



booklet
forgotten values

Master Thesis HS21

*Architectural Behaviorology for Durability
by Actor Network Drawing*

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prolog

In our society almost everything is always available. If you want something, there is a way to get it. By consuming food and using building materials from abroad we emit a lot of CO2 due to transportation.

How can we reactivate the consciousness of consuming and building locally?

Food cooperations in Zurich are promoting fairtrade, seasonal and local vegetables and fruits, thus encouraging the awareness of the consumer. For example the cooperation 'meh als gmues' in Zurich Nord produces weekly vegetables in cooperation with their members. I am convinced that this approach can also work for local building materials.

We need to find new local and social approaches of producing building materials.

Cereals is one of the main staple food on earth. The grains are harvested annually, while the straw is still a by-product and is used as litter in stable keeping and gets returned to the soil. Due to productivity improvements, ancient cereals with better nutritional values but less yield, were neglected over time.

What are the possibilities of straw as a building material?

The perennial rye 'Waldstaudenroggen' returned to the Swiss agriculture in 2017 and since 2019 the farm of the family Böhler were able to prepare seeds as well as grains for human consumption.

In my master thesis i want to promote the forgotten skill of the thatched roof and integrate the perennial rye to Zurich's agriculture.

contents

part A - research

- A1. research site / „meh als gmues“ cooperation p.1 - 5
- A2. research „Strohdachhaus in Muhen“ / thatched roof p.6 - 17
- A3. research „Waldstaudenroggen“ - perennial rye / grain farming p.18 - 20

part B - project

- B1. temperatures for bread process p.22 - 25
- B2. plans p.26 - 36
- B3. construction details p.37 - 40
- B4. model photos p.41 - 44

part C - experiments

- C1. how to make a bread p.45 - 54

sources p.55

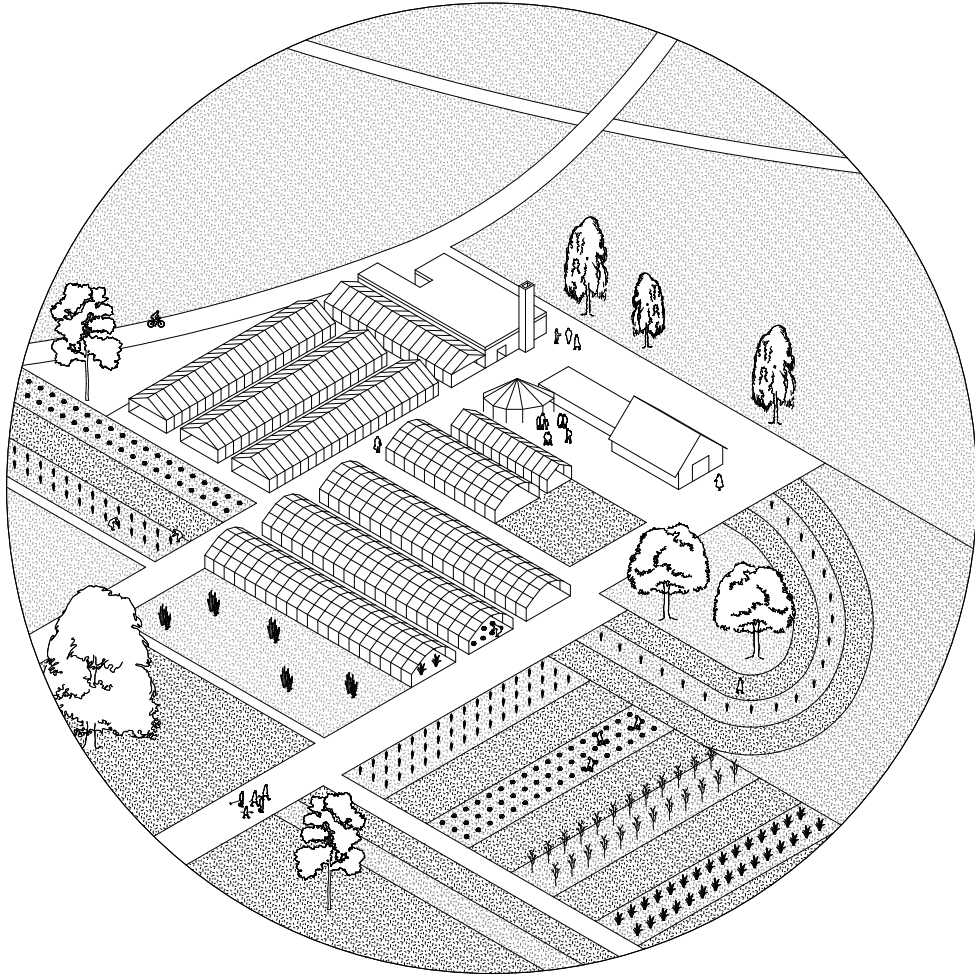


„meh als gmues“ food cooperation

The farming cooperative was founded in 2016 in Zurich Nord. The main goal is to produce locally farmed vegetables in cooperation with its members.

Together with professional gardeners you produce regional and seasonal vegetables, regardless of industrial agriculture and taking into account ecological principles and your own needs. With „meh als gmues“ you are not just a consumer. In order to get your weekly vegetables you go out on the field. In a variety of work assignments, the members help with the sowing, gardening in the greenhouses, with the harvest and other activities for 20 hours a year.

In cooperation with the city of Zurich, the food cooperation is still growing and developing new projects. Urban agroecology needs good examples that illustrate its potential for sustainable land management. The „Technikum Urban Agroecology“ is a lighthouse project in which socially, economically and ecologically sustainable use and management methods are planned, initialized, tested and conveyed in theory and practice.¹



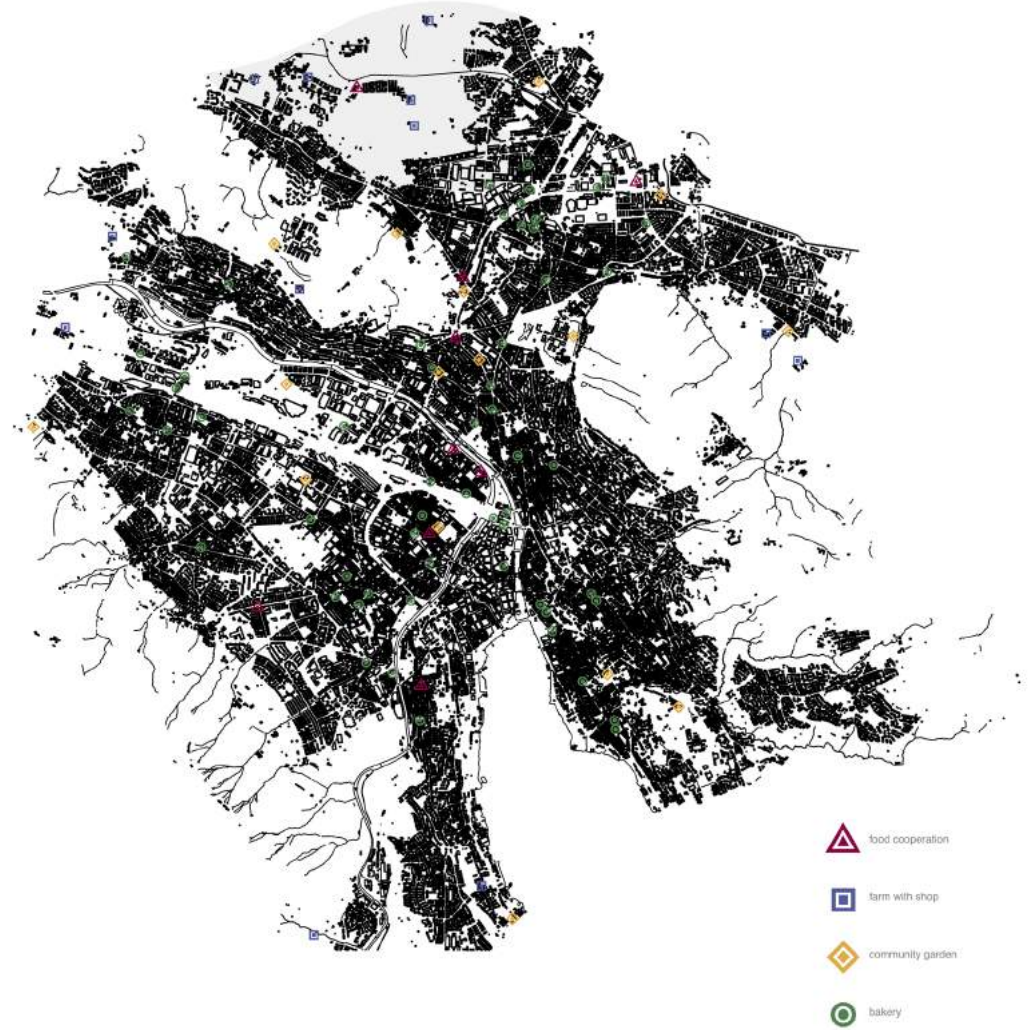


3



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zurich



„Strohdachhaus‘ in Muhen

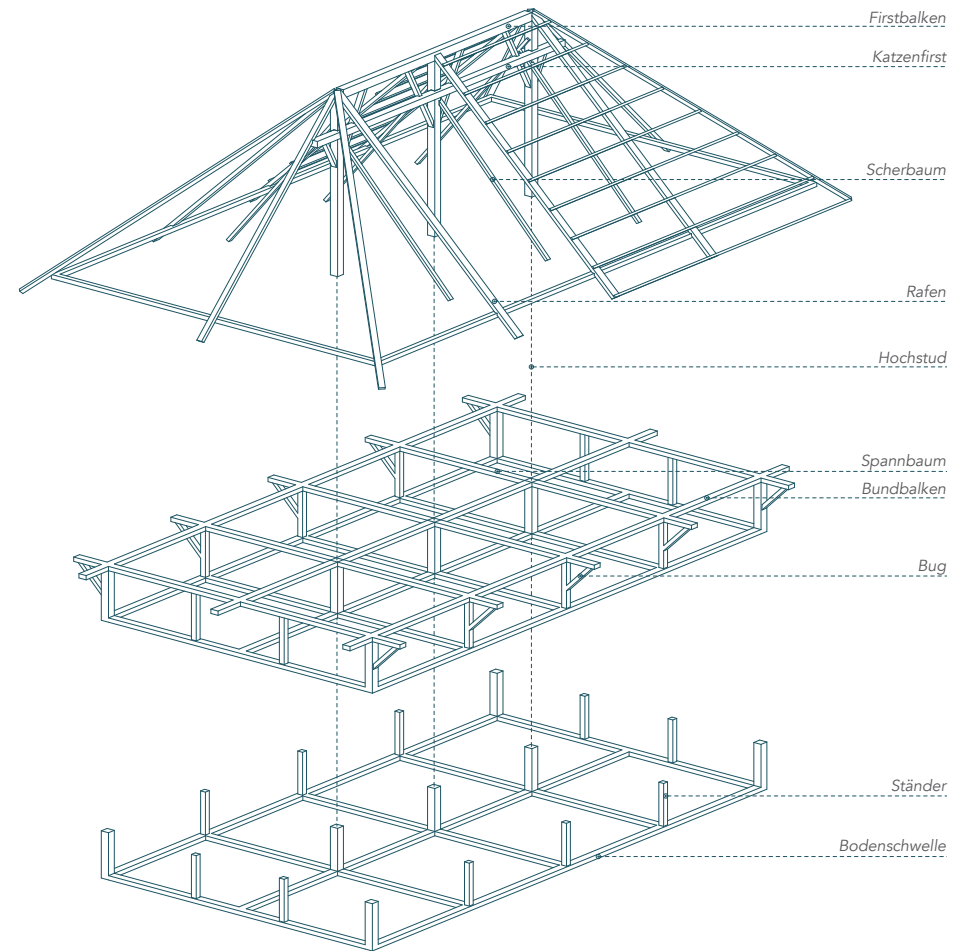
Straw roofing was characteristic of the steep hipped roof of the Swiss Plateau until the 19th century. But why did the thatched roof almost disappear?

