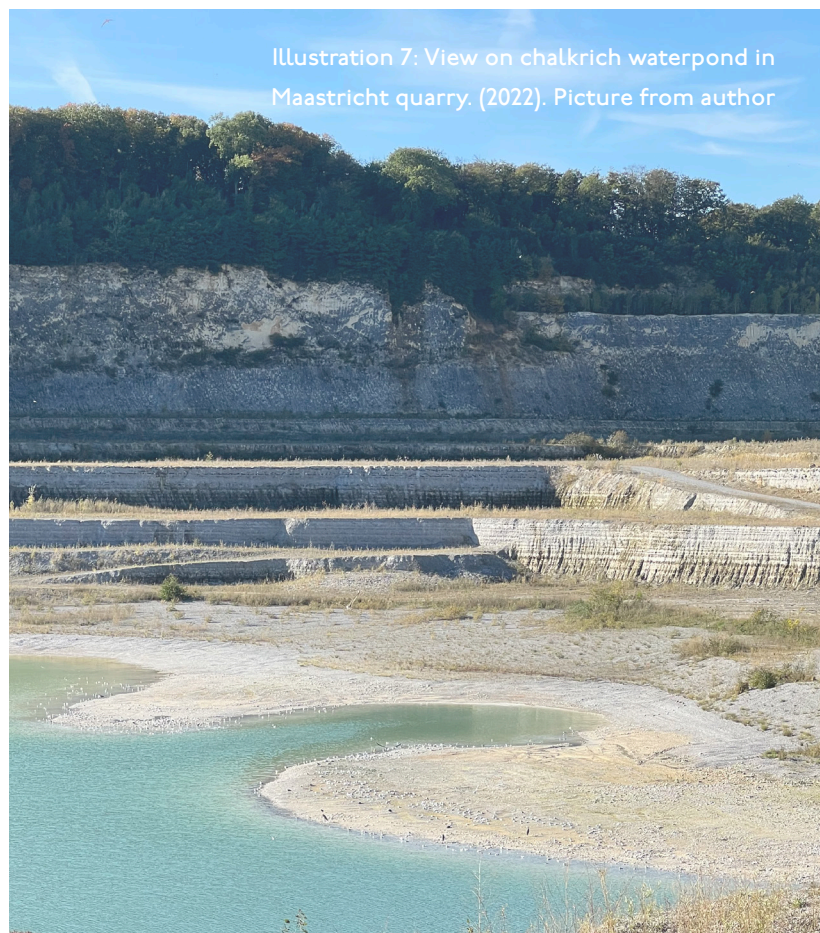


Illustration 7: View on chalkrich waterpond in Maastricht quarry. (2022). Picture from author



Illustration 8. View on viewpoint, Maastricht quarry. (2022). Picture from author

To begin with, the potential of the Maastricht quarry should be fully exploited. For example, the excavated rock walls can serve as a realistic habitat for cremno-phytic plants (plants that live on vertical rock walls). Another example is even already noticeable through the nesting of the eagle owl (oehoe). However, this does not yet say anything about the infill of the quarry itself. For this, it outlines the need for a 'close alliance' between nature, recreation and tourism (Bureau Stroming bv et al., 2007, p. 39-40). This is to be achieved by initiating a new form of agriculture. Namely, agriculture would mainly strengthen recreation and tourism by focusing on environment-friendly production of (regional) products, and the development of overnight accommodation on the farm (agritourism). Such an interpretation of a (regional) product can already be found in the surrounding area, for example: successful wine growing on the flanks of the Jekerdal valley. But the vineyards, with their marl-built farmsteads, already offer a beautiful landscape too. Partly because of this, an expansion of vineyards on former agricultural land is certainly seen as an appropriate solution (Bureau Stroming bv et al., 2007, p. 49-50). However, the 'alliance' between agriculture and nature can consist of a more nature-friendly/

nature-inclusive production of this (Bureau Stroming bv et al., 2007, p. 49). One such application of this production is care 'for' biodiversity (e.g. through protection of farmyard birds), use 'of' biodiversity (e.g. natural pest control) and reduction of negative impacts 'on' biodiversity (e.g. through circular agriculture) (Westerink et al., 2021, p. 61). The central principle of the aforementioned circular agriculture is that no more acreage and no more raw materials are used than strictly necessary. Circuits are closed 'as nearby as possible and as far away as necessary' (van der Scheer & Blacqui re, 2021, p. 14).

