

WE THE SEEDS OF THE

GAMBIA

TEC BOOK VOL. 1



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introduction

This book is aimed at those interested in sustainable agriculture, permaculture, and agribusiness in The Gambia. The contents provide a broad, regional overview of agriculture, an introduction to the challenges of today's agriculture, practical instructions for permaculture cultivation, and a summary of the positive effects of sustainable and flourishing agriculture nationally.

Topics are described with key words, pictures, and detailed text. The individual pages can also be copied and reproduced as leaflets or posters. The book is not a finished product but a collection of knowledge, which will grow. This collection of knowledge is especially to be supplemented with local experiential knowledge on sustainable living and lifestyle, agriculture and permaculture in The Gambia.

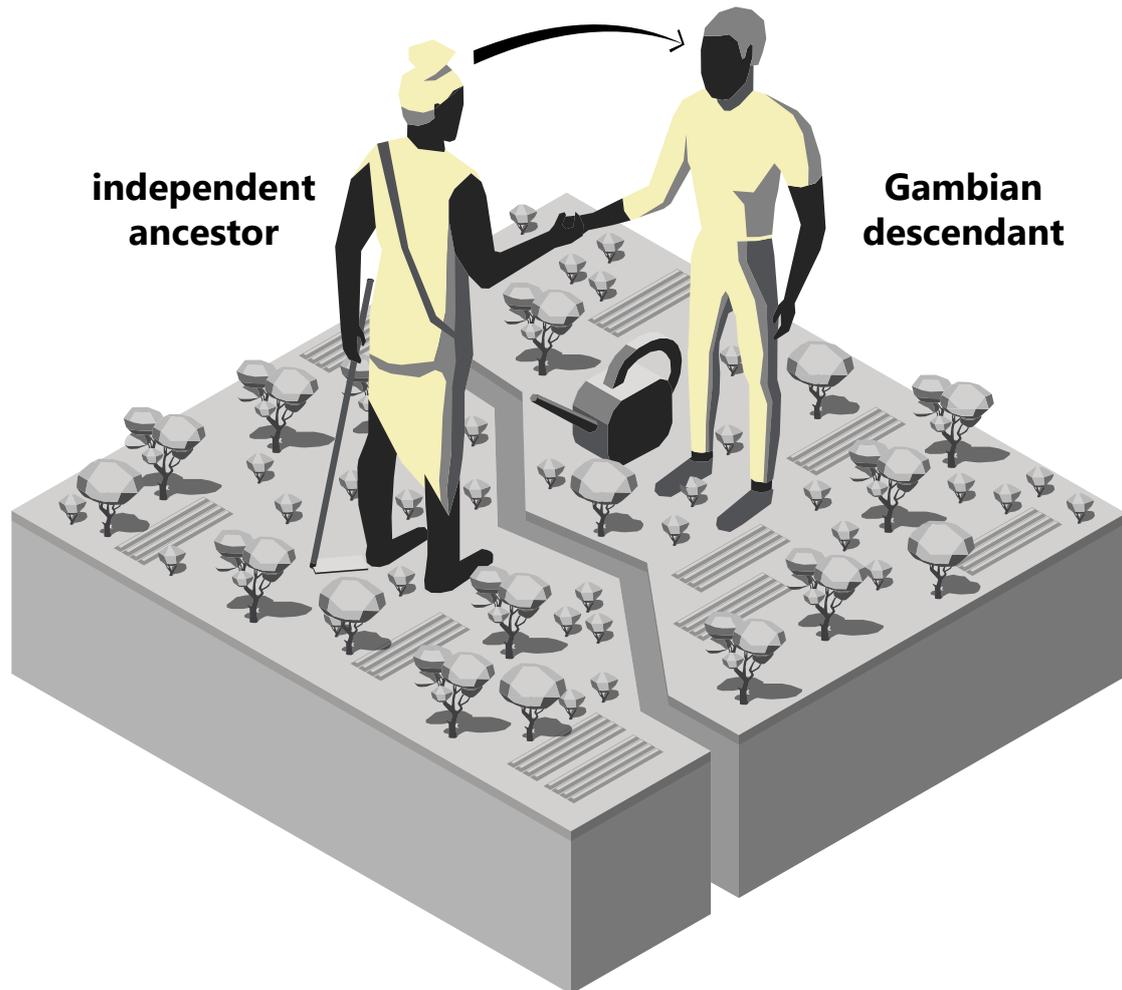
This book was developed in cooperation with the TEC in Tanji (a project of the Swiss NGO "Förderverein Humanitas") by landscape architecture students at the University of Applied Sciences OST in Rapperswil, Switzerland.

history, culture and today's challenges in Gambian agriculture- and how to change

Joshua Kohli & Moritz Moser

Land cultivation as Gambian national heritage

Ancestors of modern-day Gambians were independent farm owners. They were highly respected, and farming was considered honourable work. The Mandinka – a West African ethnic group dominant in The Gambia – were organized in a caste system comprising four castes. The second-highest caste consisted of freeborn farm owners who were responsible for land cultivation. Cultivating land and being independent farm owners enabled Gambian ancestors a predominantly autonomous existence.



Long before Europeans arrived on the continent of Africa, there were flourishing cultures with powerful empires, such as the Mali Empire and their descendants the Mandinka or the Empire of Great Fulo in the West of Africa. (Wikipedia)

The Mandinka recognized four castes. The highest consisted of nobles (royal family members, other rulers). The second highest caste consisted of freeborn farm owners, who were responsible for cultivating the land. The next caste was composed of artisans such as blacksmiths and leather workers along with the “griots”, oral historians and advisors to royalty. (www.accessgambia.com)

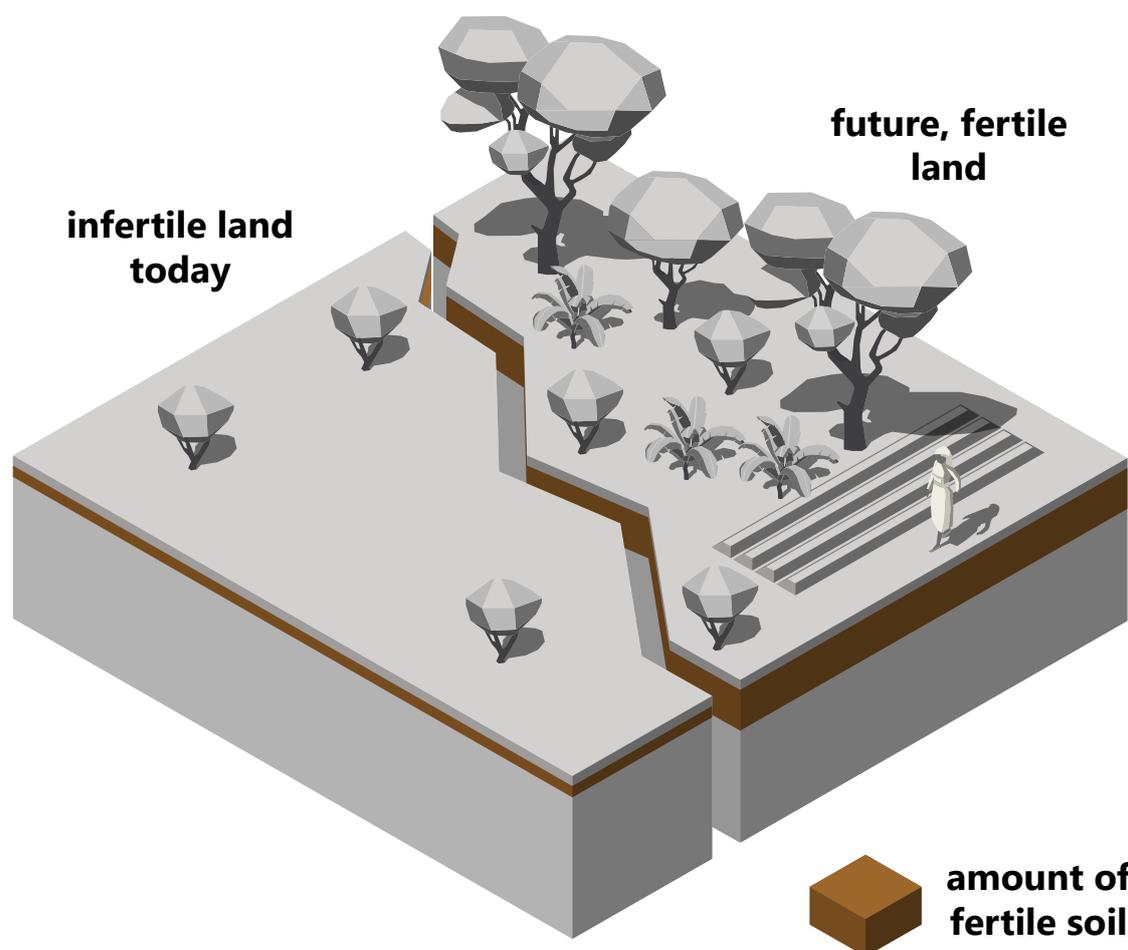
African agriculture developed independently in the West African territory around 3000 BCE (or earlier), in the lush and habitable savannah on the border between present-day Nigeria and Cameroon. (Khan Academy)

Potential of Gambian soil

Centuries ago, The Gambia boasted one of the most fertile soils of the entire African continent.

Soil fertility in The Gambia is decreasing, however, largely due to inappropriate farming techniques.

Through the adoption of permaculture farming, soil fertility can be increased, and the economical position of farmers can be improved through self-sufficiency and production of cash crops.



Reduction of soil fertility has many causes: inappropriate farming systems, excessive cultivation (monocultures like groundnut), soil nutrient runoff due to water and wind erosion, and missing organic material in the ground itself. (FAO 2018) The low soil fertility may impede higher staple food (rice, vegetables, fruits) and overall crop production in The Gambia.

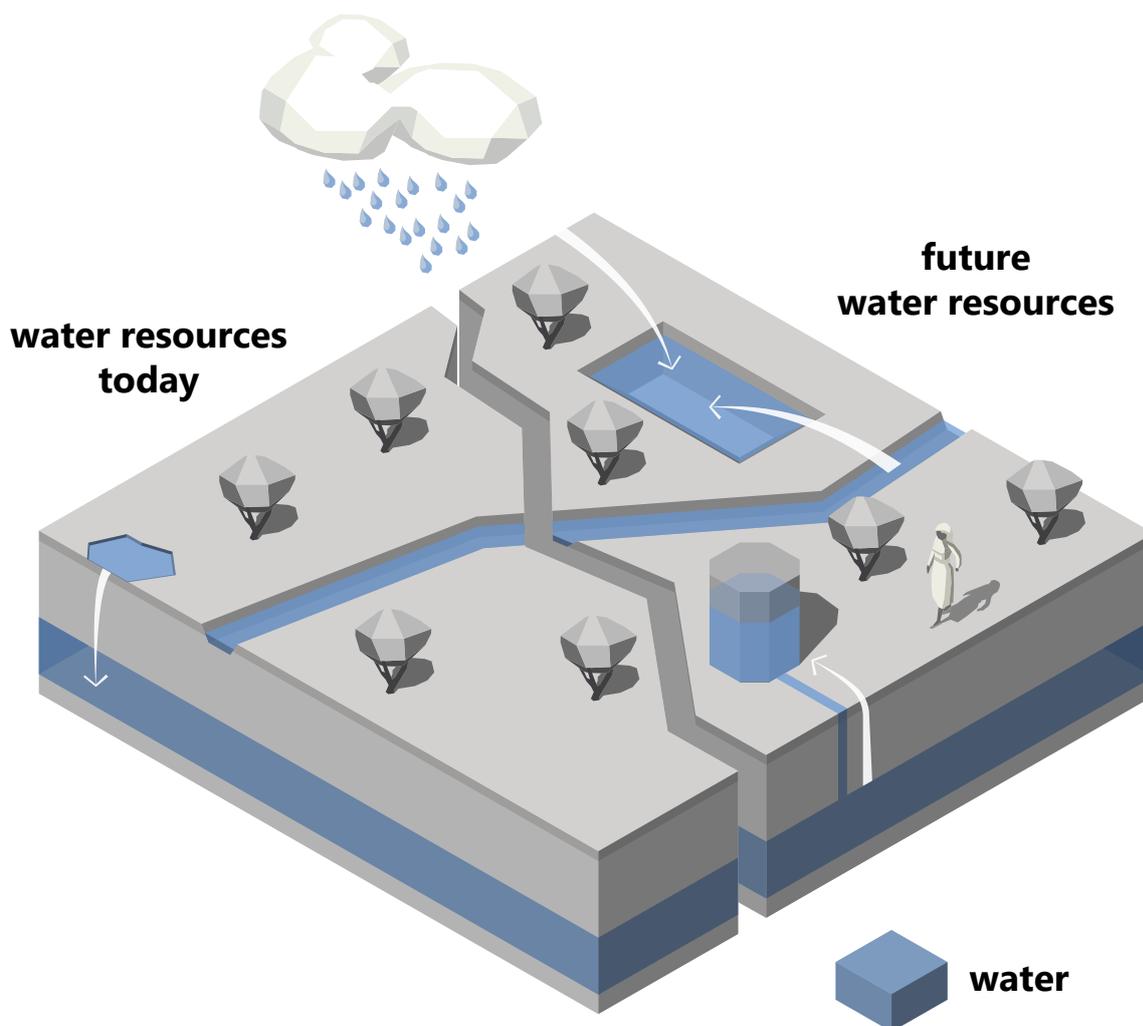
About 39% of the land area in The Gambia is arable land (FAO 2018) and with simple methods of permaculture it is possible to transform infertile soil into fertile soil. Using already existing, natural materials, soil can be fertilized, and the productivity of farmland increased. This leads to more diversity in staple foods and increased self-sufficiency. A portion of the newly won fertile land can be used for cash crops for additional income or entrepreneurial investments.

Water resource potential in The Gambia

The entire geographical area of The Gambia is located above the biggest groundwater reservoir of West Africa.

The Gambia has easy access to water because of high groundwater levels.

With easy methods it is possible to harvest rainwater during the monsoon season. This water can be used for part of the agricultural irrigation during the coming dry season.



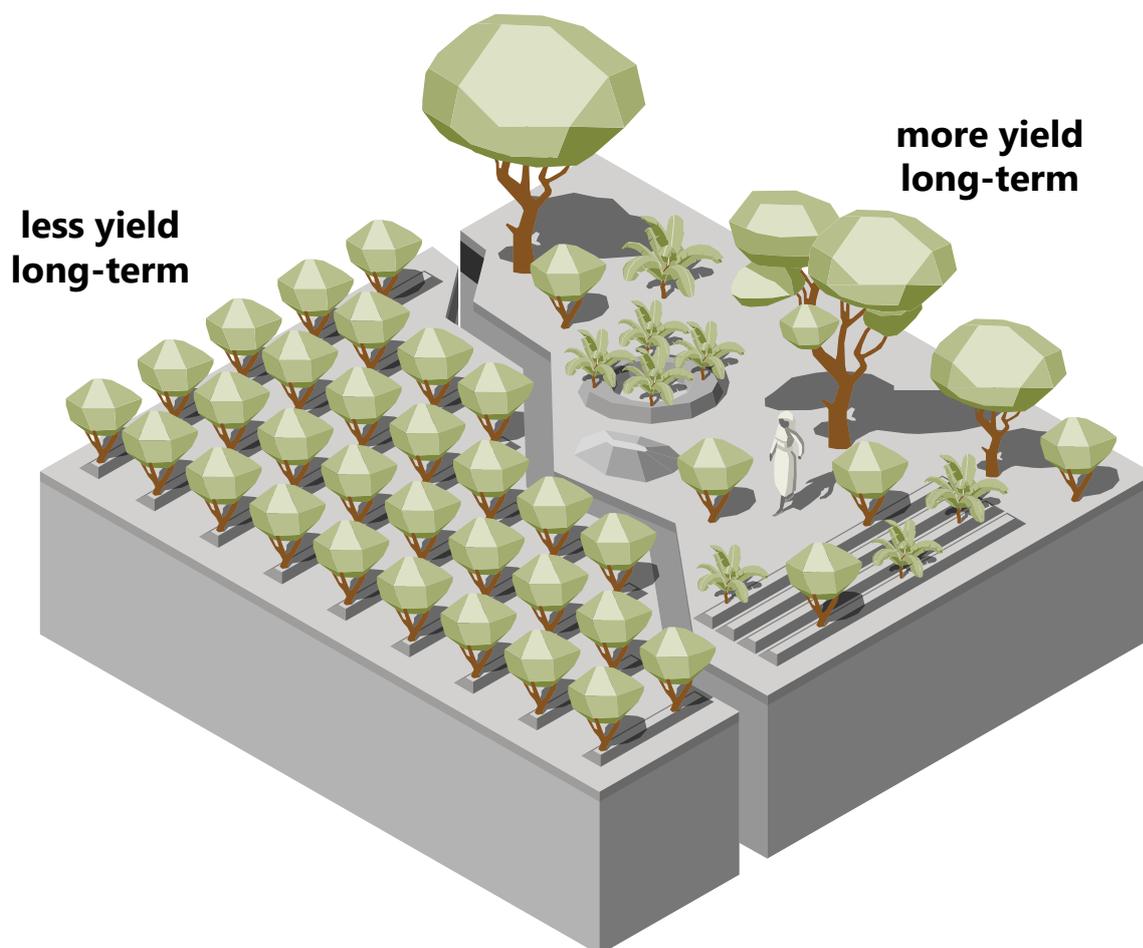
The Gambia's most precious natural resource is water – not just the river Gambia, but also the large groundwater-reservoir, which spreads below the entire country. This aquifer produces 500 million m³ water per year. The high ground water levels of this aquifer are advantageous for agriculture. The groundwater of The Gambia comprises two aquifer-systems, of which the upper water table may already be found as high as 4m below the ground. (Africa Groundwater Atlas – British Geological Survey)

With solar pumping systems, water access for irrigated farming can be secured, which makes it possible to yield crops year-round, even during the dry season. Numerous NGOs seek to partner with local farmers to ensure the purchase of such systems with the purpose of increasing the number of independent farmers in The Gambia.

Monocultures harm Gambian agriculture

The cultivation of monocultures – only one sort of cash crop – causes more crop pests, increased soil fertility loss, higher use of pesticides and fertilizer (causing additional expenses) and higher water use.

Monocultures can endanger the long-term income of a farmer. For example, if mainly groundnut is grown on farmland as a cash crop, it can harm and destroy the fertility of the soil. This negative process decreases groundnut yields in the future.



Monocultures may secure a short-term income, but they also come with negative side-effects that endanger the crop quantity and the resulting profit long-term.

Monocultures are more at risk of crop loss due to pests. The millet head miner – a pest unique to millet – can, for example, destroy an entire millet monoculture. If there is diversity in crops, only a specific crop is endangered by a given pest. Also, monocultures reduce soil fertility. Too many of the same plant species on a farmland rob the soil of its nutrients, resulting in decreased varieties of bacteria and microorganisms, which are needed to maintain soil fertility.

The necessity of pesticides and fertilizers in monocultures leads to additional and steadily increasing expenses for the farmer.

groundnut monoculture in The Gambia



https://thepoint.gm/assets/_library/2013/8/groundnut.jpg

left picture: soil erosion in potato field

right picture: soil erosion in corn field



https://farmityourself.com/wp-content/uploads/2020/04/A_potato_field_with_soil_erosion.jpg

<https://c8.alamy.com/zooms/9/8d43d496e9b74916bf0638198e892522/2bxn6n8.jpg>

danger of pests: millet head miner destroys the harvest



<https://www.agrilinks.org/post/natural-enemies-against-devastating-millet-head-miner>

degraded soil in Nigeria



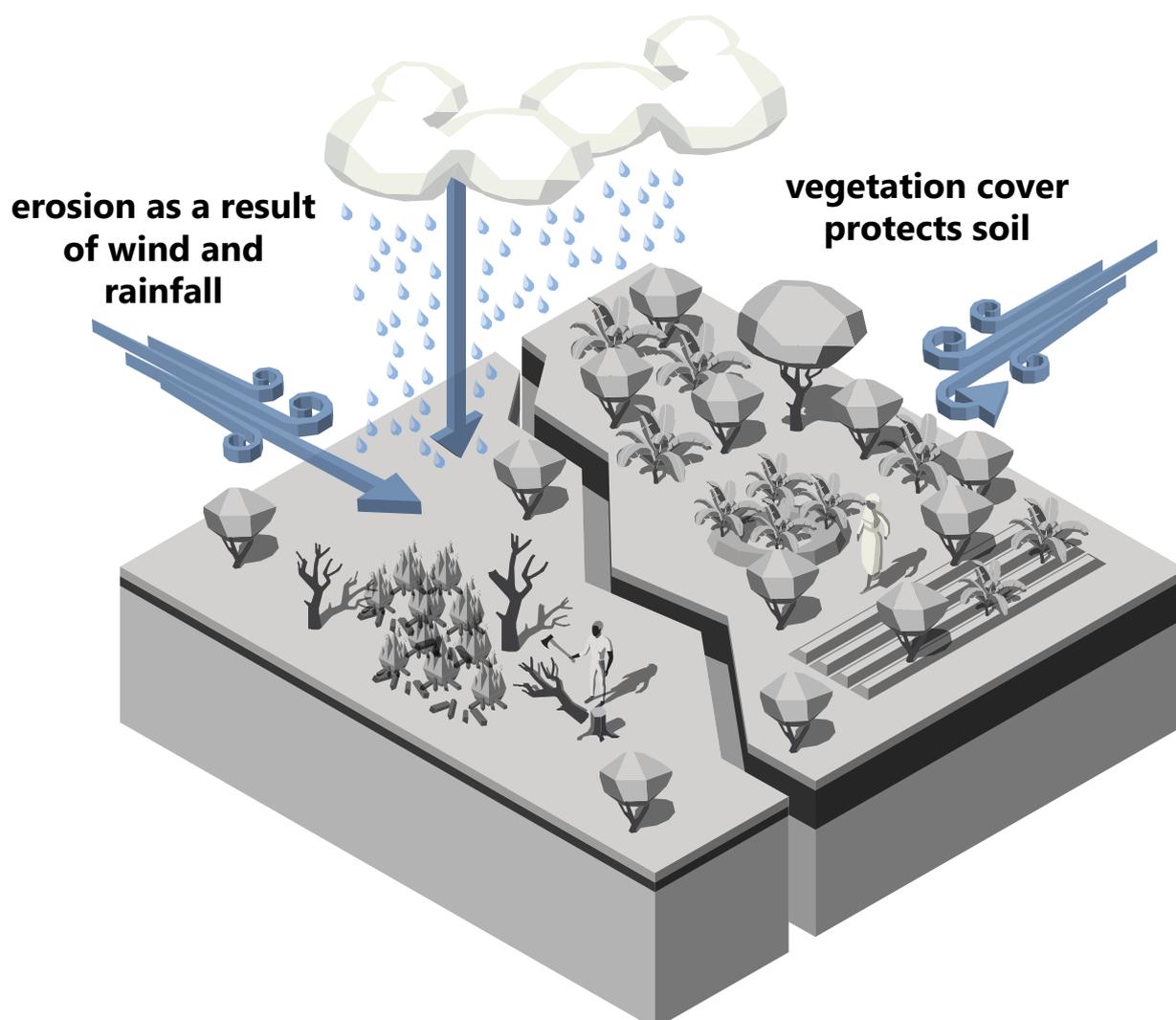
<https://www.nhm.ac.uk/content/dam/nhmwww/discover/soil-around-the-world-is-degrading/Farmer-full-width.jpg.thumb.768.768.jpg>

Soil erosion is destroying once fertile land in The Gambia

Soil erosion is one of the main threats for farming.

If soil isn't protected by a natural cover of trees, bushes, ground vegetation or crop residue, with time it will lose its fertile top soil.

Soil erosion is caused through water and wind erosion, deforestation (slash and burn), overgrazing, certain tillage methods and general missing ground vegetation cover.



Soil erosion endangers agriculture and potential profit long-term. In 1993 a national report study estimated that soil erosion leads to a loss of 12.5 tons (or one truckload full) of topsoil per hectare per year. The process of regenerating this amount of fertile soil can take years. It is essential for a secure yield to have areas on the farmland with vegetation cover, which have the function of protecting the fertile soil from erosion.

Especially with year-round exposure to soil erosion by the Harmattan (wind) and Nawet (heavy rain), land cover with vegetation is indispensable for protecting fertile topsoil. Even off-season, during low cash crop production, it is important to cover the earth to make sure there is enough fertile topsoil for the next season's various main crops.

**rill erosion
due to
heavy rain**



https://www.researchgate.net/profile/Martin-Potgieter/publication/309610614/figure/fig2/AS:423917316775937@1478081172122/Rill-erosion-Photo-http-www-freefotocom_Q320.jpg



https://www.grainsa.co.za/upload/erosion2014_11_01.jpg

**wind erosion carries
fertile topsoil away**



https://www.fao.org/fileadmin/user_upload/GSP/docs/elmina/Gambia_Priorities.pdf

**soil erosion due to
missing vegetation
which is needed to
protect and cover the
soil**



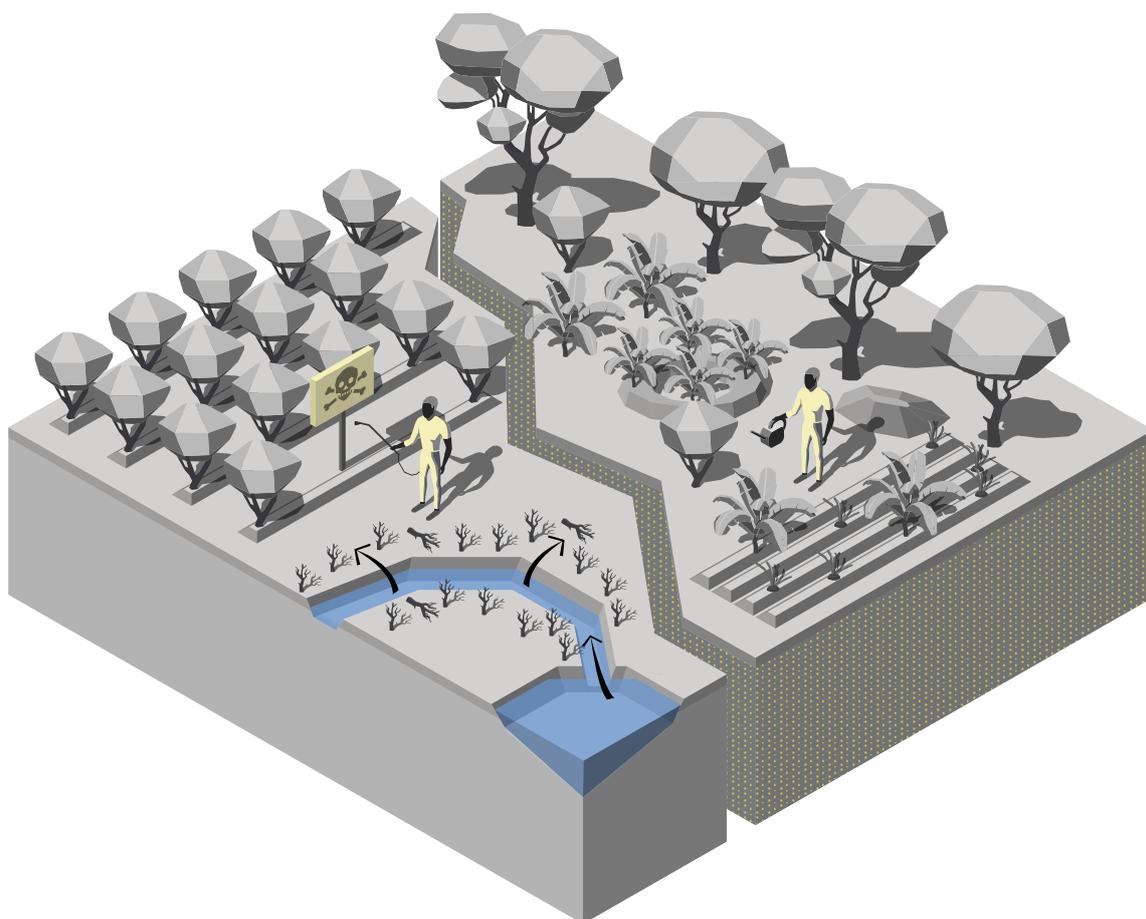
https://www.researchgate.net/figure/A-picture-showing-a-severely-degraded-area-by-soil-erosion-in-the-rangelands-near-Lake_fig3_261135236

Nutrient-poor, acidic, saline soils increasing in The Gambia

Due to soil poor in organic matter and intensive agricultural production there is constant soil nutrient loss.