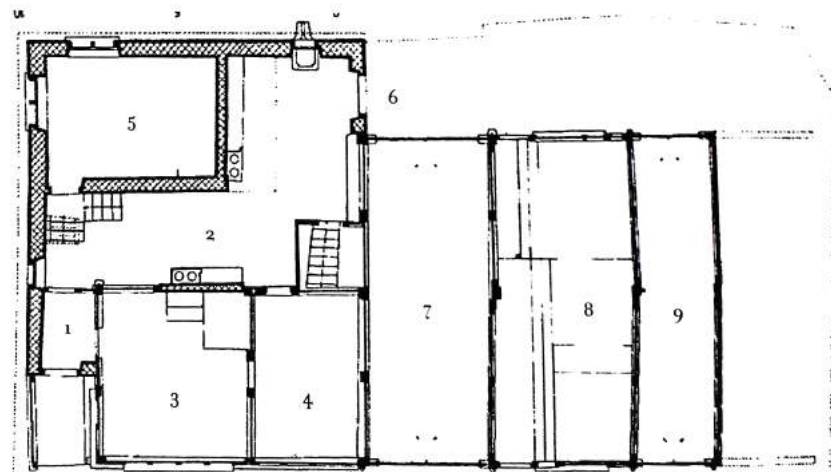
In order to use straw as roofing material, the stalks must remain stable. With industrialization and mechanized threshing, the stalks were flattened and were no longer suitable as roofing material.

In addition, thatched roofs have become less economical compared to industrially manufactured roofs. Because straw is a flammable material, there was a fear of fire. In addition, tiled roofs were increasingly seen as representative and meant prosperity. The construction of new thatched roofs was forbidden according to the regulations of the fire insurance after 1832.⁸ These different influences led to today's situation where the profession of the thatched roofer is almost extinct in Switzerland.

The Strohdachhaus in Muhen, built in 1721, is one of the last remaining ‚Hochstüdhäuser‘ in the canton of Aargau. It resembles a traditional farming house of the Mittelland and was inhabited until 1954. In 1961 an arsonist burned it down. Fortunately the living area and the 300 years old ground threshold, made from oak, resisted the fire.⁹





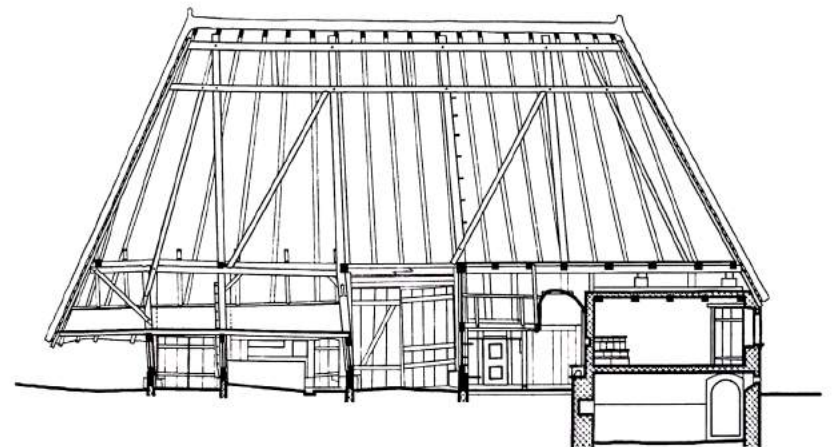
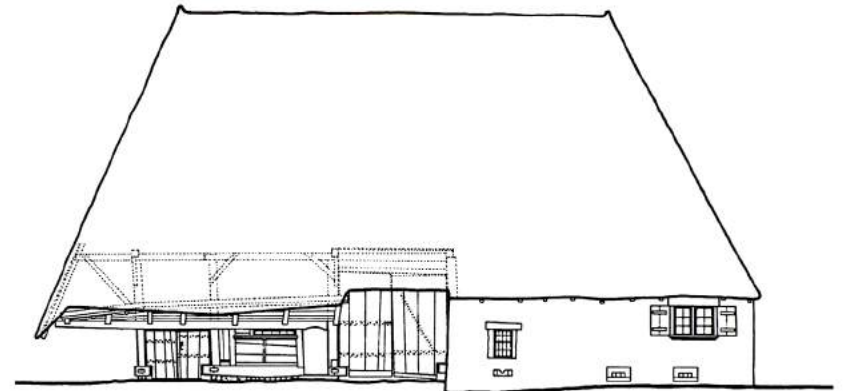


Grundriss Erdgeschoss

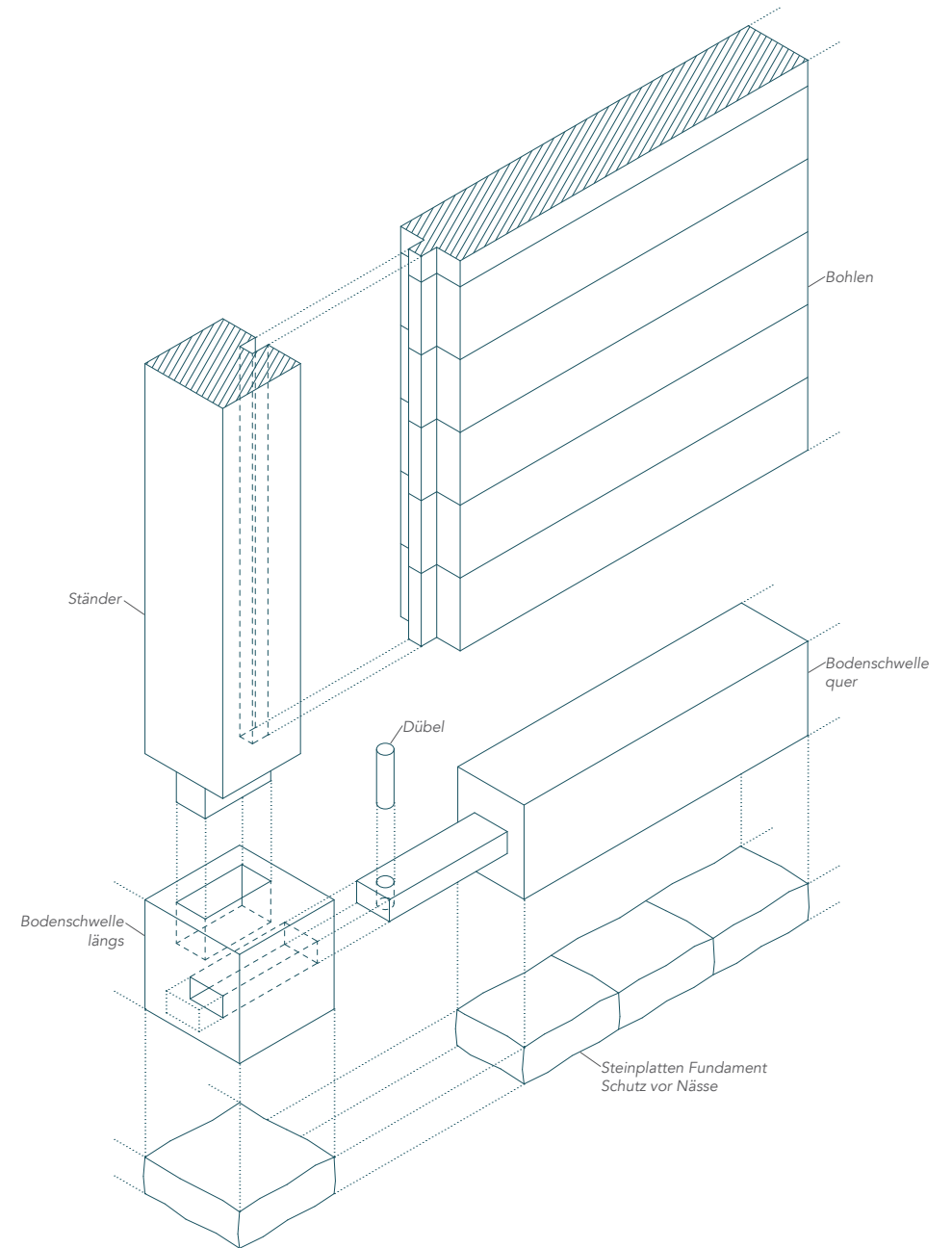
- 1 Eingang Süd
- 2 Rauchküche mit Herd
- 3 Stube

- 4 Nebenstube, Schlafkammer
- 5 Stock
- 6 Eingang Nord
- 7-9 Ökonomie: Tenn, Stall, Futtertenn, Remise

