

ECO MOYO MUSHROOM FARM
PROCESS REPORT

MYKO STUDIO

Vilde Vanberg & Jan Godzimirski

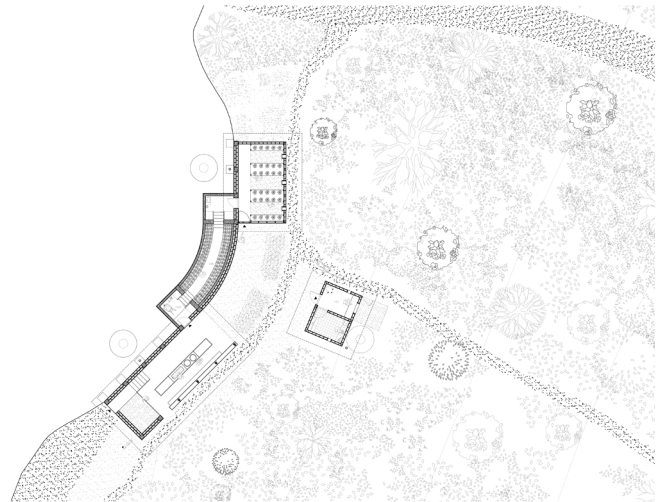
WHERE Within Eco Moyo Educational Centre, in Kilifi, Kenya.

WHAT Propose an expansion plan and a mushroom farm.

WHY Provide farming facility for Eco Moyo Farm which can generate income for the Education Centre

HOW Designing with local materials and building techniques, with the aim on partaking in the construction process in Spring 2018. The farm will be build party under ground in a slope to achieve climatic conditions required for cultivation mushroom.

This report will explore the outline of the work which has been carried out for this diploma project; Eco Moyo Mushroom farm and an expansion plan for Eco Moyo Educational Centre.



MY
KO

Content page:

Site

Eco Moyo Educational Centre

Why mushroom farm

Investigation to expansion plan

- The site in use by students
- Mapping vegetation
- Mapping routes and pathways
- Facilities needed for further expansion

Proposal for expansion plan

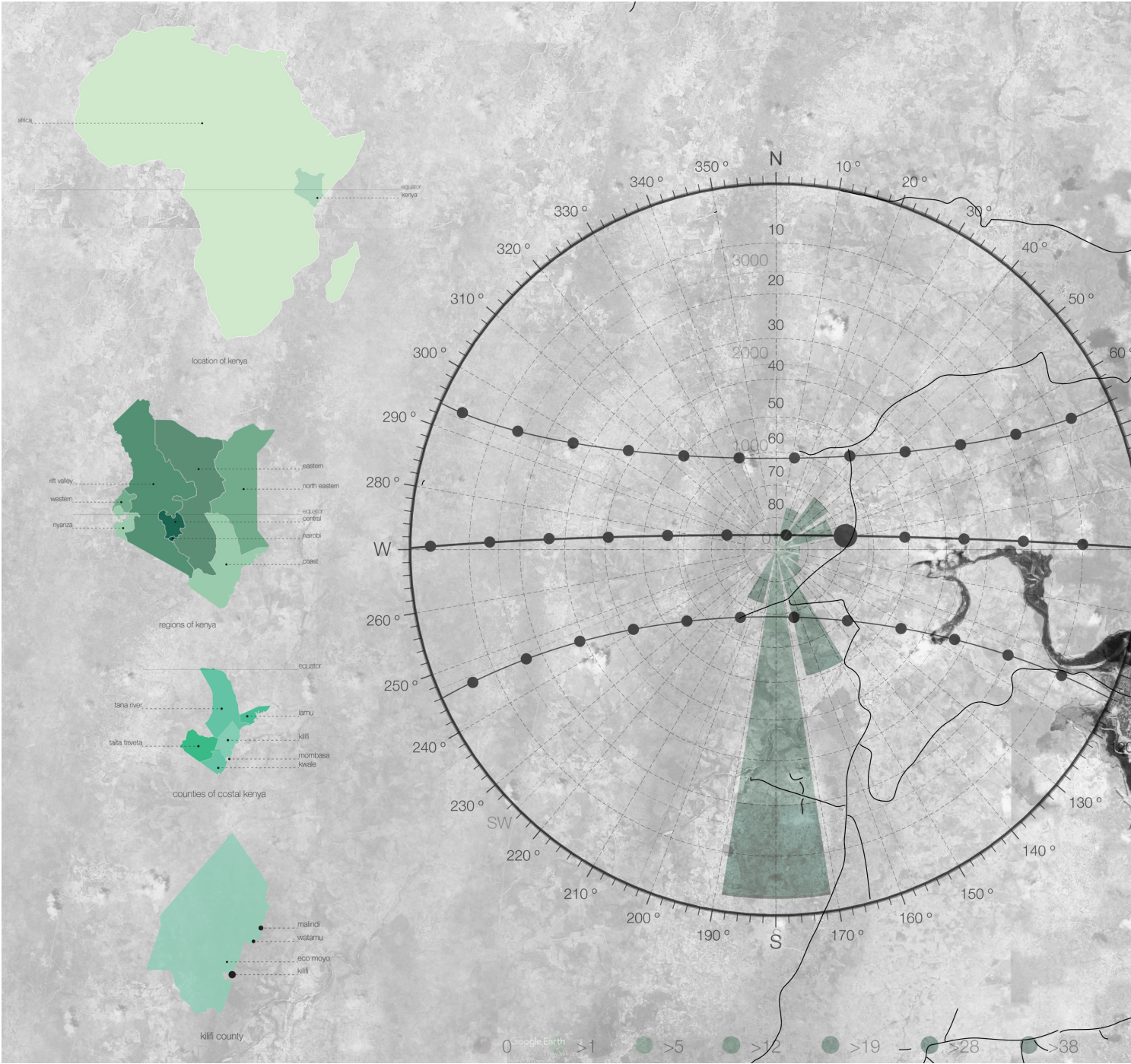
Investigation to mushroom production

- Interviews
- Diagrams of mushroom cultivation
- Estimation of budget and costs
- Reference projects
- Mushroom growing course

Exploring 3 concepts; The line, The circle, The Hall

Linear production line gives outline for a linear concept

Proposal for Eco Moyo Mushroom Farm



0 Google Earth >1 >5 >12 >19 >28 >38



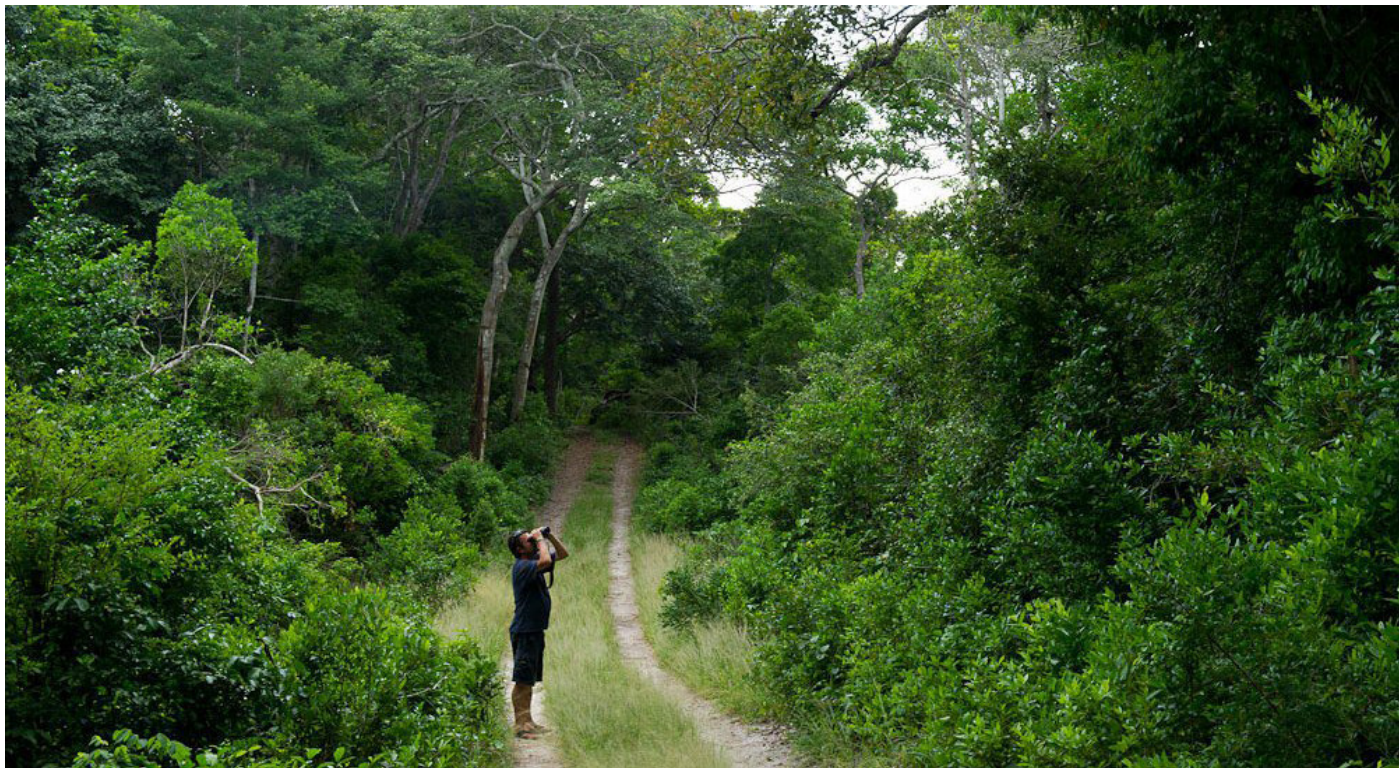
Eco Moyo Educational Center is situated in the outskirts of the coastal town Kilifi on the east coast of Africa. The town lies in the Kilifi Creek and has a population of 120 000.