Intensive production with nitrogen fertilizers combined with organic matter removal causes soil acidity.

Increased use of river water for tidal irrigation inland causes salination of terrain in coastal areas. Harvest rates of rice crops under tidal irrigation diminish drastically.



The soil in the Gambia is low in organic matter in general. Additionally due to continuous and intensive production (mostly monocultures) a significant amount of nutrients is exported from the topsoil horizon with each harvest.

The application of industrial nitrogen fertilizer causes soil acidification, especially increasing ammonium (due to H^+ releasing nitrification). Crop residue or other organic matter, generally, is alkaline. The constant removal of alkaline organic matter in intensive agriculture contributes to soil acidification. The 2011 Agricultural Census shows that 41% of Gambian villages report soil acidity and 42% report soil salinity.

With tidal irrigation in coastal regions, there is danger of salt-water intrusion into farmland. After water evaporation the crystallized salt can cause hyper salination of the soil and lead to sinking harvest rates, mostly for rice cropping (WASCAL).

**nitrogen fertilizer
causes soil
acidification**



https://ifdc.org/wp-content/uploads/2020/12/GHANA_ATT_Farmer-Broadcasts-Fertilizer-in-Rice-Field-1024x682.jpg



https://www.grainsa.co.za/upload/bekalking2013_07_pic01.jpg

**salt-water encroach-
ment on rice field
after tidal irrigation**



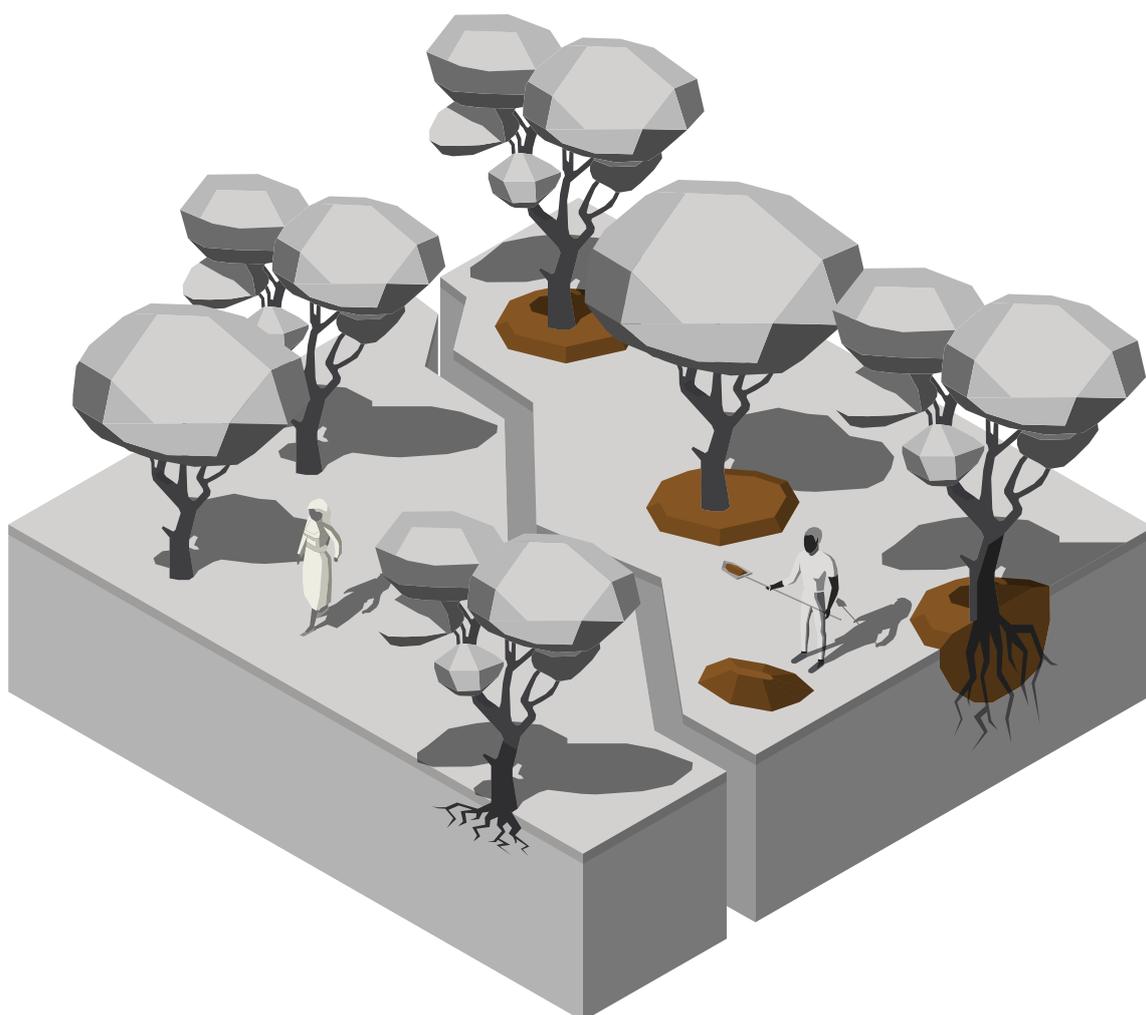
https://i.guim.co.uk/img/media/cb7cc80f065f038e458fa6089e03431c70af6/0_275_8120_4870/master/8120.jpg?width=620&quality=45&auto=format&fit=max&dpr=2&s=974bb93b7c3d76edd4b02106be6db588

Low and slow formation of fertile topsoil

Because of the advancing soil erosion natural formation of topsoil can't equalize the loss of fertile top soil.

Non-utilization of composting with free materials like crop residue, organic household waste or coal also slows down the formation of fertile top soil.

Most of this valuable organic waste, which is a free and very effective fertilizer, is dumped in informal dumpsites or burned.



The natural cycle of topsoil formation no longer functions by itself. This natural, autonomous process to enhance soil fertility was destroyed through soil erosion and inappropriate farming practices.

It is estimated that about 53% of municipal solid waste in The Gambia is organic waste. Most of this solid waste gets disposed of in ecologically damaging processes like waste dumping in informal dump-sites or even waste burning. Only an estimated 3% of the whole country's organic waste is composted. (Circular GHG mitigation opportunities – The government of The Gambia)

A study from Babucarr Jassey shows that households in Sukuta Nema produce an estimated 610kg or 3m³ of organic waste per year. With this amount of composted organic waste, a significant and sustainable soil enhancement could be achieved.

**degraded farmland
in Buduck**



<https://www.worldagroforestry.org/sites/agroforestry/files/inline-images/Degraded%20farmlands%20in%20Buduck%2C%20Central%20River%20Region%20of%20the%20Gambia.jpg>

**fertile, dark soil
through composting**



<https://sgp.undp.org/all-documents/country-documents/1026-fangsoto-guide-on-composting/file.html>

**burning of waste
mixed with
organic matter**



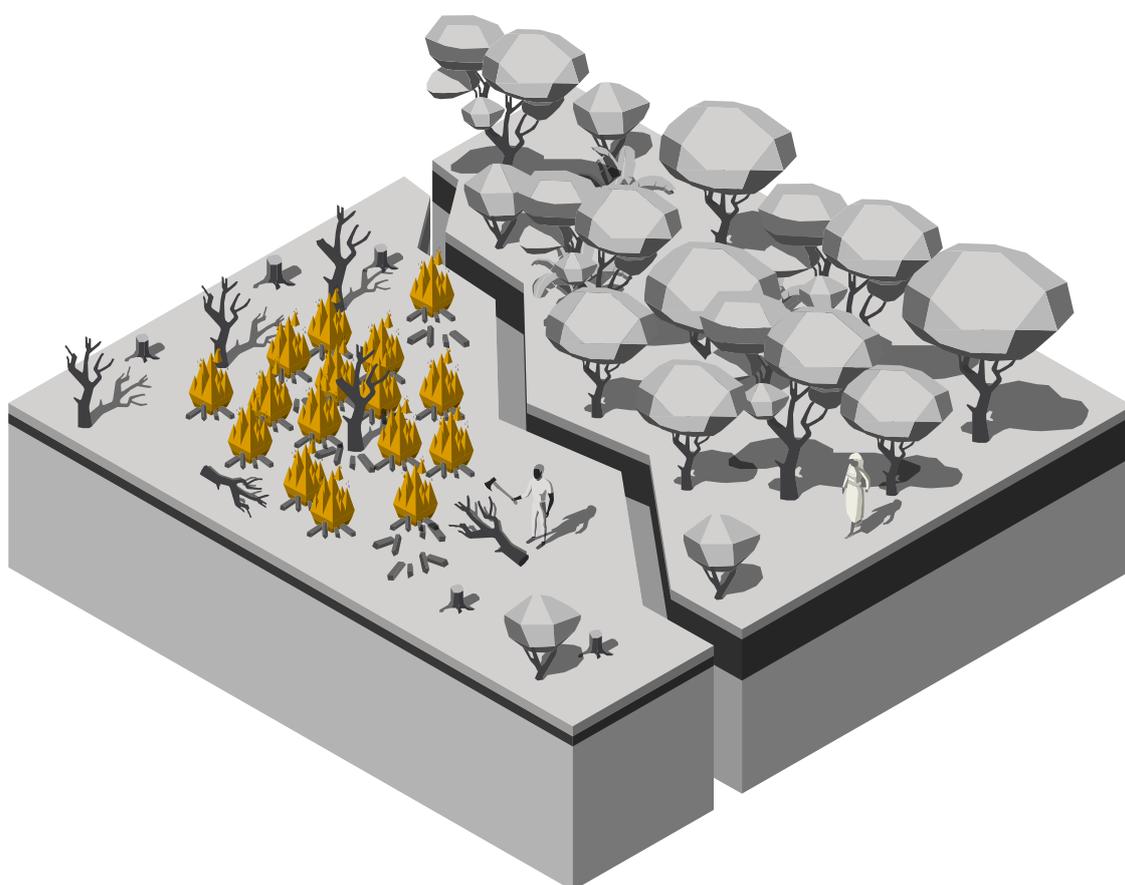
<https://woimacorporation.com/wp-content/uploads/2019/01/Burning-waste-in-Morocco-pollution-drowning-in-waste-WOIMA-Corporation.png>

Deforestation is accelerating land degradation and desertification

The change from traditional, sustainable agroforestry to monoculture cropping systems brings less yield long-term.

Excessive deforestation (also slash and burn) due to land preparation for farming leads to long-term soil degradation.

Trees and bushes provide natural wind protection and water storage. Excessive deforestation leads to long-term, large area desertification of once fertile land.



Deforestation erroneously promises more space for seemingly more profitable monocultures. But with the slash and burn method soil can only be fertilized for a short time. Compared to the long-term soil enhancing functions of trees and bushes, deforestation causes long-term damage to the soil, leading, in the worst-case scenario, to large-area desertification. Since 2000 The Gambia has lost 15% (688 hectares, or 964 soccer fields) of its tree cover (Global Forest Watch).

As a form of sustainable agriculture, agroforestry is rooted in the country's traditions. The combining of trees with crops conserves soil nutrients and water and averts erosion. Based on the agroecological zones in The Gambia, agroforestry yields are remarkably higher than prevailing agricultural methods. Crop yields are double on average (Circular GHG mitigation opportunities –The government of The Gambia).

exemplary agroforestry



https://media.springernature.com/lw685/springer-static/image/art%3A10.1007%2Fs13593-019-0589-8/MediaObjects/13593_2019_589_Fig1_HTML.jpg?as=webp

slash and burn land preparation techniques deplete topsoil



<https://m.psecn.photoshelter.com/img-get/I00002o4EUjMw4Oo/s/1200/I00002o4EUjMw4Oo.jpg>

excessive tree logging leads to deforestation



<https://trialinternational.org/wp-content/uploads/2020/03/slider.jpg>

desertification of once fertile land because of deforestation in Senegal



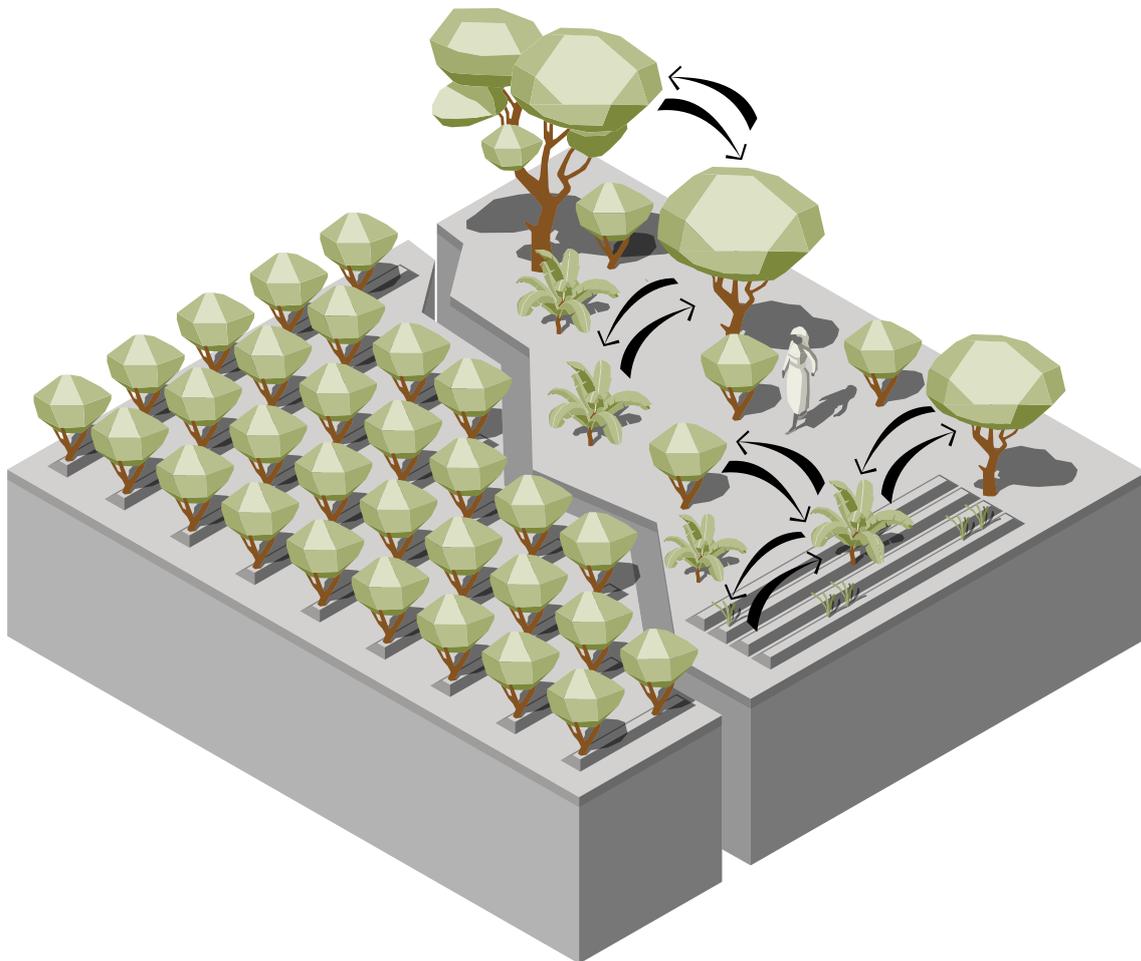
https://www.afrik21.africa/wp-content/uploads/2020/06/shutterstock_1020809017-1024x535.jpg

Lack of companion planting in farming

Like humans, plants are connected through relationships, some of which are even so beneficial, that crop yield is increased. Companion planting can provide nutrients, water, shade, windbreak, climbing aid or even natural pest control for each other.

Today's intensive, modern agriculture doesn't make use of any of these beneficial, free, and natural plant relationships. Instead, high-maintenance and costly farming systems are prevalent.

Soil becomes poor in nutrients mainly because of increased soil acidity. Soil pH has a major impact on a crop's ability to access the nutrients within the soil. Low soil pH (highly acidic pH from 1 to 4) binds soil nutrients, which then become unavailable for plant uptake. (Ronen 2007)



Soil becomes poor in nutrients mainly because of increased soil acidity. Soil pH has a major impact on a crop's ability to access the nutrients within the soil. Low soil pH (highly acidic pH from 1 to 4) binds soil nutrients, which then become unavailable for plant uptake. (Ronen 2007)

But there are some exceptional plants adapted to these harsh conditions. The African Winterthorn's (*Faidherbia albida*) "inverted phenology" (leafless during the rainy season and in leaf during the dry season) has the ability to bind nitrogen and draw water and nutrients from deep soil layers. It has a beneficial effect on the microclimate, soil fertility and soil moisture for adjacent crops (Plantnet Project). The use of companion planting markedly reduces the need for synthetic fertilizers, which generate constantly rising, additional costs for farm owners.

**exemplary
row intercropping**



https://www.agrocrops.com/myadmin/uploads/blog/medium/img2_1515137820.jpg

**exemplary
companion planting
on the site of TEC**



Snapshots from Video from TEC site in Tanji

**companion planting
vegetable garden in
Saruja**



<https://i0.wp.com/www.chronicle.gm/wp-content/uploads/2020/02/saruja2.jpg?resize=750%2C430&ssl=1>

The national consequences of excessive groundnut cultivation

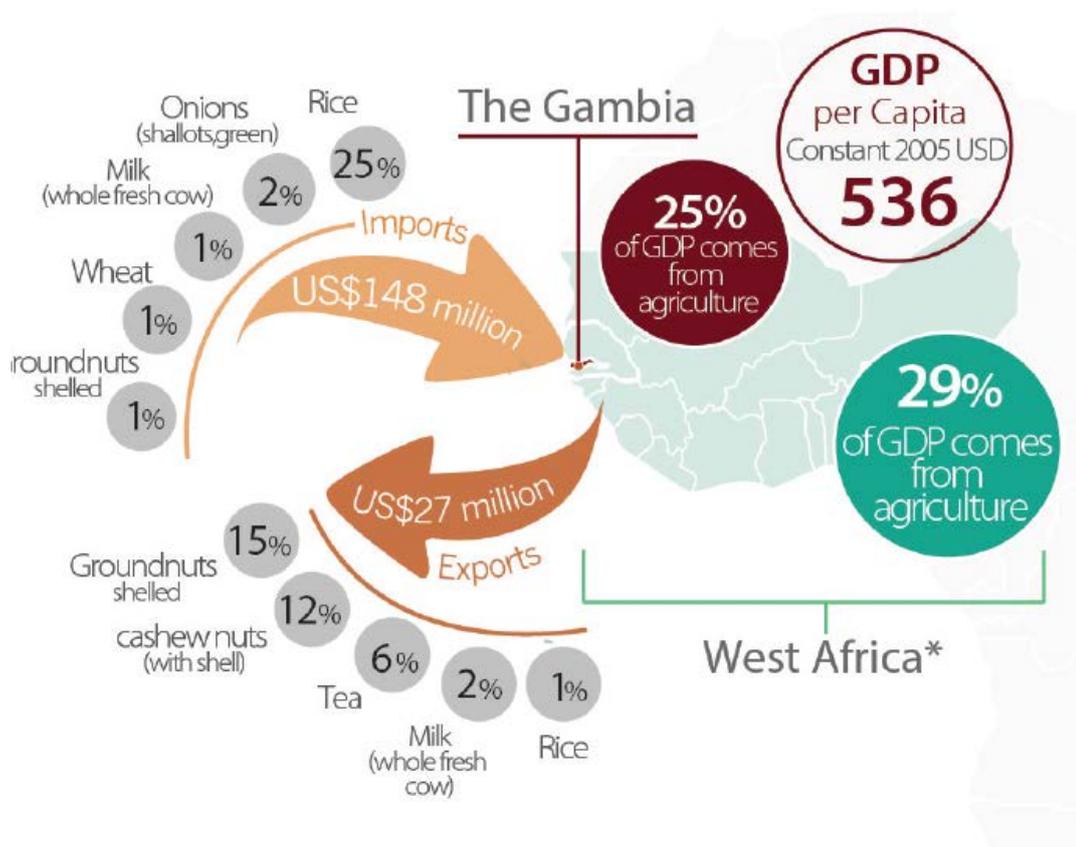
Groundnut fields account for about 28% of the total harvested area in The Gambia. Staple foods like rice or other essential foods like vegetables have a much lower land use. For the export product peanut, for example, a large expanse of land is needed, which could be more productively used for the self-sufficient cultivation of rice and vegetables for inland consumption.



The total of agricultural land is estimated at 605 ha or 54% of the whole land area of The Gambia. As one of the major cash crops for export, groundnut cultivation accounts for a large share of this available agricultural land. Compared with staple food crops, only millet has a slightly higher percentage of land use. Compared to the rest of West Africa, the Gambia's national rice harvest has a deficit of an estimated 1476 kg per hectare (FAO 2018).

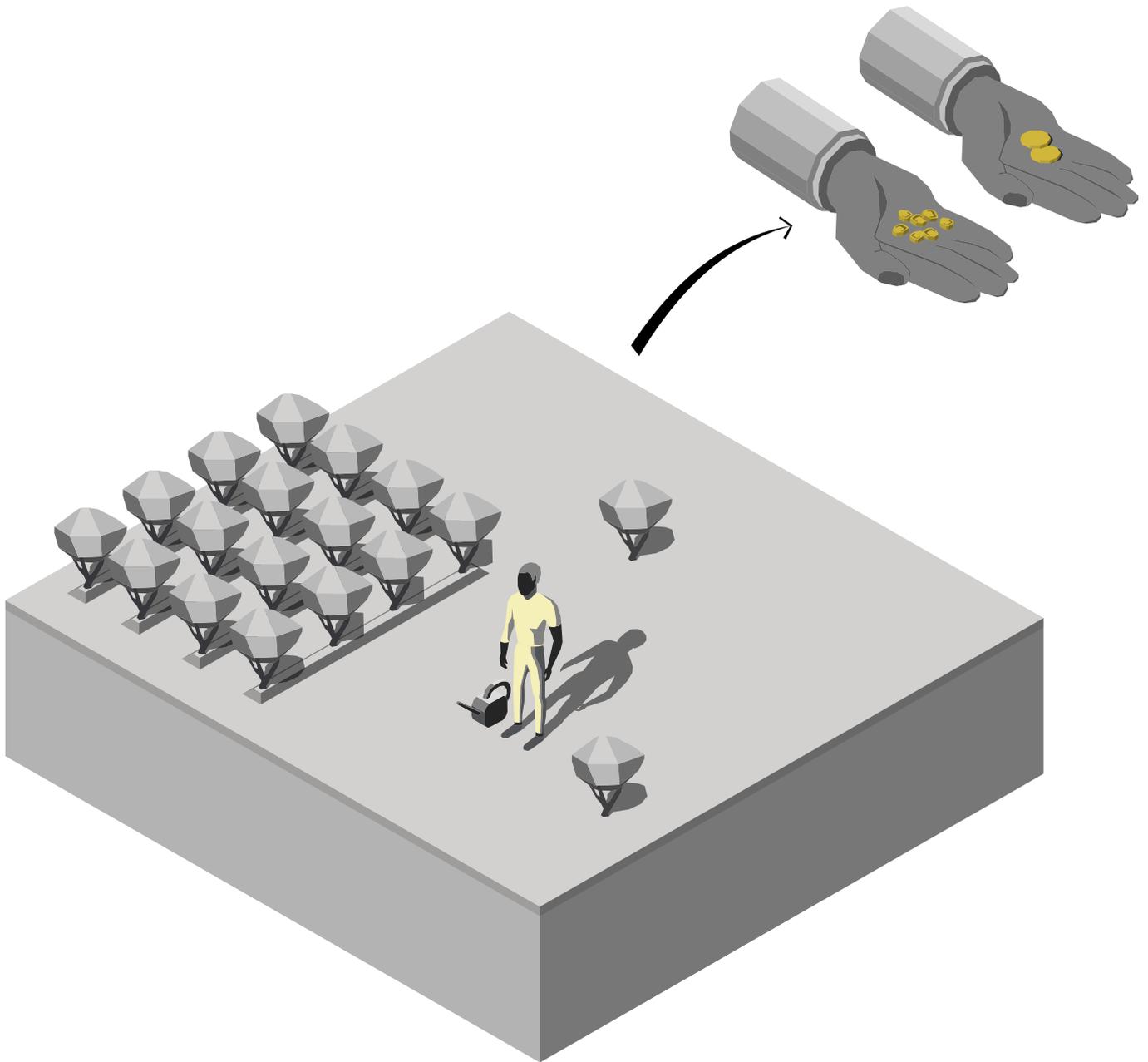
Although the Gambia could be largely self-sufficient in (staple) food with a more diversified agriculture, there is a focus on groundnut export and its profits. But peanuts are often grown in monocultures for maximum yield. Aubert (1962) records values of organic carbon under a savannah vegetation in Casamance as 1.7-1.9%, this figure dropping to 0.8-1.0% after 2 years cultivation of groundnut. The omission of rotating groundnut with other crops can cause the incidence of rosette disease or accelerated breakdown of the soil structure with a consequent decrease in permeability and increase in runoff and erosion. There are also difficulties with soil water absorption: the time required for 25 mm of water to enter the soil under groundnut is 120 minutes, under bush only 30 minutes (22 The agricultural development of The Gambia: an agricultural, environmental and socio-economic analysis, Volume 1).

An estimated 25% of GDP comes from agriculture. Of this 25%, the export of groundnut makes about 5% of GDP.



The graphic (FAO 2018) shows a trade deficit in agricultural products of 121 million US dollars, which leads to an estimated 29% of the required food having to be imported (World Bank 2020). According to Statista, The Gambia's whole trade deficit in 2020 amounted to around 633.99 million US dollars.

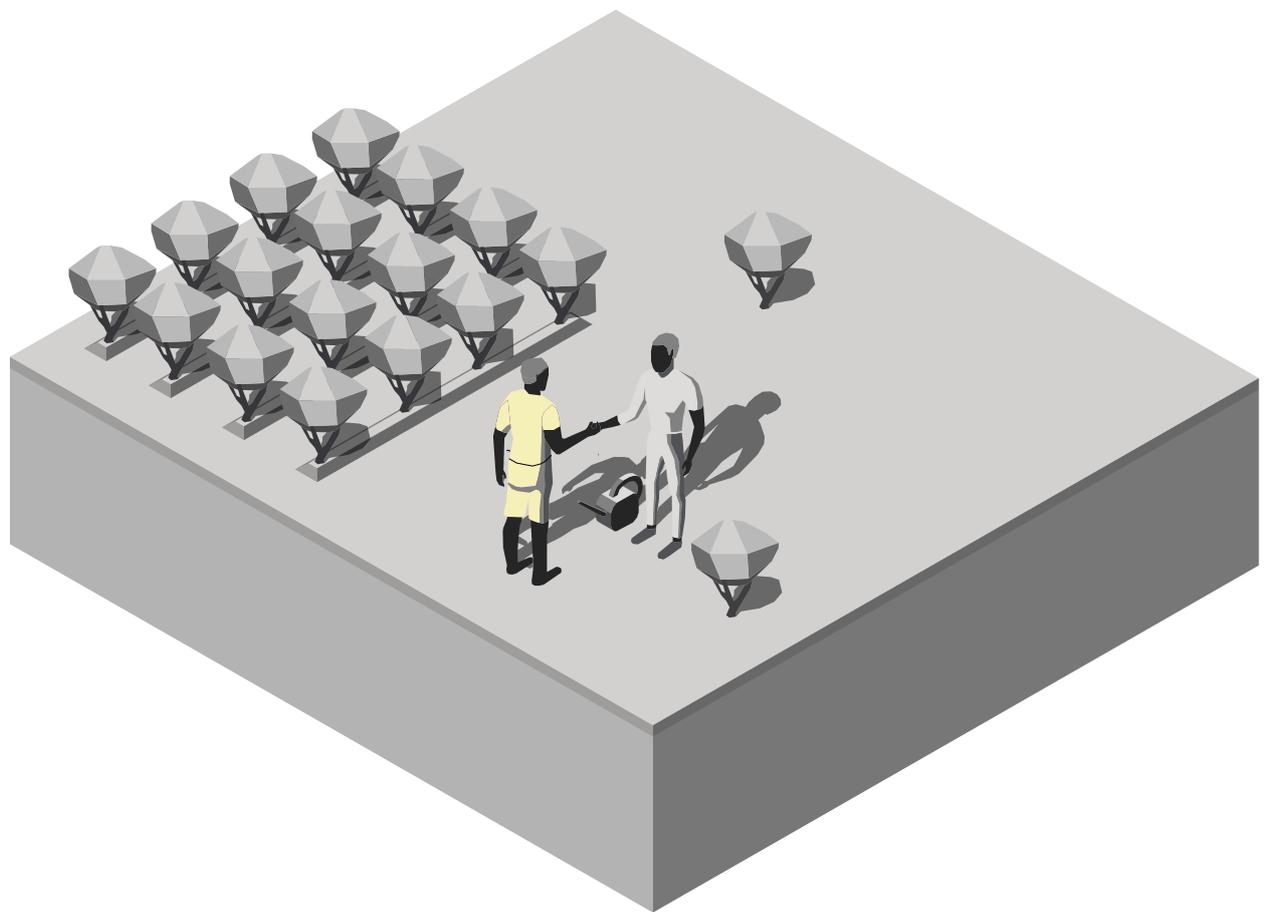
Compared to the 15% export of groundnut, 25% of rice must be imported. Rice, therefore, is a staple food with which The Gambia could actually supply itself. The currently practised and rather one-sided agriculture thus has a strong influence on the macro-economy of the country. If the deficit is to be eliminated, agriculture must reorient itself and diversify its production.