Groundfloor, Strohdachhaus in Muhen¹⁰

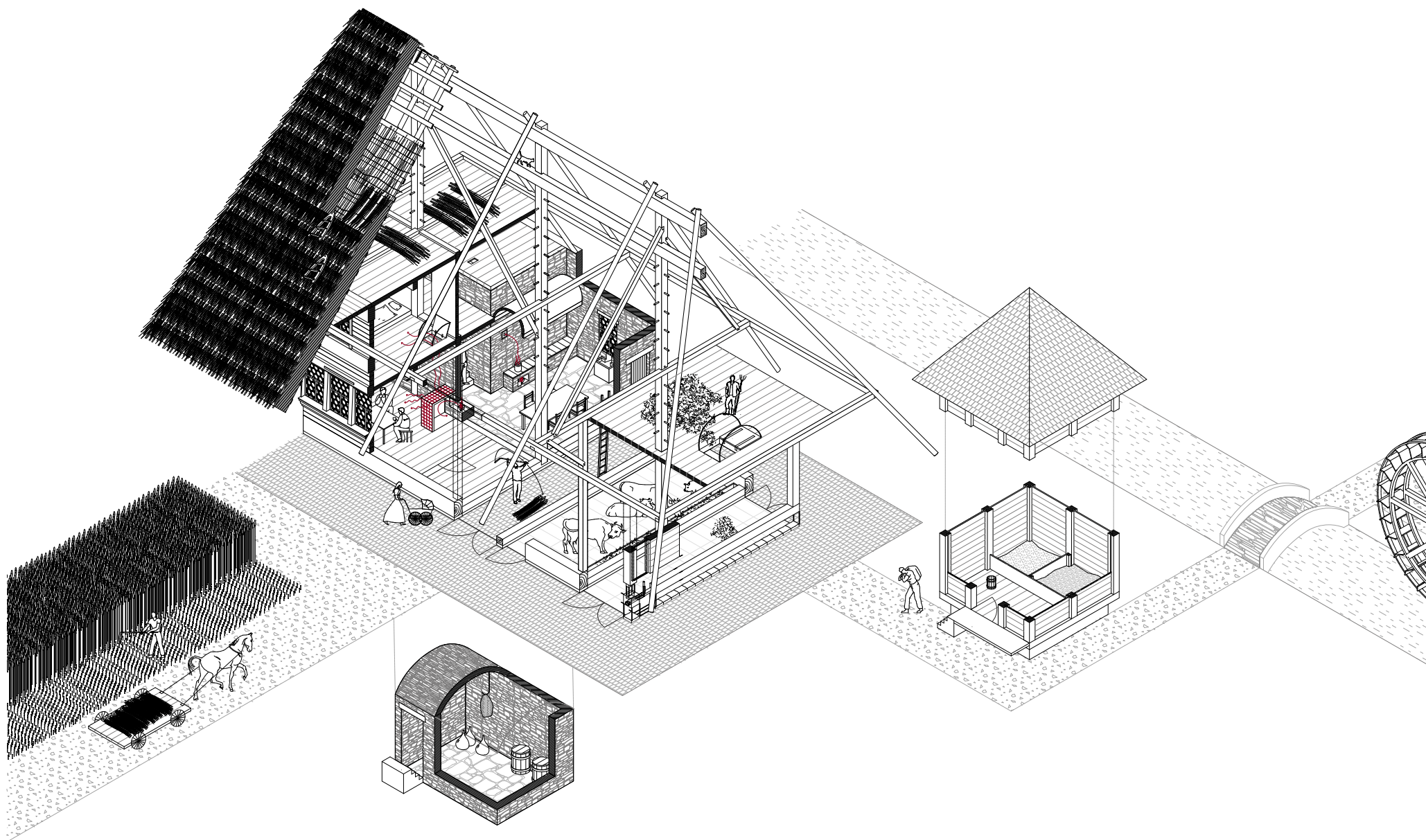


Sections, Strohdachhaus in Muhen¹¹









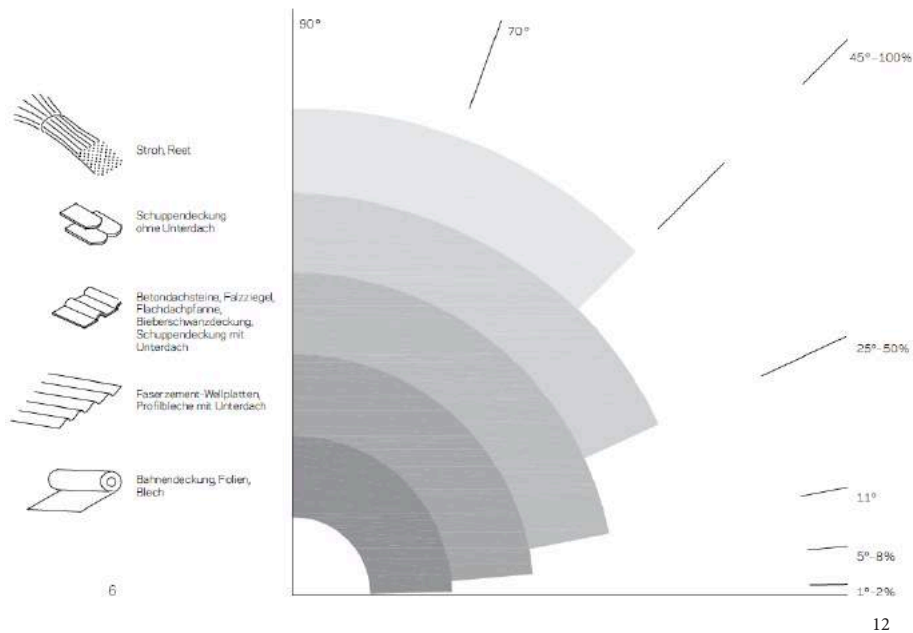
Hochstudhaus



Durability

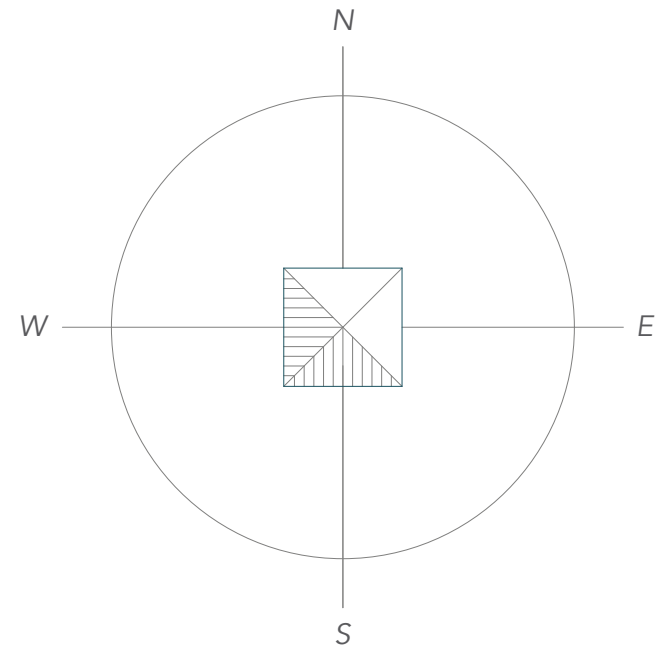
The lifespan of a thatched roof is on average 15 to 20 years, with ongoing maintenance and a good location it can be up to 30 years.

The most important factors that determine the lifespan of a thatched roof are the roof angle, orientation of the roof surface, mechanical damage to the roof skin by storms and animals, as well as the plant rotting processes.



Angle

The influence of the roof angle on durability is of fundamental importance. Since stagnant water accelerates the rotting of the plant structure the most, a steep roof pitch of at least 45° to 50° is required. A free position of the house promotes the quick drying of the roof cladding.



Orientation

It is not only the proportion of sun and rain that determines the rotting of the natural material, but also the rapid change in these climatic factors. In particular, it is the roof sides to the south and west that tend to show above-average aging behavior. The roofs, sloping to the north and east, with more balanced temperatures, are less exposed to weathering.

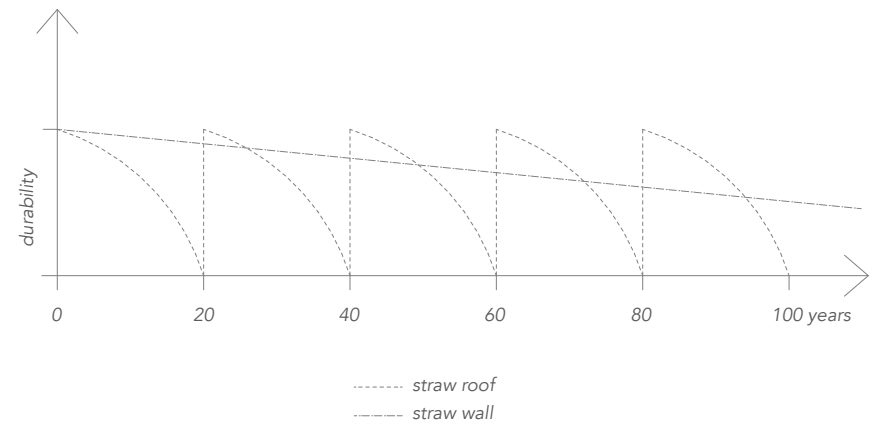


13

Mechanical damage

Any force that affects the strength of the roof, i.e. one or more stalks slip out of the seam or bond, has a negative impact on the durability of the roof skin.

Soft roofs are storm-proof because their elastic roof skin is springy and absorbs all vibrations without losing the cohesion.



Natural rotting process

Compared to the lifespan of a straw roof, the material used in wall construction can live much longer.

By conserving inside of layers of plaster, there are buildings with straw insulation aging above 100 years.



International Thatching Society

„ITS is an international platform for exchange of knowledge and news about thatching and thatched constructions. The longterm goal is to upgrade thatch to become a modern and competitive roof, acknowledging the historic skills and techniques for future reference.“¹⁴



15



„Waldstaudenroggen“ - perennial rye ¹⁶

The perennial rye is ancient grain which probably comes from the near East. Just like other ancient grain types, the perennial rye is almost forgotten because the harvest yield is around 50% than that of today's breeding rye. In addition the perennial rye is a 2-year-old cereal plant, which only yields in the second year of cultivation. Therefore the plant is cut after one year and is used as fodder for animals. After the cut, the plant will sprout again and overwinter. Only next year can the grain be threshed („Dreschen“) and processed into flour in the mill.¹⁷

The cultivation of the perennial rye brings an advantage for the soil quality. It has a strong and fine root system that penetrates the field profile. Thus, it ensures loose soil, which is suitable for growing vegetables in the following year.

The perennial rye is particularly valued for its very high levels of fiber and minerals. It has around 50% more than the usual breeding rye. It grows extremely high in the field - up to 2m. Therefore the stalk of the perennial rye is strong and suitable to use it as a building material.¹⁸



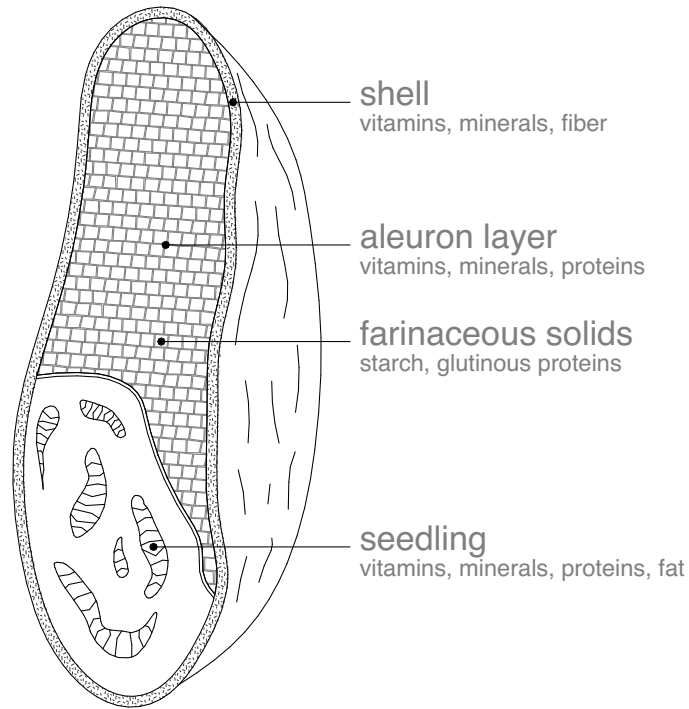
grain farming

The opening up of cheap production areas by the railways around 1870 was a great competition and led to a decline in grain cultivation.²⁰

In 2019, bread and fodder grain was grown on almost 141,000 hectares, which corresponds to the area of the canton of Aargau.

Around one are planted with bread grain per person, mainly wheat, spelled and rye as well as rice, emmer and millet. However, Switzerland continues to procure a considerable amount of grain from abroad: in 2019, grain imports for human consumption amounted to around 250,000 tonnes.²¹ This includes bread wheat, durum wheat, rice and oats, among other convenient products which contain grains.

The straw is mostly used as litter for stable keeping, in order to use it as roofing material, the mowing with the grain scythe can be used to keep the straw stable. The „Sensengruppe“ in Zurich founded in 2013 wants to give the handwork with the scythe a higher priority again.²² This is also compared to the mechanized gyroscopes more animal, plant and environmentally friendly.



The cereal grain consists of vitamins, minerals, fiber, proteins and fat but primarily contains starch inside the farinaceous solids. Therefore, grain is valuable and indispensable as an energy source for human nutrition.

forgotten values



The project ‚forgotten values‘ is integrating the ancient grain ‚Waldstaudenroggen‘ (perennial rye) to the crop rotation of the vegetable cooperation ‚meh als gmues‘ in Zurich Nord. The recultivation of the perennial rye brings an advantage for the soil quality. It has a strong and fine root system that penetrates the field profile. Thus, it ensures loose soil, which is suitable for growing vegetables in the following year.

Straw roofing was characteristic of the ‚Hochstudhaus‘ in the Swiss Plateau until the 19th century, but the craftsmanship of the thatched roof is almost forgotten today.

The goal is to create a social space to regain the knowledge of the forgotten craftsmanship of the thatched roof and provide Zurich with ancient grains, bread and straw as a building material.

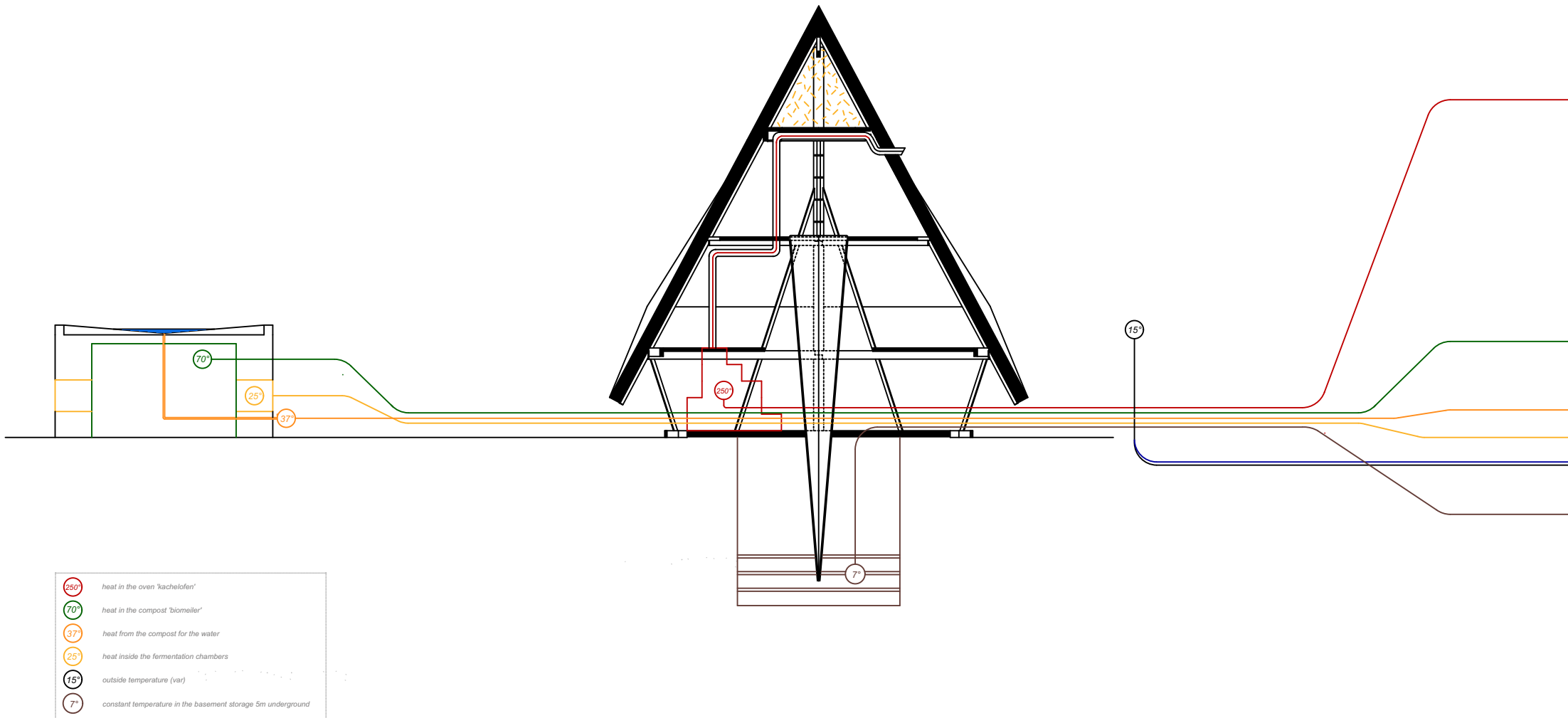
Bread

Zurich has a total of 67 local bakeries. The city of Zurich could supply itself fully with regionally produced bread. Currently, only 60 to 80 percent of the bread consumed comes from the region.²³

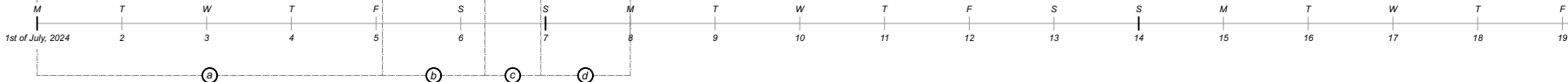
Sourdoughs contain a community of lactic acid bacteria and yeast fungi that humans have been using for several thousand years for the production of bread. The metabolic products of these microorganisms loosen the dough and improve the digestibility, aroma, taste and shelf life of the baked bread. Sourdough is of particular importance when using rye flour. For wheat flour, pure yeast can be used as a leavening agent, but in the case of rye flour, acid needs to be added that the bread rises and doesn't stay flat.