But besides the fact that production, and of course construction, must be nature-inclusive, the use of materials must also be sought 'as nearby as possible'. On top of this, materials should not only be 'extracted', but also ensure the regeneration of new materials. This is to ensure long-term resource continuity. For this, the waste of earth's resources must stop as much as possible (R stlund & Bj rling, 2020, p. 2). In this, the regeneration of materials should already be included in the design process. The regenerative process works from the macro scale (the catchment or bioregion) to the local. It starts with a connection to the essence of place

Figure 1: Living Building Challenge. (2007) square wise.

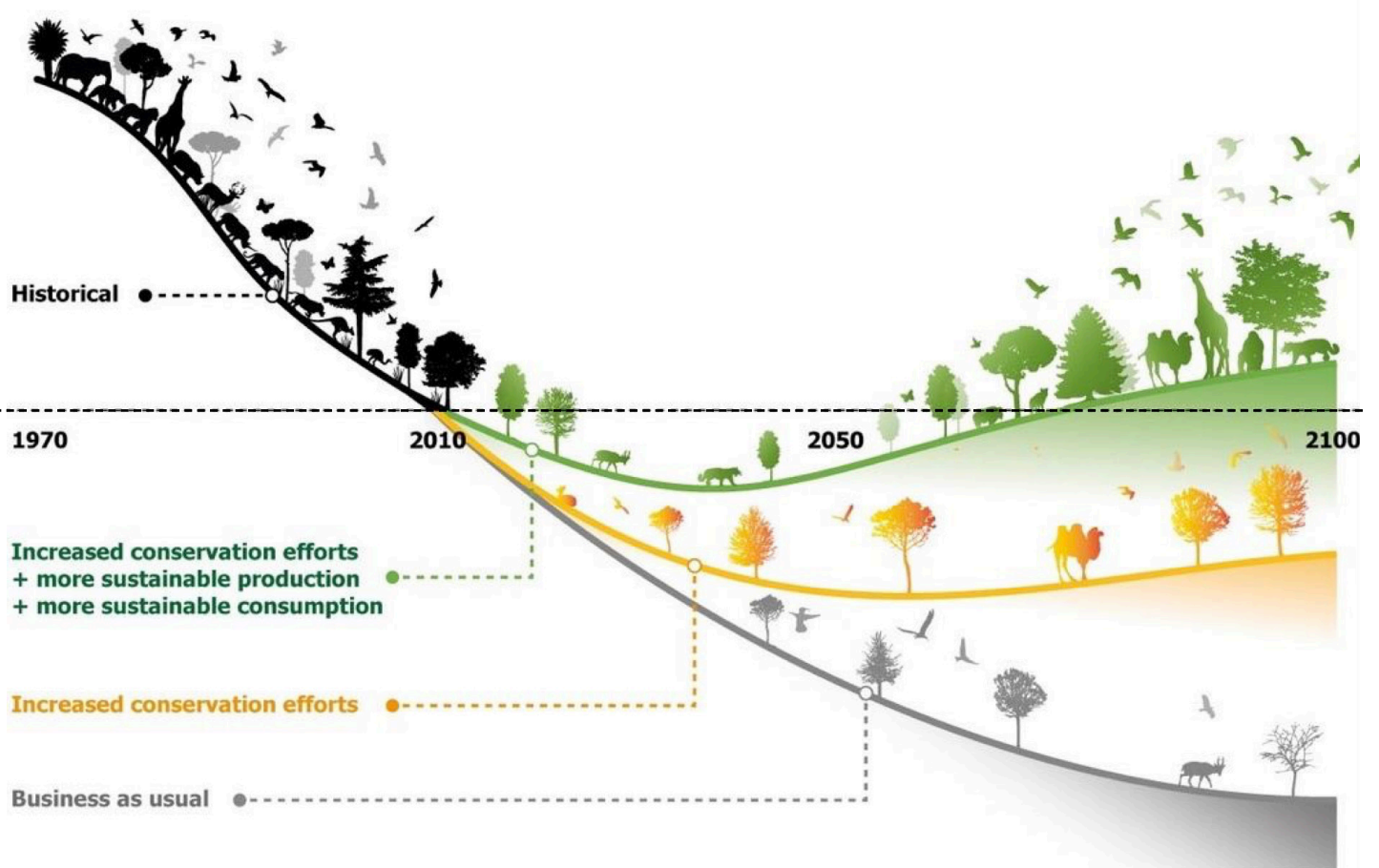


Figure 2: Regenerative design concept. (n.d.) Luc Eeckhout



Illustration 9: View on 'three giants', Maastricht quarry. (2022). Picture from author



Illustration 10: View from oehoe valley, Maastricht quarry. (2022). Picture from author

Overall design question

How can a nature-inclusive winery complex be realised in the Maastricht quarry, using locally harvested and generated materials and conditions?