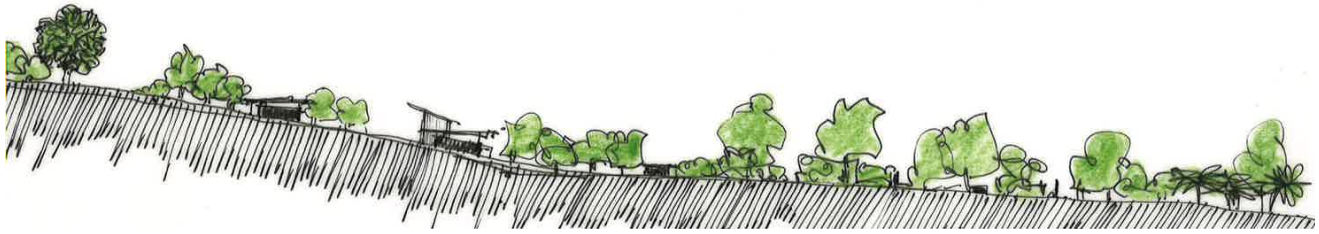
The climate here is hot and humid, without huge variation between season due to its placement 3 degrees south of equator. Rainy seasons appear twice, long rainy season in mid March to May and October to December. The wind direction is dominant from south and south-east.

The study of climatic conditions has influenced the project as oyster mushrooms require specific climatic conditions. Wind direction and sun path has affected the orientation and placement of the mushroom growing facilities.

The images on the following page illustrates the rich variation in vegetations and soil conditions in Kilifi county. The rural areas consist of wild forests and cultivated land with field crops. The coastal area is green and lush after rainy seasons, but the ground water is salty and the soil is red consisting of sand and small amounts of clay.









Eco Moyo Educational Centre

Eco Moyo Educational Center is founded and run by Lindsey Sanner through voluntary engagement and fundraising by Eco Moyo Auction. The school consists of 4 classrooms and several outdoor teaching and growing areas. Currently 70 students are enrolled at the school in the age between seven and seventeen, with the aim of expanding to 200 students by January 2018.

The Education Centre consists of two parts: The first is *Eco Moyo Primary School* which is modelled on Green School Principals with emphasis on practical approaches to each subject together with ethics, ecology, training in individual thinking and communication skills.

The second part is *Eco Moyo Farm* which will be based on Permaculture Principals for the cultivation of food crops, timber and animal husbandry. The goal is to meet the consumption needs of students and staff, while functioning as a demonstration site for locals and visitors.

Eco Moyo Mushroom Farm aims to be a pilot project providing a farming facility for the school, while also generating an income for the Educational Centre. Situated in relation to adjacent classrooms and outdoor teaching facilities the ambition is to provide spaces where the students can interact and learn from the farm.

Investigation to expansion plan: how is the site being used?

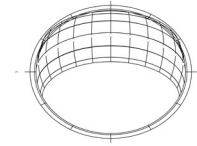
The proposal for our expansion plan is based on the idea that the school would benefit from a more structured layout.

Therefore the first step is to define and establish a plan for developing further, and find a location for the mushroom farm to benefit the overall layout of the school. Several outdoor learning facilities are arranged around the site in relation to the compost and watering systems.

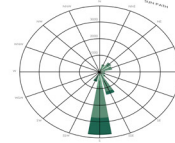
The mushroom farm will need to be integrated into this network to make it complete - and to improve the ecosystem. The aim is to provide a facility which can improve the overall eco-system of the land, in addition to allow the students to interact and learn from the farm.

Agriculture is an important part of the project to improve soil conditions, grow locally, be self sustained and teach Green.

Sun diagram. Being located 30 south of ecvator the sun radiation is mainly straight from above



Dominant wind direction from south



Rainwater harvesting and location of water tanks and well.

Mapping large and important trees on site, with the aim of preserving them and make them visible/ accessible.

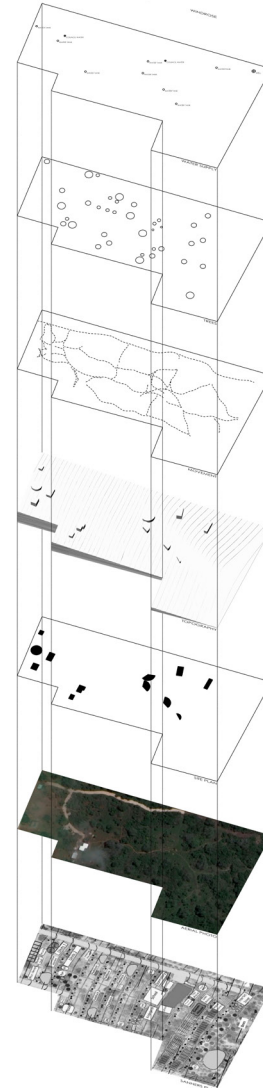
Roads and pathways on site, both mapping existing and proposed circutaltion routes.

The site is situated on a sloping hill with 10% gradient.

Facilites and buildings on site.

Areal photo showing the site green and lush.

Masterplan by Lindsey Sanner in 2015, with the ambition of divided the plot into linear zones, follwoing the contour lines. Focus on food production, edible gardens and keeping animals.