The process of making a bread depends on different temperatures. The main temperatures are 7° celsius to store, 25° celsius for fermentation and 250° celsius for baking.

The cold of the basement is used to store the sourdough and vegetables, the heat of the compost is used for fermentation and the heat of the fire inside the ‚kachelofen‘ is used to bake.



temperatures in the bread making process

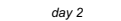


(a)



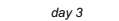
wholegrain rye flour 50g
37° water 50ml

mix and keep at 25° in the
fermentation chamber of the
"Biomeiller"



sourdough from day 1 100g
wholegrain rye flour 50g
37° water 50ml

mix and keep at 25° in the
fermentation chamber of the
"Biomeller"



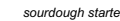
sourdough from day 2 50g
wholegrain rye flour 50g
37° water 50ml

mix and keep at 25° in the
fermentation chamber of the
"Biomeiler"



sourdough starter for baking
110g per bread

by repeating the step from day
3, the sourdough gets stronger
over time

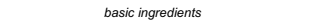


sourdough starter

sourdough starter for keeping
40g

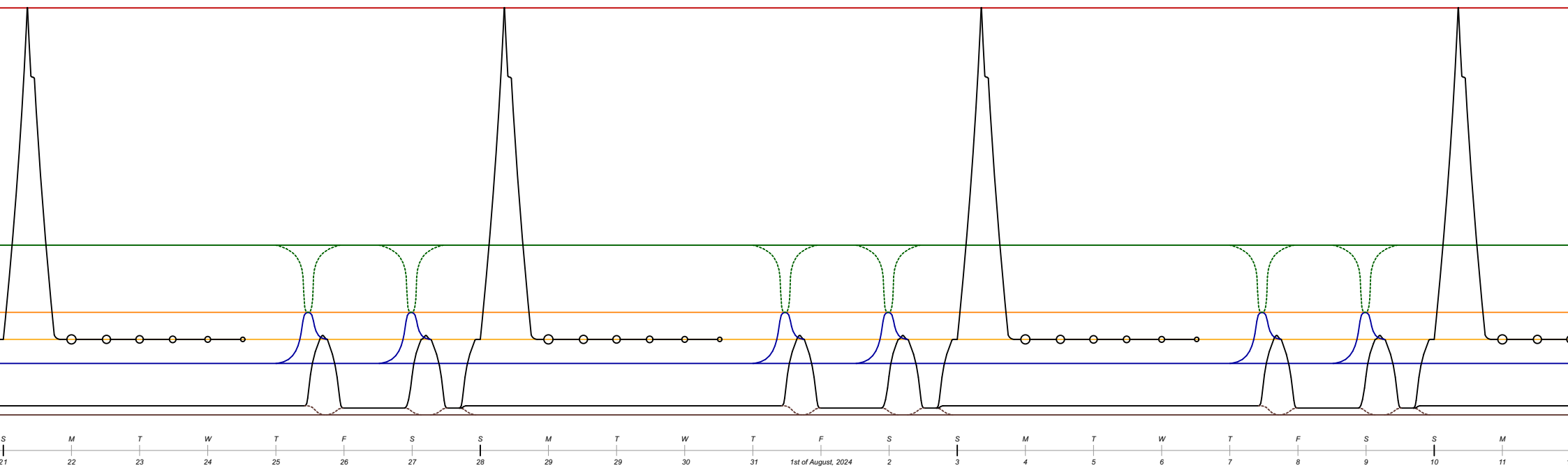
stored in the cellar at 7°
needs to be refreshed with
step from day 3 every week

④



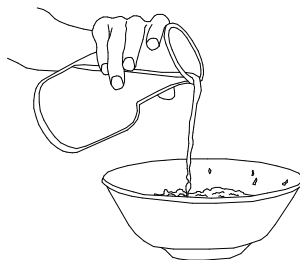
basic ingredients

wholegrain flour 300g
wheat flour 300g
water 350ml
salt 12g



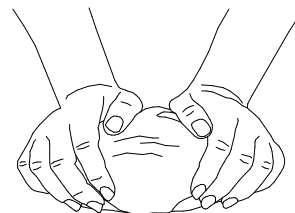
wholegrain rye flour

the handmade wholegrain rye flour is milled every week



water

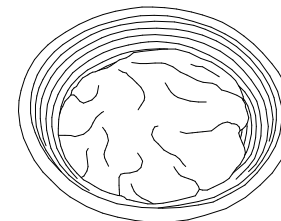
the water is stored inside the "biomeiler" filtered and heated up to 37° to activate the sourdough



kneading

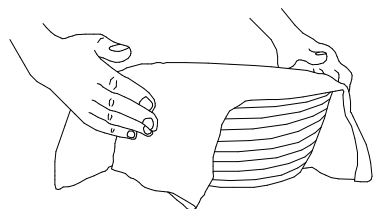
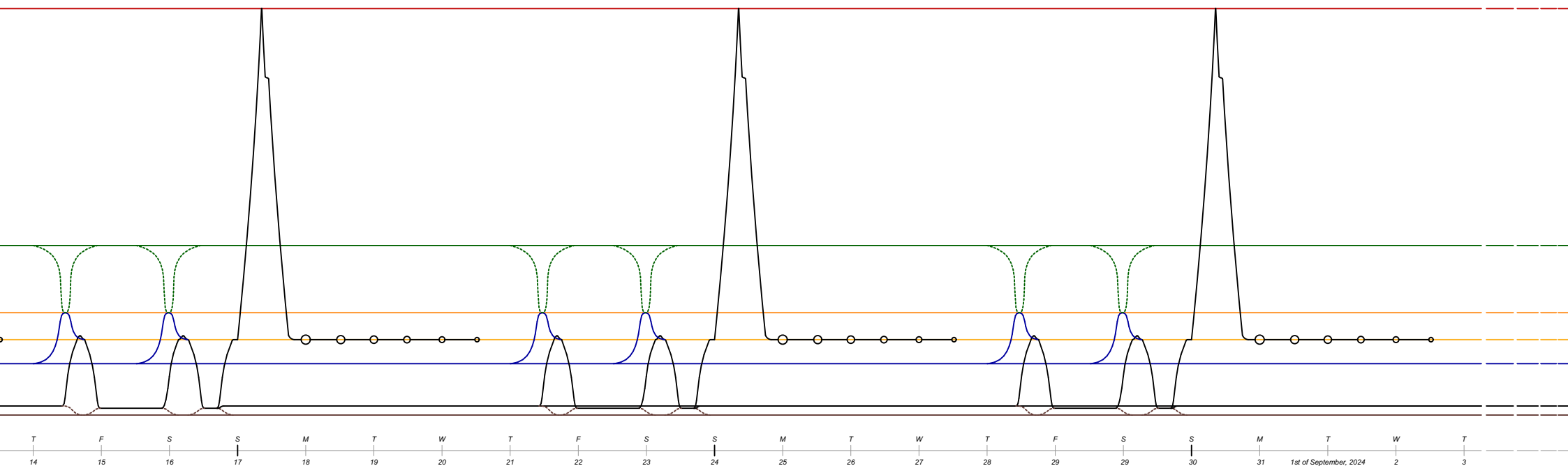
the kneading of the dough combines the water with the flour and should be done atleast 5 minutes

c *the fermentation*



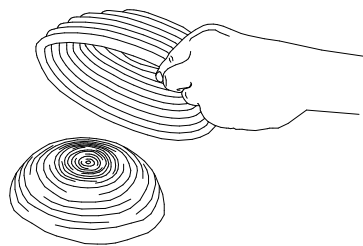
fermentation basket

the fermentation basket helps the dough to rise and keep its form and moisture



covering up

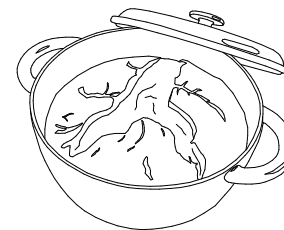
the covering up is done with a wet towel to keep the dough moist while its fermenting for atleast 12 hours in the cellar at 7°



finished sourdough

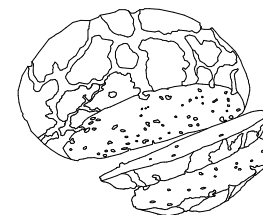
by taking out the sourdough it reveals its pattern which occurs during fermentation in the basket and is ready to bake

d baking



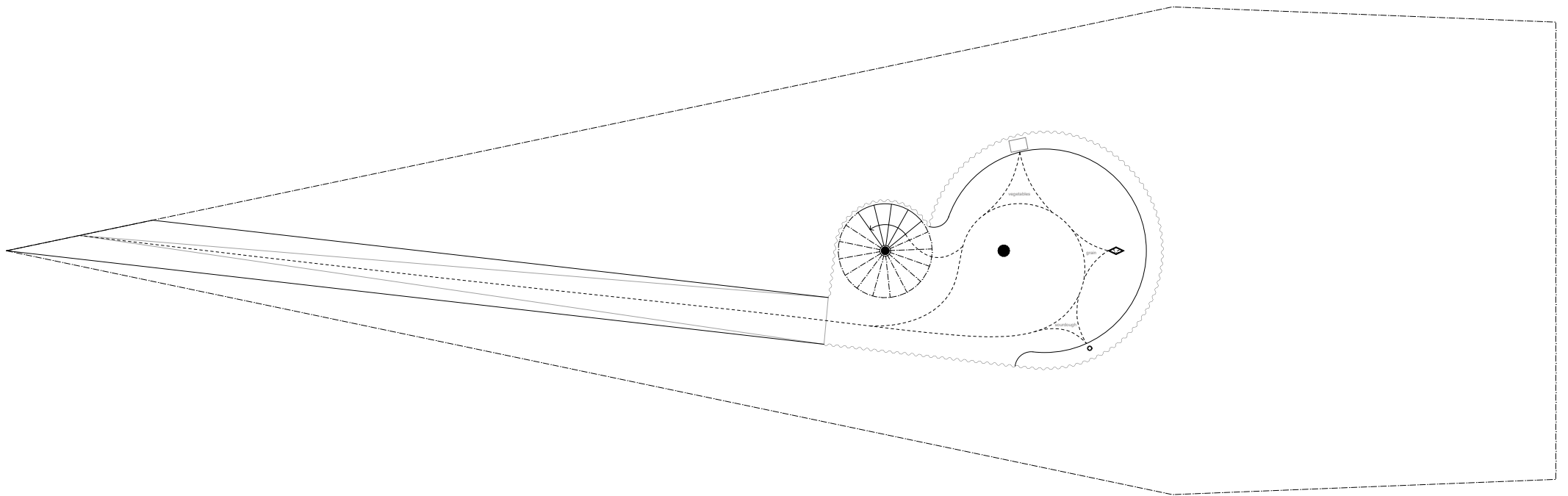
fireproof bowl with lid

the dough is baked inside a bowl with a lid to keep the moisture inside during the baking process at 250° for 10 minutes, then 190° for 30 minutes and again 10 minutes without the lid

