GROWING A HOUSE

The potential of local Dutch soils

MNEXT MATERIALS & ENERGY X TRANSITION

GOING BIOBASED

Biobased production has been on a rise lately. No wonder. With the depletion of resources and eminent climate change, the world is looking for ways to keep up with the production demand while lowering the **carbon footprint**. Biobased **renewables** are a great solution as their formation is much **faster** than that of a fossil carbon and they are easily **recyclable**. However, this solution comes with challenges such as **durability** of the materials and **space** requirements for their production. Especially in the Netherlands, these (mainly) crops will compete with (not only) the food industry and construction sites.

THE IDEA IS...

While biobased construction is a big part of this project, it would not be possible without one important component: **SOIL.** Daily it:

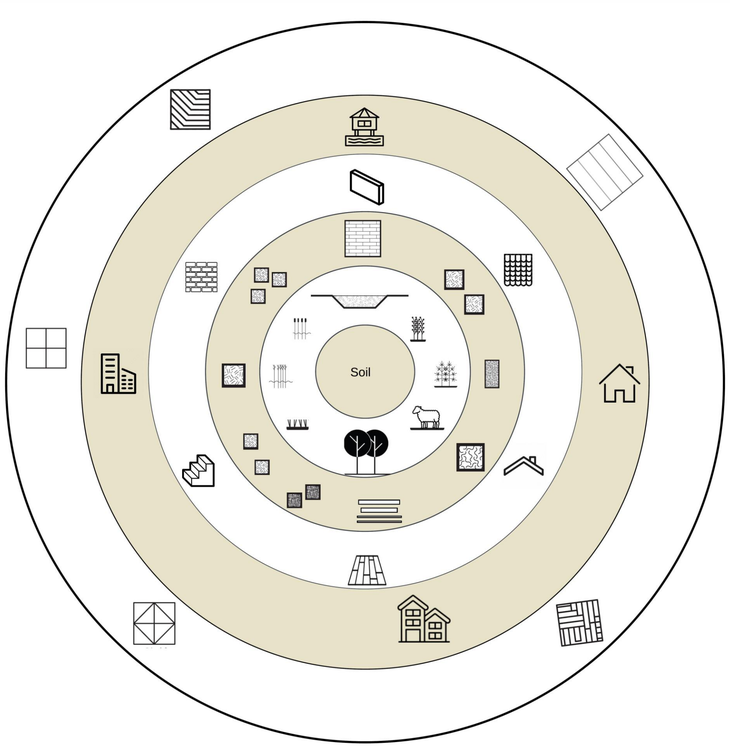
- Provides habitat,
- Stores nutrients,
- Buffers against outside elements and pollution,
- Functions as structural support.

This project considers three common soil types in the Netherlands: **sandy soil, clay, and peat**, from three different directions.

- What kind of **construction is complementary** with individual soil types?
- What material **sources thrive** in which of these soil types?
- What would that mean for the **landscape** we live in?

The aim is to **illustrate** how much space it would take to build a bio-based house on a specific soil type, what kind of materials could be produced on the same soil type, and additionally, what kind of limitations would need to be considered?

Figure 1.: Representation of placing the soil in the focus before exploring its possibilities.



WHAT DID WE DO

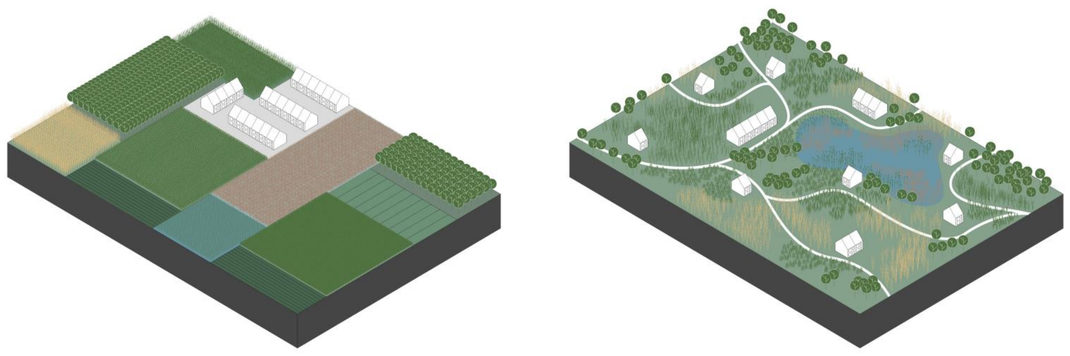
As shown in the Fig.1, the idea of the project was to consider the soil. The theoretical part of the project stemmed from the soil types, and could be divided into following sections:

- Architectural elements suited to the soil type,
- Material sources inhabiting, found, or growing well on the soil type,
- Materials available on the Dutch market (preferably produced in the NL)
- Materials sourced in agricultural settings,
- Materials sourced in semi-natural settings.

Most of the data was gathered through a literature research and from data gathered for other MNEXT projects (former CoE BBE). Data on possibilities of timber production in semi-natural environments was based on an interview with staatsbosbeheer.

Afterwards, calculations were done to determine how much **land** would be needed to produce the materials for a model house and how much **product** could be produced on a hectare of land. These calculations were based on **yield data** gathered in the literature research and approximation of **material needs** for model houses.