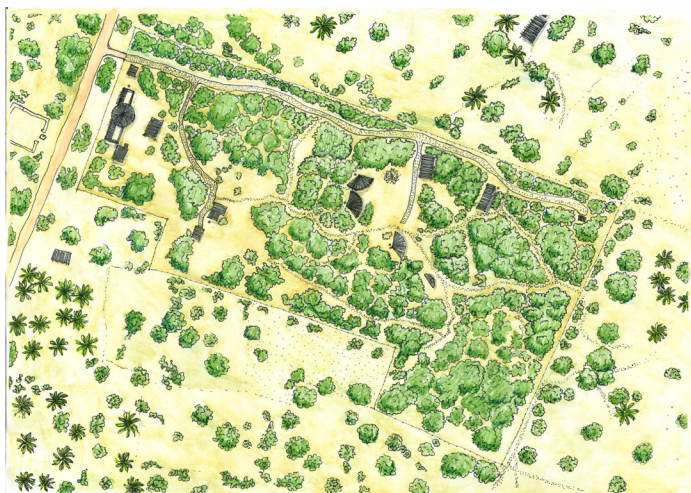




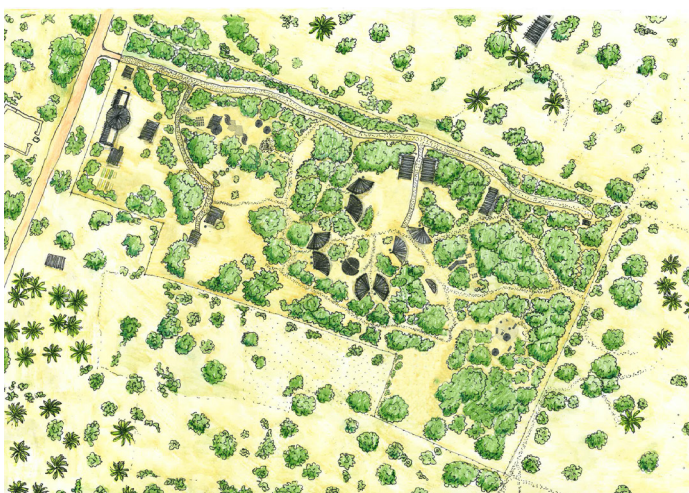
June 2016



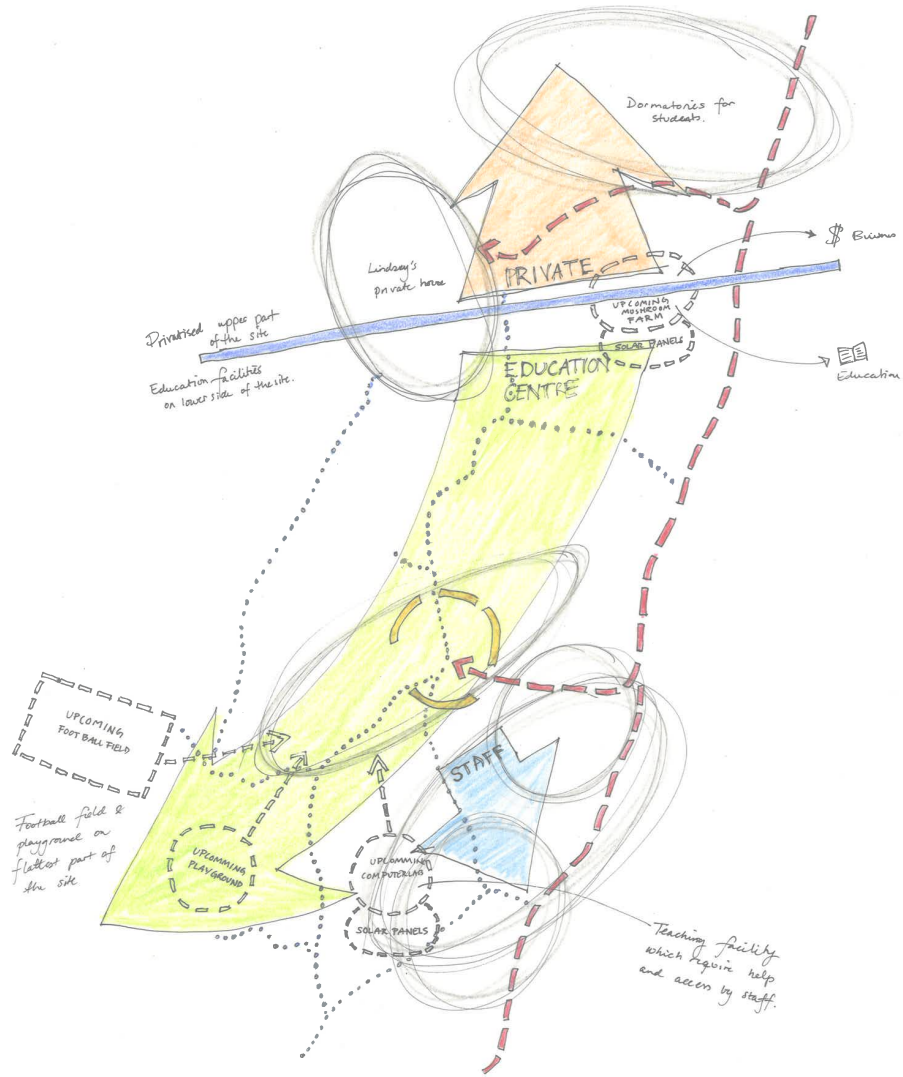
Dec. 2016

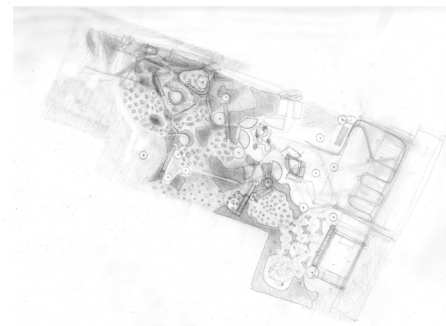
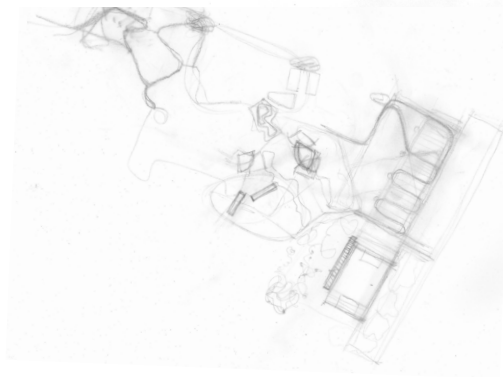


June 2017



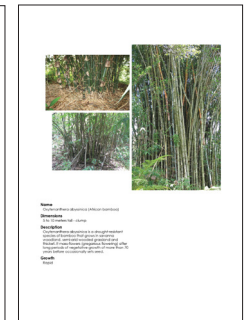
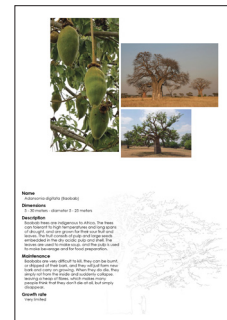
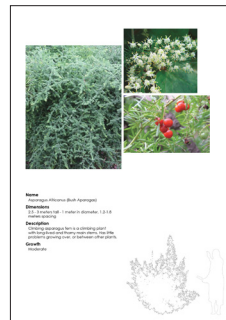
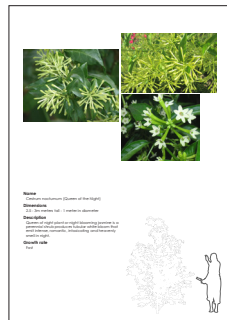
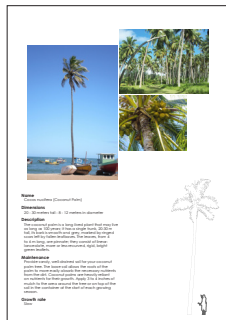
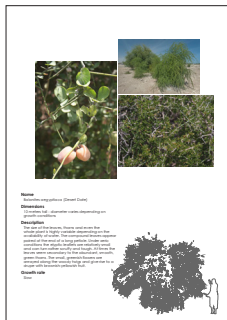
Dec. 2017







Investigating existing vegetation on site







1. Guard house
2. Dormitories
3. Kitchen
4. Compost Toilet
5. Eco Moyo Mushroom Farm
6. Lindsey Sanners House
7. Compost Toilet
8. Classroom, proposed for 2018
9. Classroom, proposed for 2018
10. Classroom, proposed for 2018
11. Classroom, completed Dec. 2017
12. Classroom, completed May. 2017
13. Classroom, completed May. 2017.
14. Classroom, completed July. 2017.
15. Classroom, proposed for 2018
16. Compost toilets
17. Staff rooms
18. Staff rooms
19. Staff dormitories
20. Well
21. Football field
22. Playground, proposed for 2018

The expansion plan of the site is based on micro analysis of local conditions and minute observations of vegetation and local conditions. Without imposing of geometrical systems or network, we have analyzed the spacial structure determined mainly by vegetation. By studying in detail the location of mature trees and masses of bushes, this has lead to the location of specific buildings. The position of these buildings take into consideration climatic requirements and conditions such as need for shade or breeze.

Throughout the diploma project we have had frequent meetings and corespondent with our client Lindsey Sanner. Our studies, research and proposals has been deliberated and appreciated. Dividing the site in different zones; private areas, defining a central school court yard, teaching facilities and private area for staff has been important and will be followed in the future.

Sanner has expressed her ambitions of intergrating more agriculture projects at Eco Moyo to keep the community self sustained and to provide economic support. By proposing a mushroom farm we will improve the compost system, which will generate good soil conditions to allow for further growing projects. We imagine the Mushroom Farm to become a pilot project on site which can enable the school to evolve and expand.