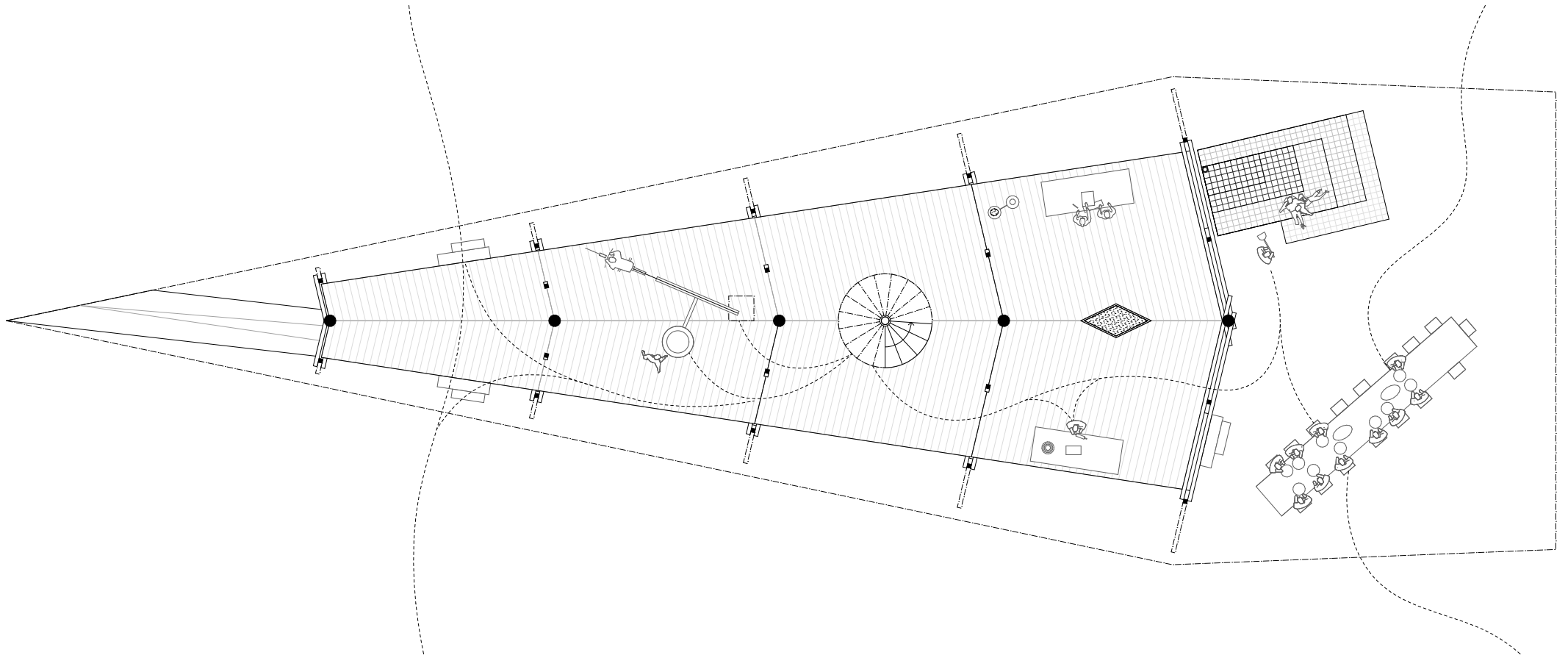


the sourdough bread

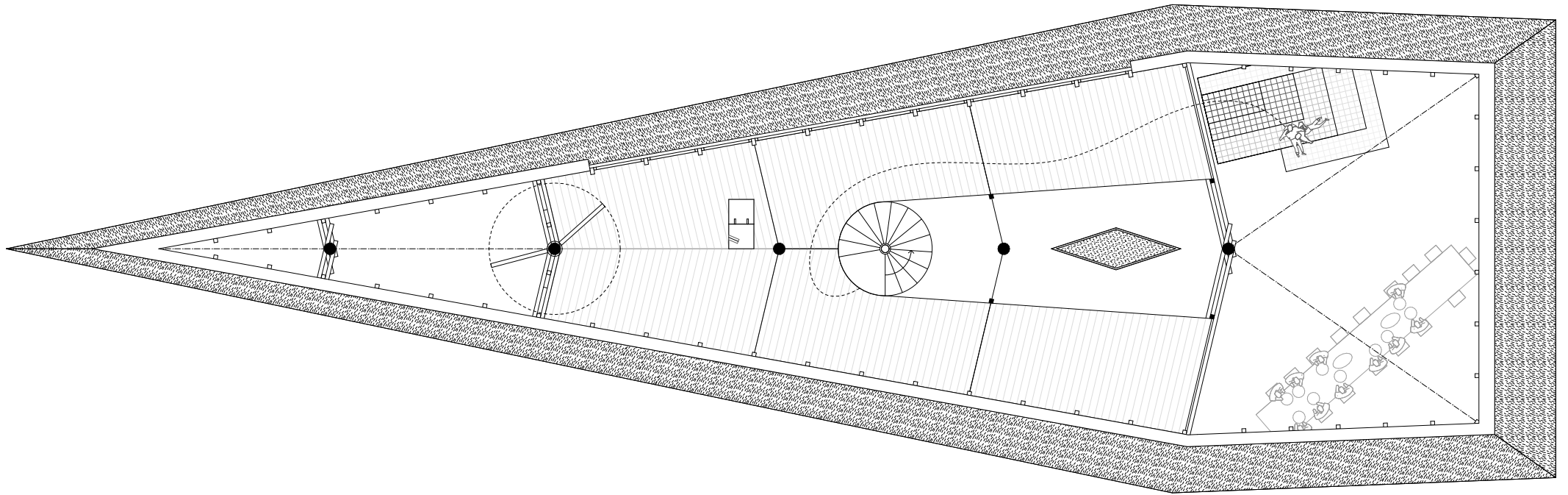
While sourdough lasts up to a week, wheat bread with a high yeast content can go off after two to three days. Because the more sourdough in the bread, the longer it stays fresh.