Research question

a. Subquestions

How can the use of oak from the local context be applied within the concept of shearing layers to ultimately facilitate regenerative processes and nature-inclusive design interventions?

a. Subquestions

To get a better grip on the overall question, a distinction will be made between the different themes within the subquestions. Whereby the first five mainly apply to the research itself, and the other themes mainly on the integration and the design.

Research

Regeneration

1. What does the regenerative process of oak wood look like?
2. What is needed from the local context to facilitate oak regeneration?

Material properties

3. What are the general properties, qualities and specific applications of oak?
4. How can the uses of wood be incorporated into the shearing layers concept?

Nature-inclusiveness

5. What nature-inclusive design interventions are there with wood?

Integration

Maastricht quarry

6. In what ways can the quarry respond to the regenerative design process?
7. Besides oak, what other materials can be found in the local context?
8. To what species can the quarry facilitate habitats and living conditions?
9. What is the 'genius loci' (immeasurable properties) of the Maastricht quarry?

Design

Winery

10. What does the process of making wine look like?
11. Which contextual factors can contribute to the design of a winery?

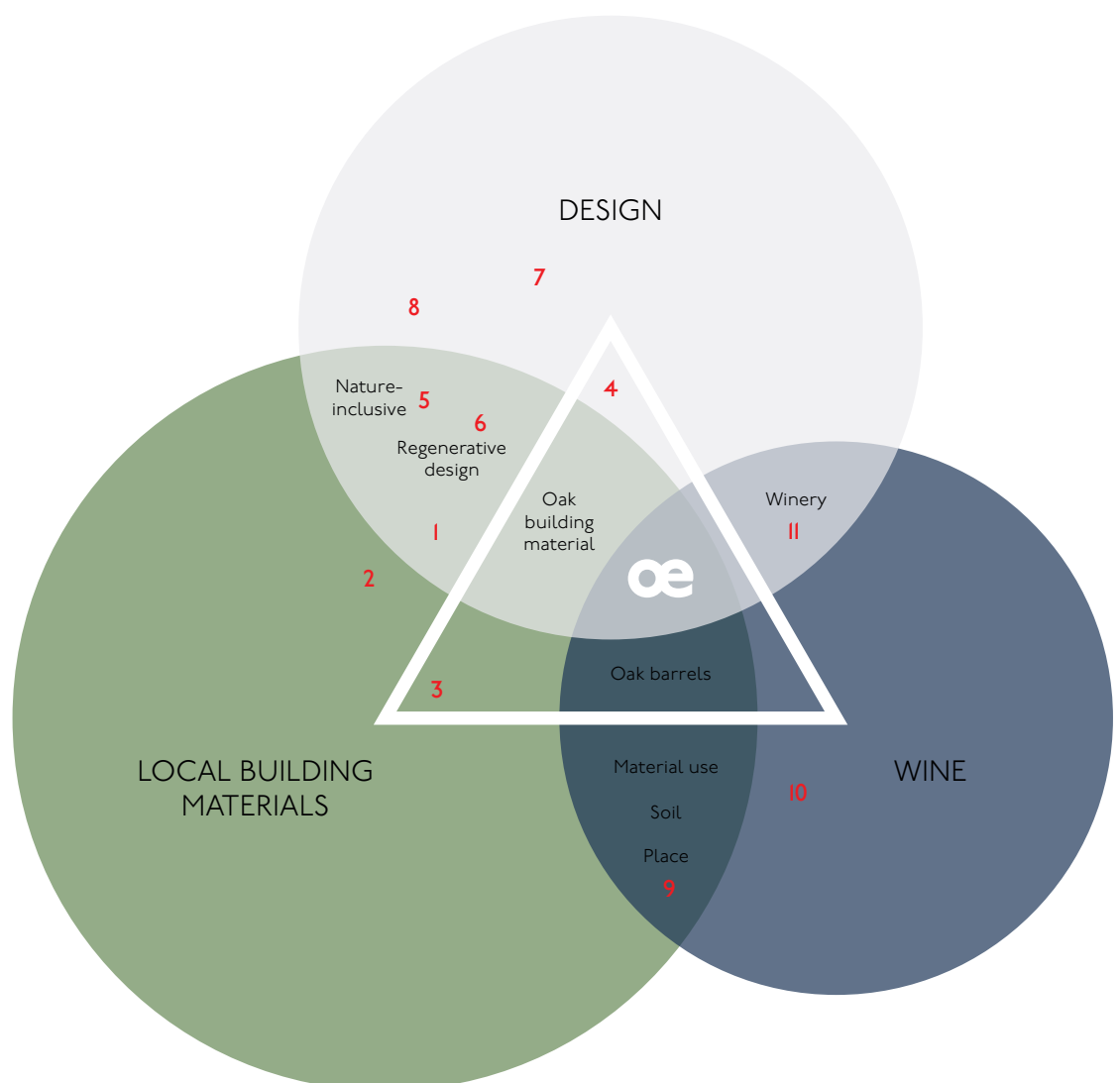


Figure 3: Research focus with placement of subquestions. (2022) Made by author

Research structure

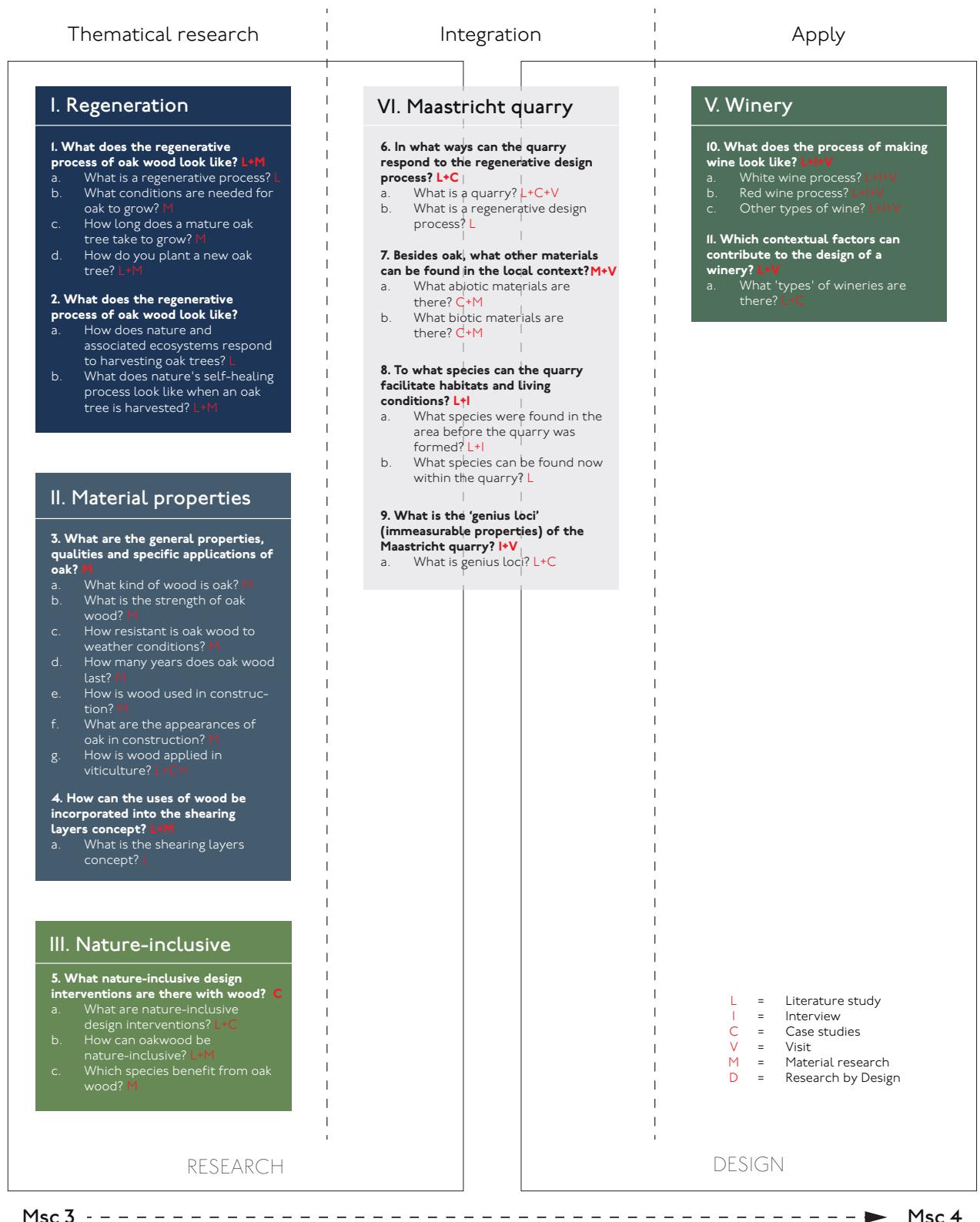


Figure 4: Research structure. (2022) Made by author