Conventional intensive agriculture (monoculture)

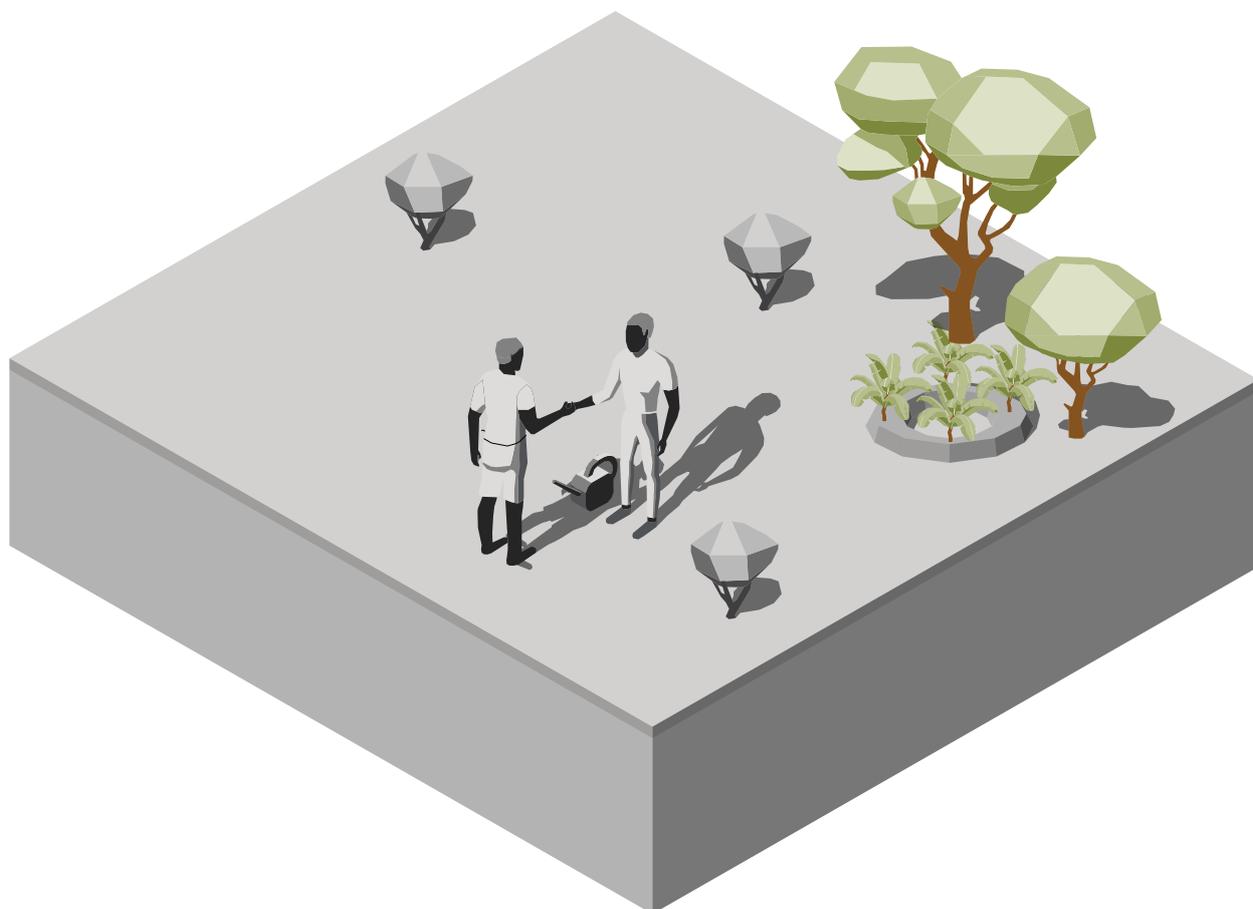
=

**Cause of long-term below average
revenue and profit**



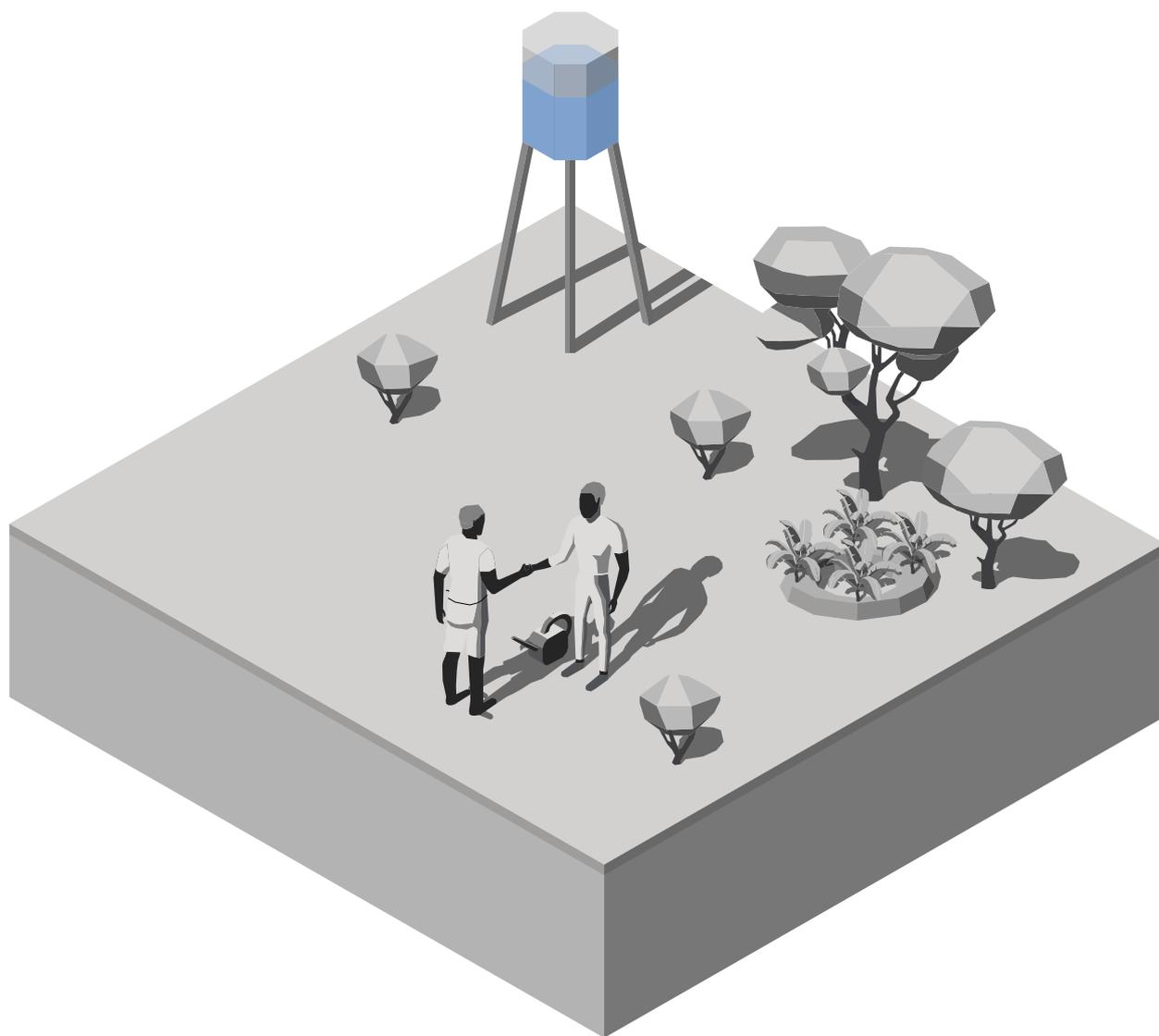
**The solution:
a partnership with the people from TEC.**

They will help you establish a self-sustaining and sustainable agriculture.

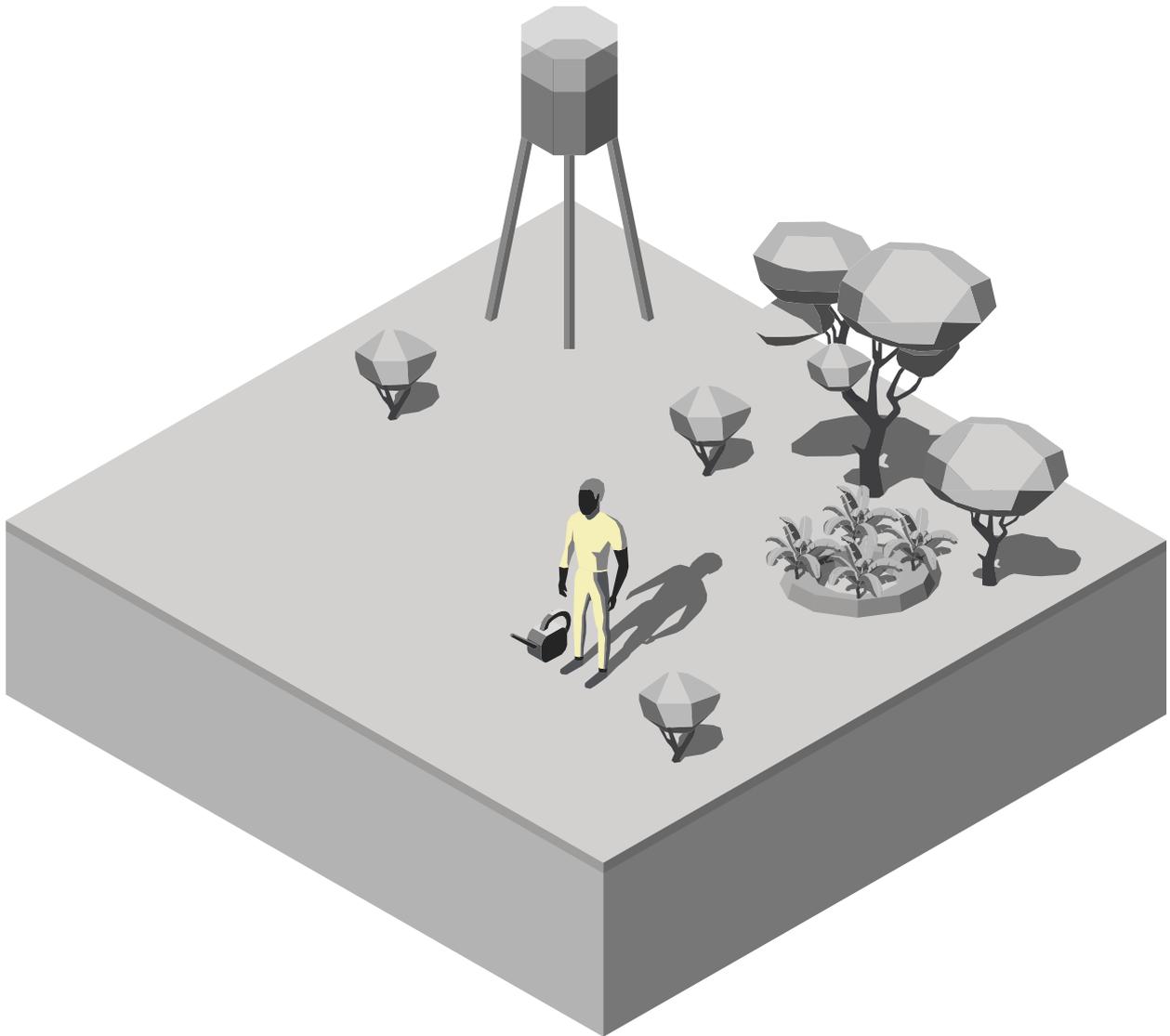


The TEC makes its knowledge and cultivation methods available to you.

The TEC and its staff help you to switch from monoculture to diversified crop cultivation.

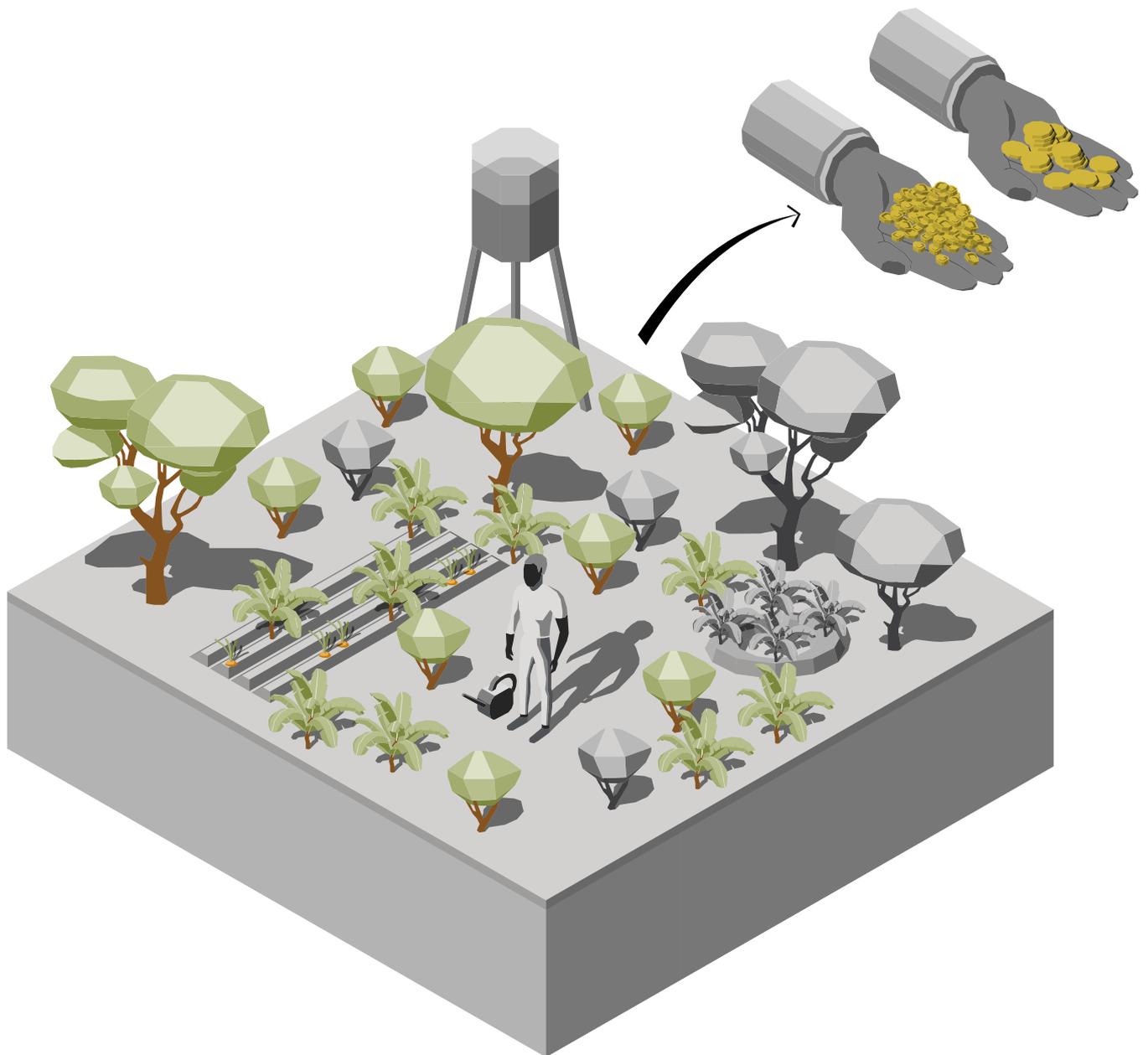


**With micro-loans from the TEC, you can build a water tank.
Irrigation for your farm is now also ensured for dry periods.**



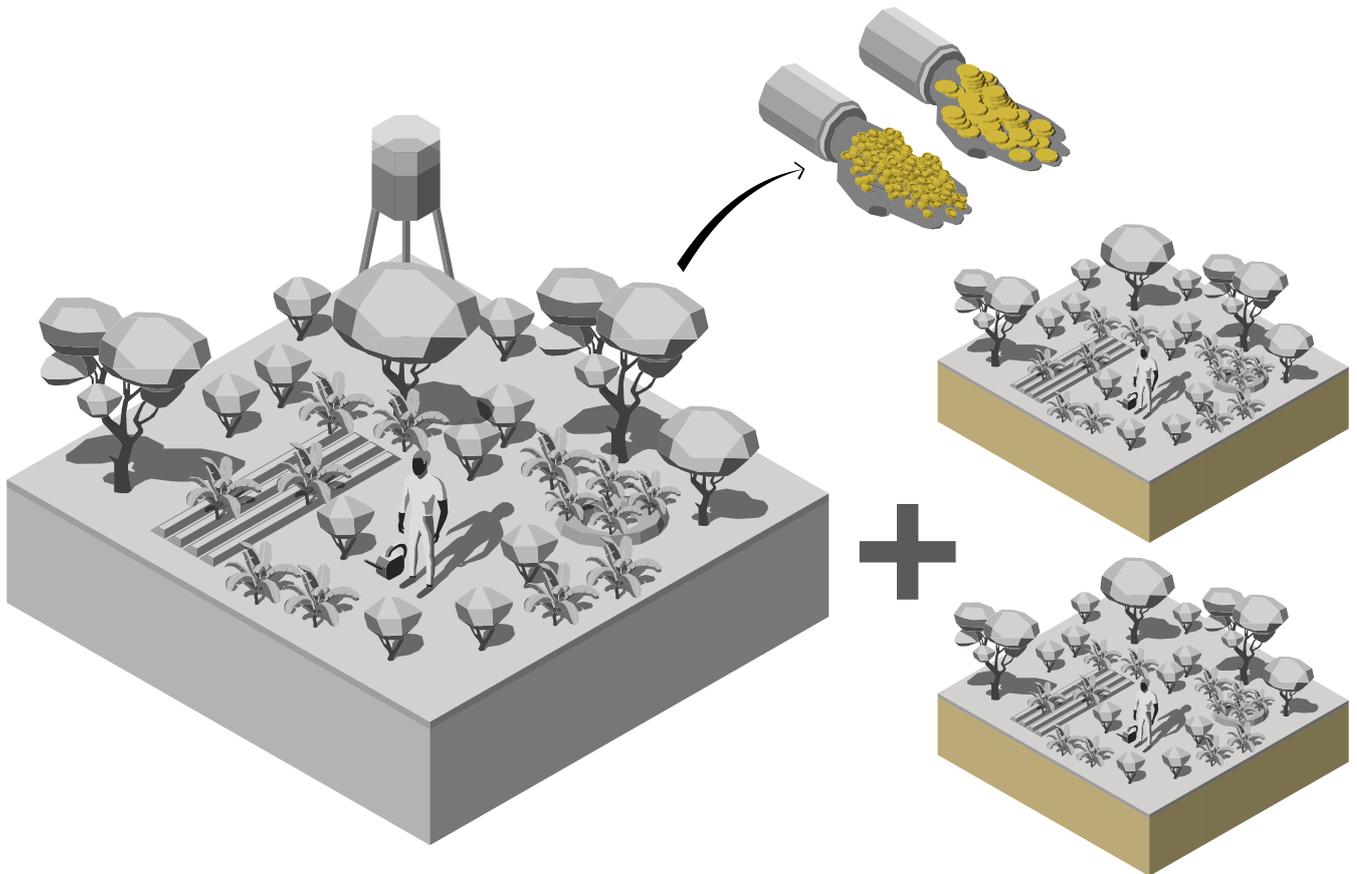
You are now an independent farmer who has the knowledge and methods for sustainable agriculture.

You now know how to produce fertile soil, how to naturally fertilise the soil with nutrients, how to do companion planting and how to produce high quality agricultural products.



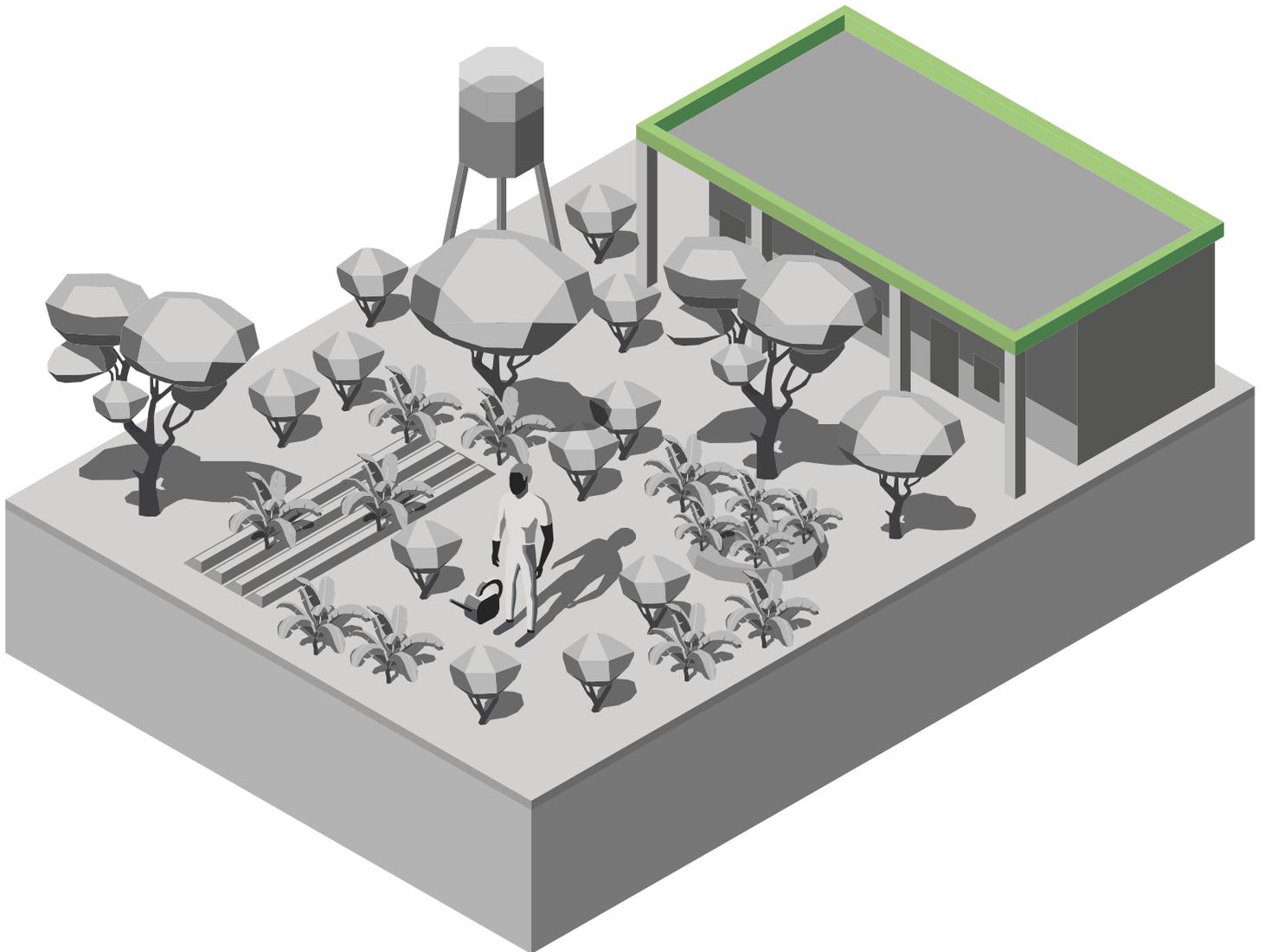
Over time, yields increase due to new methods such as agroforestry and companion planting.

Through your sustainable agriculture, your income is secured and you earn surplus money.



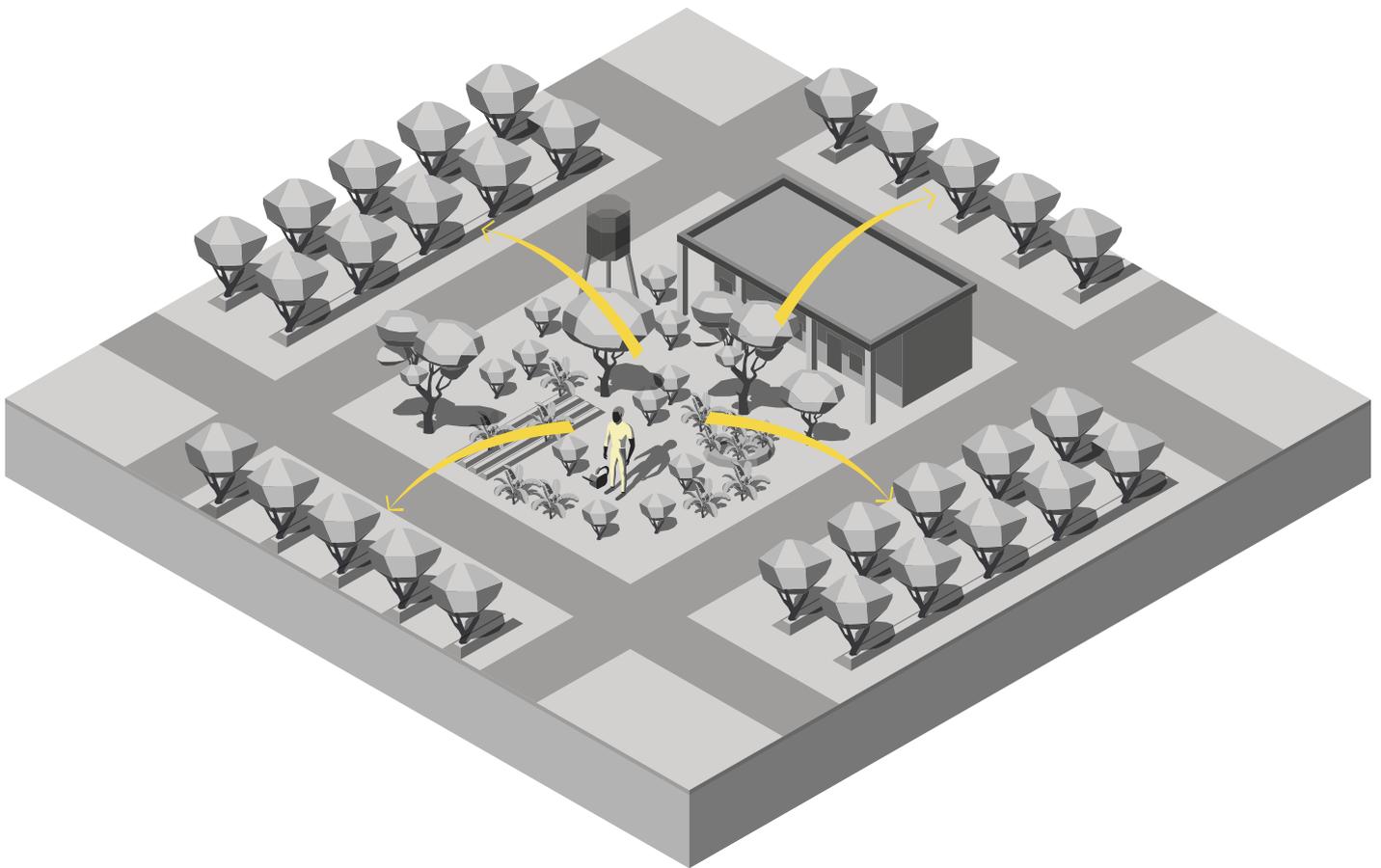
You are now an independent farmer who has the knowledge and methods for sustainable agriculture.