Oyster mushrooms

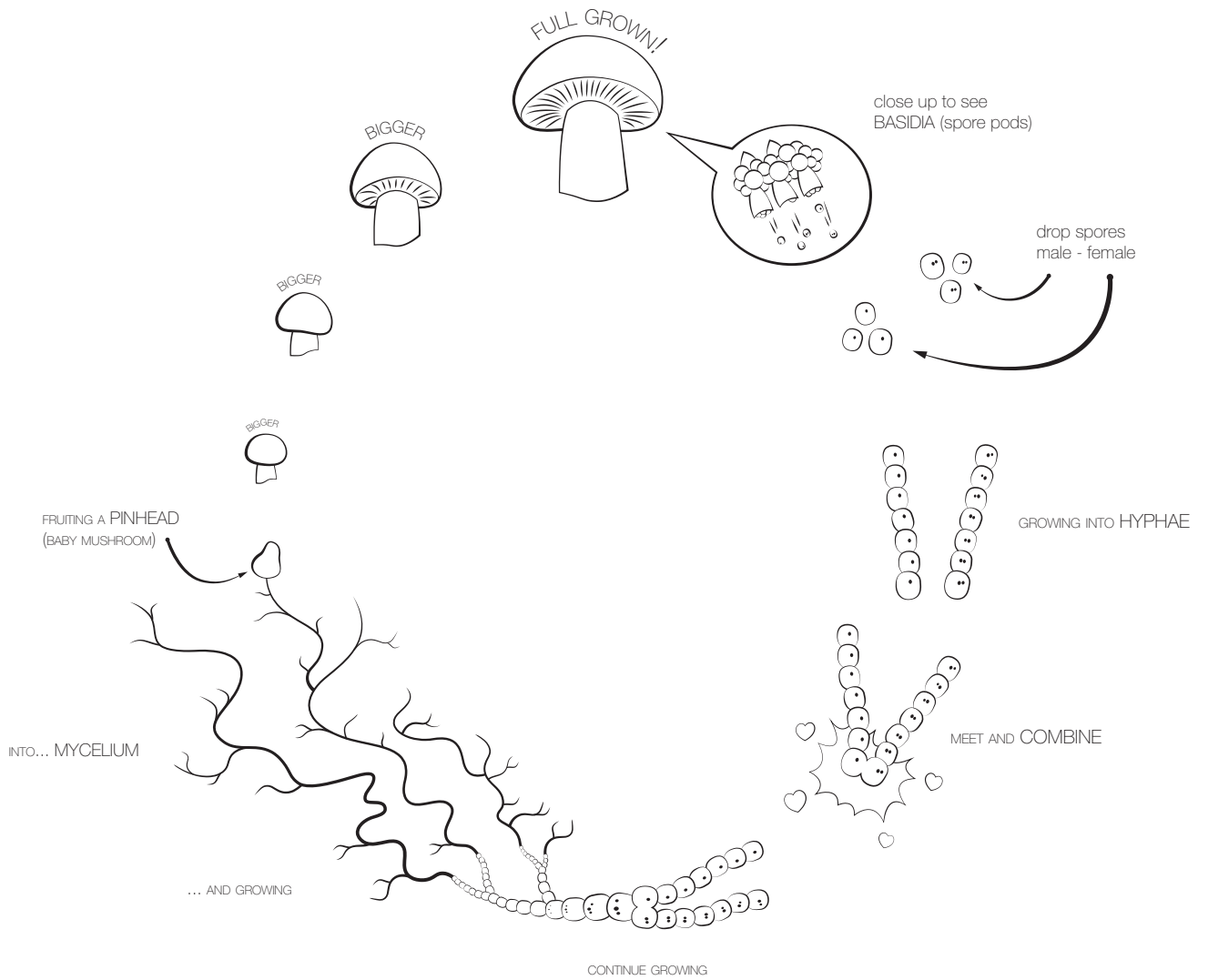
Why mushrooms?

Initiated by our client Lindsey Sanner we defined the program for a mushroom farm based on the need for farming facilities on Eco Moyo. In 2016 Lindsey research the potential customers for mushrooms in the area of Kilifi. Due to a large number of Italian restaurant and hotels in this coastal region the demand for mushrooms is big.

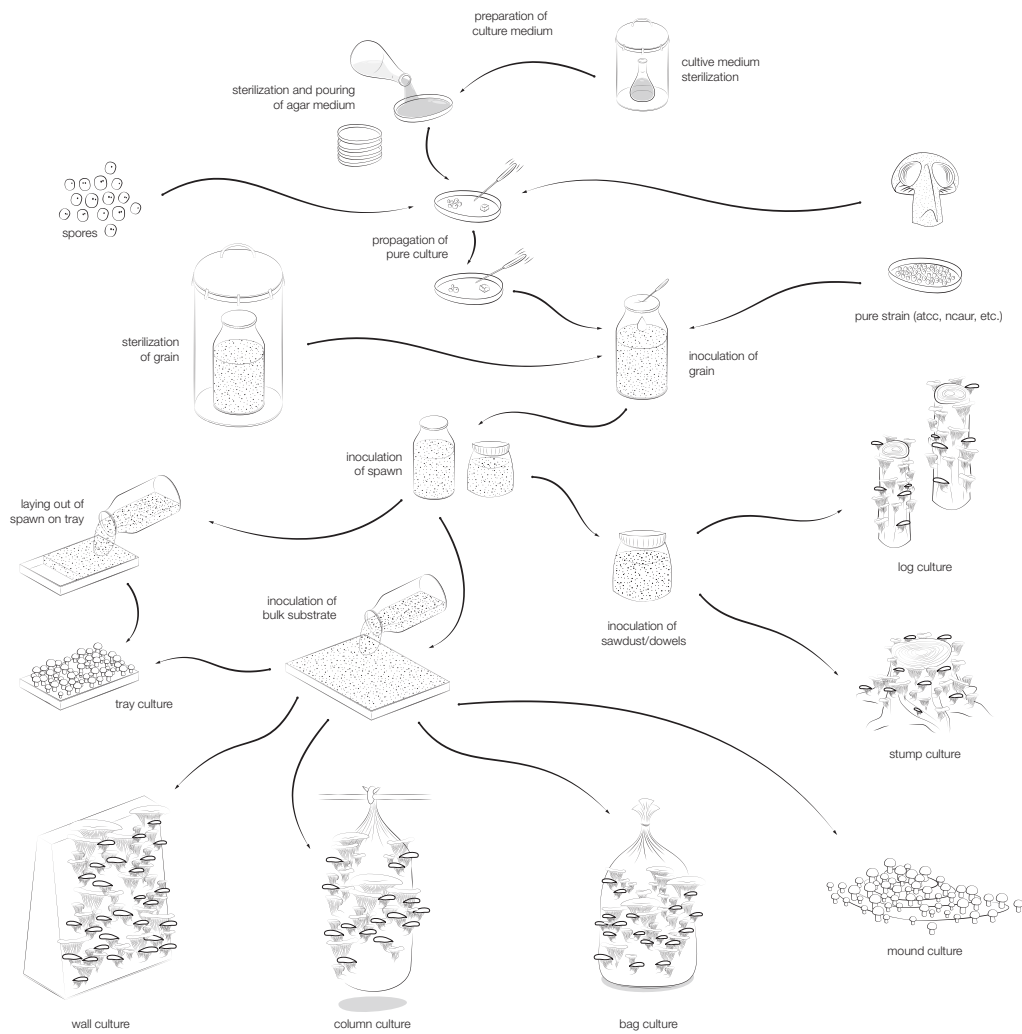
Mushrooms are a great source of protein, copper, potassium, zinc, selenium and B vitamins. Mushrooms are also a great source of dietary fiber and are low in both saturated and unsaturated fat and can enrich the diet of the Eco Moyo students.

In addition a mushroom farm will contribute and strengthen the holistic approach for the school. The waste product from mushroom production is contributing to a rich compost which generate fertile soil. This again can generate further growing projects within the school.

There is also an economical aspect influencing the choice of program. Oyster Mushrooms are sold for 60 NOK per kilo, in Kenya and can contribute in keeping the school self sustained and have a regular income.



Cycle of mushroom growing



Production cycle of cultivating mushrooms:
 Commercial farming pushes the growing cycle to happen much faster.



Eco Moyo Educational Centre

300 000NOK

Budget/ annual cost for the entire school

\$

Money from sponsors and Fundraising auction
&

Income from Eco Moyo Mushroom Farm can cover
approx 1/6 of the annual budget for the school



Annually: grow and harvest 880-1000kilo of Oyster Mushrooms a year

Growing Cycle: 7 weeks. Starting every 5th week. 10 cycles annually.

Cultivation bags: 100-110 bags of mushroom per cycle

Substrate: Every cycle requires 430 kilo of substrate, 4300 kilo of substrate annually

Mushroom for sale: Every cycle will producing approx 80-100 kilo of mushrooms

Oyster Mushrooms are sold for 60 NOK per kilo in the Kenyan market

Annual income from mushroom production: **60 000NOK**

Expenses (annual):

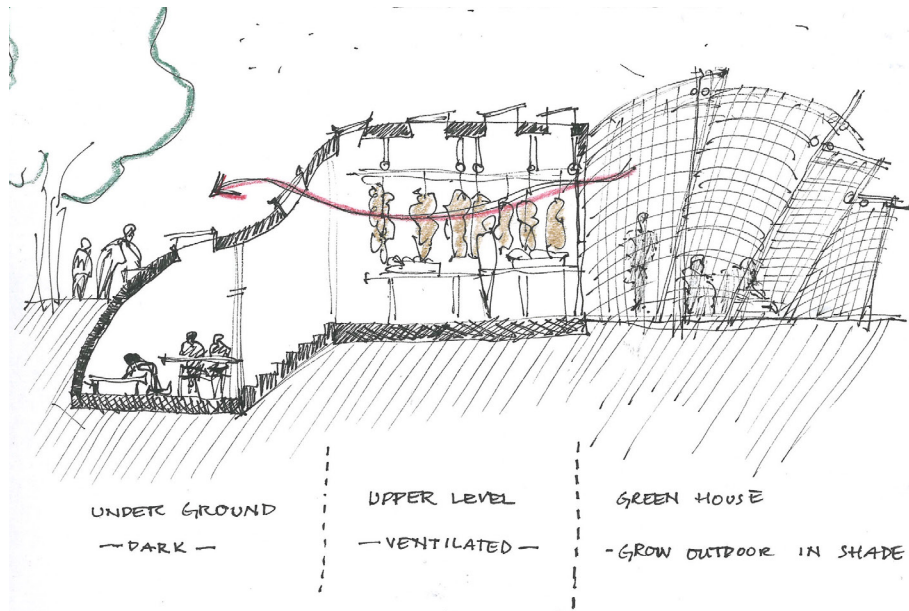
Substrate: 4000 kilo of Hay, 200 bales of hay = 4000 NOK