Illustration II- View from kiekoet, Maastricht quarry (2022). Picture from author

The research methodology is shown in the table below. From each sub-question formulated, it is explained how this question will be addressed. However, this then only concerns the sub-questions from the actual research itself.

Research Question	What data do you need?	How can this data be collected?	How will this data be analysed?	What will be the expected results?
1 What does the regenerative process of oak wood look like?	Qualitative data on how such a process looks like, and quantitative data in addition to see how this is applicable to oak.	Literature study on regenerative design; material research on the life span of oak.	A "Material Flow Analysis" (MFA) is used to look at how flows and stocks of oak in a well-defined system can be quantified. And how this system can be regenerated.	A quantitative and complete 'life cycle flow' view, where flows are closed over a given timeframe.
2 What is needed from the local context to facilitate oak regeneration?	Qualitative data on the conditions of a particular site and how this can support oak tree growth.	Literature research on the contextual conditions; material research for oak growth; visitation to have a better overview on the actual site.	By evaluating all the possibilities and difficulties of the need to grow trees in that particular location.	A conclusion and recommendation on how a specific site (with its associated biodiversity) can be used for growing oak trees.
3 What are the general properties, qualities and specific applications of oak?	Qualitative data, to investigate the qualities, such as chemical properties, strength, tactility and durability; Quantitative data, to map the applications.	Mainly material research on the properties of wood; case studies to see which applications there are; wood database	Through an overview containing all the performance and applications of the material in question.	A summary where it is made clear what the material content is and how best to apply it.
4 How can the uses of wood be incorporated into the shearing layers concept?	Both qualitative data, to investigate the different layers, and quantitative data, to investigate in what quantity the material is needed.	Literature research on the concept of shearing layers; wood database.	By listing all possible uses of wood within the different building layers formulated in the concept of shearing layers. To then evaluate which application within which layer the material is best applicable.	A recommendation in which oak fits best within the specific building layer. Including possible design principles.
5 What nature-inclusive design interventions are there with wood?	Quantitative data of which nature-inclusive applications are currently in existence.	Database of the municipality of Amsterdam about nature-inclusive design. And casestudies on similar nature-inclusive projects.	By listing all design interventions that can be made with oak. It also evaluates whether the intervention in question is useful for the site.	A kind of toolbox clarifying which nature-inclusive design interventions can be translated into design principles.