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As your farm grows, so does your yield and therefore your income.

After you have saved, you can build your own house on the farm.



You are now a role model for your neighbouring farmers. They see how your new methods work very well.

You pass on the knowledge you have learned from the TEC and teach them how to farm sustainably.



Through your knowledge transfer and your help, the neighbouring farms also become sustainable farms with secure income for their families.

Together you can achieve great things and contribute to the independence of The Gambia. You can change the future of the country today!

permaculture as a possible solution

Tim Hegewald & Nadine Veraguth

This chapter contains short instructions on a variety of agricultural topics. They are divided into individual modules and are intended to give an impression of what is possible.

The modules can be put together in different combinations and can be used in different sizes.

The modules are divided into basic and extended. With the basic modules, success can be seen quickly and they can be easily tried out. Extended modules take a while until success is seen and basic knowledge is very important.

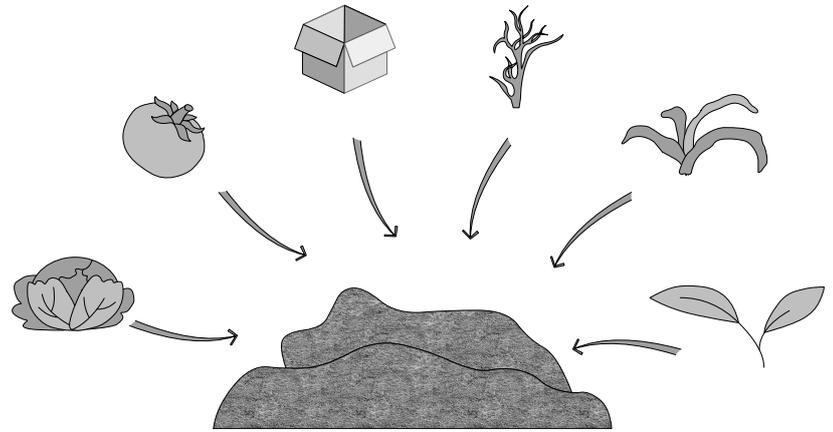
What is Permaculture?

Permaculture is a concept for sustainable agriculture. The material cycles and systems of nature are observed and recreated. Humans work together with nature to achieve the highest possible output without destroying the natural resources. So, no monocultures are planted and no pesticides are used. In permaculture, people work with the conditions on site. There are no universal solutions.

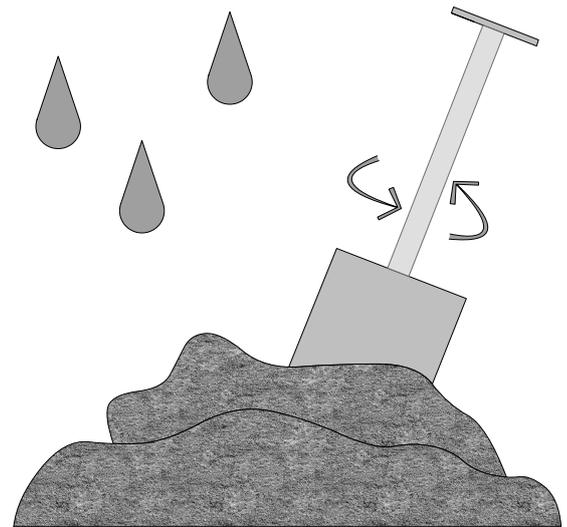
Basic modules | Compost

Compost can play an important role in successfully growing plants, as it has many essential benefits. Compost contains lots of important nutrients and acts as a fertilizer. It also helps the soil to retain water and protects plants from many diseases. By feeding microbial life in the soil it also helps loosening up the ground. Compost can be created using organic waste like leaves, bushes or unused vegetables and fruits. You should also add some brown material like small wood chips, branches or cardboard. It needs to be kept moisturised and should be turned around with a shovel every few days. By covering up the compost with branches, plastic or any other available material, water can be retained more easily during the dry season.

Gather organic waste to form a pile



Keep the pile moisturised and turn the material around every few days to let in air



https://scoutwiki.scouts.org.za/wiki/Making_compost

Pros	Improvement of soil fertility and raised yields, healthier soil, usage of otherwise unused material
Cons	Organic matter has to be collected and transported
Type of plants	The remains of all plants can be used as a basis for compost. Equal parts of brown and green material should be used

Workload, needed personell	Low effort, after collection the compost mostly maintains itself, has to be turned every few days for faster results
Time until harvest, number of harversts per year	Compost needs about 4-6 months to fully develop, depending on temperature and humidity
Needed material	Organic matter, shovel, water, something to cover up the compost if available

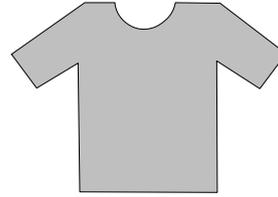
Basic modules | Compost Tea

Compost tea is a mixture created using water and compost. Through the process of „brewing“ the tea, microbes multiply in the liquid. Those microbes are said to have beneficial effects on the plants, their health and their growth. In combination with the fertilizing effect of the compost, the tea becomes a valuable source of nutrients and health for plants. The tea needs to „brew“ for 1-2 days and be stirred around about once an hour. After 1-2 days, the tea can be distributed on and under the plants using a watering can.

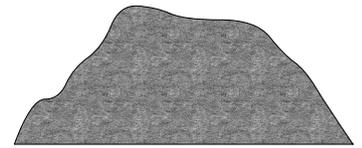
Bucket



Porous fabric, eg. a shirt



Compost



Brewing compost tea

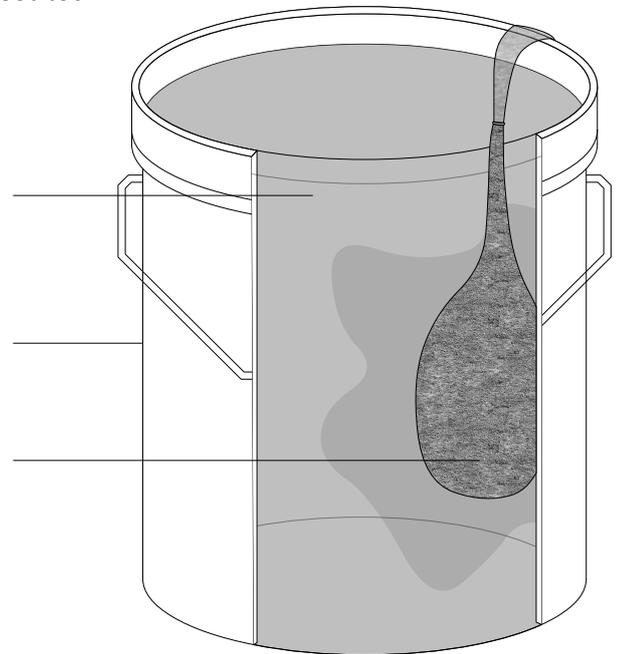


<https://turpenaturalsolutions.com/en/compost-tea/>

Water

20 liter bucket

Fabric (shirt) filled with half a liter of compost

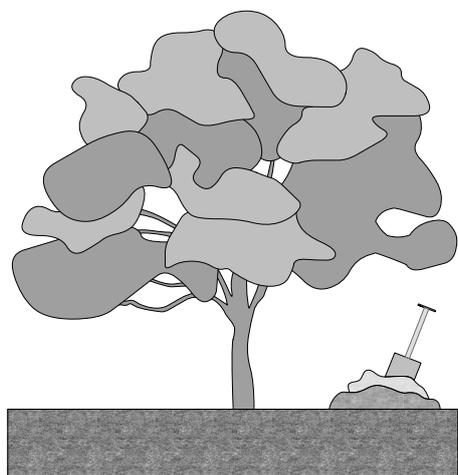


Pros	Keeps pest away from plants, usable against plant diseases, increase of natural resistance, acts as fertilizer
Cons	Organic matter has to be collected, needs developed and good compost, additional equipment is required
Type of plants	Any plants can be used for the composting process, the finished compost tea can be used on any plants

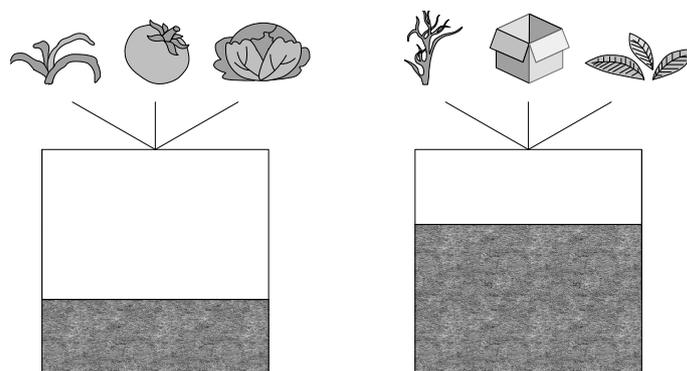
Workload, needed personell	High effort, the compost tea needs to be controlled and stirred regularly, compost needs to be available first
Time until harvest, number of harvests per year	Process of multiplying microorganisms takes up to 2 days, new compost tea can be made all 2 days. Don't brew for more than 2 days.
Needed material	Water, compost, big water container or bucket, porous cloth or fabric like a shirt 1 part compost to about 30 parts water

Using the Berkeley method compost can be produced faster, but it needs more attention in return. The compost heap should be located under a tree where it is protected from too much sun or heavy rain. The heap is built using alternating layers of green, nitrogen-rich material like grass clippings, fruit or vegetable scraps and brown, carbon-rich material like sawdust, cardboard, dry leaves, straw or branches. After forming the pile on a square of approximately 1 meter in length, it needs to be watered until it is dripping water out of the bottom. After that it needs to be left for 4 days. After that, the heap needs to be turned every second day for 18 - 28 days. The outside layers should be moved to the inside and vice versa. After those 18 - 28 days, the compost is ready to be used.

Place pile under a tree where it is protected from heavy rain or too much sun



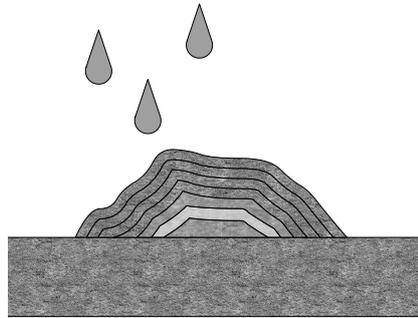
Use 1/3 green, nitrogen-rich material and 2/3 brown, carbon-rich material



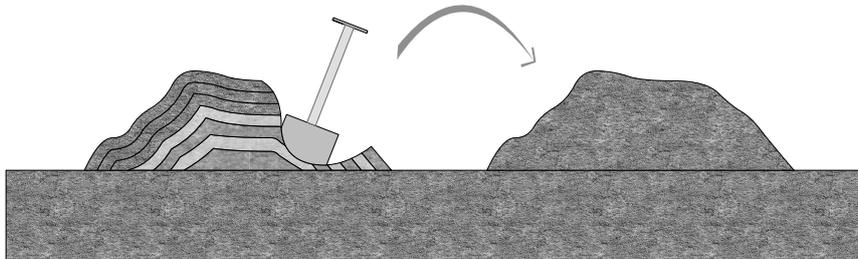
Pros	Usage of otherwise unused material, improvement of soil through fertilisation, faster production than conventional compost
Cons	Organic matter has to be collected and transported, needs more effort than conventional compost
Type of plants	The remains of all plants can be used as a basis for compost

Workload, needed personell	Medium effort, the pile needs to be turned every other day
Time until harvest, number of harversts per year	It takes about 3-4 weeks for the compost to develop, depending on temperature and humidity
Needed material	Organic matter, shovel, water

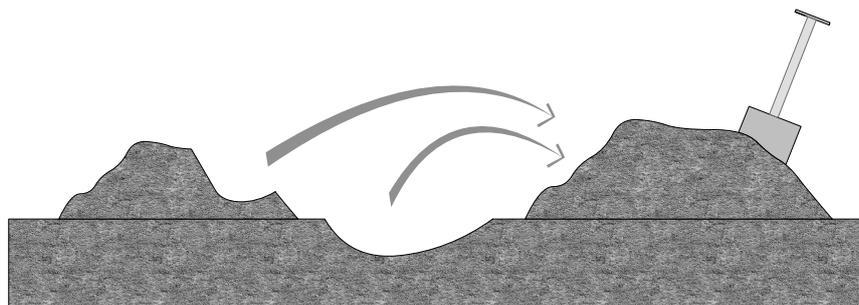
After forming a pile with alternating layers of green and brown material, water it until it is dripping water from the bottom



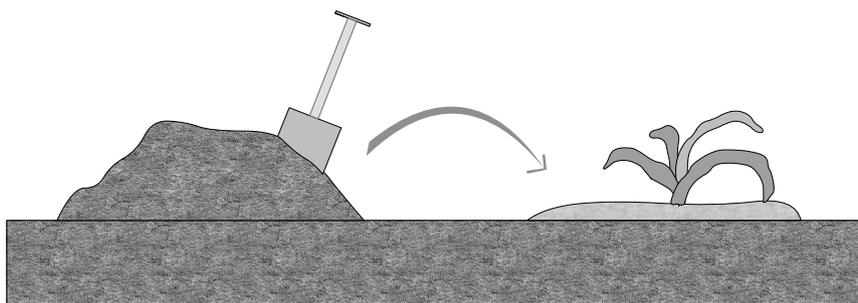
After 4 days, turn the pile around every other day for at least 14 days. The layers from the outside should be moved to the inside.



The created compost can then be mixed with existing soil from the ground



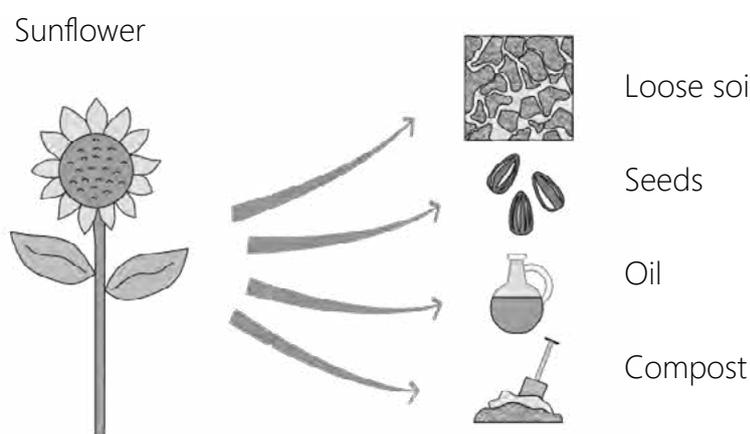
In the end, the mixture of soil and compost can be used to grow plants on it



Basic modules | Plants as soil conditioners

Some plants have the ability to improve the soil they grow on. They do this by loosening it up and binding nutrients in a way that makes them usable for other plants that are used later. These soil conditioning plants also increase the amount of organic material in the ground. Some good plants include sunflowers, mustard, lupins and phacelia. Besides their use in improving the soil, those plants also produce goods that can be used further.

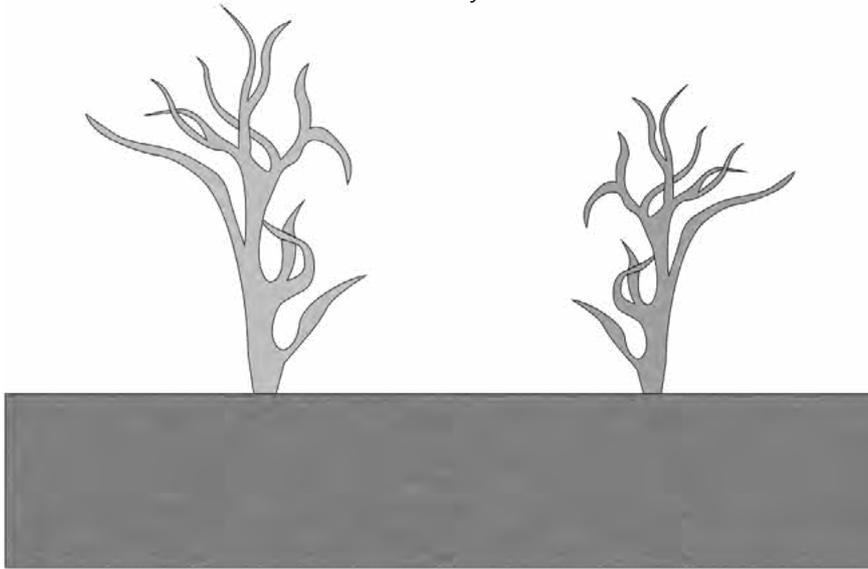
Sunflowers can be processed to oil or their seeds can be eaten, mustard seeds can be sold, lupinseeds have various uses like processing them to flour. All of the proposed plants also produce nectar and are attractive for pollinators like bees. The parts of the plants that can't be processed further may be used as compost or mulch.



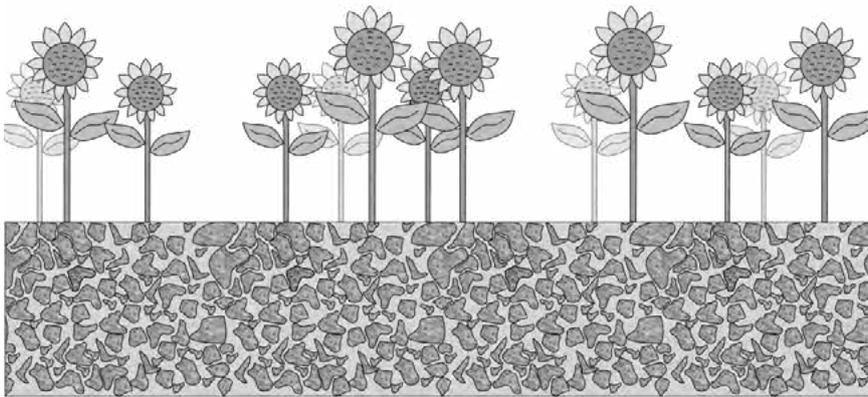
Pros	Enrich the soil with important nutrients and prepare it for other plants, some plants can be further processed, protection against erosion, binding of water in the soil
Cons	A lot of seeds are needed
Type and number of plants	Sunflowers, mustard, lupins, phacelia

Workload, needed personell	Medium. Young plants need to be watered regularly, weeds might need to be removed
Time until harvest, number of harvests per year	Sunflower: 3 months, once Mustard: 4 weeks, multiple Lupins: 6 months, once Phacelia: no harvest, bloom after about 8 weeks
Needed material	Seedlings, water

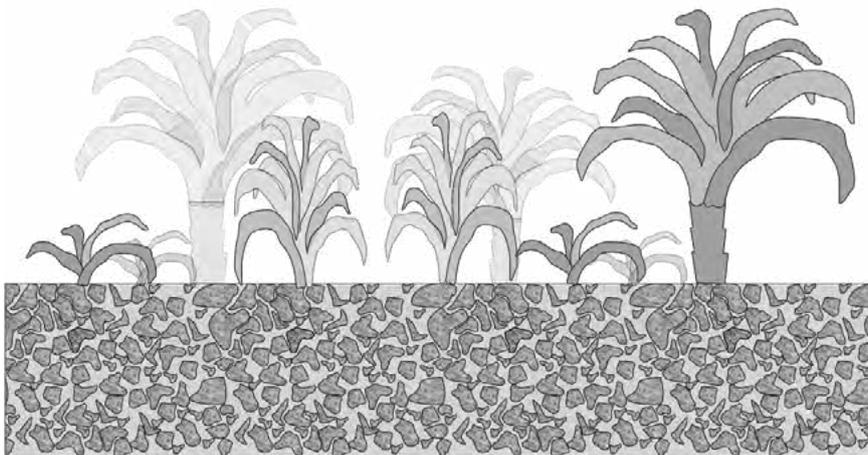
Hard and dry soil



Plants as soil conditioners loosen up the soil



After the conditioning other plants grow better



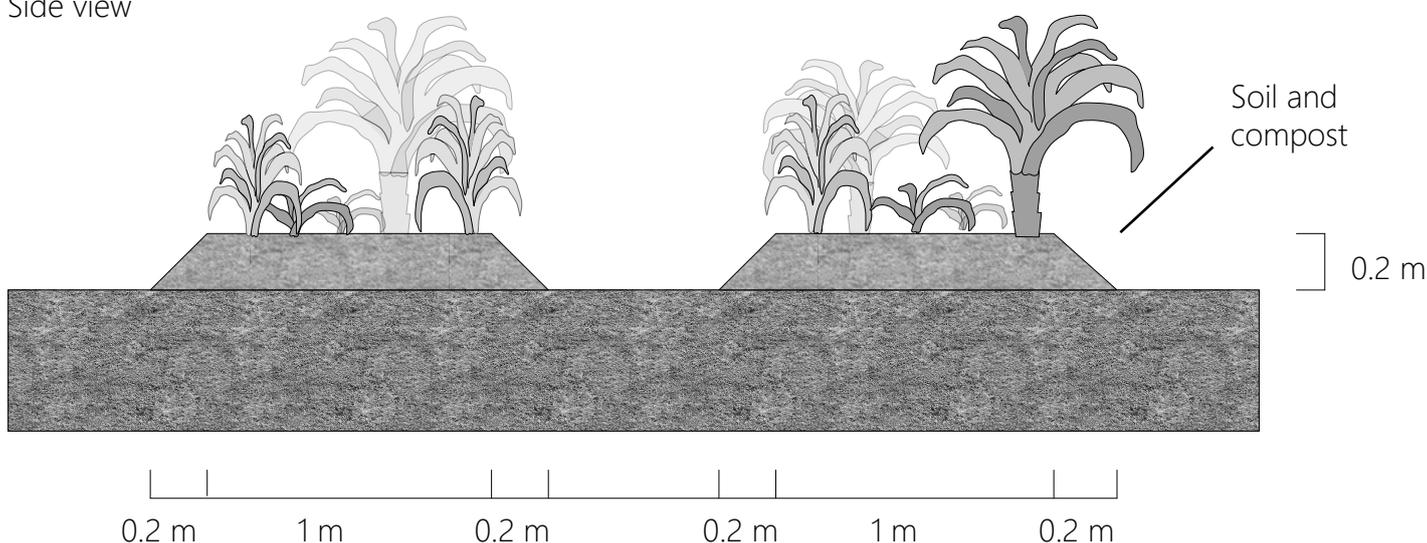
Basic modules | Permanent raised bed

Permanent raised beds describe the technique of building planting beds some centimeters above the surrounding soil. Those beds can be created using soil or compost. By doing this, fertile soil can be accumulated and loosened up. The roots of the plants also get more room to grow. The beds create space for various plants, which can then be combined in different ways.



<https://joegardener.com/wp-content/uploads/2021/02/Designated-paths-708x466-1.jpg>

Side view



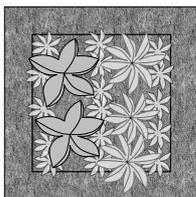
Pros	Deepen the soil and space for plants to grow, improved drainage, compact soil gets loosened up, some plants can profit from each other when planted in proximity
Cons	Needs to be watered regularly, building the raised beds takes some effort
Type and number of plants	All kinds of edible plants, good plant combinations follow on the next pages

Workload, needed personell	High, needs to be permanently maintained. Basic knowledge about planting combinations is required
Time until harvest, number of harversts per year	Depending on used plants, a high yield can be reached
Needed material	Shovel, seedlings, compost or soil

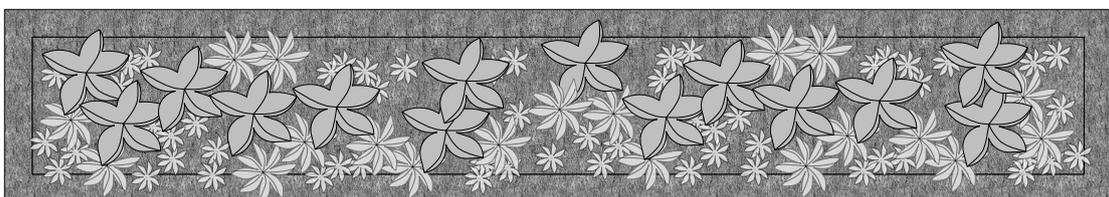
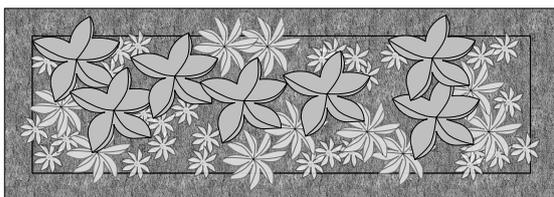
Top view



Scalability



One big benefit of this system is its scalability. It can be started with a plot as small as 1 to 1 meter, but it can also be extended to big fields.



Companion Plants

When planted together, some crops can profit from each other and form symbioses. On this page, each row represents one plant and the partner plants that work well together with it. Below that the possible benefits are listed. Plants that should not be planted together are crossed out.