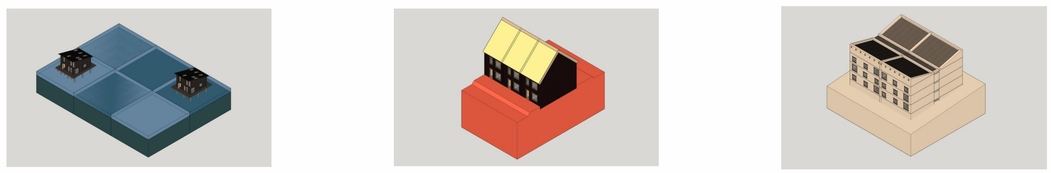
Figure 2.: An illustration of organized, highly managed agricultural setting, and semi-natural setting with limited management and interlacing landscape elements.



MODEL HOUSES

Model houses reflect variety in the soil type as well as biobased materials (or their sources). On peat soil type (left), the houses are smaller, detached, sparsely distributed. Lighter materials were considered for this model. On clay soil (middle), the house is semi-detached with brick finishing and reed roof, and on sand soil is the apartment building (right), built with rammed earth walls.

Figure 3: Depiction of model houses for each soil type (from left: detached house on peat soil, semi-detached house on clay soil, apartment on sandy soil)

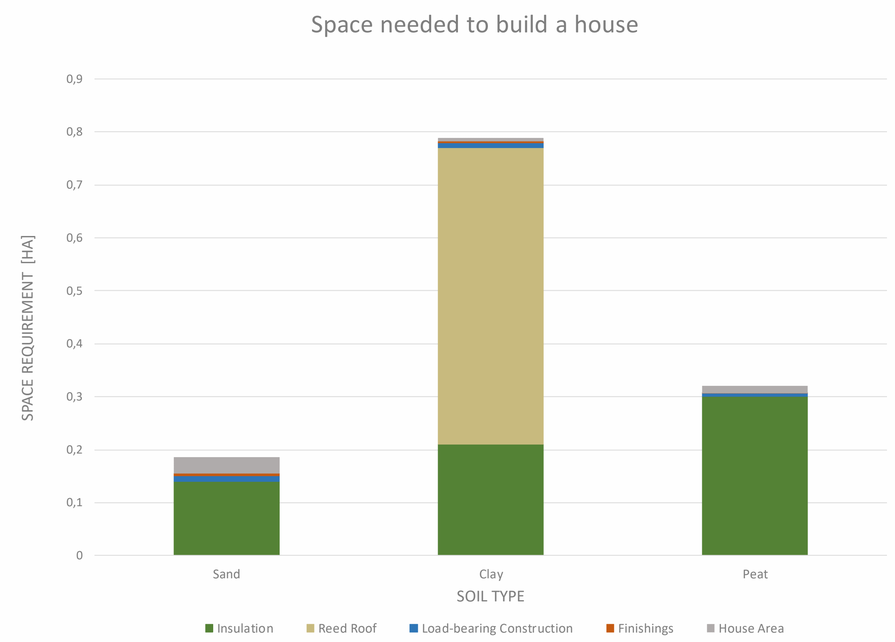


QUARTER OF A HECTARE?

While this project aims to **estimate** the area required to source materials for bio-based house, the results suggests that **0.185 ha** is enough to source the materials and build a house.

This result can be seen in Fig. 4 below, as the graph shows the space required to produce materials for one model house on each of the soil types in this project. The space is further divided according to the building elements, such as insulation and finishings.

Figure 4: Graph displaying the space needed for materials to build a model house on individual soil types



WHAT DOES THAT MEAN

The results of this project **outline** what could currently be expected. Fig. 4 only showcases the materials with **highest product yields** for each model house. We need to keep in mind that the size of the expected house is included in the space requirement and differs per each model. It can be noted in Fig. 3 that models vary also in their type (detached, semi-detached, and apartment).

Can be noted:

- The insulation requires more space than the construction materials,
- Reed roof requires significant amount of space compared to all other materials,
- Finishing materials have no significant contribution,
- Rammed earth is not represented in a graph as it was concluded it could be sourced from the foundation of the house.

It is worthy to add that the represented load-bearing construction material is timber with longer harvest rotation period that is not considered in the representation of the result. The significance of the harvest rotation time varies based on the tree species and its estimated yield and rotation time.

FURTHER ON

This project only outlines what could **currently** be expected. It needs to be noted that multiple biobased materials were **not considered** due to their absence on the market. Agricultural waste and nature-management waste streams were, likewise, not considered and might provide a viable and efficient option.

Regarding **timber** production, the data varies greatly due to different management strategies, harvest rotation times of different species, the variety in their dimensions, and climate conditions. As such, it **uncertain** to what degree is the result an accurate estimation. A more detailed research with focus on Dutch agriculture may bring clarification.

While the decisions made during this project were based on the soil types, an evaluation of **landscape** needs from broader perspective still needs to be evaluated based on the challenges and values each soil type brings. Especially regarding **peat** soil, as typical agricultural trend of draining the soil brings forth many environmental problems.

Project Onderste Boven

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