Bags: 1000 sterilized and filtered grow bag = 4000 NOK

Spores: 7% spores ration of substrate. 280kilo spores= 2800 NOK

Salary: 1 or 2 people will be working at the farm= Undefined

(According to calculations and guidelines from www.gruten.no and www.kuzabiashara.co.ke)



Initial sketch of mushroom farm

HAY STORAGE

INOCULATION ROOM

SPO



HAY STORAGE

INOCULATION ROOM

SPO

Requierments:
accessible from main road
dry
shaded

Requierments:
clean water, w/o salt or clorine
clean enviornment
sufficent lighting
ventilated facilities
shaded

Requierments:
dark
ventilated
controlled light for ins
sufficent floor area fo
clean
lockable

Program and farm facilities

PRE RUNNING ROOM

Store in dark, cold room



CROPPING ROOM

Store in light, ventilated room, 5-10 days



WASTE MANAGEMENT

Used and left over hay substrate is gathered in a compost and turns into fertile soil for plants



PRE RUNNING ROOM

Inspection
for inspection

CROPPING ROOM

Requirements:
light
well ventilated
high humidity
water basin
sufficient circulation
lockable

WASTE MANAGEMENT

Requirements:
fresh air
sufficient circulation



Drill holes in logs, grow outdoor



Hanging (and resting) bags, artificial lighting.



Place bags horizontal, one hole.



Blocks/bags placed on shelves. Not direct light



Large trays, one growing room

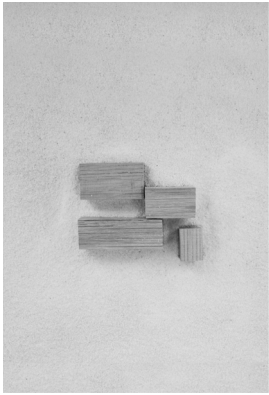


Bags stacked in angled structures



Atmospheric inspiration

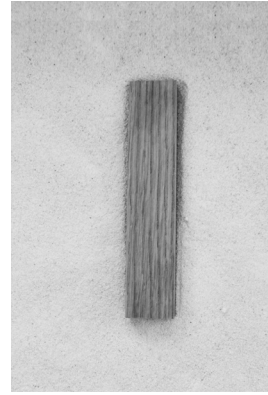
Winery in Piemonte, Italy. Combination of industrial materials (floor tiles, tanks, pipes etc, and damp, dirt and strong smell of wine and acid. Photos by Jeff Bramwell.



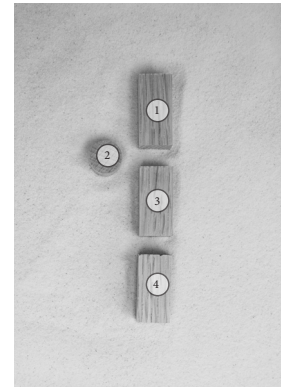
The Hall:
Testing placing all facilities close to each other to cover the farm under one connecting roof



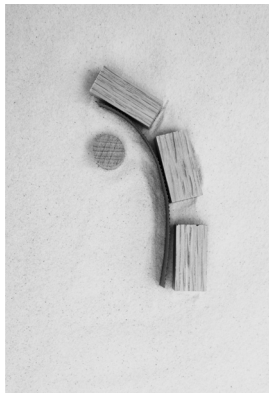
Circular production:
Splitting up all the facilities in a circular arrangement to define each production zone and the cycle of mushroom growing.



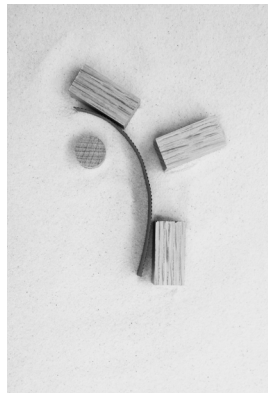
The Line:
Exploring a linear production line is with a building stepping down and along the contour lines.



Linear production line with four specific facilities:
1. Inoculation room.
2. Spore running room.
3. Office
4. Cropping room



Giving the linear building a curve, to introduce a direction to the line and to create a defined space adjacent to the farm.



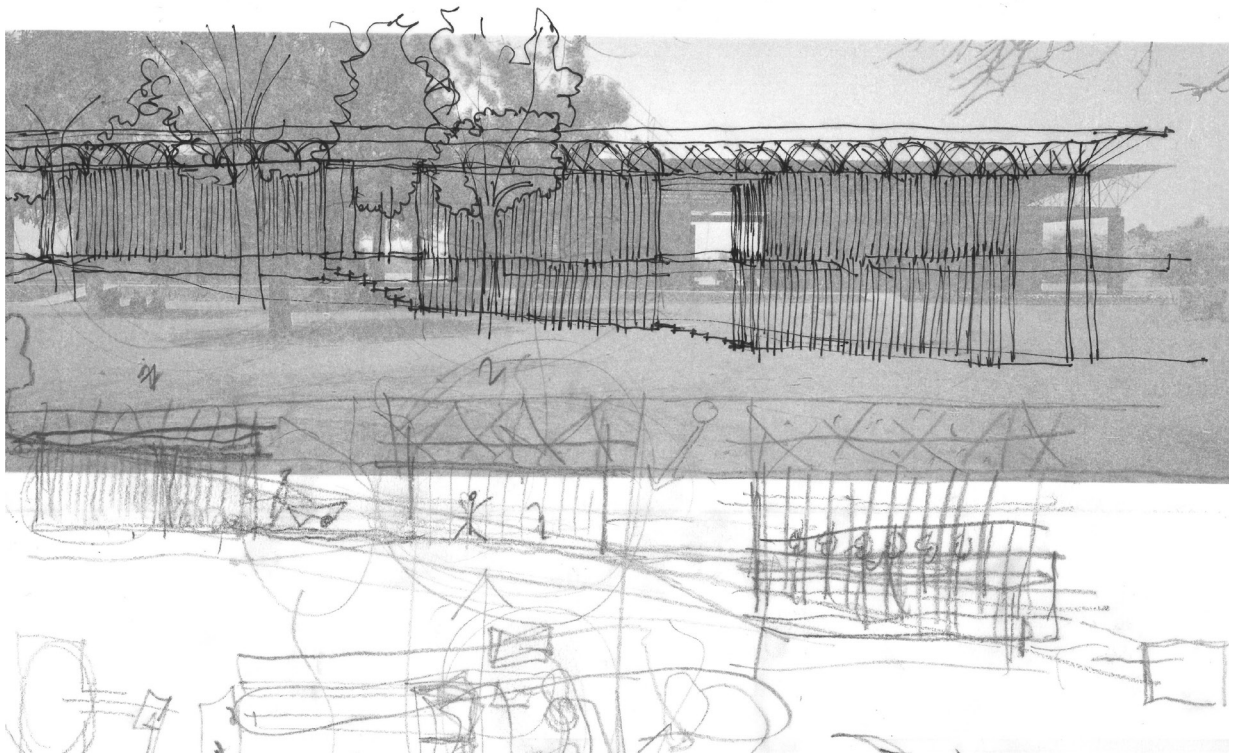
Exploring a new arrangement by moving the office away from the curved circulation route.