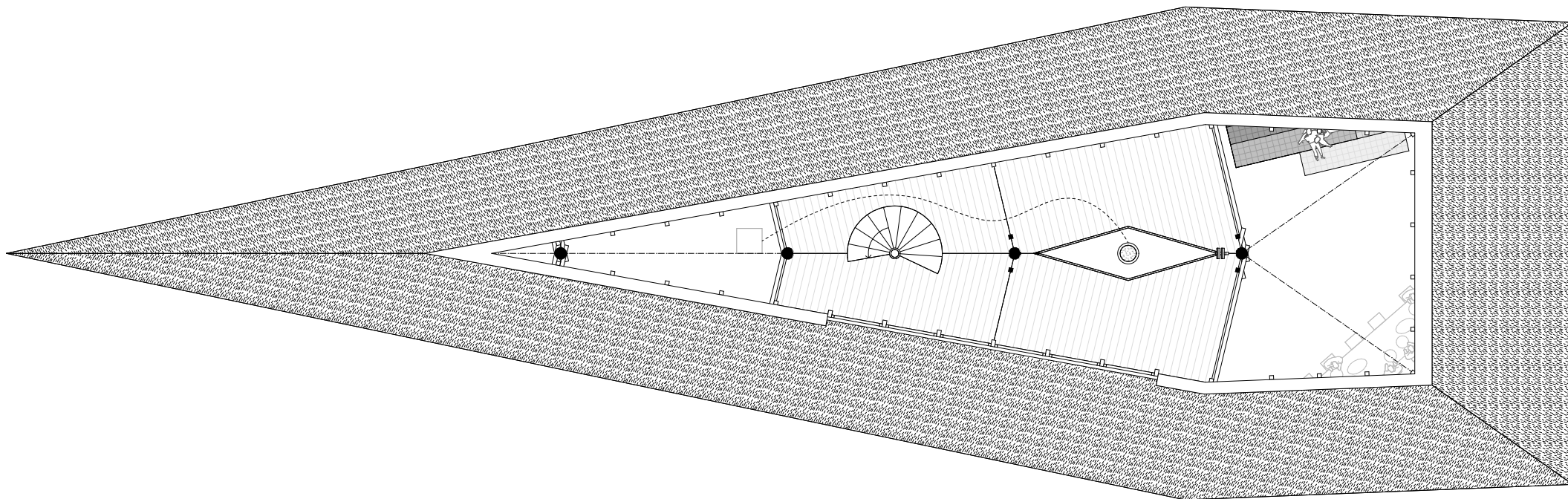
basement storage



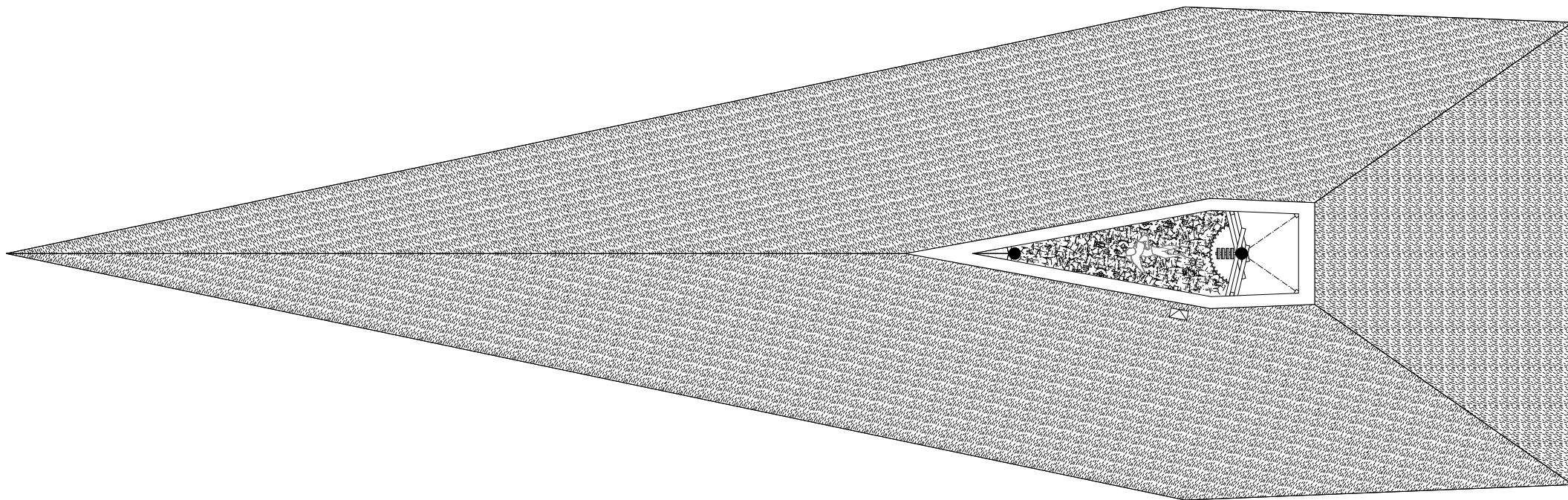
groundfloor



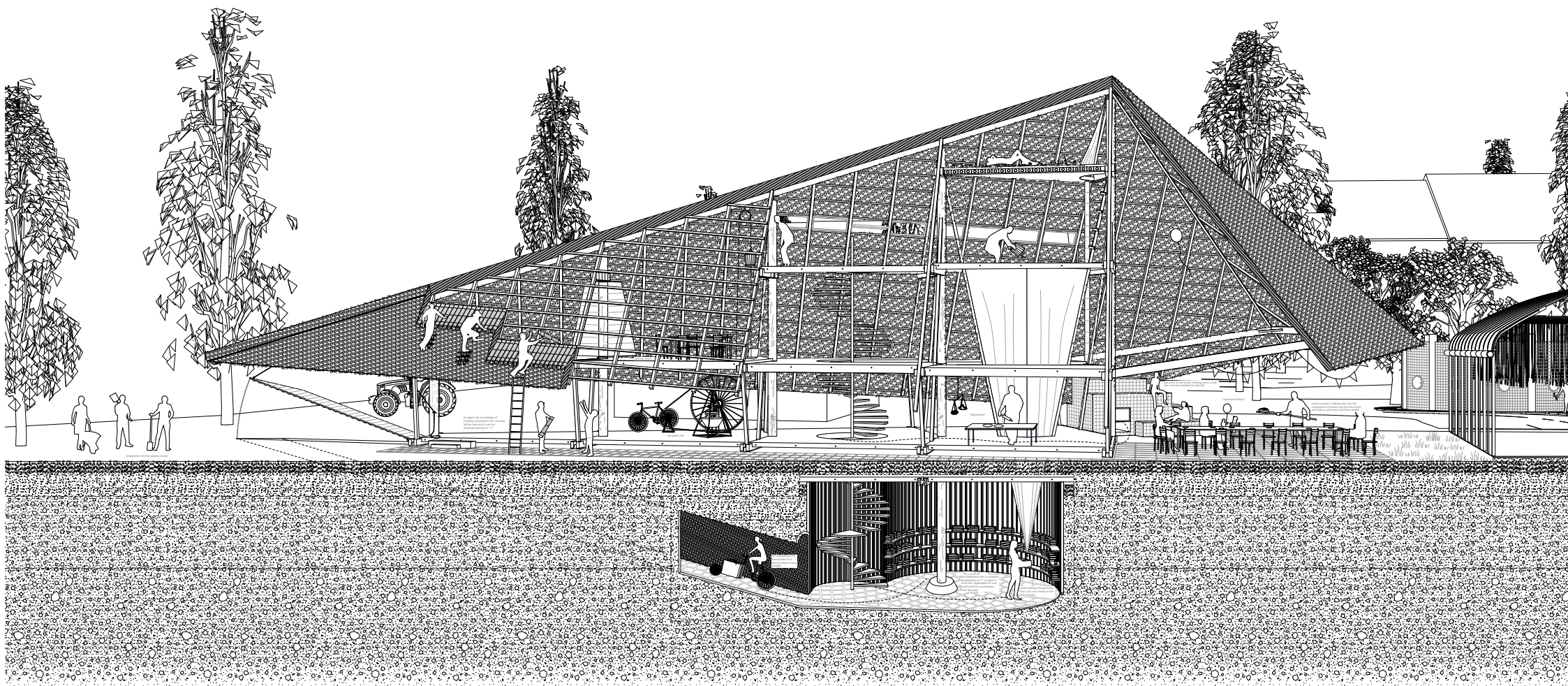
1st floor

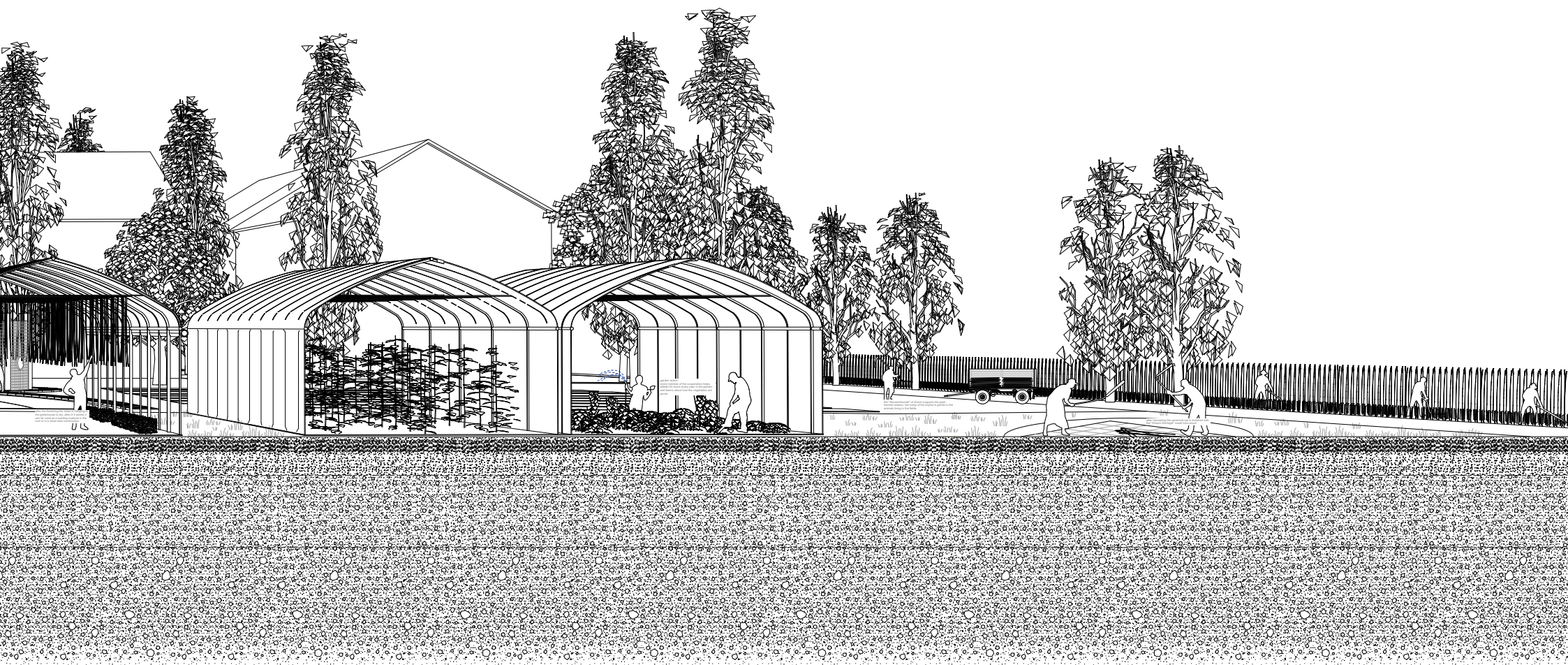


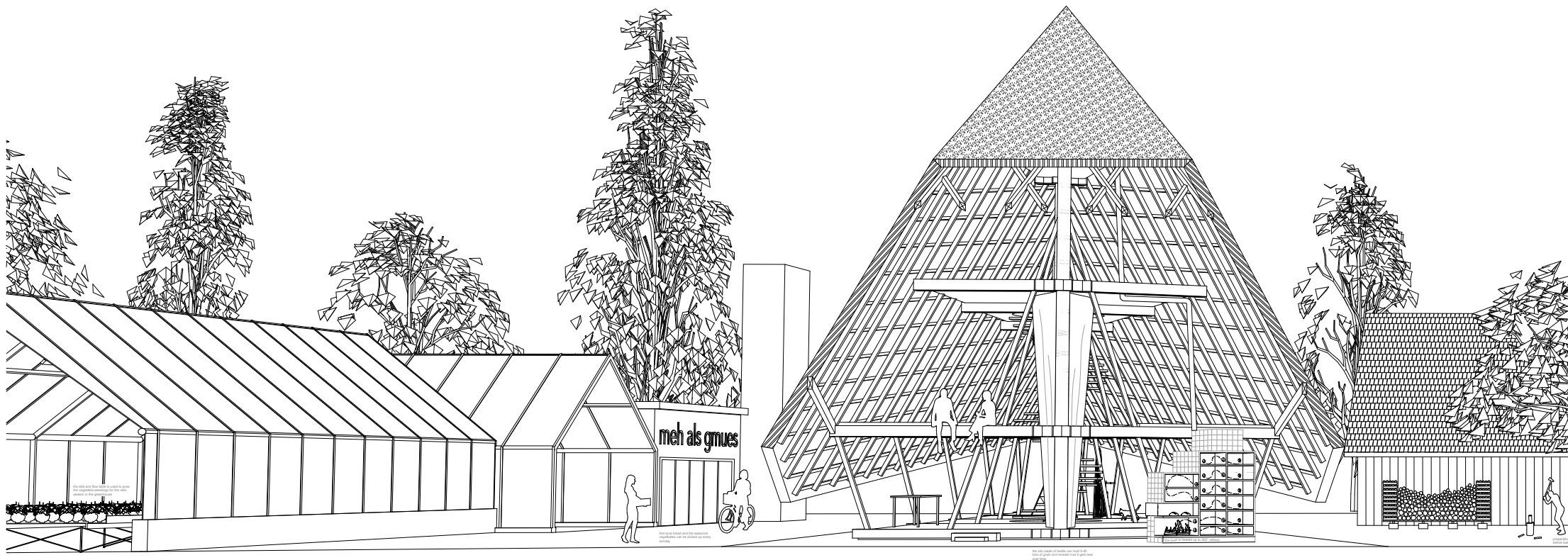
2nd floor



nest











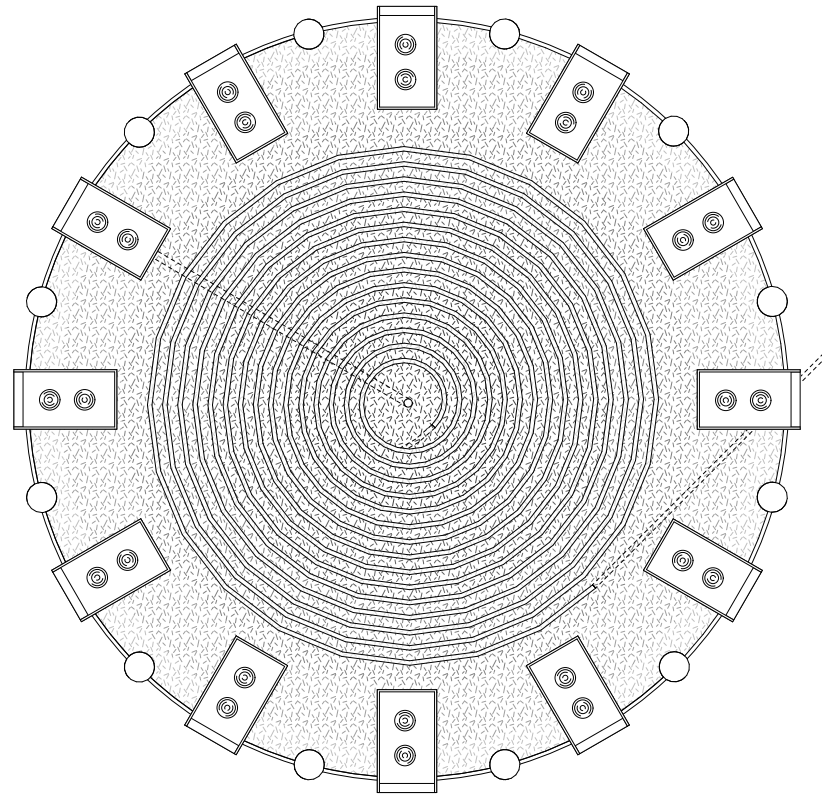
compost

The composting process is the breakdown and remodeling of organic matter. During this process temperatures up to 70° celsius can occur inside the compost.

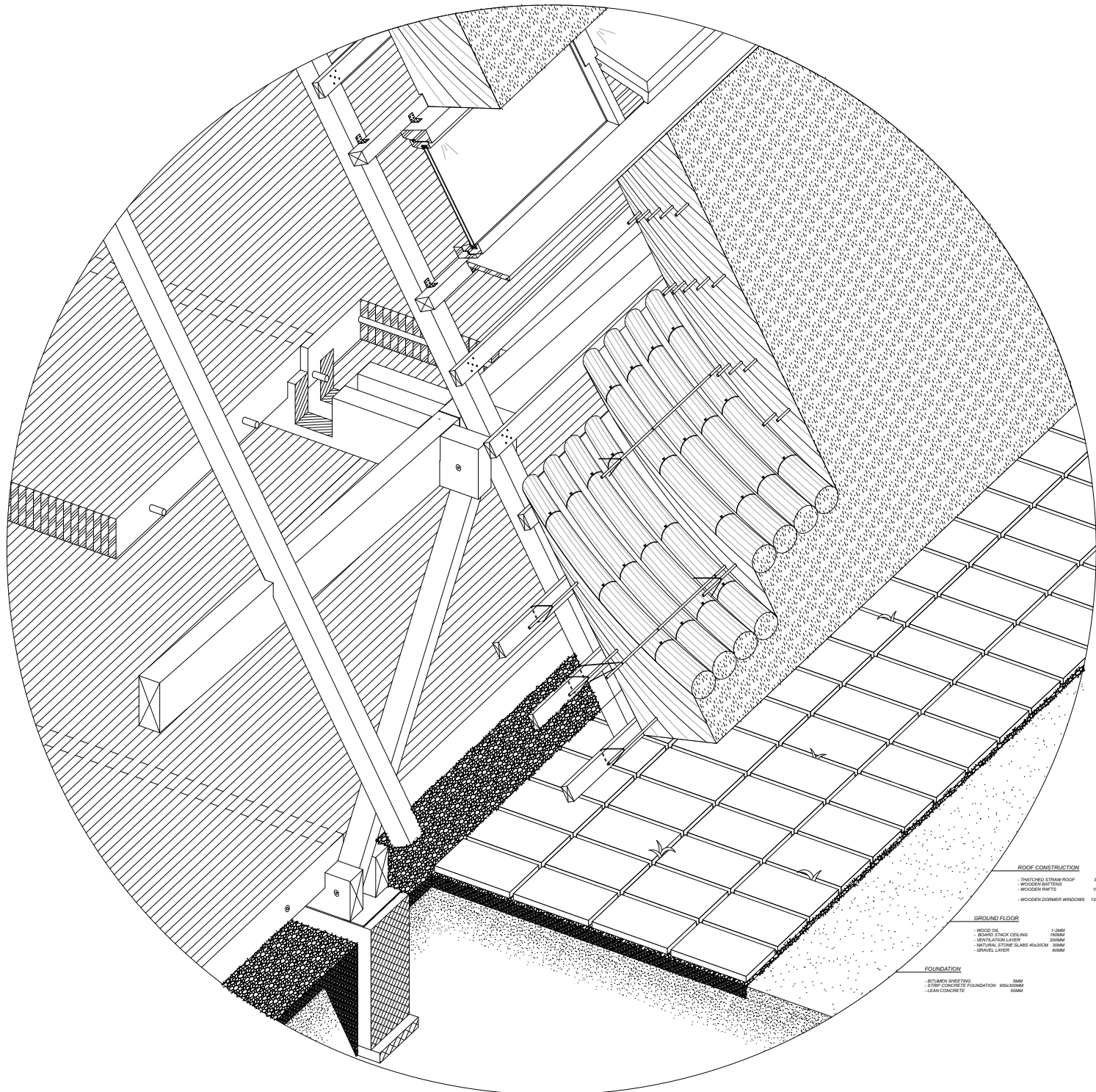
A „Biomeiler“ is a large compost heap, consisting of wood chip-pings and bio waste.