Beans: Eggplant, Carrot, ~~Lettuce~~, Pea, Potato, Rosemary

Benefits: Fix nitrogen to soil

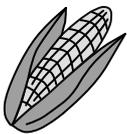


Cabbages: Corn, Cucumber, Lettuce, ~~Oregano~~, Pea, Rosemary



Carrot: Lettuce, Onion, Pea, Radish, Tomato

Benefits: Help loosening the soil, attract parasitic wasps which fight other pest



Corn: Cabbages, Onion

Benefits: Provide shadow and structure for other plants



Cucumber: Beans, Cabbages, Lettuce, Onion, Pea, ~~Potato~~

Benefits: Act as living mulch, help weed management and soil moisture retention



Eggplant: Beans



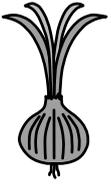
Lettuce: ~~Beans~~, Cabbages, Carrot, Cucumber, Onion, Pea, Pumpkin, Radish, Tomato

Benefits: Grows in between other plants



Melon: Radish

Benefits: Act as living mulch, help weed management and soil moisture retention



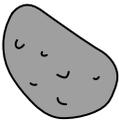
Onion: Carrot, Corn, Cucumber, Lettuce, ~~Pea~~, ~~Potato~~, ~~Tomato~~

Benefits: Repel insects and disorient them, masks the scent of other plants

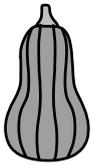


Pea: Beans, Cabbages, Carrot, Cucumber, Lettuce, ~~Potato~~, Pumpkin, ~~Tomato~~

Benefits: Fix nitrogen to soil



Potato: Beans, Cucumber, Onion, Pea, Pumpkin, Tomato



Pumpkin: Beans, Lettuce, Pea, ~~Potato~~, Radish

Benefits: Act as living mulch, help weed management and soil moisture retention



Radish: Cabbages, Lettuce, Pea, Tomato

Benefits: Repel cucumber beetles and flea beetles



Rosemary: Beans, Cabbages, Carrot, ~~Tomato~~

Benefits: Repel insects like cabbage loopers and carrot flies



Sunflower: Potato, Pumpkin

Benefits: Support for climbing plants, provide shadow



Tomato: Carrot, Lettuce, ~~Onion~~, ~~Pea~~, ~~Potato~~, Rosemary

Benefits: Provide shadow, produces natural insecticide

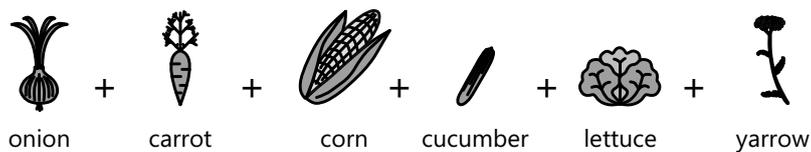
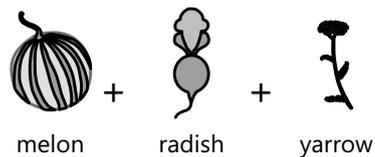
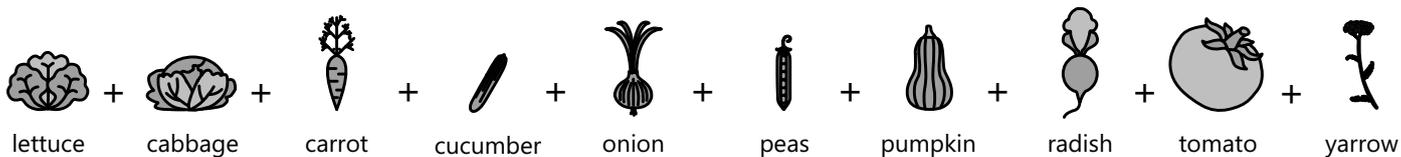
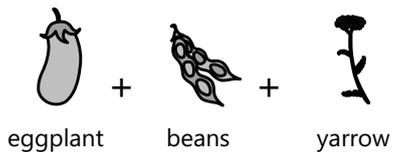
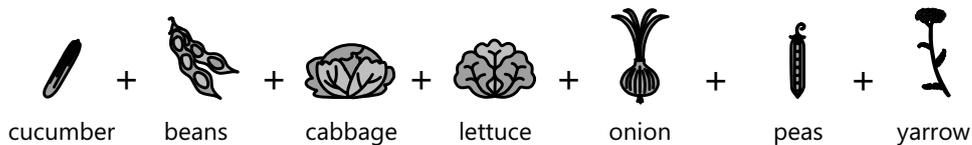
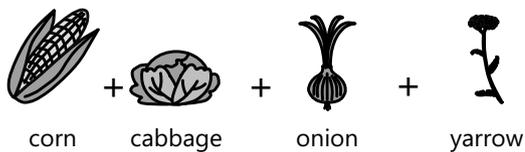
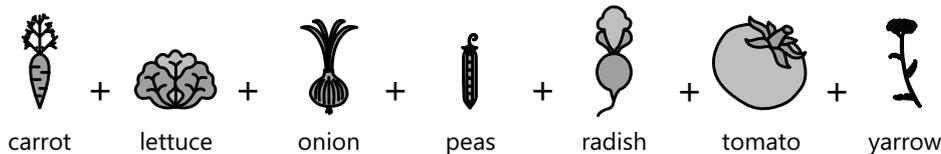
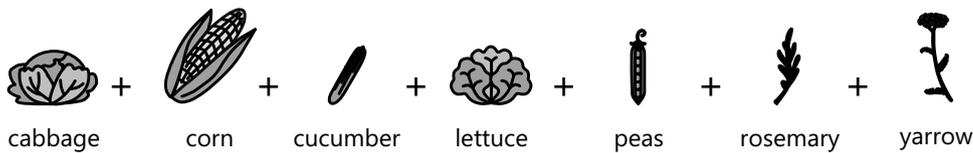
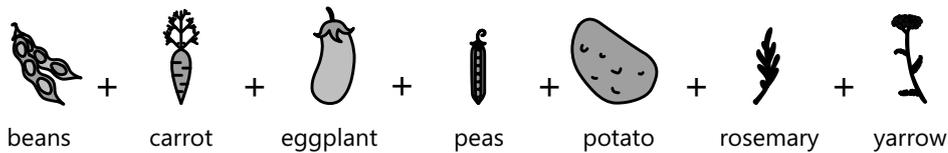


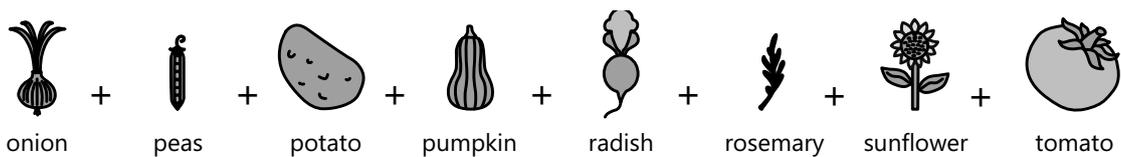
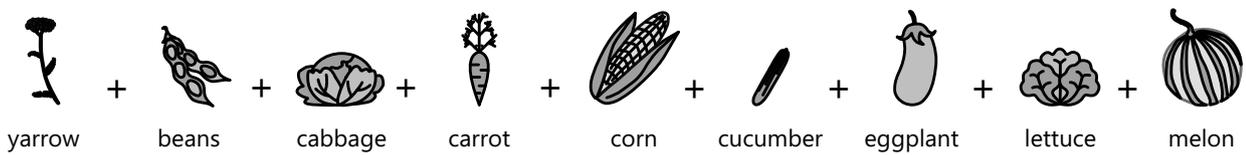
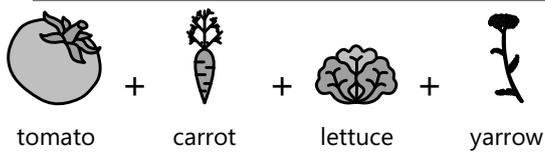
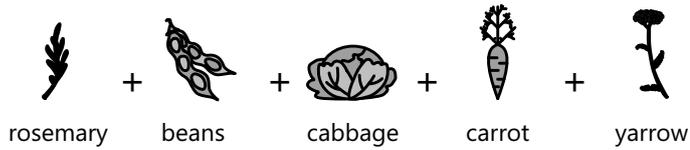
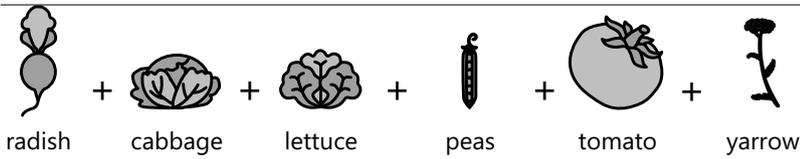
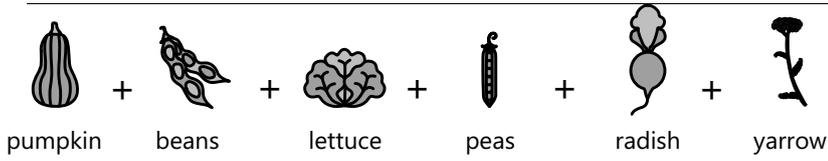
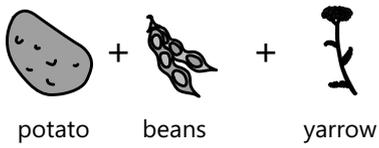
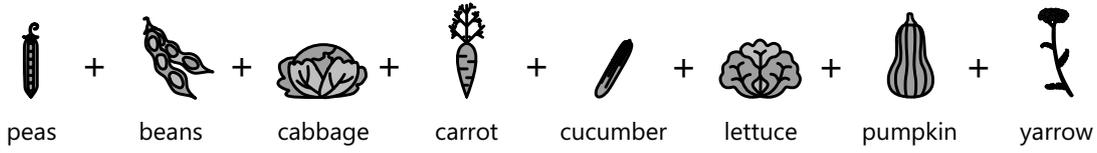
Yarrow: Aubergine, Beans, Cabbages, Carrot, Corn, Cucumber, Lettuce, Melon, Onion, Oregano, Pea, Potato, Pumpkin, Radish, Rosemary, Thyme, Tomato

Benefits: Attract beneficial insects like ladybugs and predatory wasps

Companion plants: Good matches

Plants that work well together and form symbioses are depicted on these pages as symbols. Each row shows one plant and partner plants that form good matches.

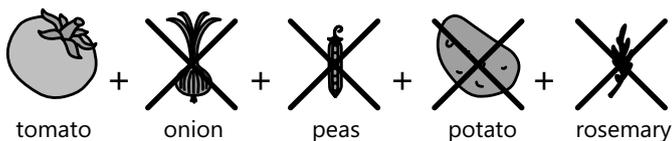
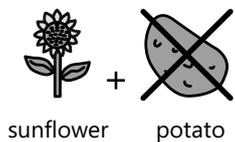
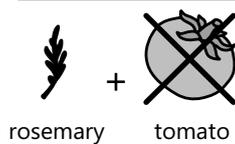
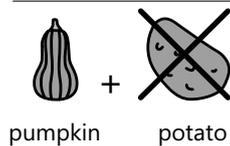
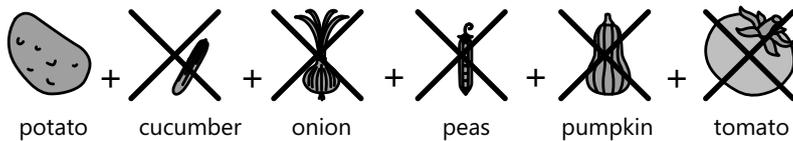
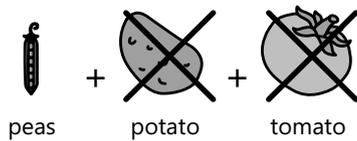
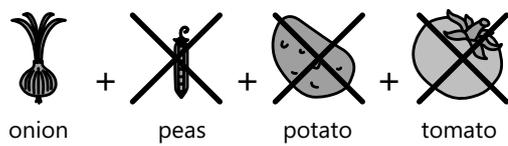
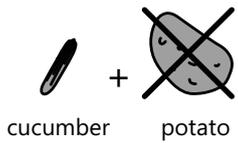
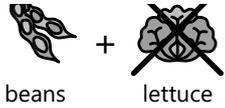




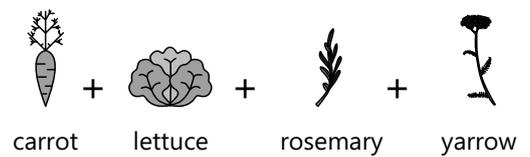
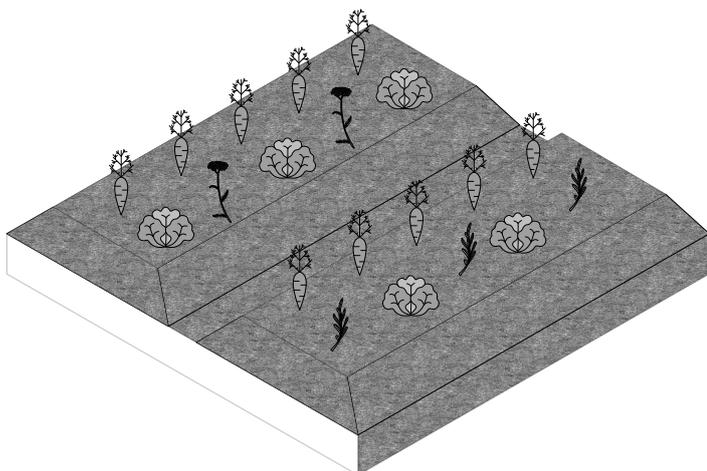
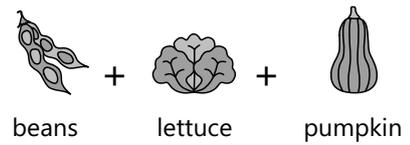
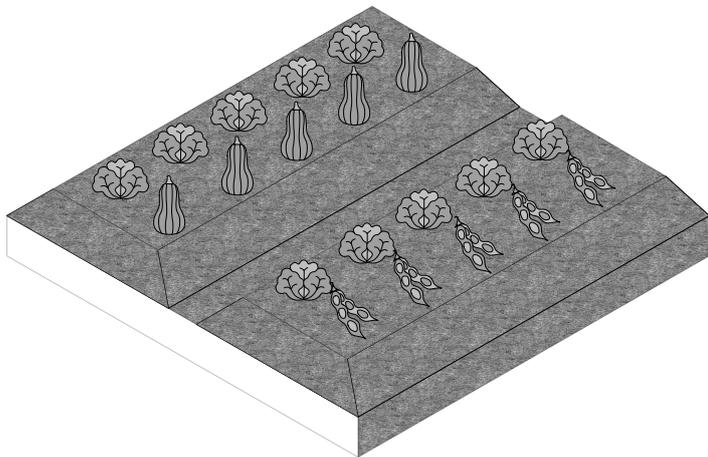
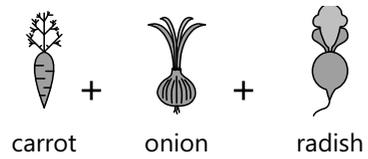
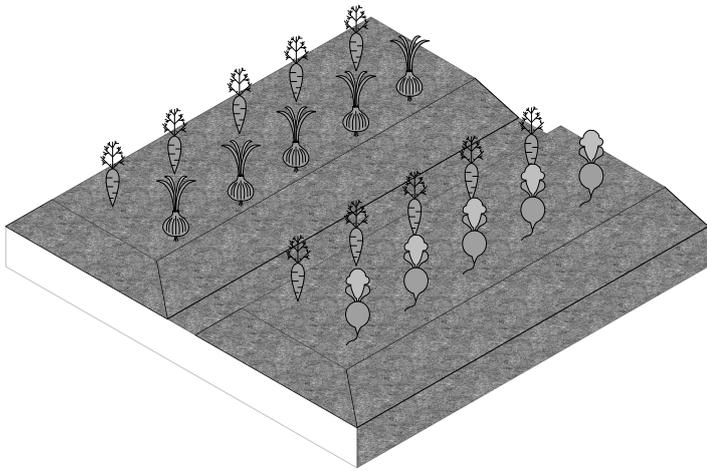
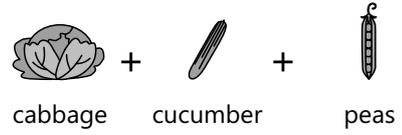
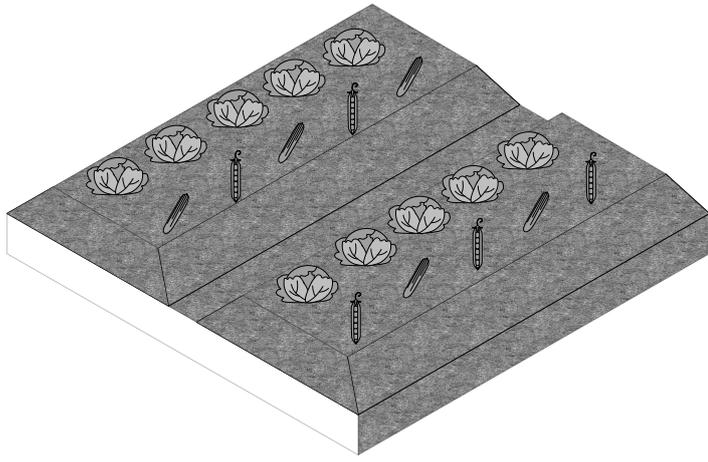
Companion Plants: Bad matches

Some plants don't work well together and should not be placed in each others proximity. Some negative effects include the production of shadows or the adoption of tastes.

Companion plants can be arranged in different combinations. Some examples are shown on the right hand side.



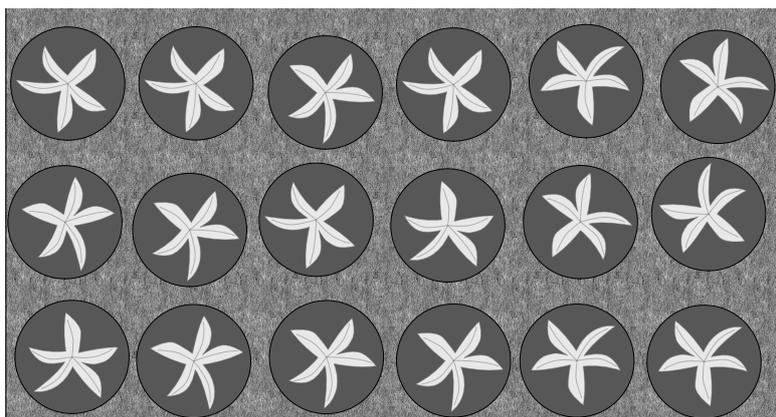
Planting scheme examples



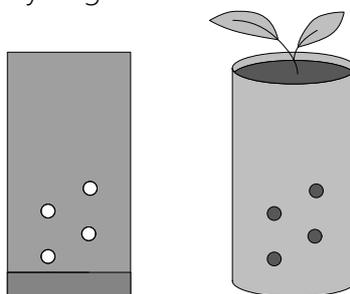
Basic modules | Nursery beds and bags

Plants can be reproduced using different methods. Smaller plants like vegetables are easy to reproduce in nursery beds. Those beds have a soil with high nutrient content, which can be achieved by mixing the soil with compost or Terra Preta if available. This method works well for annual plants like cucumbers, tomatoes, lettuce or radishes. For bigger and perennial plants, so called nursery bags may be used. These plastic bags help the plants to develop healthy roots, before they are planted to other places. The bags also help retain water and regulate temperature. These bags should also be filled with nutrient rich material, like a mixture of soil and compost or Terra Preta.

Top view: nursery bags for bigger plants



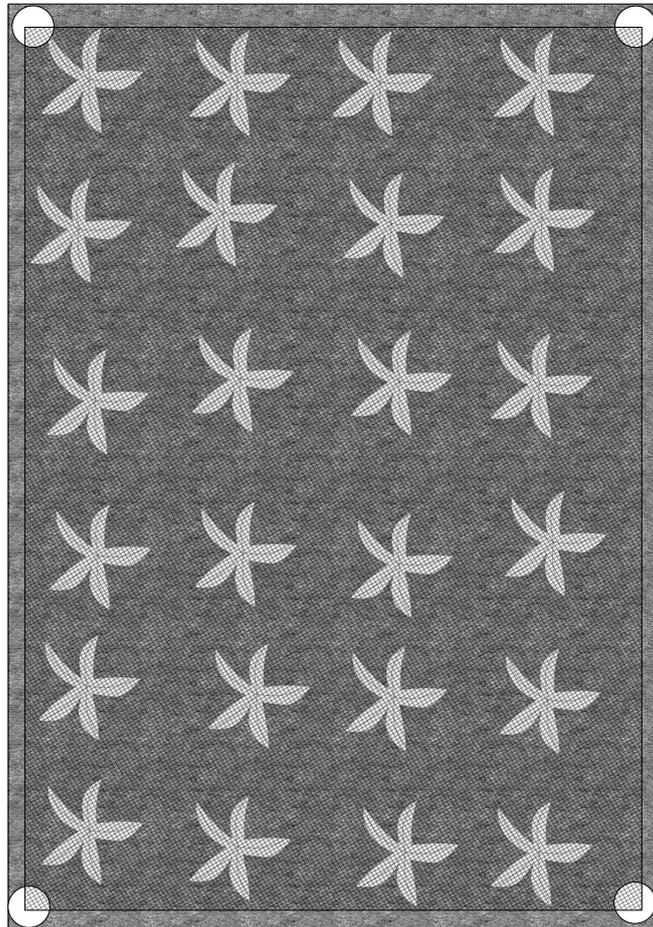
Nursery bags with holes on the sides



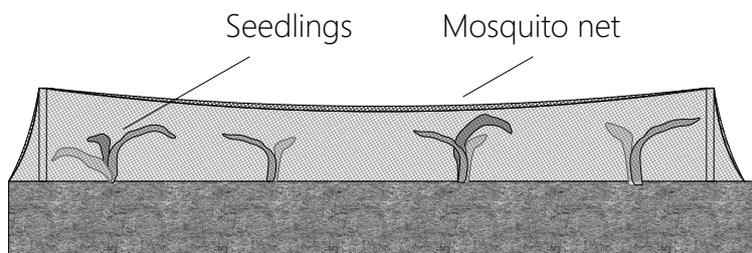
Pros	Production of plants for personal use or sale on the market, help the plants grow healthy roots
Cons	Special beds need to be built with extra protection against pests, nursery bags are needed for bigger plants
Type and number of plants	Any available seeds can be grown in these nurseries, like tomatoes, cucumber, lettuce, raddish, squash or papaya

Workload, needed personell	Medium, preparing the beds and filling the nursery bags takes some time, the plants need to be observed after planting
Time until harvest, number of harversts per year	Depending on type of plant, it may take some weeks up to several months for a plant to grow big enough to be placed into a different bed
Needed material	Seeds or seedlings, mosquito net for protection against pest and to provide shadow, plastic nursery bags

Top view: nursery bed for small plants

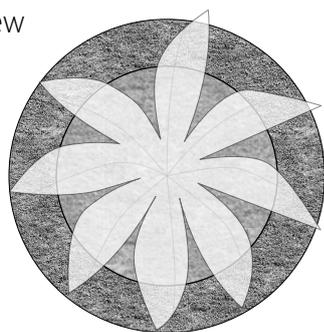


Side view: nursery for small plants



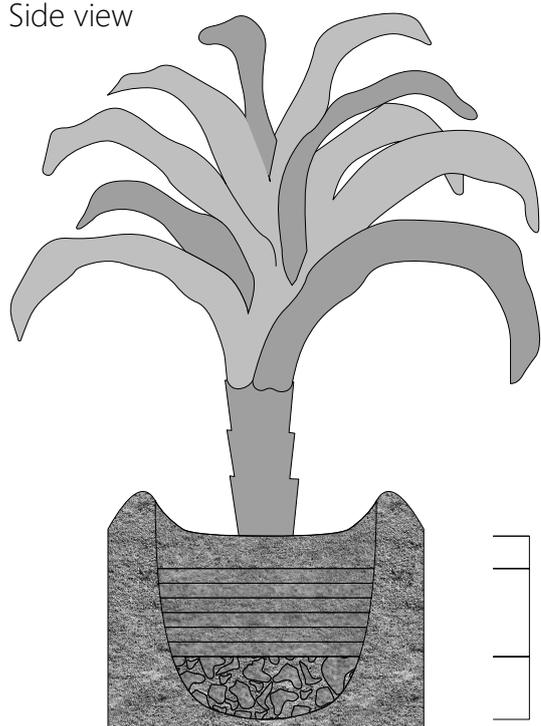
Basic modules | Tree pits

Top view



0.2 m 0.6 m 0.2 m

Side view



0.2 m 0.6 m 0.2 m

0.1 m
0.3 m
0.2 m

Tree pits provide water and nutrients for the plants they contain. Using different layers in the design of those pits, the trees are provided with optimal growing conditions. The lowest layer serves the drainage of excess water and may not always be needed, it is filled with sand or stones. The next layers consist of alternating coats of brown, carbon-rich material and green, nitrogen-rich material. The top layer is made out of a mixture of soil, sand and compost of equal parts. The wall around the pit serves the preservation of water and stops it from running off.

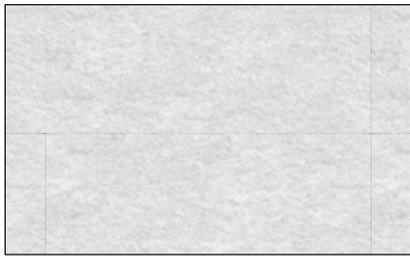


<https://www.greener.land/wp-content/uploads/2018/12/zai-pits.jpg>

Pros	Collects rainwater, stops water from running off, nutrients are provided, compact soil gets loosened up
Cons	May increase termite activity, mulch needs to be kept away from tree to avoid damages caused by termites
Type and number of plants	Banana, Papaya, Breadfruit tree, Cashewtree, Avocadotree, Orangetree, Citrustree, Guanabana, Hibiscus, Gmelina (Bechwood), 1 tree per pit, 1 Pit per Meter

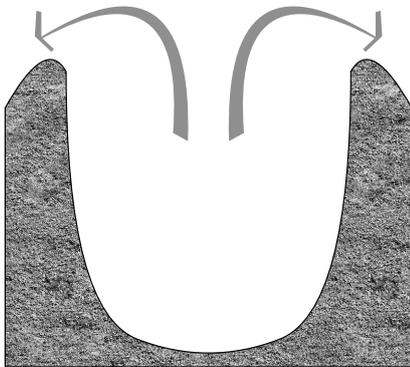
Workload, needed personell	Low, needs to be watered some times after completion
Time until harvest, number of harversts per year	Depending on used plants
Needed material	Seedlings, shovel, sand, compost, organic material

Start with empty plot



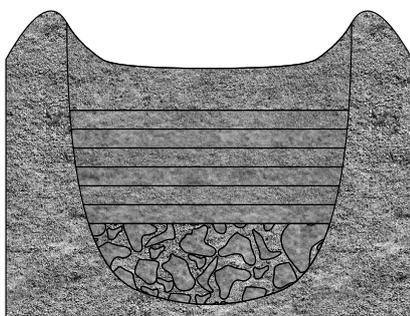
1 m

Form a hole



0.6 m

Use different kinds of material to fill the pit



0.1 m

0.3 m

0.2 m

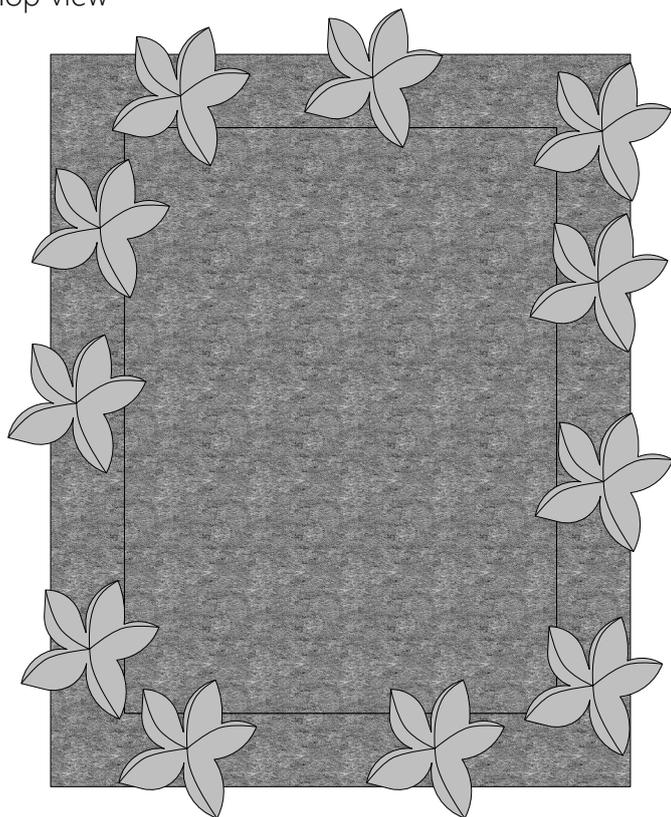
Cover with a mixture of soil, sand and compost

Alternating layers of brown (carbon-rich) and green (nitrogen-rich) material

Drainage: Stones or sand

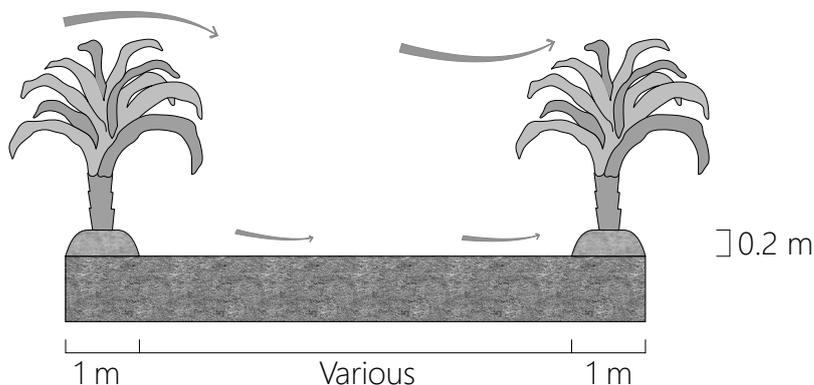
Basic modules | Soilbanks with trees

Top view

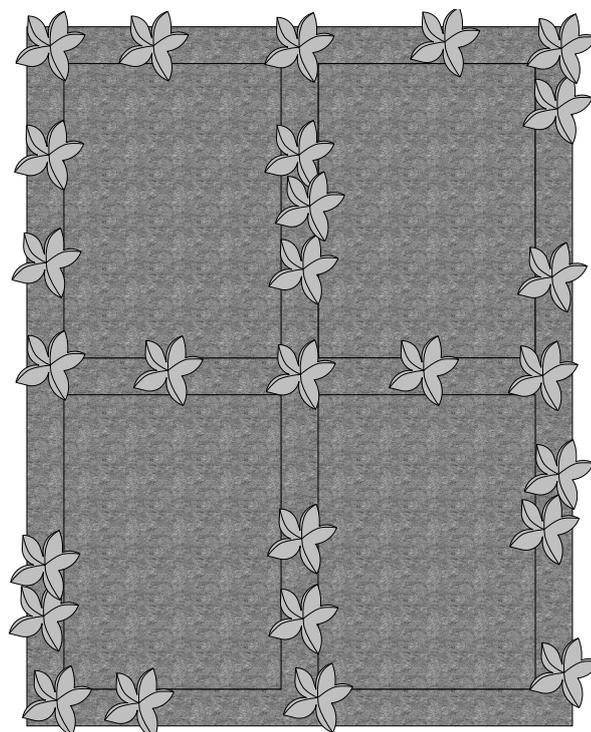


Building walls out of soil and planting trees on top of them can have various benefits for farming. They not only lessen the flow off of water, they also keep leaves and other mulch from flowing away. The raised banks also provide loosened soil where trees can grow more easily. Those trees can also act as windbreakers.