Figure 4: Research methodology. (2022) Made by author

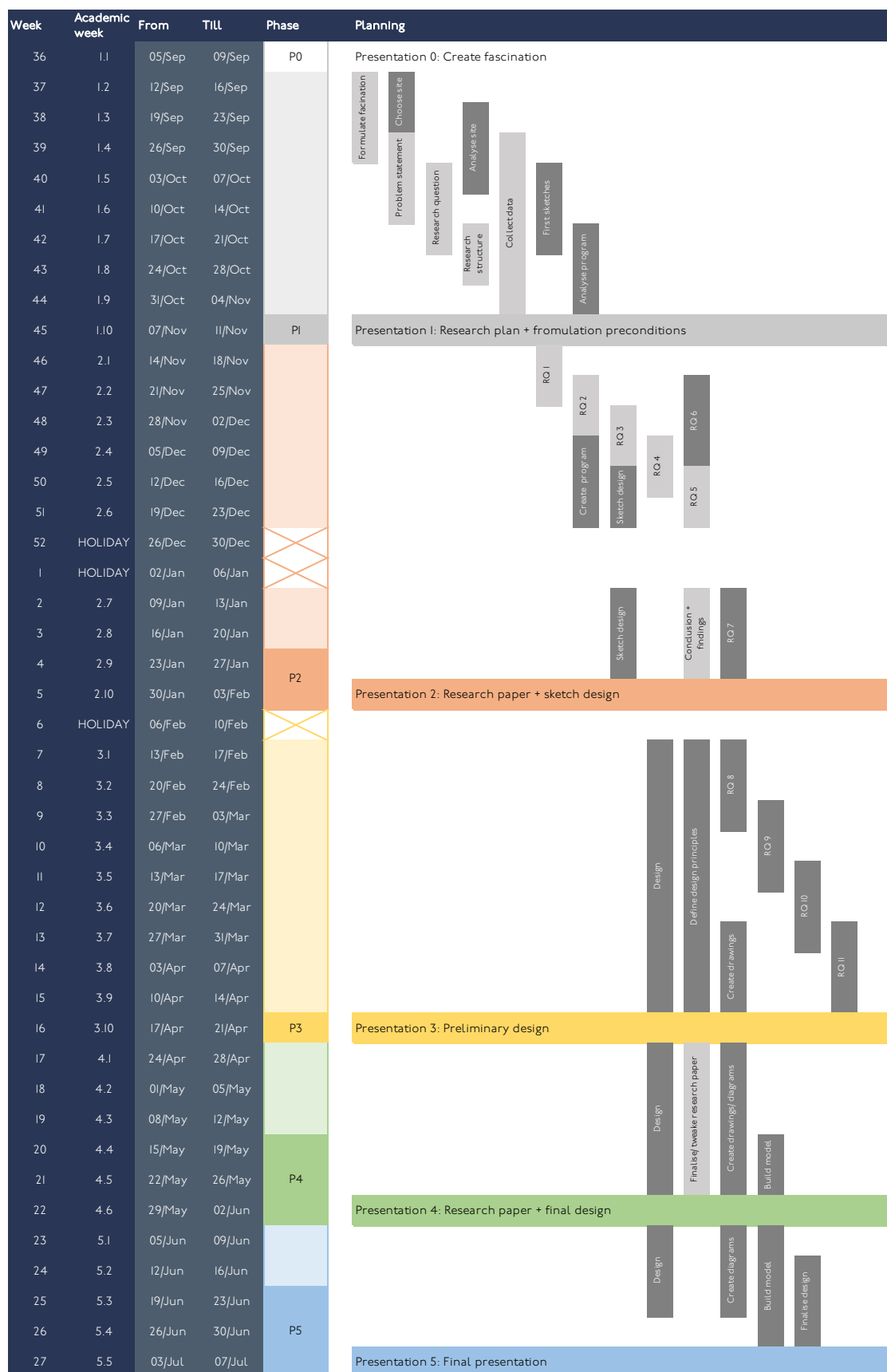


Figure 5: Research (grey) and design (dark grey) planning. (2022) Made by author

Expected results

- a. Relevance
- b. Hypothesis
- c. Antithesis

This chapter first looks at why this research is relevant, then further highlights all the expected/possible results.

a. Relevance

If we continue to build in this way, rich biodiversity will die off and eventually create an uninhabitable world. This is while all future images end in large measures of population growth. By the year 2050, the earth is even expected to have 10 billion inhabitants. This is only possible with a new approach to the existing/old system. This starts with a holistic within a municipal scale.

b. Hypothesis

1. By constructing a framework around a single material (oak wood), it provides guidance when exploring possible other regenerative materials.
2. By further highlighting this principle of a regenerative design process, the role of the architect will shift from mastermind to facilitator of the local materials available. And as a result, the specific site will be perceived differently.
3. These specific uses of different materials can be framed according to their life cycle. For this, the concept of shearing layers provides a good basis.

4. By not only working together 'with' nature (through regenerative design), but also working 'for' nature (using nature-inclusive design interventions), this will ultimately have a positive impact on biodiversity.

c. Antithesis

1. Despite the understanding of oak regeneration, it appears that this particular material does not lend itself well to this. This is because the rate at which we build now and in the future is much higher than its growth rate. However, perhaps this knowledge will be applicable with other wood types.
2. Although it emerges that this regenerative design process works successfully in this specific context, it appears that to realise this in other areas would require much more space than is achievable. The Netherlands is a small country, with very little space to develop, let alone plant trees for this construction.

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