The generated heat inside the „Biomeiler“ can be used to heat water or air for heating purposes. The water flows through inserted spiral shaped tubes, heats up and is pumped to the neighboring house. An expected annual heat yield of around 40'000 kWh can be generated.²⁴ This produced heat can also be used in the bread making process. The fermentation chambers are inserted around the compost and should have a constant temperature of 25-30° celsius. On top of the „Biomeiler“ the rainwater is collected running through a filter and heated up inside. From a water tap the water is collected and will be cooled down to 37° celsius to be used in the sourdough.

The duration of the „Biomeiler“ is usually between 10 to 15 months. In addition to the heat produced during that time, the ripe compost is used as a soil improver and closing the circle.



„Biomeiler“ compost and fermentation



ROOF CONSTRUCTION

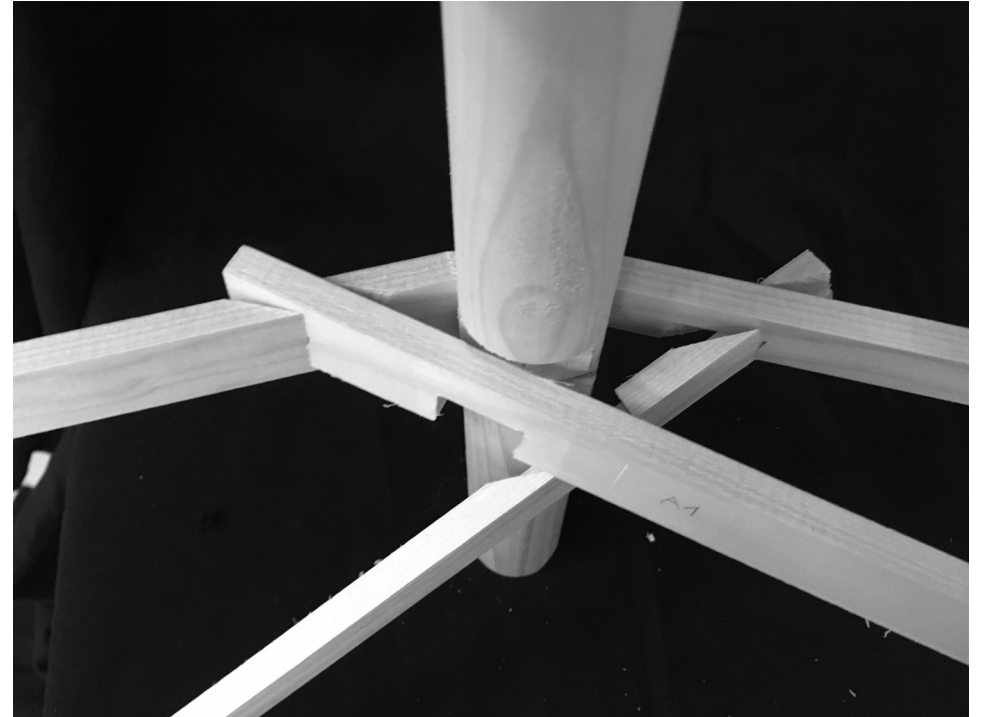
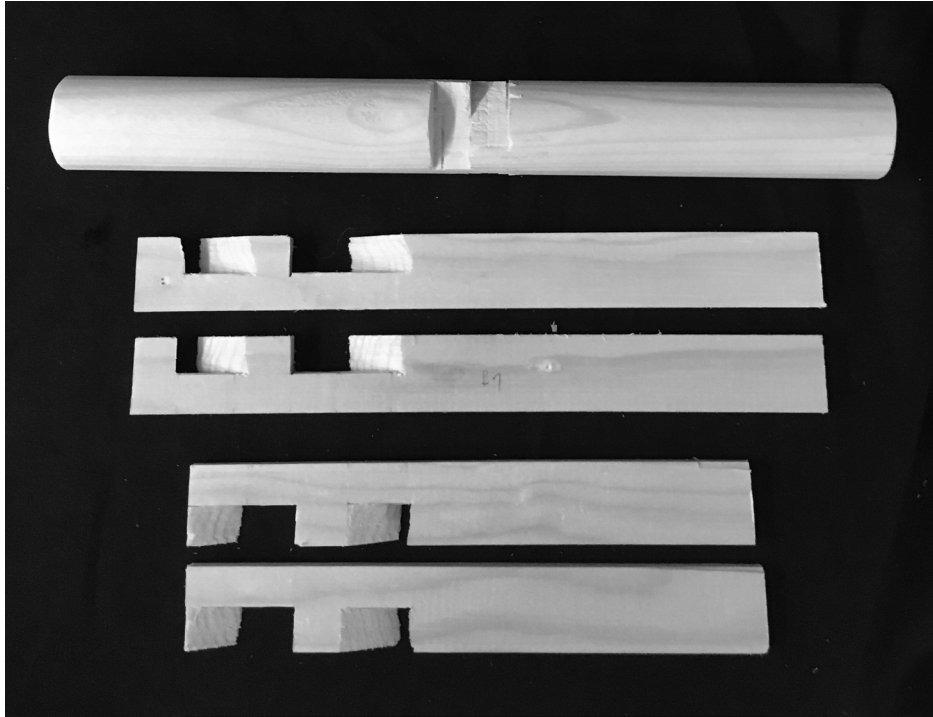
- THATCHED STRAW ROOF 300/300MM
- WOODEN RAFTERS 80/200MM
- WOODEN RAFTS 100/100MM
- WOODEN DORMER WINDOWS 1200/700MM

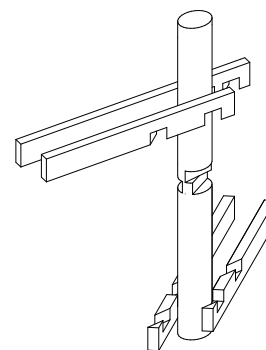
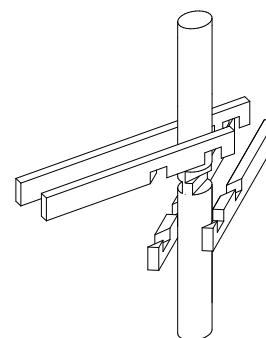
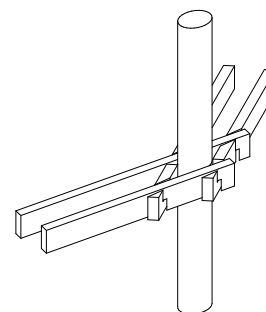
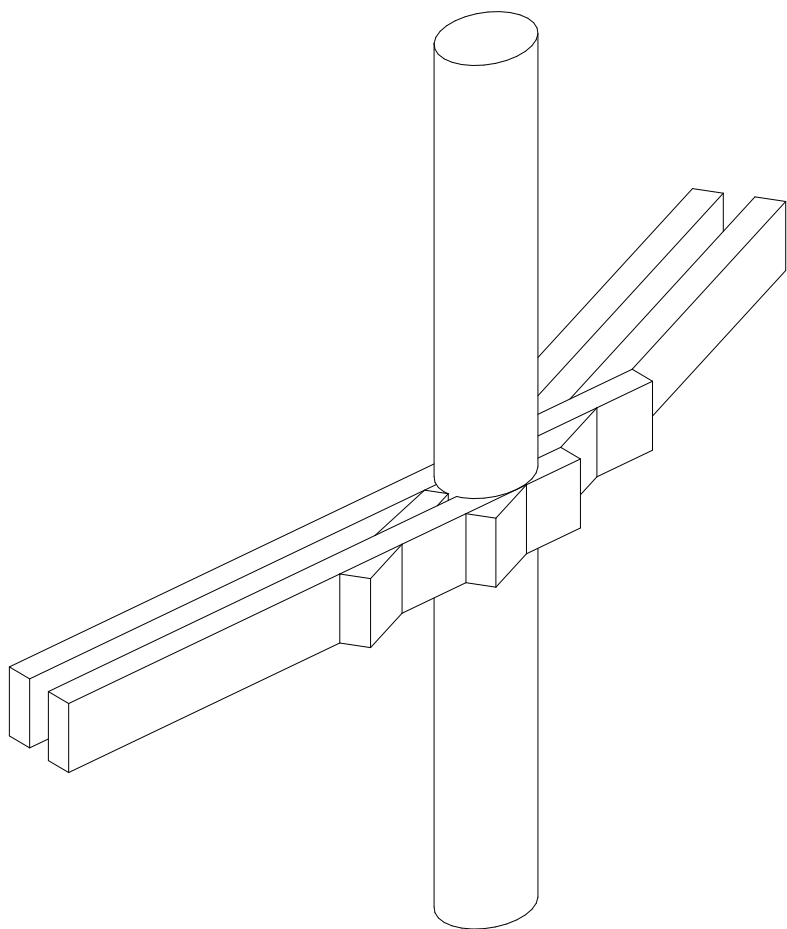
GROUND FLOOR

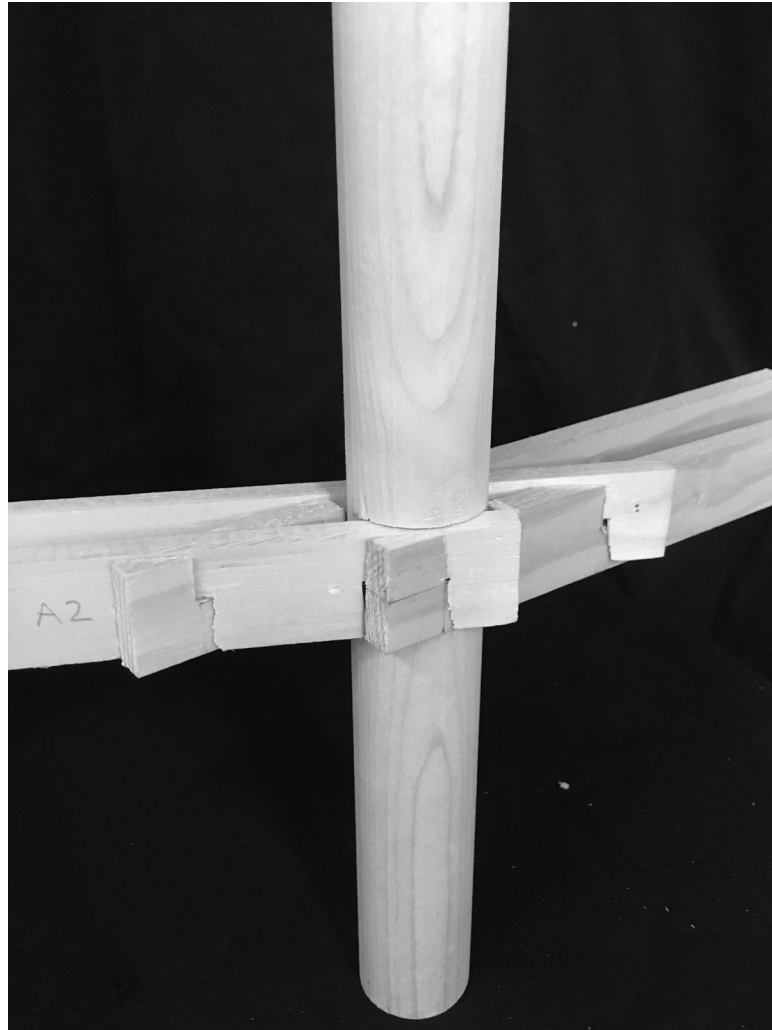
- WOOD JOIST 1-200MM
- BOARD STRUCK CEILING 100MM
- VENTILATION LAYER 200MM
- NATURAL STONE SLABS 600/200 200MM
- GRAVEL LAYER 60MM

FOUNDATION

- BITUMEN DRAINAGE 5MM
- STRAP CONCRETE FOUNDATION 900/300MM
- LEAN CONCRETE 60MM

















experiments

Fresh yeast from dates (unsulphurized), sugar and water.