Side view



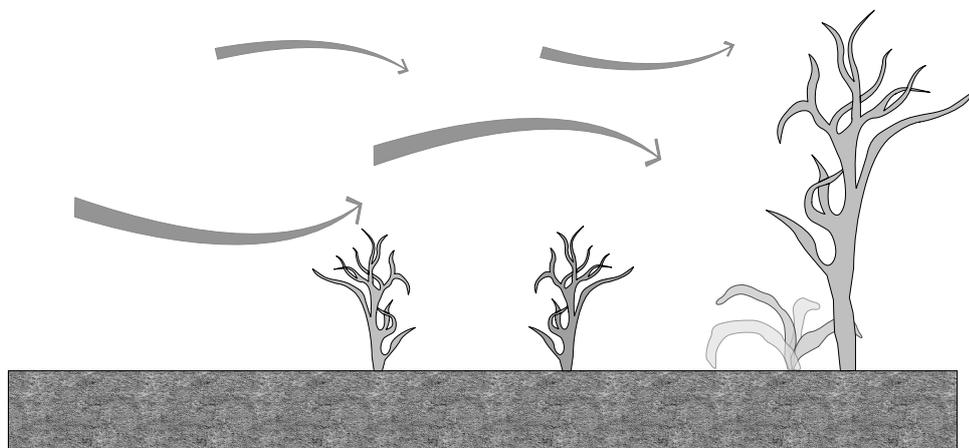
Possible arrangement with multiple raised soilbanks next to each other



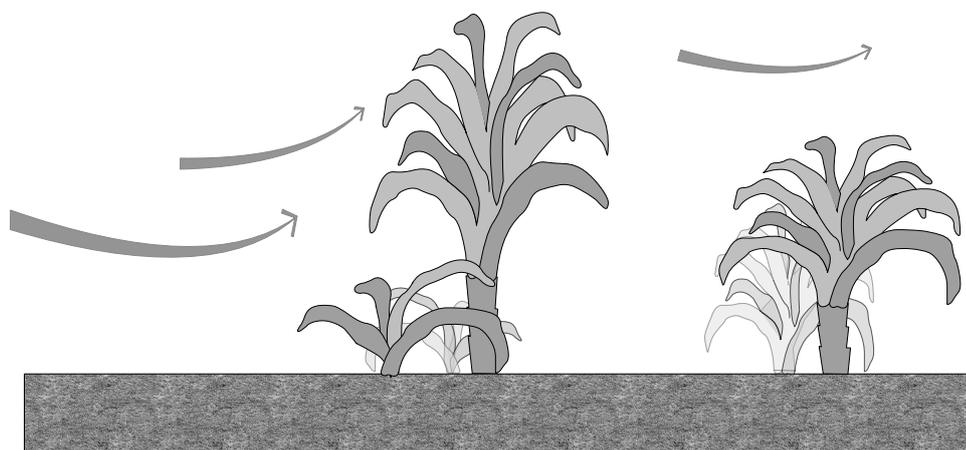
Pros	Stop water from running off, stop flushing out of organic matter like leaves, compact soil gets loosened up
Cons	
Type and number of plants	<ul style="list-style-type: none"> - Cassavas - Avocado tree - Lemongrass - Corn

Workload, needed personell	Medium, after completion of the soilbanks the plants need to be watered regularly
Time until harvest, number of harvests per year	Cassava: 12 months, 1/year Avocado tree: 5 years, 1/year Lemongrass: 3 months, anytime Corn: 3 months, once
Needed material	shovel, seedlings or trees

Without windbreaking trees



With windbreaking trees

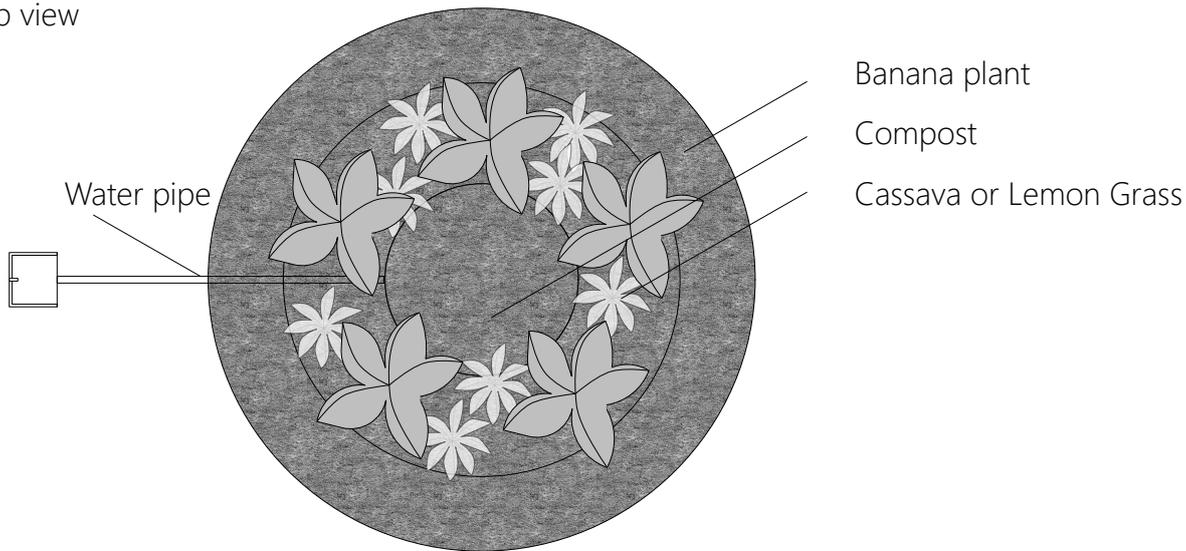


The strong and dry winds in the gambia are potentially damaging to plants. The winds dry out the leaves and stress the plants. The power of those winds can be reduced by planting trees which reduce their speed and impact on other plants.

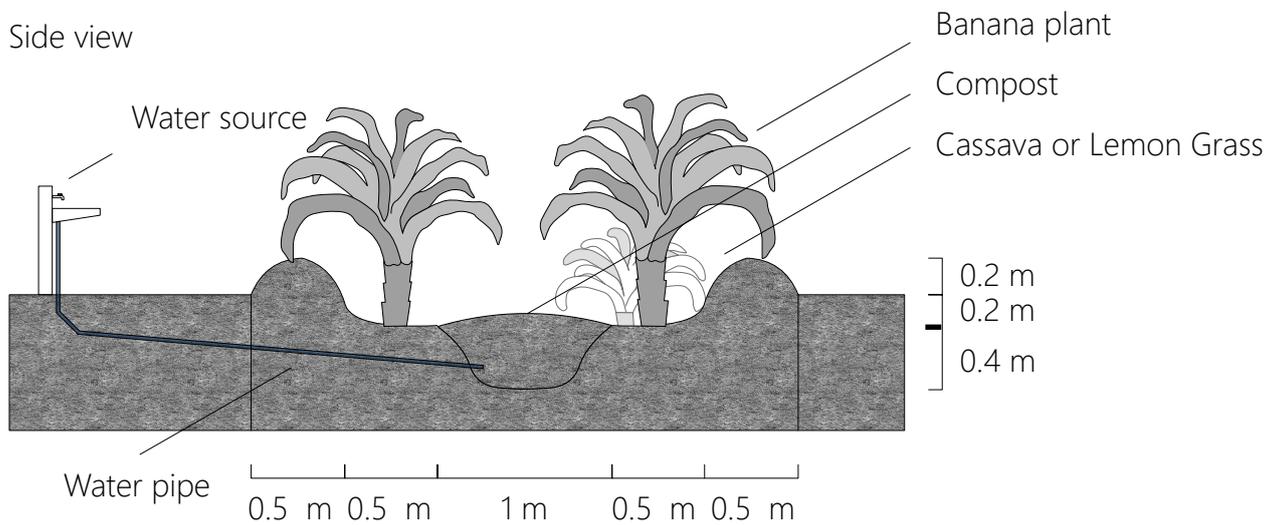
Pros	Breaking of winds and protection of exposed plants, protection against erosion, binding of water in the soil, generation of yield, produce shadow
Cons	Need a lot of space, potentially produce too much shadow, buying grown up trees is expensive
Type and number of plants	<ul style="list-style-type: none"> - Flamboyant tree (<i>Delonix regia</i>), one per 5-10 meters - Mango tree (<i>Mangifera indica</i>), one per 10 - 15 meters - Lemongrass (<i>Cymbopogon citratus</i>), up to 1 per meter - Pigeon peas (<i>Cajanus cajans</i>). 1 per meter

Workload, needed personell	Low, easy maintenance after initial planting of trees, cutting the trees one times per year may be necessary
Time until harvest, number of harversts per year	<p>Flamboyant tree: No yield, but cut branches can be used as fertilizer, release nitrogen</p> <p>Mango tree: Harvest one time per year, May to September</p> <p>Lemongrass: at any time</p> <p>Pigeon Peas: After 140 days, once per year</p>
Needed material	Seedlings or trees

Top view



Side view



Pros	Use of waste water Food production Simple maintenance
Cons	Too much water can drown the plants, but a lot of water is needed to maintain the plants
Type and number of plants	Bananas, 1 per meter Cassavas, Lemon Grass between Bananas

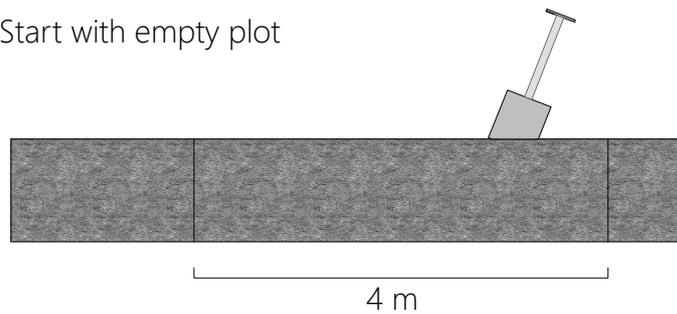
Workload, needed personell	Medium, building the circle needs some work, excess water needs to be removed
Time until harvest, number of harversts per year	Bananas can be harvested after 1-2 years, after that they wont blossom again. Bananas form rhizomes, no new plants are needed. Old plant can be used as compost
Needed material	Shovel, seedlings, water pipe, needs to be watered every day during dry season



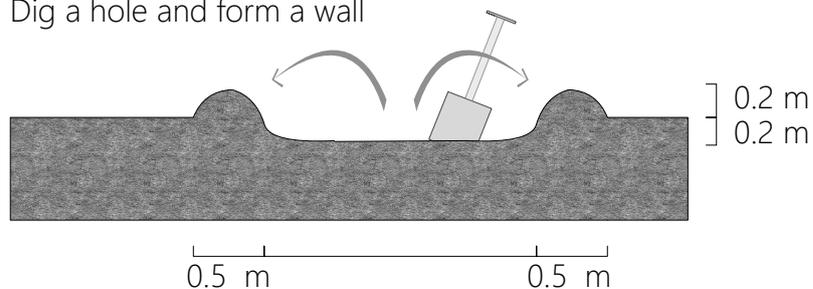
Patrick Müller

A banana circle consists of a hole in the ground surrounded by a small soil wall. There is compost in the middle to fertilize the plants. The banana plants are located inside the wall of the circle. Otherwise unused water can be channeled into the hole in the circle and be used by the banana plants. The harvested bananas can then be sold on the market or eaten.

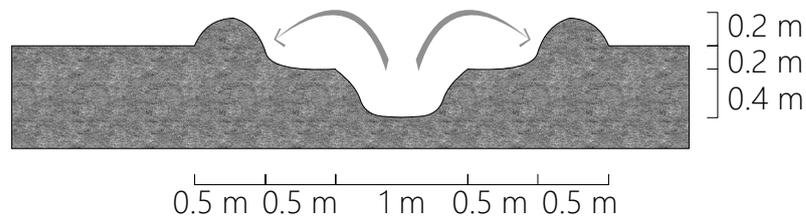
Start with empty plot



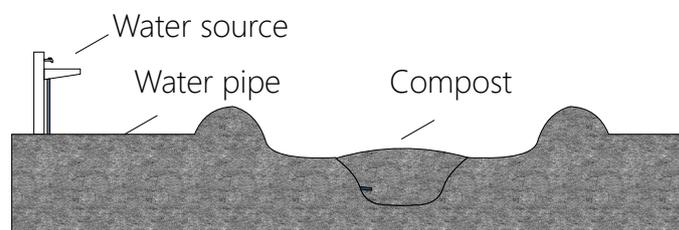
Dig a hole and form a wall



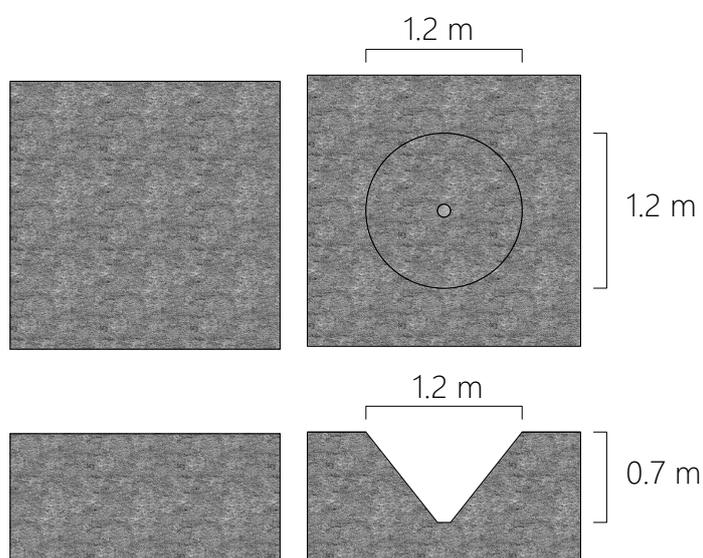
Deepen the hole in the middle



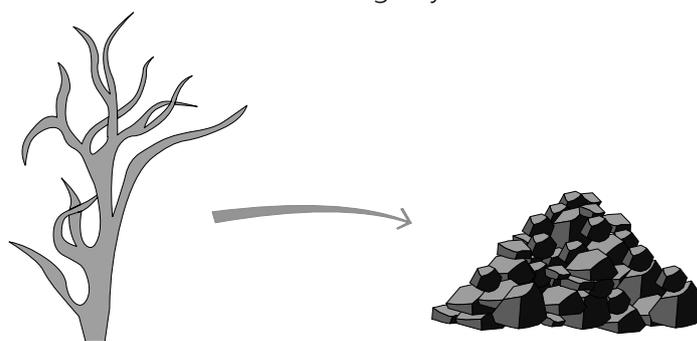
Add compost and water



Using a Kon-Tiki Kiln, the easy production of biochar, which is a type of charcoal, is made possible. After shaping a cone shaped pit in the ground, a small fire is created using wood. The flame should never get big and wood needs to be added to the fire to the point of almost smothering it, without actually smothering it. Using this method, the wood doesn't get a lot of oxygen and doesn't burn to ashes, but transforms into biochar instead. After adding layers of wood to the fire, always keeping it on a low flame, the pit can be filled to the top. After that, the fire needs to be extinguished either by water or by soil. If soil is used, the newly formed coal needs to be kept covered for a few days before it can be harvested. Either way, the pit needs to be emptied after the process or a new pit needs to be dug. Biochar has various uses including the maintenance of soil health, improvement of soil productivity or its use as a component of Terra Preta.



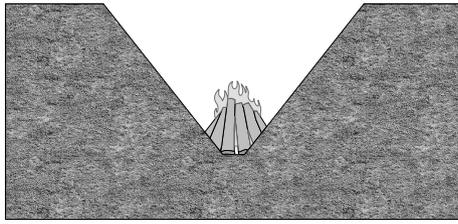
Production of charcoal using dry wood



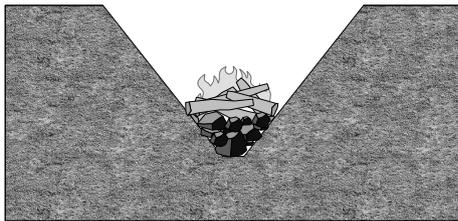
Pros	Relatively easy production of charcoal, no external tools are needed
Cons	Kon-Tiki Kilns can only be used once before they need to be cleaned or replaced
Type and number of plants	Any untreated wooden material can be used in the production. The wood needs to be dry

Workload, needed personell	Medium, during the production of the coal, the pit needs to be surveilled and maintained at all times
Time until harvest, number of harversts per year	Depending on the amount of used wood, it takes about 3 hours for one pit of coal to be processed
Needed material	Shovel, wood, matches or lighter, water or soil to extinguish the fire

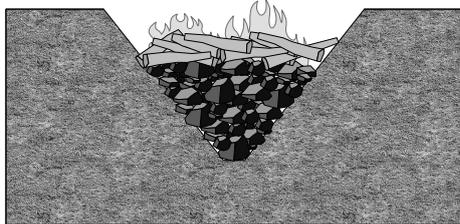
Start small fire with dry wood



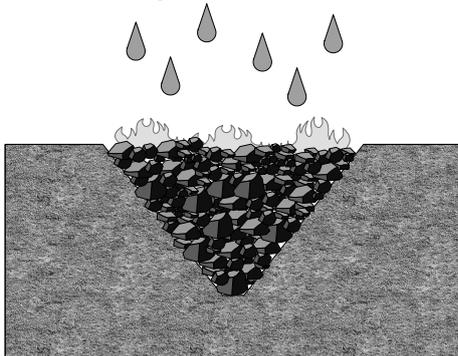
Keep the flame small



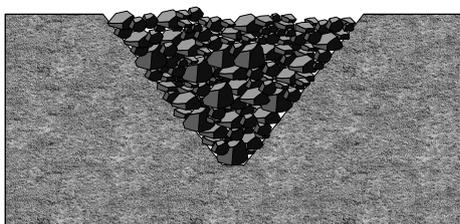
Keep adding dry wood



Extinguish with water

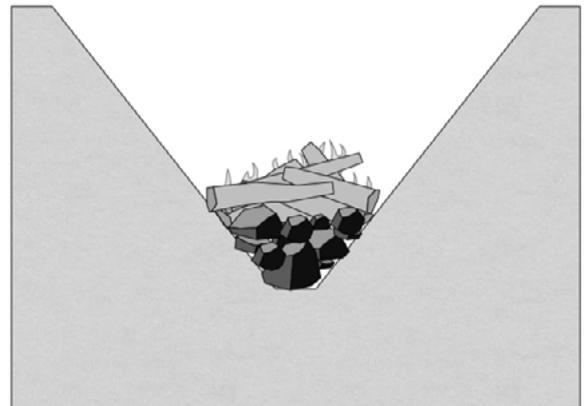


Ready to use biochar

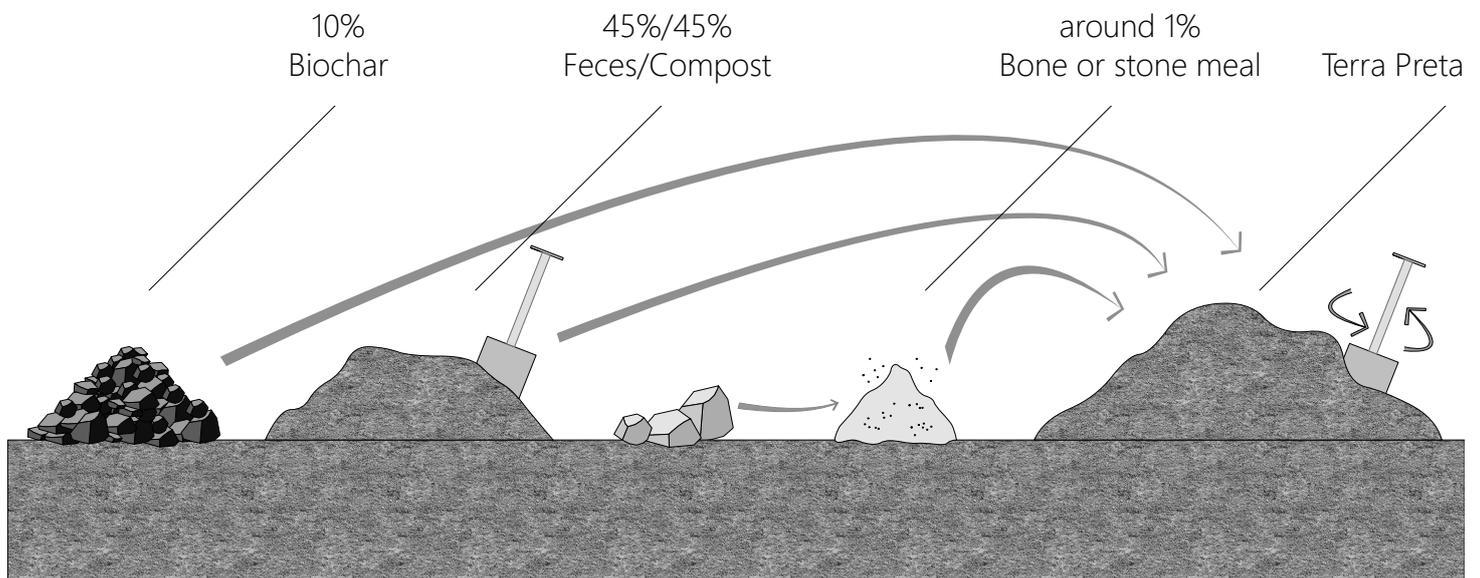


<https://bit.ly/3xSN3Q4>

The flame needs to be kept small by adding layers of wood on top. If the flame gets too big, the wood turns into ashes.



Terra Preta, or black soil, is the name of a very fertile soil, which was first used in South America. It is one of the most productive soils for agriculture. Terra Preta is produced artificially using biochar, compost, bone- or stone meal and feces from animals or humans. When mixing those ingredients, the share of biochar should be around 10% and around 45% feces and compost respectively. The bone or stone meal only takes up around 1%. All those ingredients are then mixed and accumulated to a heap. This heap needs to be left standing for around 4-6 weeks and turned around occasionally, so that the biochar can become saturated with nutrients. If the Terra Preta is used too soon, the biochar may bind nutrients from the soil and make it unavailable to plants.



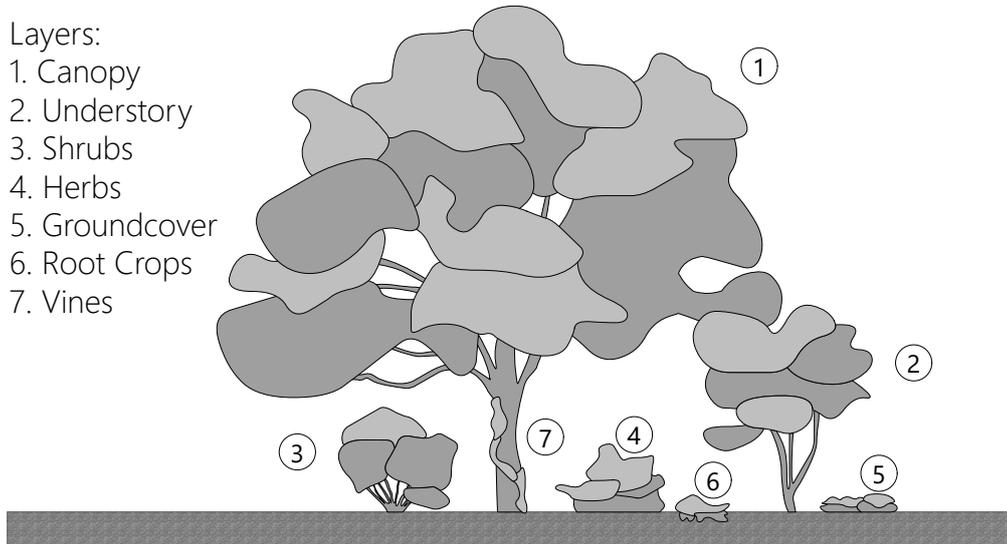
Pros	One of the most fertile soils for agriculture, retention of nutrients and water, long-term improvement of soil conditions
Cons	Relatively difficult production, needed material may be hard to obtain
Type and number of plants	Any kind of plants are used for the production of biochar and compost

Workload, needed personell	High, a lot of material is needed and needs to be pre-produced or bought, knowhow about mixing ratios is needed
Time until harvest, number of harvests per year	If all the needed material is available, it takes about 4-6 weeks until the Terra Preta can be used
Needed material	Biochar, compost, human or animal fecies (for example from compost toilets), bone or stone meal, shovel

A food forest is a diverse planting of edible plants that attempts to mimic the ecosystems and patterns found in nature. It is a nature-friendly option for self-sufficiency. The fruits, nuts, wood and other products can be sold. To save space, different types of plants can be planted in layers to create an efficient food forest.

Layers:

1. Canopy
2. Understory
3. Shrubs
4. Herbs
5. Groundcover
6. Root Crops
7. Vines



Example plants

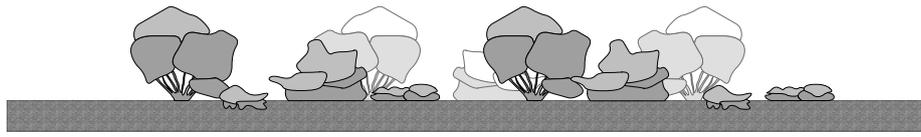
Helpers: Flamboyant, Mother of cacao, Moringa, Leucaena, Apple ring acacia, ...

Producers: Coconut Palm, Sweet sop, Soursop, Leucaena, Mango, Bushman-go, Cashew tree, African locust bean, Tamarind, Citrus fuits, Papayas, Banana, Passion fuit, ...

Pros	Shade Self-sufficiency Income from the sale of the harvest
Cons	Takes a long time for plants to bear fruit Needs a lot of knowledge about the plants
Type of plants	There are two types of plants: - helpers: ensure a functioning ecosystem - producers: form for example fruits or produce wood and cellulose To get better soil, 80% of the plants should be helping at the beginning

Workload, needed personell	High at the beginning, later less and less The goal is a functioning ecosystem that survives without much help
Time until harvest	Most plants take about 4 years to develop fruit
Needed material	Shovel, different plants, water, fertiliser

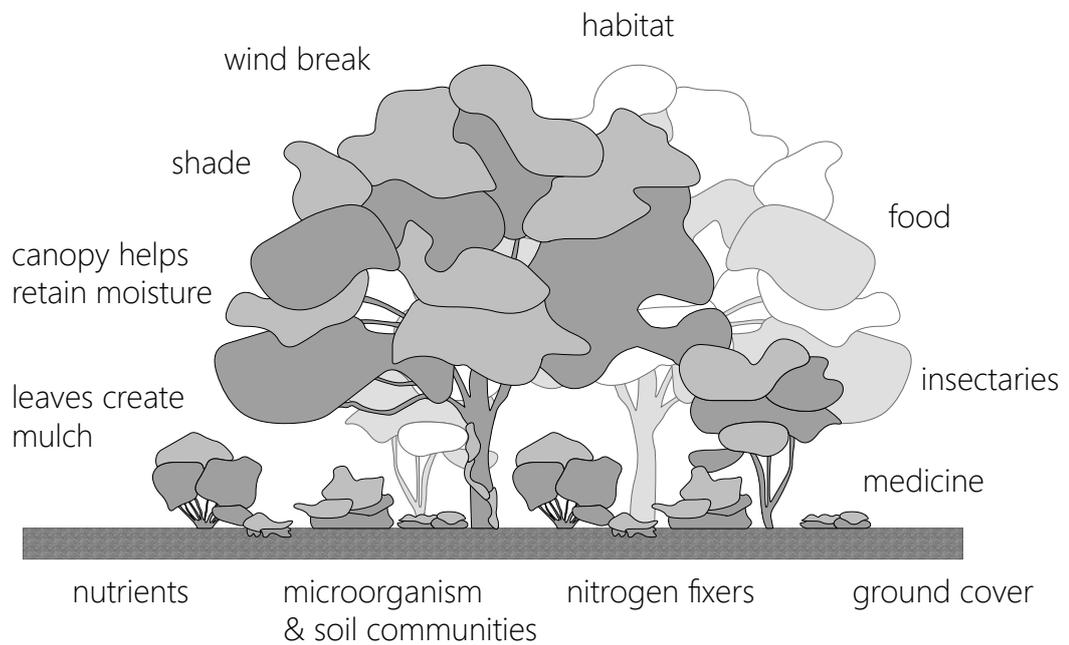
Start: 80% helpers
20% producers



50% helpers
50% producers



Goal: 20% helpers
80% producers



Bees pollinate plants and are therefore important for nature and food production. They feed on flower nectar and produce honey and wax. Bees can be kept in beehives, which can be built from wood.