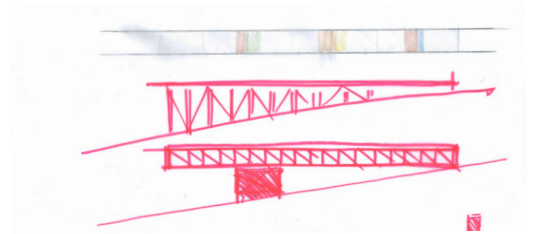
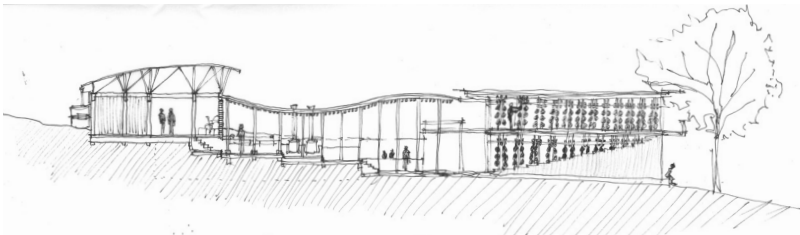
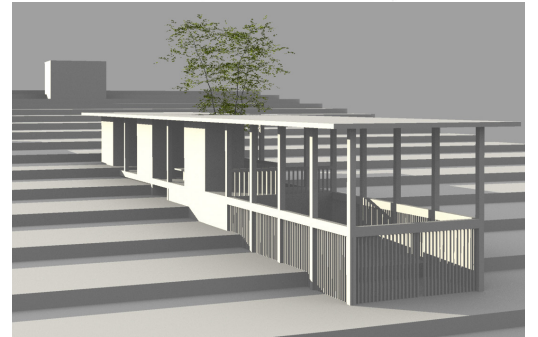
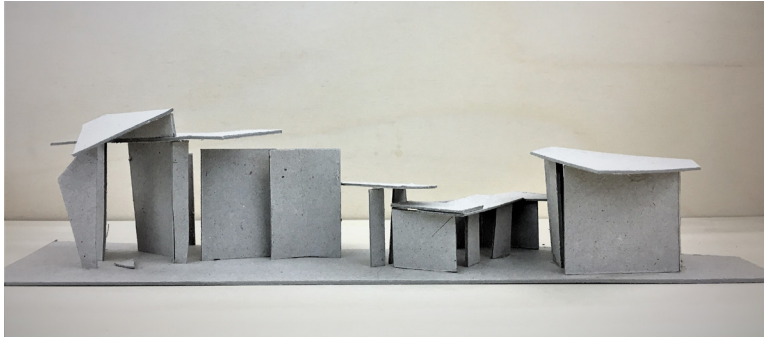
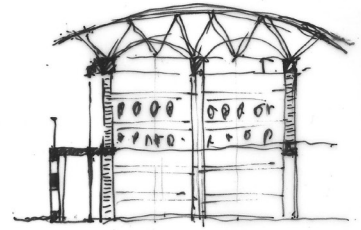
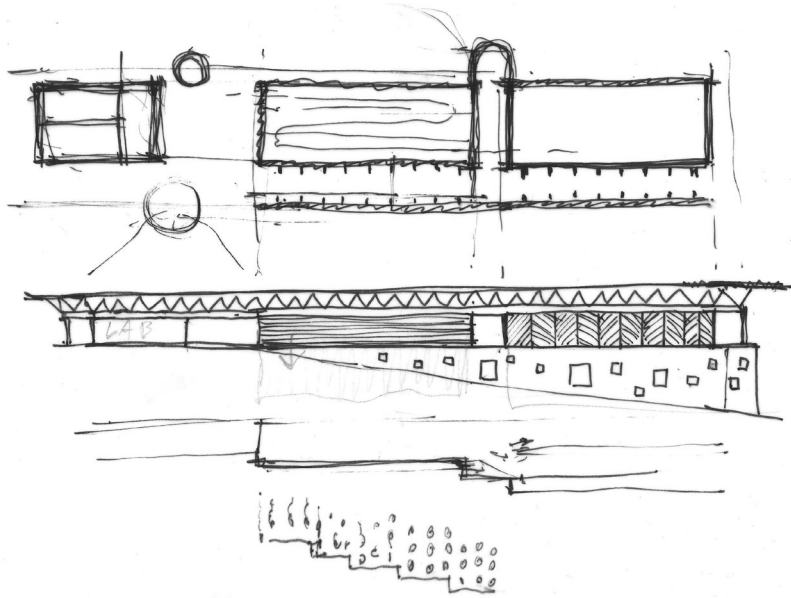


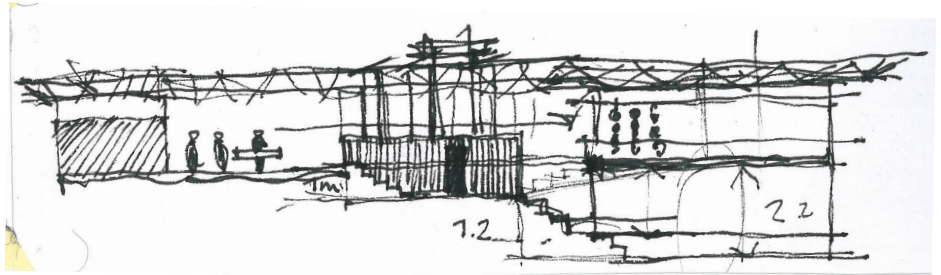
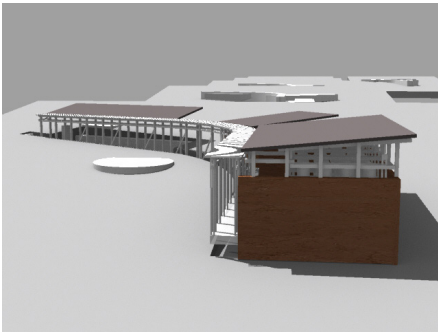
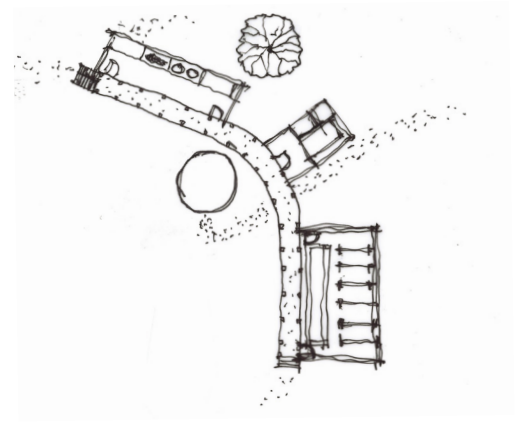
Moving it even further creates a space or a square between the buildings. The spore running room is to be dug down under ground.



The new curved arrangement enabled us to explore space-making and to shape zones adjacent to the farm.

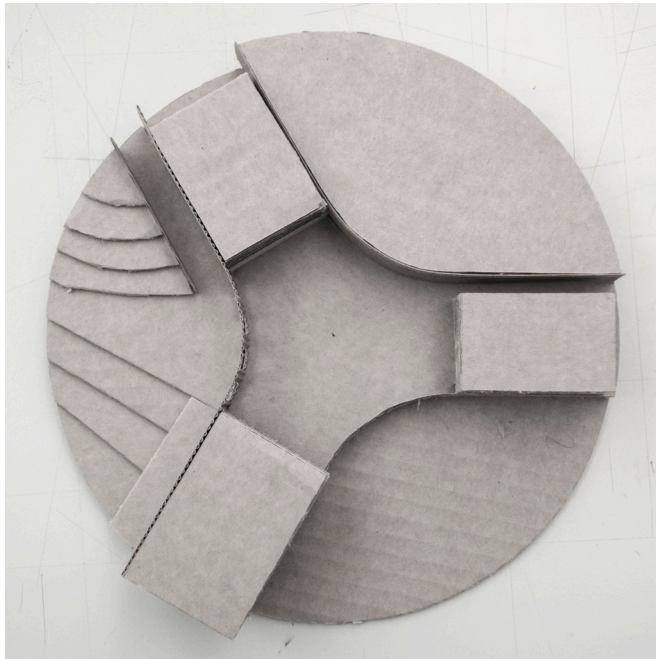
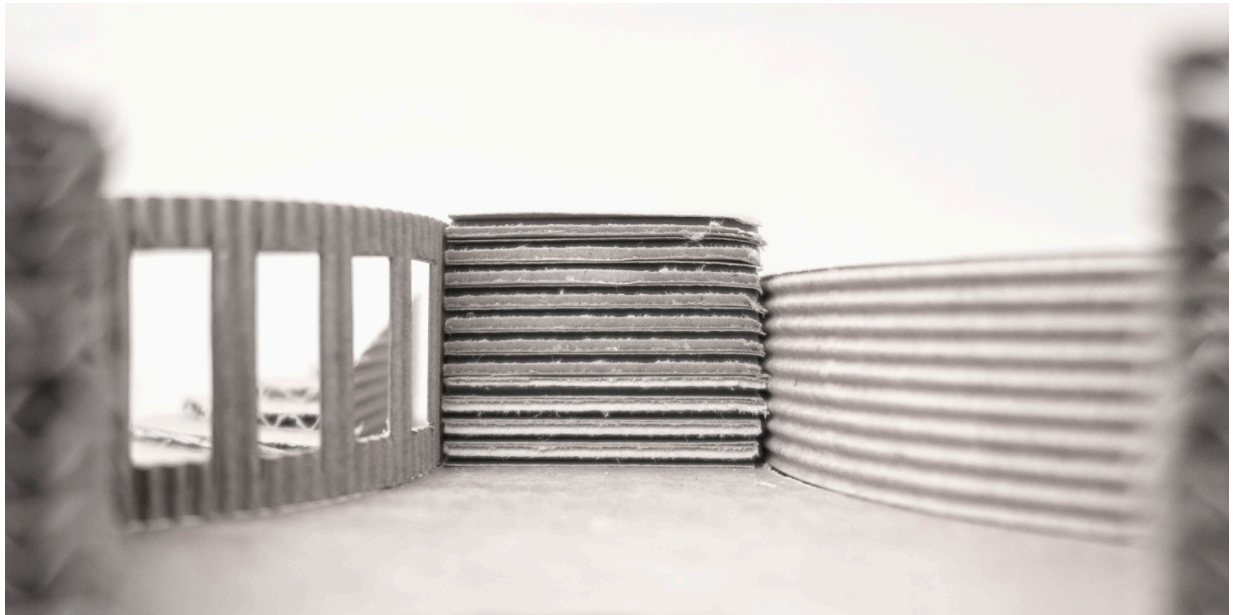