Filled inside a bottle. The natural yeast on the dates will multiply itself, by keeping it next to the heater.



day 1



day 2



day 3



day 4



day 5



day 6

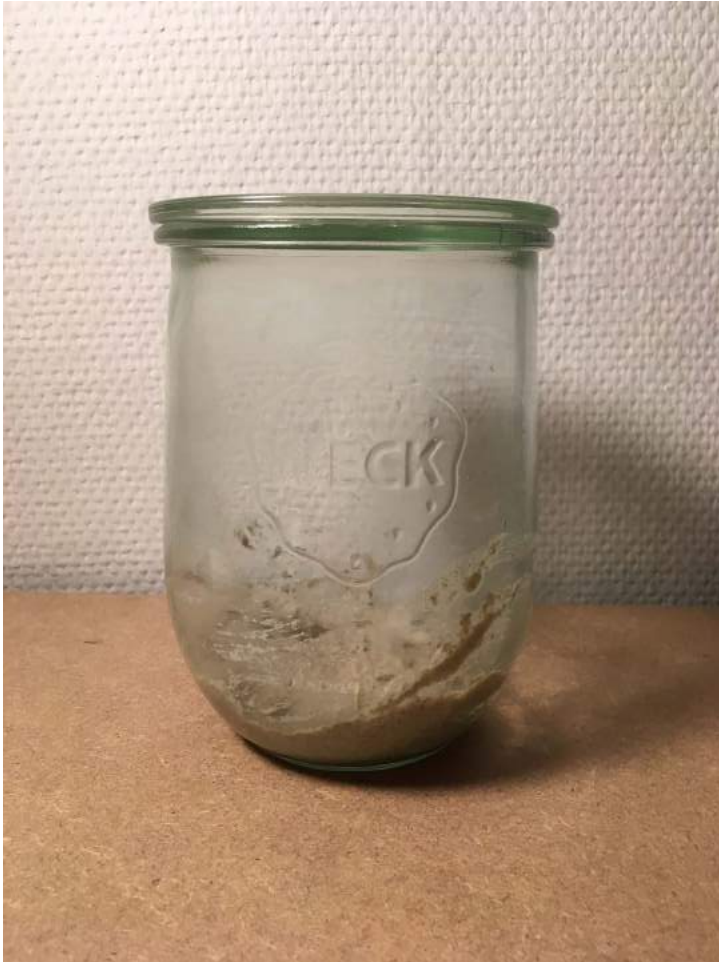


day 7

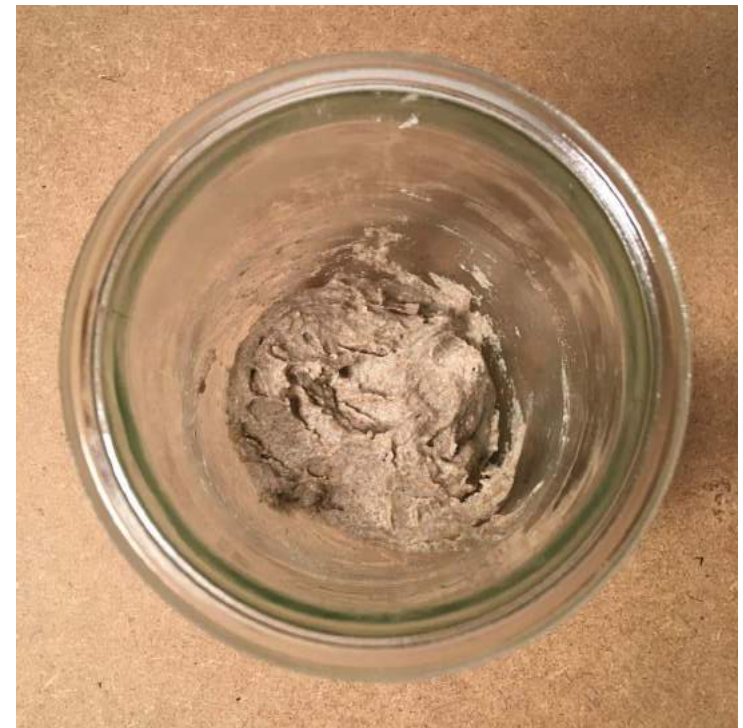


day 8



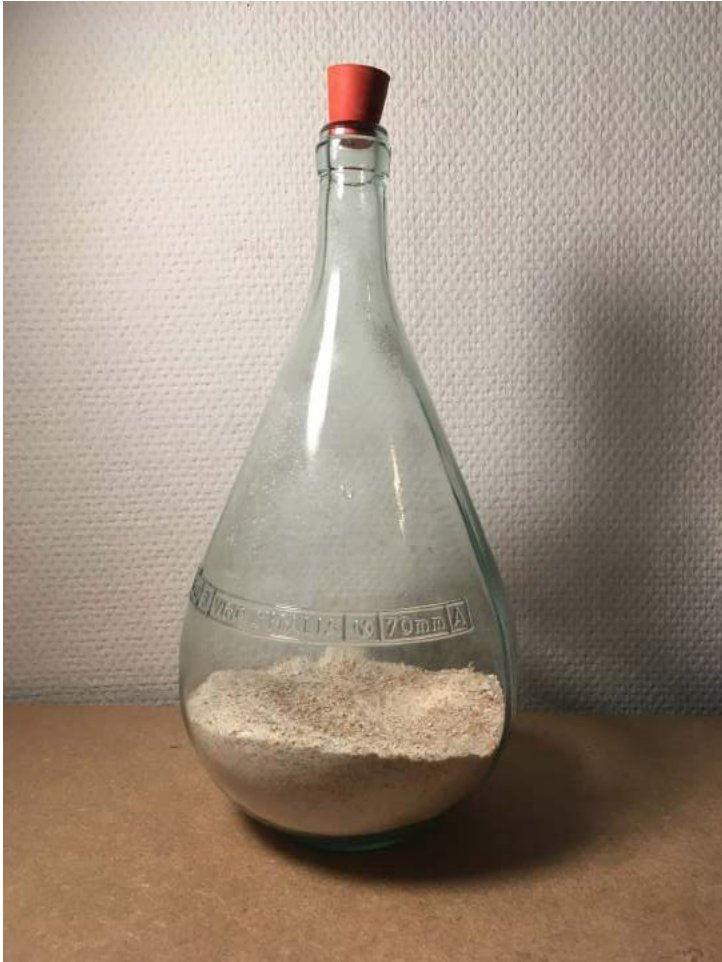


Sourdough starter

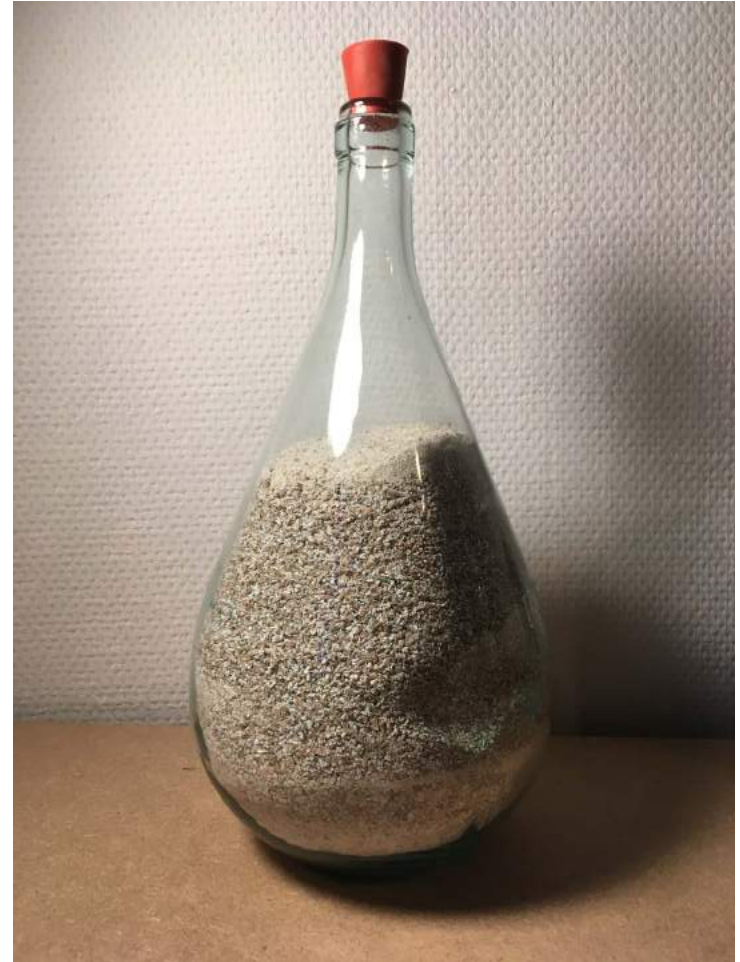


Sourdough from ‚Roggenvollkornmehl‘ and water (37°)





wheat flour



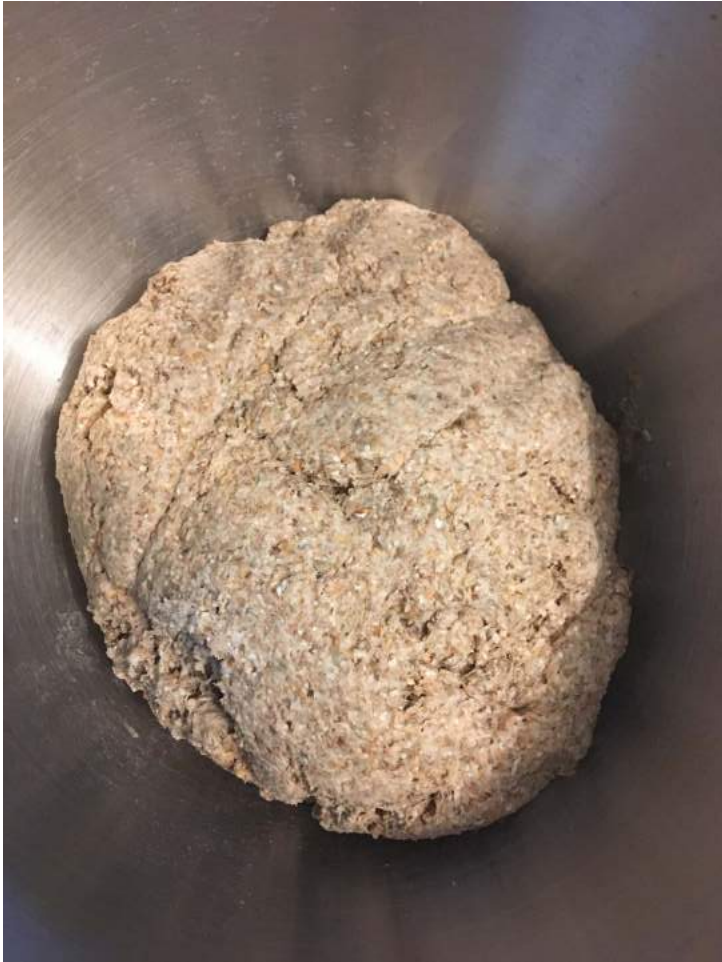
„Waldstaudenroggen“ flour



„Vorteig“ resting 2 hours



„Hauptteig“



„Hauptteig“ resting 4 hours



„Hauptteig“ in „Gärkorb“ resting 16 hours in the fridge.



Glass-pot with lid to keep the moisture inside.



*10 minutes 250°
30 minutes 190°
10 minutes without lid*



„Waldstaudenroggen-Sauerteigbrot“

sources

- 1 Webseite: <https://mehalsgmues.ch/>. Aufgerufen am: 10. Januar 2022.
- 2 Webseite: <https://mehalsgmues.ch/>. Aufgerufen am: 29. Oktober 2021.
- 3 Webseite: <https://mehalsgmues.ch/>. Aufgerufen am: 29. Oktober 2021.
- 4 Webseite: <https://mehalsgmues.ch/>. Aufgerufen am: 29. Oktober 2021.
- 5 Webseite: <https://www.verein-ortsgeschichte-seebach.ch/historisches/die-ortsgeschichte/index.html>. Aufgerufen am: 21. Oktober 2021.
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