<https://beebuilt.com/pages/buying-your-first-top-bar-hive>

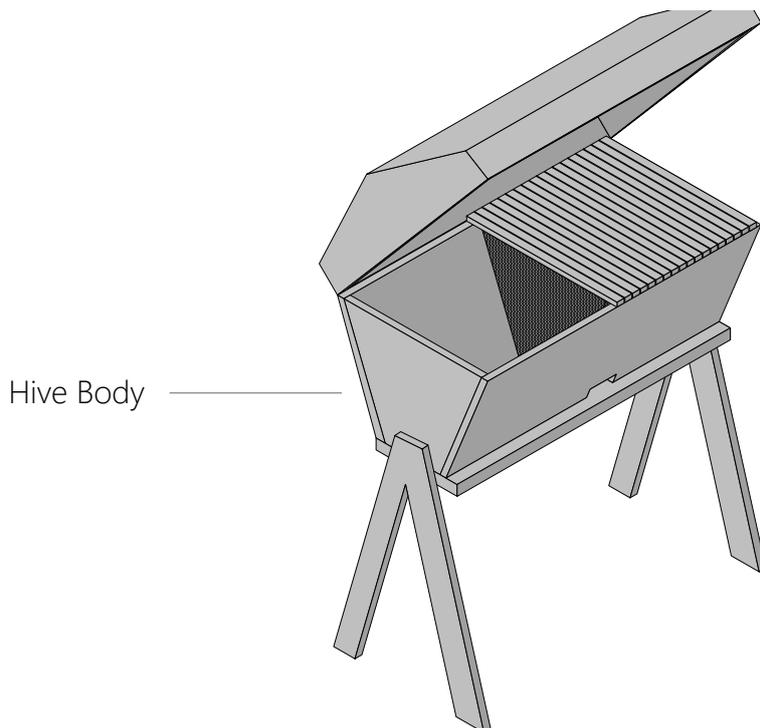
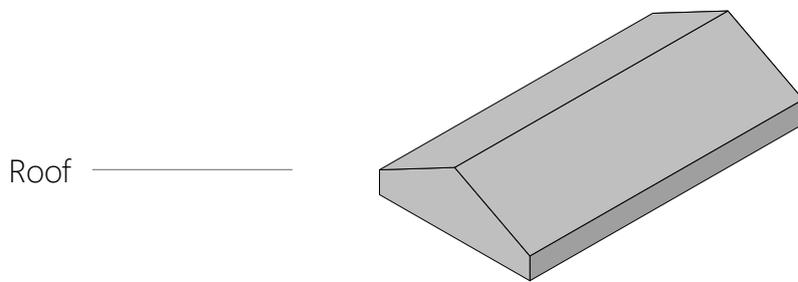
The Kenyan Top Bar hive is a simple and effective way to keep bees. You hardly disturb the bees, which results in them being less aggressive.

Example plants bee fodder

Mother of cacao, Leucaena, African Mahogany, African locust bean, Lupins, Phacelia, Yarrow, Onion, Carrot, Avocado, Sunflower, Mango, Guava, Pumpkin, Cabbage, ...

Pros	Bees are important for nature and food production Produce honey and wax Can earn additional income Possibility to make soaps and cosmetics
Cons	Needs basic knowledge Aggressive insects, need expensive protection equipment
Workload, needed personell	Low to medium, the bees have to be controlled, honey and wax must be harvested

Time until harvest, number of harvests per year	with a good hive, 8 litres of honey and 1.5 kg of wax can be extracted per year
Needed material	Protective clothing, beehive, bee colony, honey and wax extraction equipment
Further information	10 beehives can be self-financing after 18 months Organisation Africa BEEcause operates in the Gambia, supports beekeepers

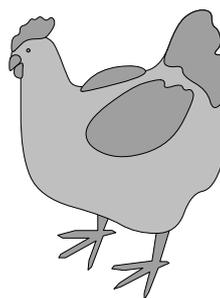
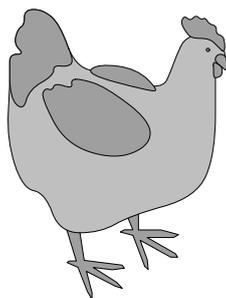


The honey you can harvest comes from the combs that are completely filled with honey and capped. Remember that these capped honey stores can also be crucial for the survival of the bee colony. If a large proportion of the combs are uncapped, the honey is not ready and should be left in the colony until it is capped.

The clean honeycombs are probably the furthest away from the entrance. Always check the combs for bee larvae, as these are needed for the colony's continued existence. You should remove the honeycombs in the early morning, in high heat the honeycombs can break off.

The finished honeycombs can be cut from the wooden sticks and put back into the beehive. This way the bees can build new combs.

Chickens are easy farm animals to keep. They need relatively little space and you can start with just a few animals. Chickens lay eggs that can be sold. In addition, the droppings can be used as fertiliser.



Example plants chicken fodder

Apple ring acacia, African locust bean, Gumbar tree, ...

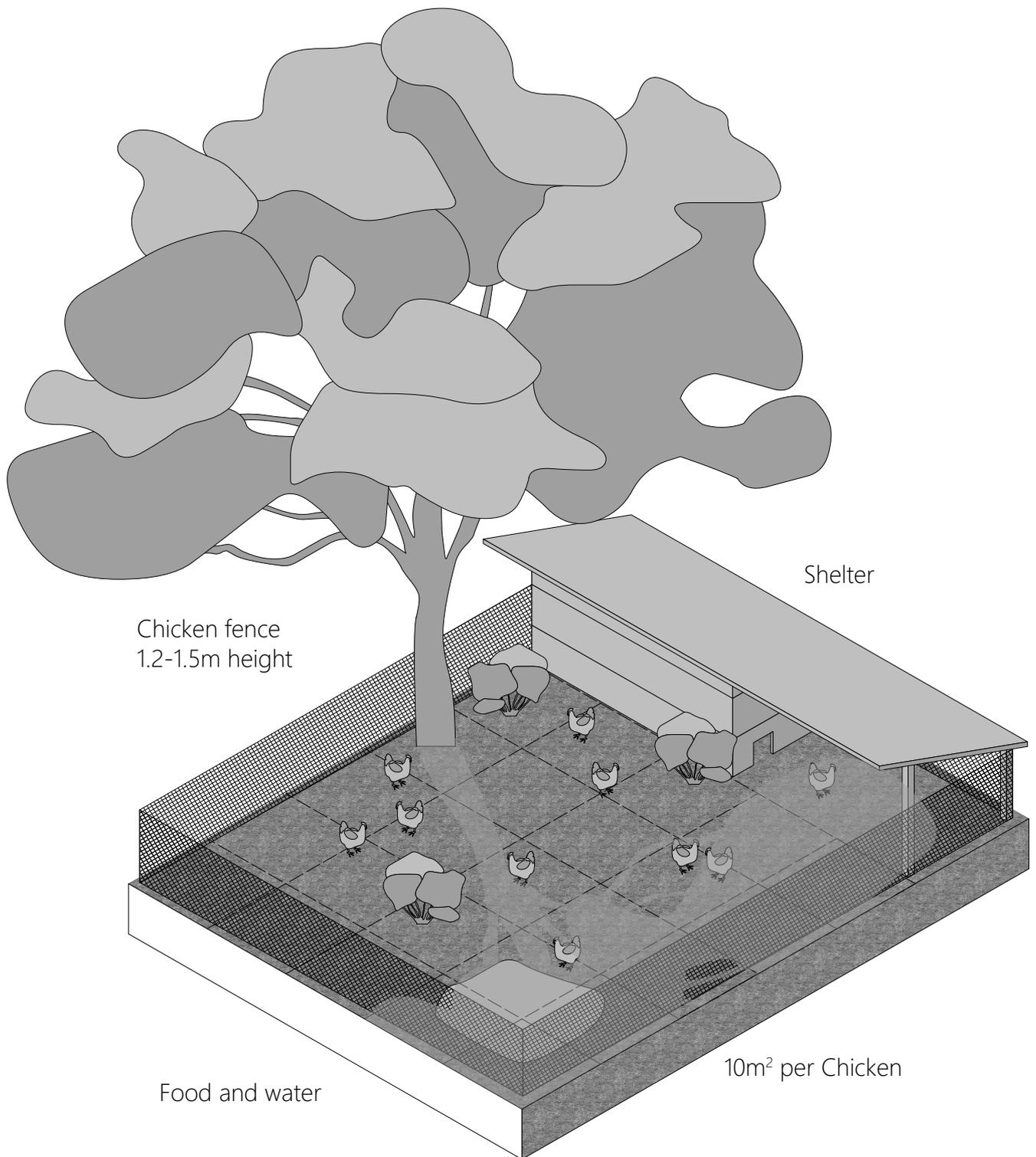
Other chicken fodder: grains (cereals, corn, soya, ...), soft food (potatoes, cooked rice, ...), green food (grass), fruit & vegetables (melon, cucumber, ...), worms and insects.

Cut food as small as possible!

Do not feed: spicy food, citrus fruits, avocados, tomatoes

Pros	Can start with 2-3 animals Excrement as fertiliser Egg sales as additional income
Cons	Eating off plants if you are not careful
Workload, needed personell	Medium to high, feeding, cleaning out, collect the eggs

Time until harvest, number of harvests per year	3-5 Eggs per chicken per week
Needed material	Shelter, fence, food, water
Further information	Chicken available as either layers or broilers, must be cross-bred to get a robust breed 10m ² should be available per chicken



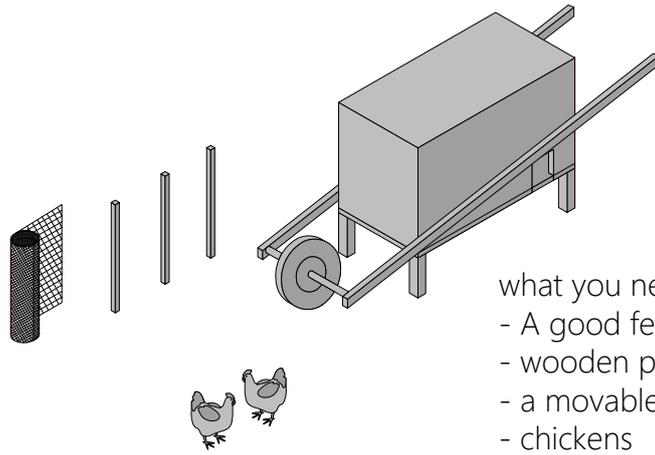
There must be raised bars in the enclosure. It should be as dark as possible and the waste must be removed regularly.

The chickens need enough shade in the enclosure and natural structures must be present. For example, grasses, branches and small bushes.

The animals must be protected from predators.

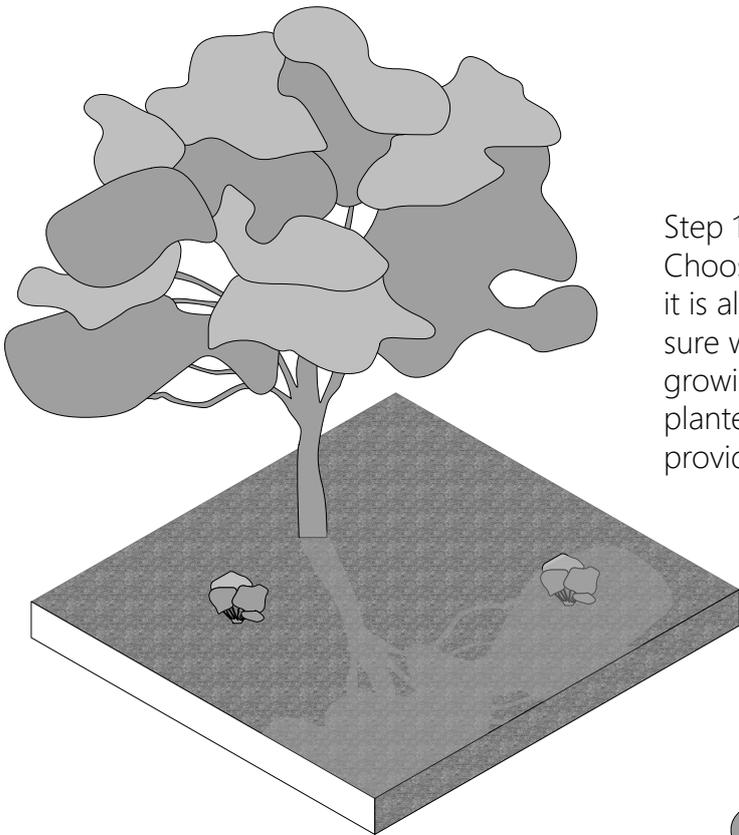
The ISA brown chicken species is a widespread type of laying hen. They are able to adapt well to different climates, poultry management styles and housing systems. This could be a suitable species.

Moveable Chicken Encloser

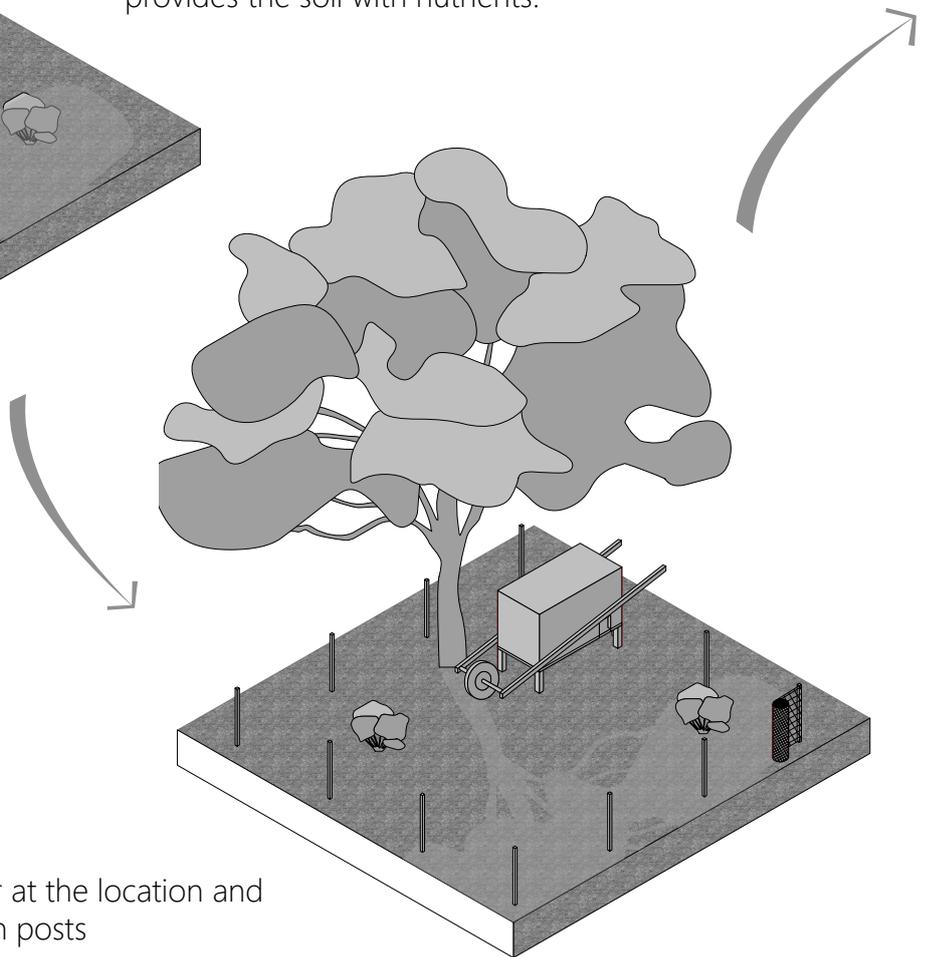


what you need for it:

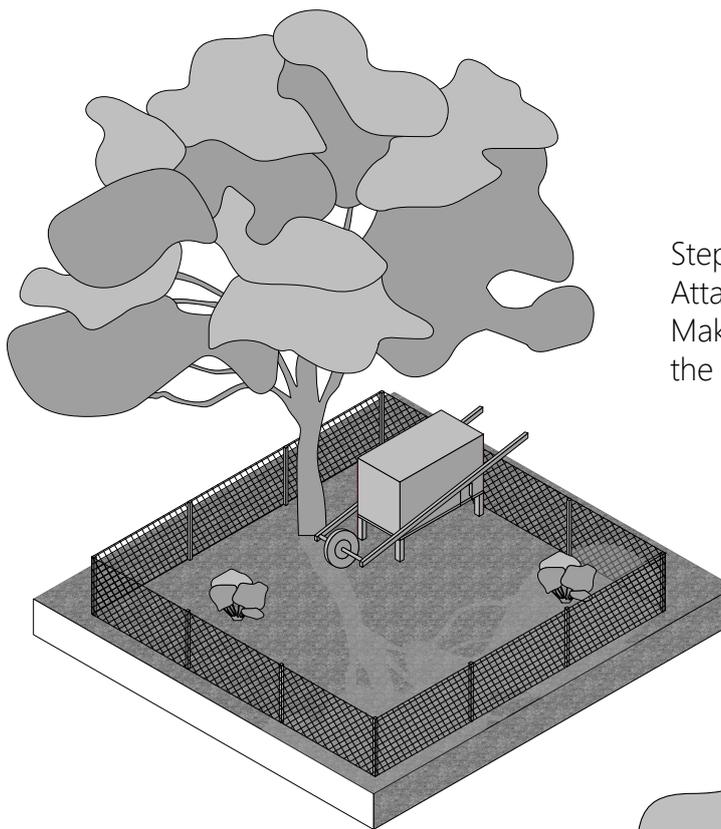
- A good fence
- wooden poles to attach the fence to
- a moveable chicken shelter
- chickens



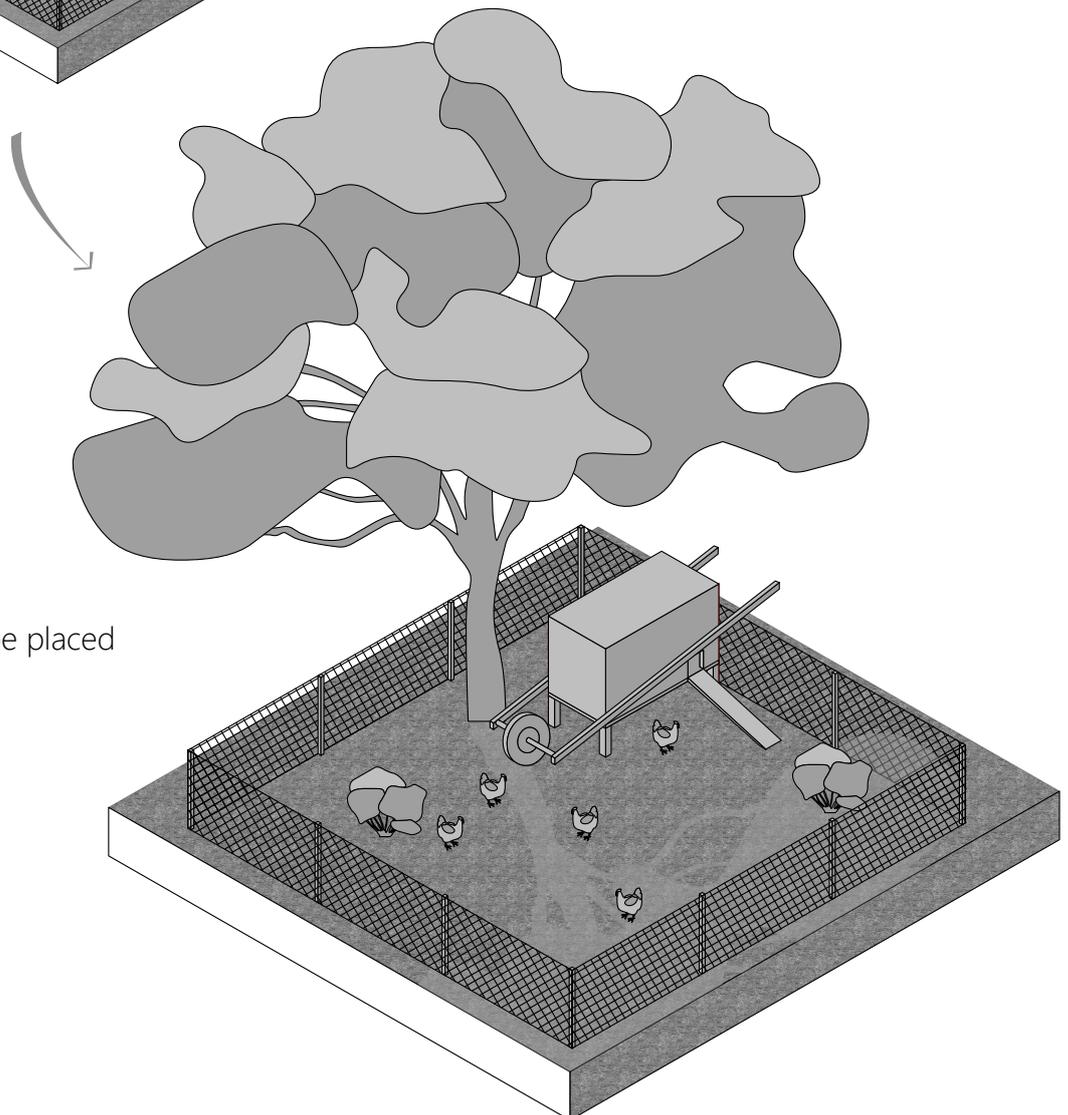
Step 1:
Choose a place for the chickens
it is always worth positioning the enclosure where no vegetables are currently growing, but where they will soon be planted. the waste from the chickens provides the soil with nutrients.



Step 2:
Position the shelter at the location and
put up the wooden posts

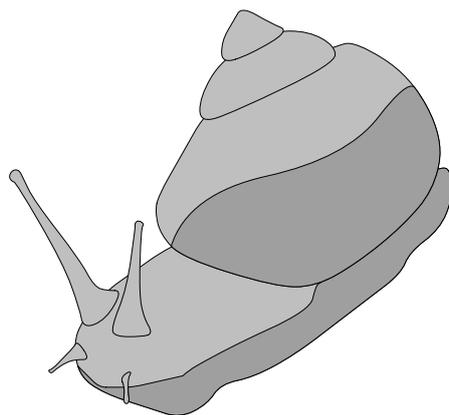


Step 3:
Attach the fence to the posts.
Make sure there are no gaps, otherwise
the chickens can escape



Spep 4:
the chickens can be placed
in the enclosure

Snails are easy to grow and multiply quickly. They are considered a delicacy and are healthy, and their slime can be used as luxury cosmetics. They can be sold to hotels and tourists.



Example of snail fodder:

Leaves: cassava, eggplant, cabbage, lettuce

Fruits: mango, banana, eggplant, tomato, cucumber

Tubers: cassava, sweet potato

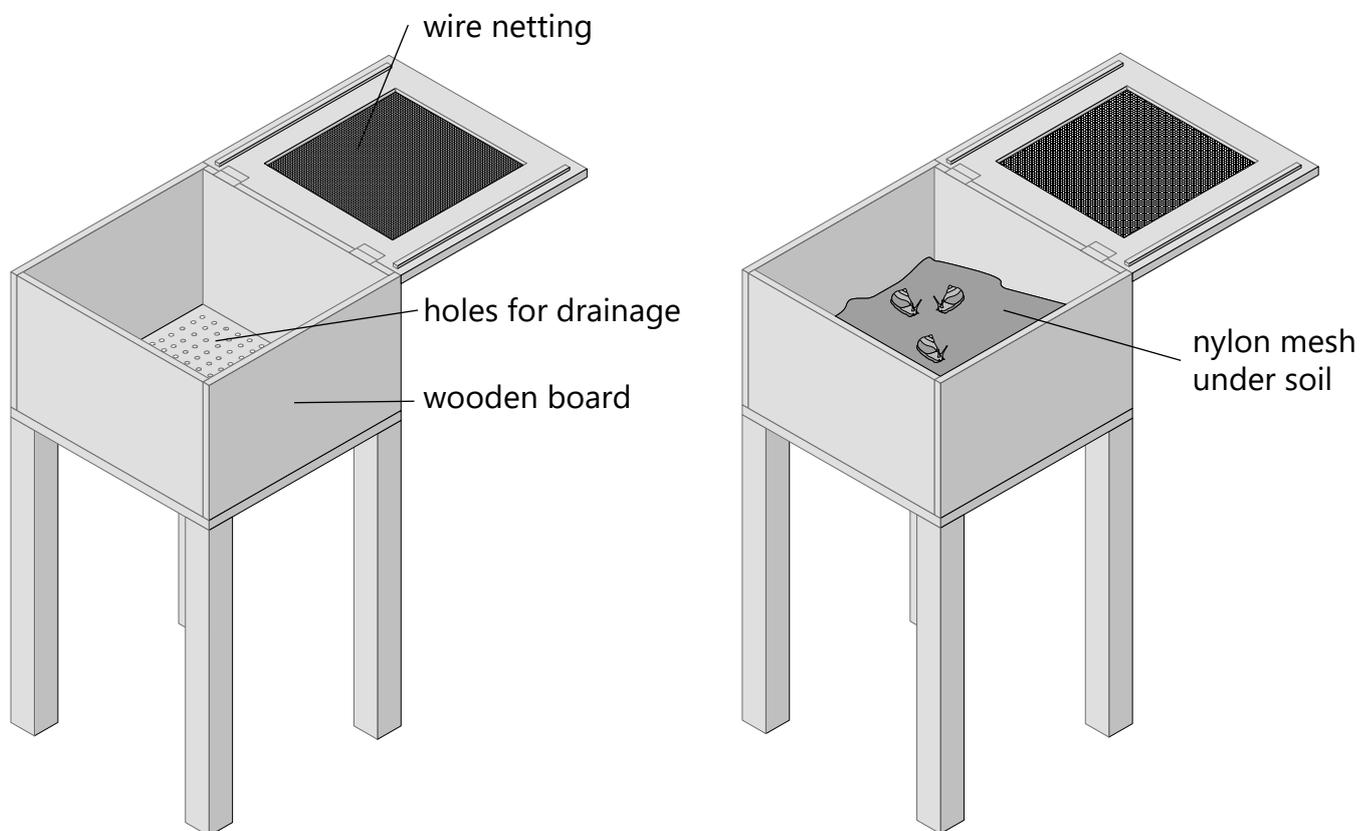
Household waste: peels of fruit and tuber, like banana

Do not feed:

plants with hairy leaves or toxic chemicals

Pros	Can be started small Snails are considered a delicacy Are healthy to eat Can teach by themselves many things
Cons	Dry season can lead to problems Can eat away plants and become pests
Snails for farming	Achatina achata (giant snail, tiger snail) Achatina fuliva (garden snail, foolish snail)

Workload, needed personell	Low, have to be fed and controlled
Time until harvest	Grown up after 6-12 months
Needed material	Enclosure in the shadow, water, food (leaves, fruits, ...), a few snails to start



Dimensions: about 0.6m x 0.6m up to 1m x 1m
 either placed in well-drained soil or on timbers about 50cm above
 the ground

There is a book on snail farming in West Africa by Joseph R. Cobina. It is freely available on the internet. The book contains more information about snail farming and different ways of breeding.
<http://videa.ca/wp-content/uploads/2015/07/Snail-farming-manual.pdf>

Tilapia used to be farmed often in small fish ponds near rice fields or farms. They are relatively easy to breed and grow quickly. This is one way to avoid the problem of overfished seas.