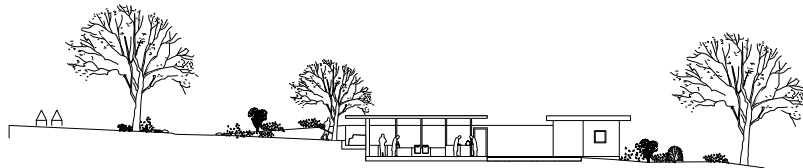
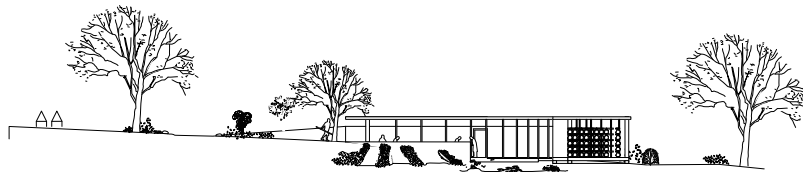
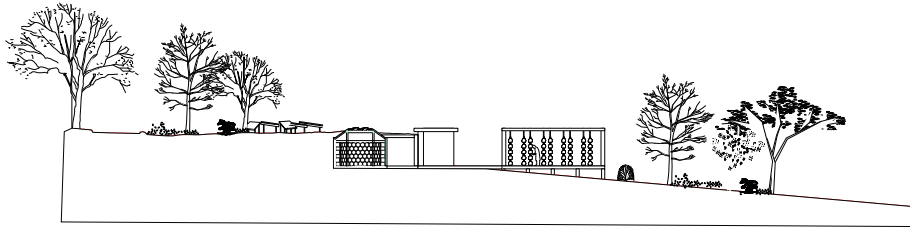
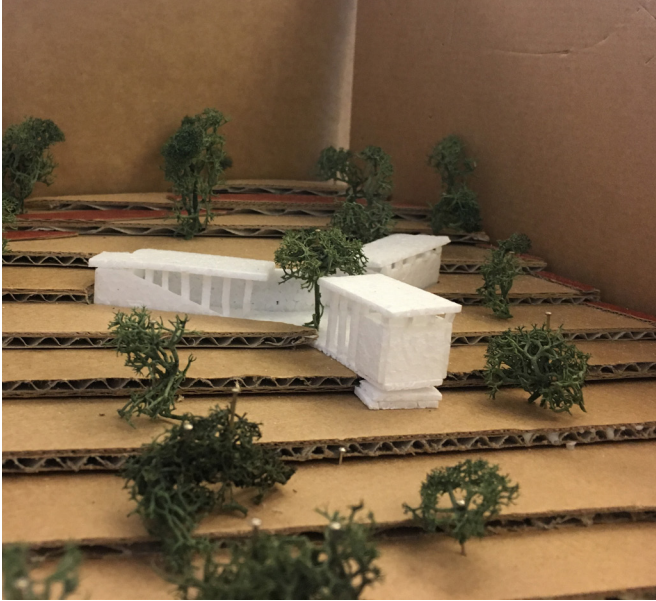


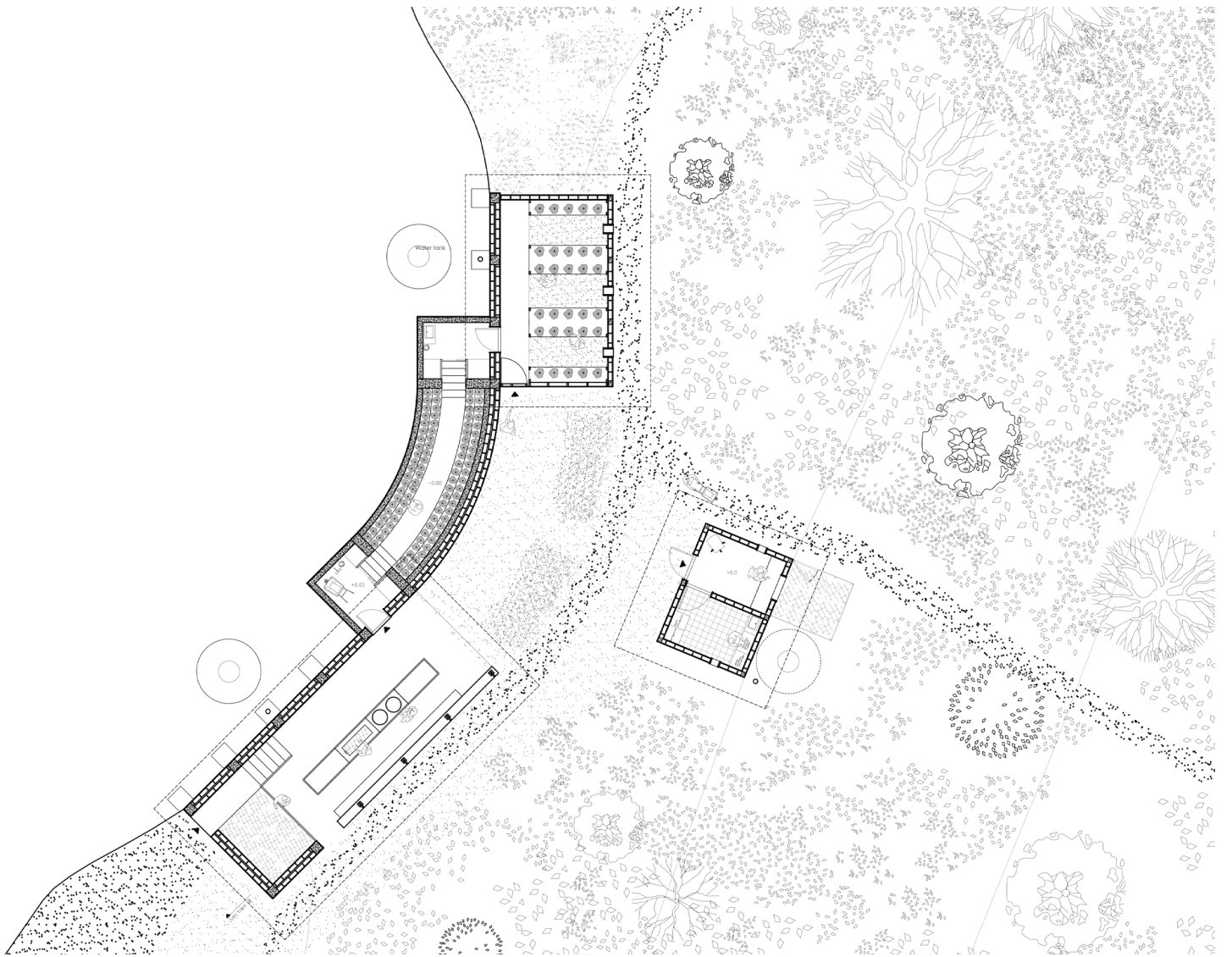
Situated in a slope with 10 percent incline the facilities of the farm need to stretch over 30 meter in length for the site drops with one level. How can we achieve to make growing room no. 1 - the spore running room, to be partly dug down or under ground?

By curving the wall and place it INTO the terrain rather than dug down.

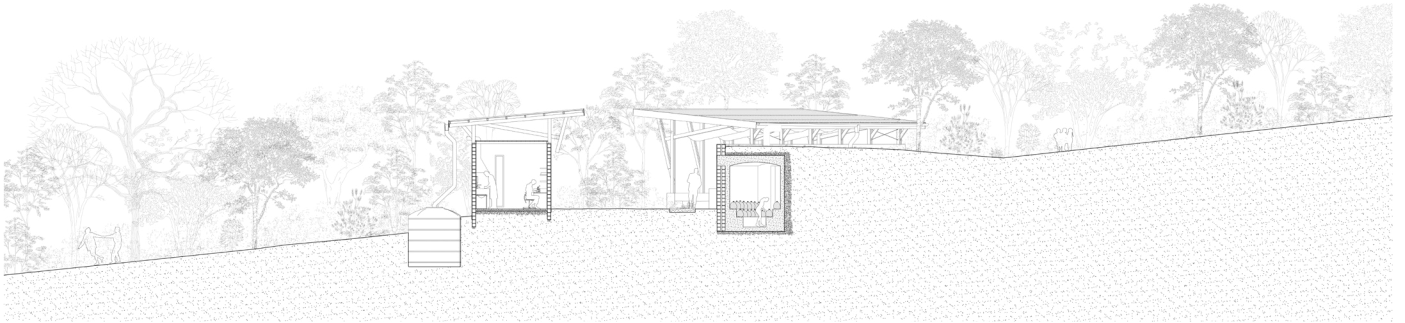


Model to explore the space between the buildings

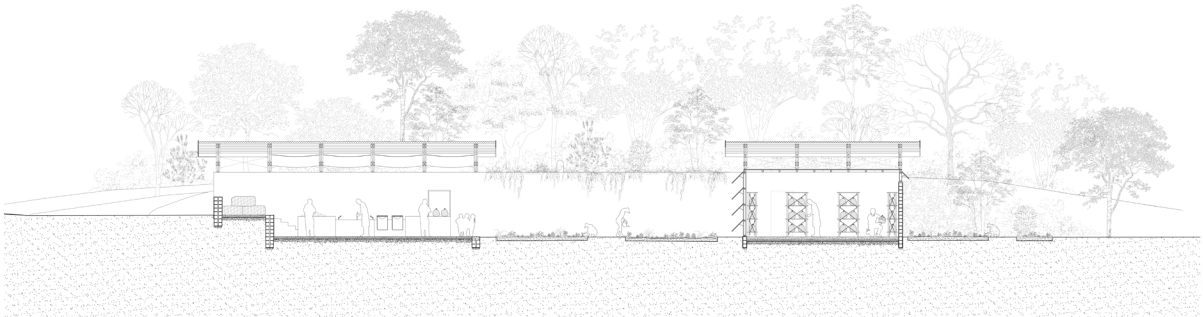




Section A, 1:50
Towards south, through spore running room and laboratory



Section B, 1:50
Through incubation room and crapping room



Elevation 1:50



Section 1:50



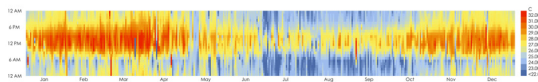
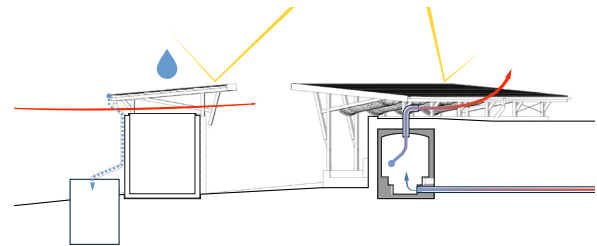
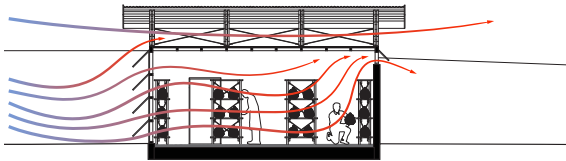
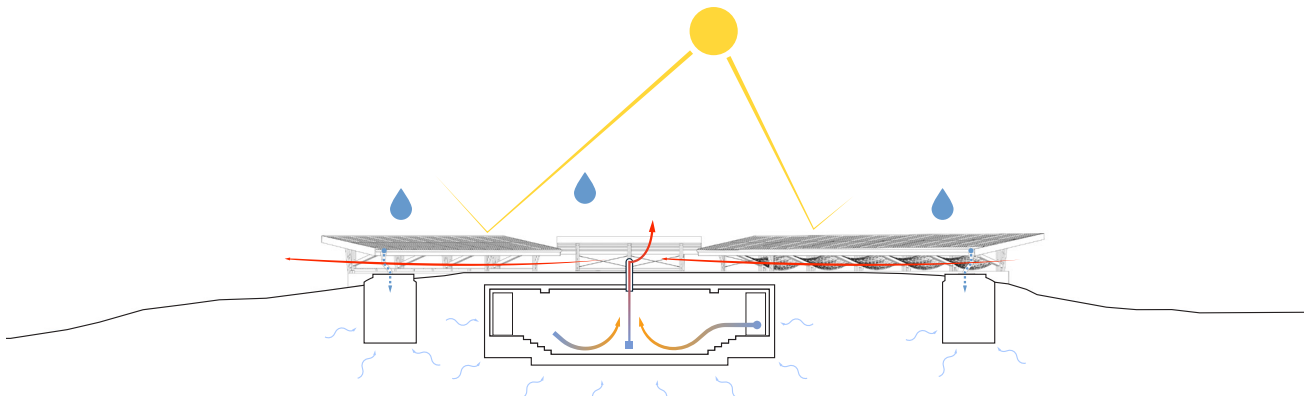
External view
View from east



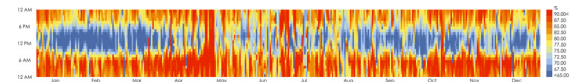
External view
View from south





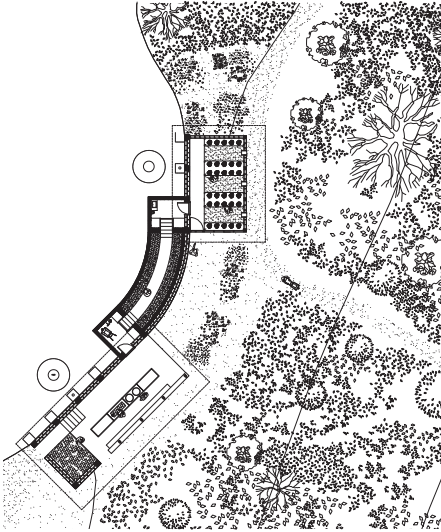


Dry Bulb Temperature - Hourly



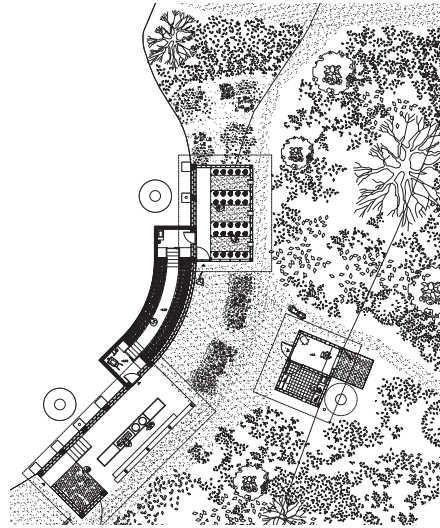
Relative Humidity - Hourly

Due to limited availability of electricity the project aims to utilize natural air ventilation and the heat retention property of the soil. The spore running room is therefore dug down to keep a stable temperature while improving the success for the biological process to occur.



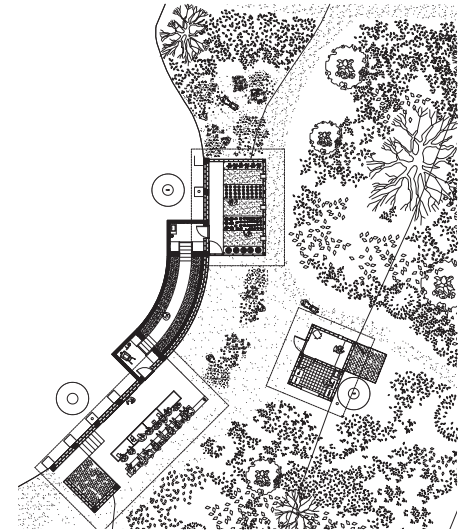
PHASE I:

The farm can function only consisting of the incubation room, spore running room, cropping room and storage. Therefore we suggest that the construction of lab/office awaits till a later stage, when the business has developed.



PHASE II:

Full scheme including facilities for office and laboratory.



PHASE III:

As a wish from the client and the need for more educational facilities we suggest the inoculation room can be used as biology class room for students at Eco Moyo. Due to the cycle of mushrooms growing the facility will be in use at specific times. The spore running room will be occupied permanently, while the cropping room can function as plant germination and propagation space.

Mushroom growing course

To get an understanding of the process of cultivation mushrooms and the facilities needed we signed up for a oyster mushroom growing course with Gruten AS in Oslo.

The course gave an introduction on how to mix substrate, spores and prepare the cultivation bag. The substrate we used was coffee ground. The bag was prepared 30th. September and the mushroom fruited in beginning of December.



Mushroom growing experiment on coffee ground



Day 1



Day 2



Day 3



Day 4



Day 5



Day 6



Day 7



Day 8



Day 9



Day 10



Day 11



Day 12



Day 13



Day 14



Day 15



Day 16





Day 21



Day 22



Day 23



Day 24



Day 25



Day 26 - Marking



Day 26 - Cutting



Day 26 - Cutting



Day 26 - Water Bath in 5C in 10 hours



Day 26 - Exposed to light 24 hours /a day



Day 27



Day 28

After several weeks no



Mushroom growing experiment on hay

At Eco Moyo Mushroom Farm the mushrooms will be cultivated on hay substrate. Therefore we did a second test of cultivating oyster mushrooms with a similar procedure, but using pasteurized hay as substrate.

The choice of using hay as substrate is based on research on similar growing project done in hot and humid climate.

Hay is

- easily accessible in Kenya
- cheap
- easy to store
- generate rich and fertile compost as waste product