The fish eat the larvae of mosquitoes, therefore breeding fish can reduce the spread of malaria.



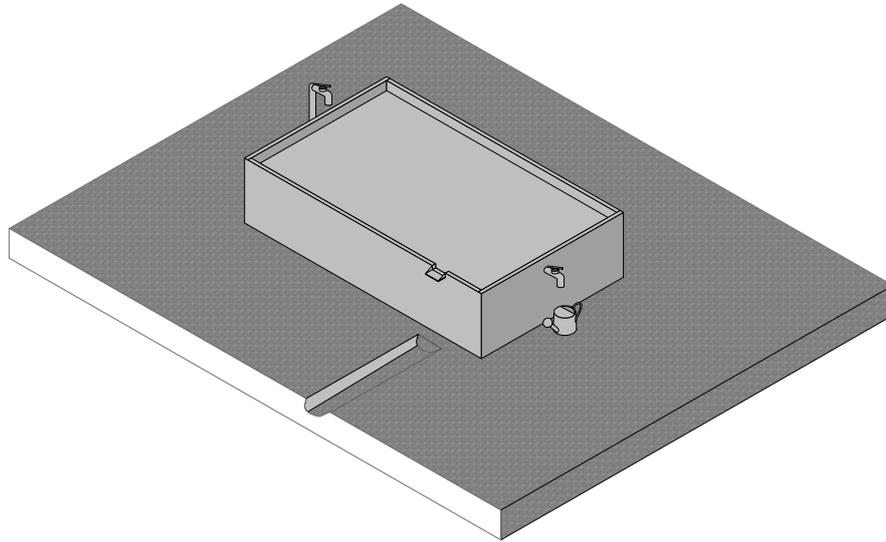
<https://www.tagesspiegel.de/themen/genuss/aquakultur-nun-wo-fischers-fritz-nicht-fischt/25467194.html>

Example of fish fodder:

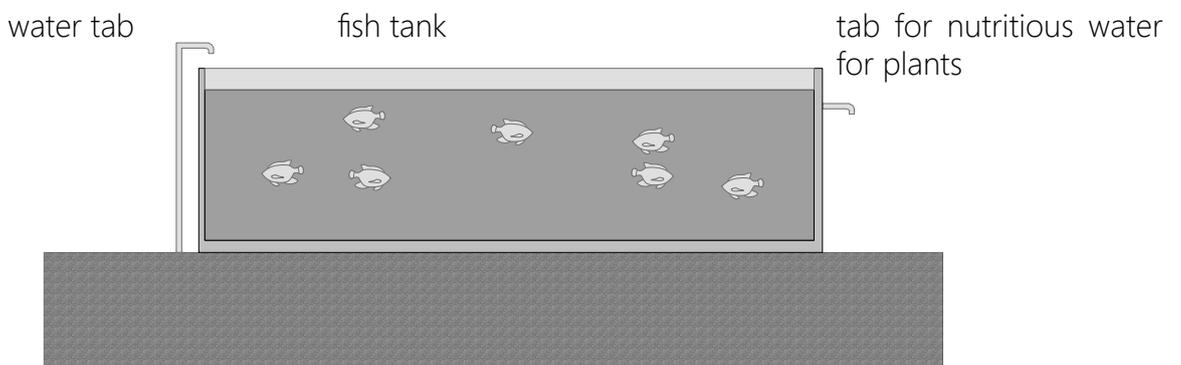
Corn, slurry, duckweed, algae, plant waste
for 1kg fish, only 1.5kg of dried food is needed

Pros	Can start small Can grow them in different environments (even in rubbish bins used as tanks) Makes hardly any demands on water quality or ph-value Providing nutrients for crop garden
Cons	Needs knowledge, it is not quite easy to breed fish successfully, fish must not be released into the wild
Fish for farming	Tilapia

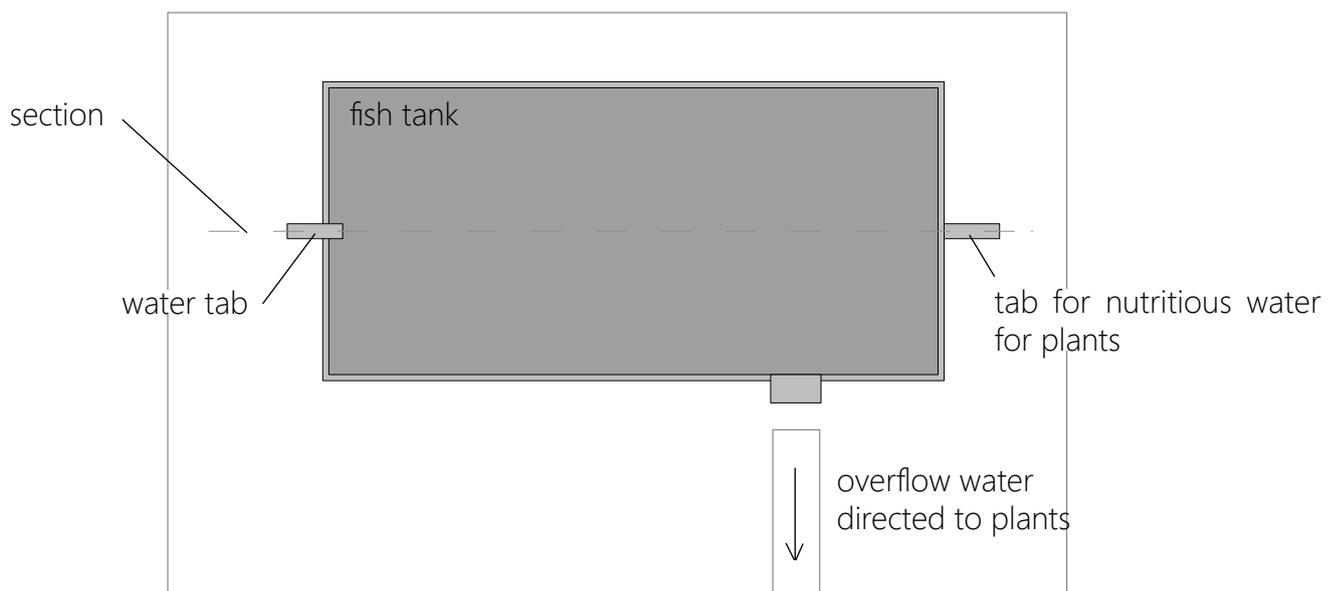
Workload, needed personell	Medium, need to be fed and controlled Mother fish with young need separate tank
Time until harvest	After about 6 months they can be caught and sold
Needed material	Tank/basin, water, food, fish



Section front view



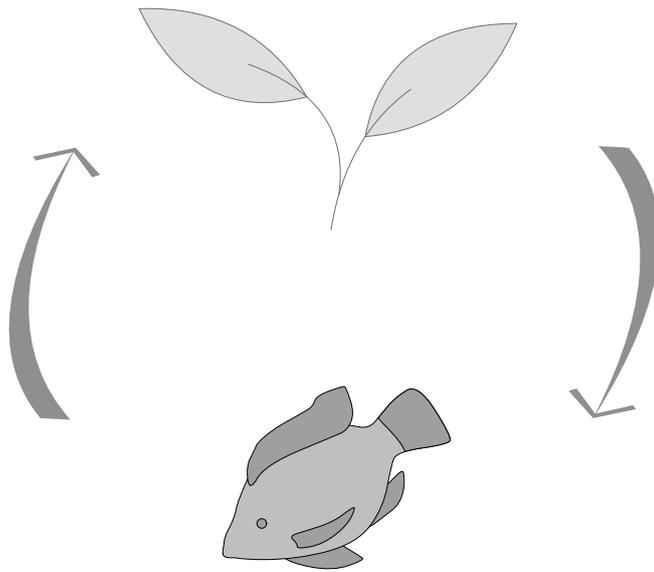
Top view

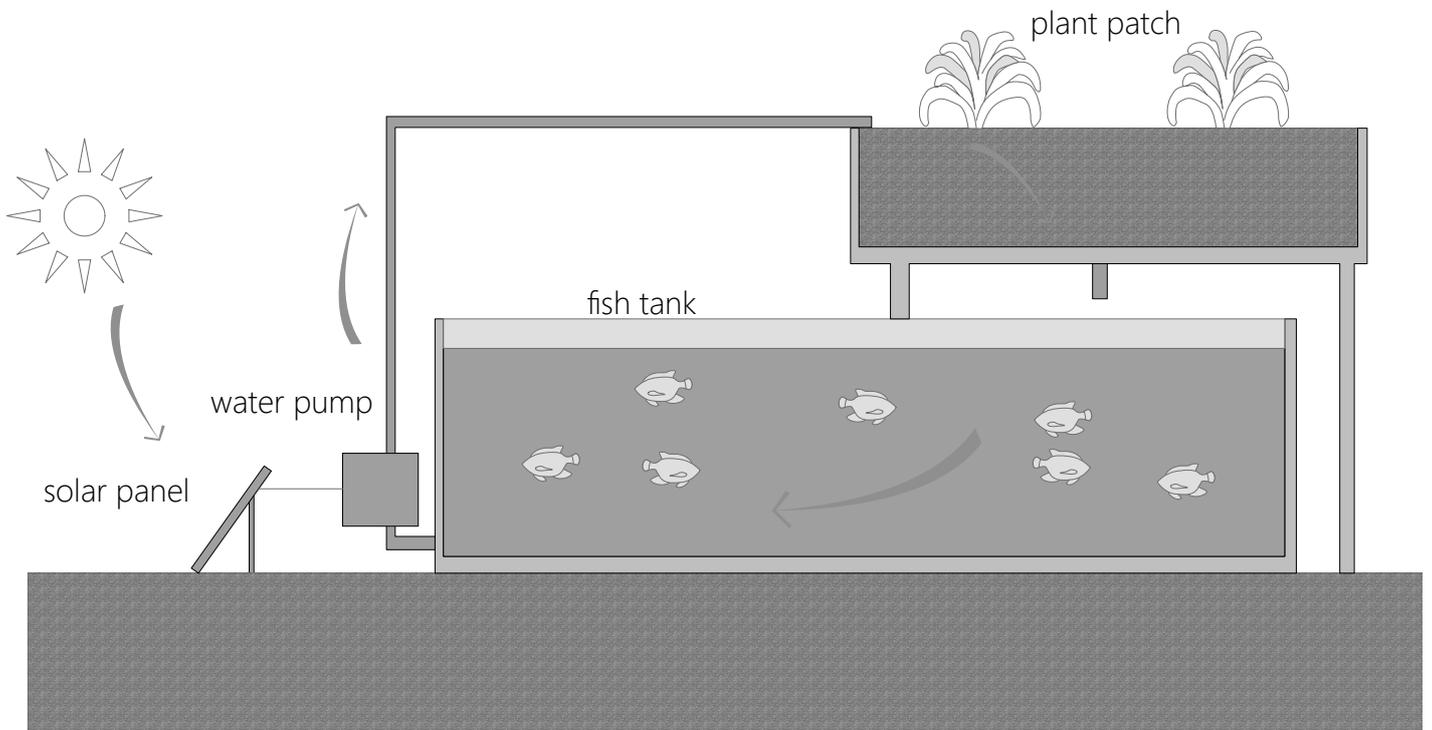


The basin/tank can be made of different materials, it just has to be leak-proof. The tank is placed next to a water point. The water tap should always run a little. The water for watering the plants is drained off at the other end of the basin. This water already contains many nutrients from the waste of the fish. The overflowing water is led directly to the plants.

Aquaponic Fish Farming

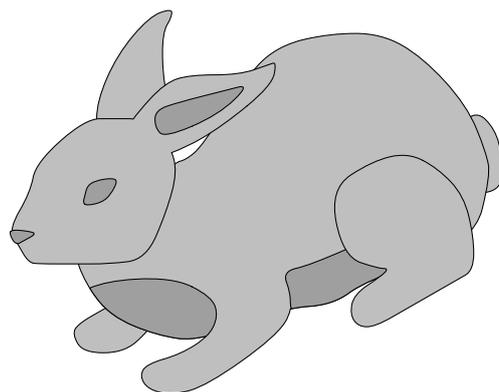
In this system, fish are farmed and vegetables are grown at the same time.
A cycle is created in which water and nutrients are passed on.





The water from the fish tank is pumped into a raised patch via a solar pump. The plants are irrigated in this way. The waste from the fish provides the plants with fertiliser. The water runs through the soil and is cleaned. The clean water flows back into the fish tank.

Rabbits are easy to breed and grow quickly. The meat can be sold at markets and to hotels. In addition, the skin and fur can generate an income.



Example of rabbit fodder:

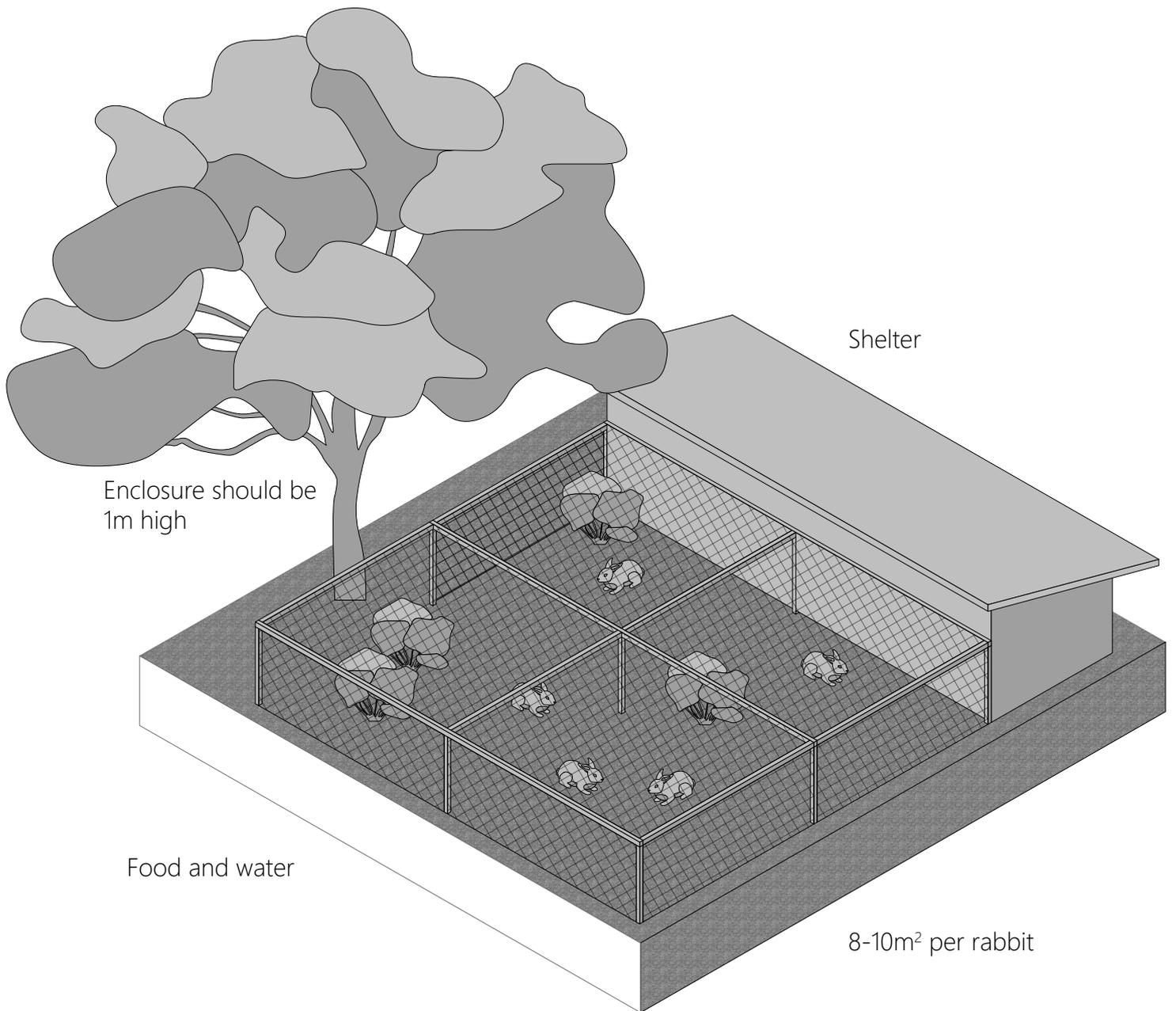
About 75% of the diet: Grass hay, leafy greens (radish tops, carrot tops, cucumber leaves, lettuce, kale, spring greens)

About 15% of the diet: non-leafy vegetables (carrots, cabbage, edible flowers, squash)

About 10% of the diet: fruits (mango, banana, melons, papaya)

Pros	Can be started small Reproduce quickly Not only meat, but also skin and fur is popular Waste can be used as fertiliser
Cons	Basic knowledge is needed Can eat plants if not in the enclosure
Workload, needed personell	Low to medium, feeding, cleaning out

Time until harvest	Fully grown after 6 months
Needed material	Need 120g food per day, water, enclosure, shelter
Further information	Reproduce quickly (one female has up to 40 babies a year). One male serves up to 5 females To start 1 male and 1 female needed Should not be kept alone

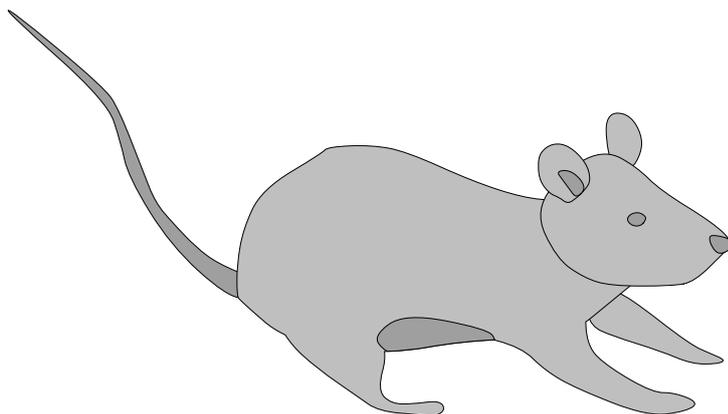


Rabbits can spend all their time outside in a closed enclosure. The meshes in the fence must be small enough to prevent predators from entering.

They like to dig tunnel systems, so it is advantageous to dig the fence a little into the ground and keep filling in the holes.

The rabbits should have enough shade and love a natural ground covered with grasses.

Breeding gambian pouched rats for meat is becoming increasingly popular. They are relatively easy to breed and reproduce quickly.



Example of pouched rat fodder:

insects, snails, nuts, seeds and fruits

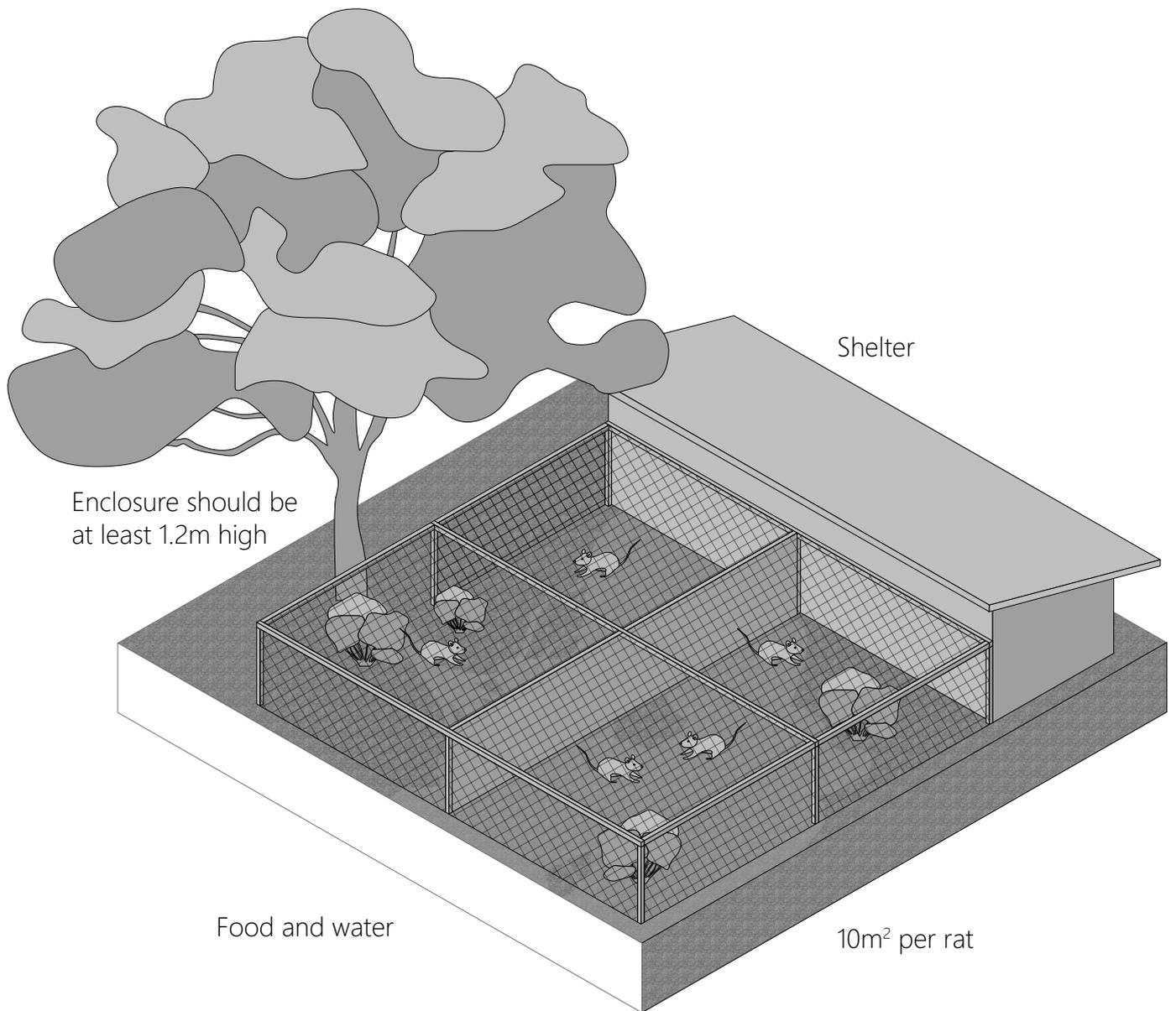
They eat what is available to them.

They get their name from the way they collect food in their cheek pouches.

In nature, they sometimes live in termite mounds, they also eat termites.

Pros	Can be started small Reproduce quickly Waste can be used as fertiliser
Cons	Basic knowledge is needed Can eat plants if not in the enclosure
Workload, needed personell	Low to medium, feeding, cleai-ning out

Time until har-vest	Fully grown after about one year
Needed material	Food, water, enclosure, shelter
Further informa-tion	Are active at night Have an extremely good sense of smell



The gambian pouched rats are social animals, they can be kept as pairs or small groups. The males can be aggressive towards each other. They like to climb, so the enclosure must be completely closed off. The larger the enclosure the better.

They like to dig tunnel systems, so it is advantageous to dig the fence a little into the ground and keep filling in the holes.

The gambian pouched rats originally live in the forest, so they need enough shade in the enclosure and natural structures must be present. For example, grasses, branches and small bushes.

Many diseases arise due to hygiene problems. A compost toilet can be easily built and provides more hygiene. In addition, natural fertiliser can be produced.

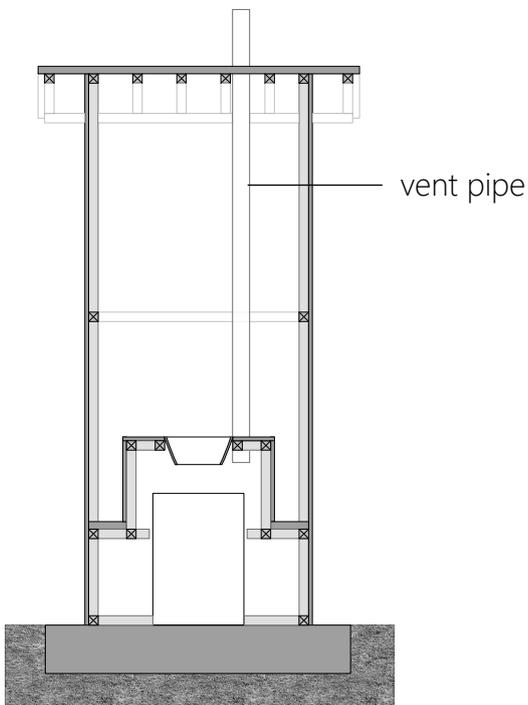


<https://www.gelterkinden.ch/de/aktuelles/meldungen/archiv/Neues-Kompost-toilet-im-Gemeindepark.php>

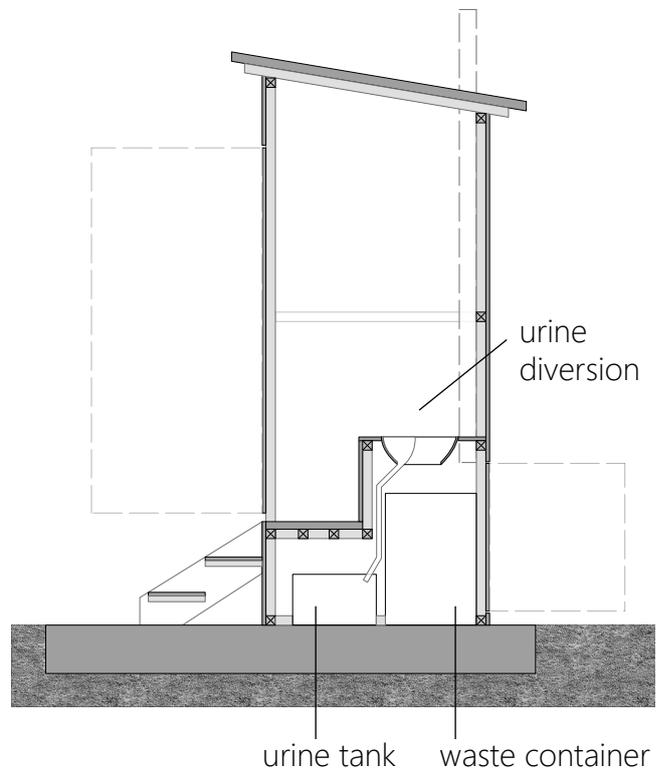
Pros	Fewer diseases through more hygiene Simple extraction of fertiliser
Cons	Expensive construction
Workload, needed personell	Low, after construction only needs to be emptied and cleaned

Time until harvest	Time until the extraction of fertiliser depends on the intended use
Needed material	Shelter, toilette bowl with urine and waste separation, separate container, ventilation pipe, wood chips or leaves, shovel
Further information	The waste can be burnt with leaves and wood to obtain nutritious soil

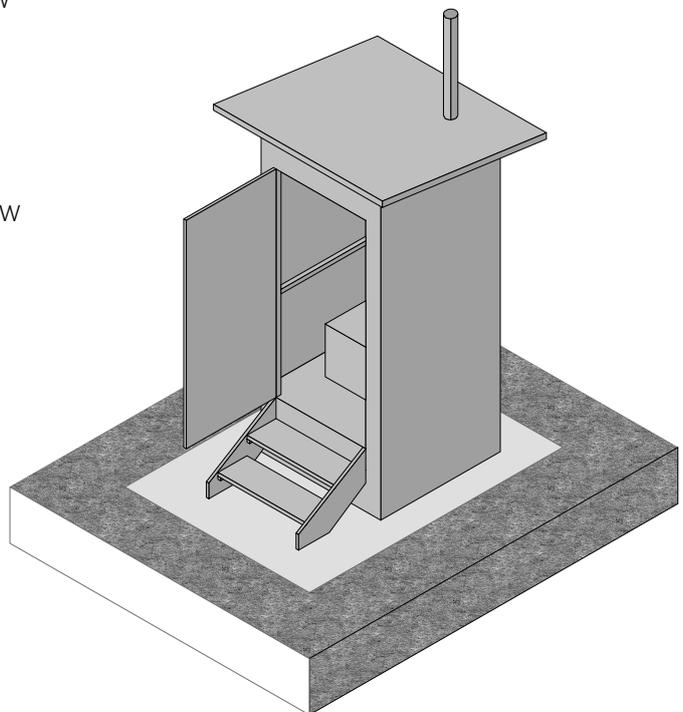
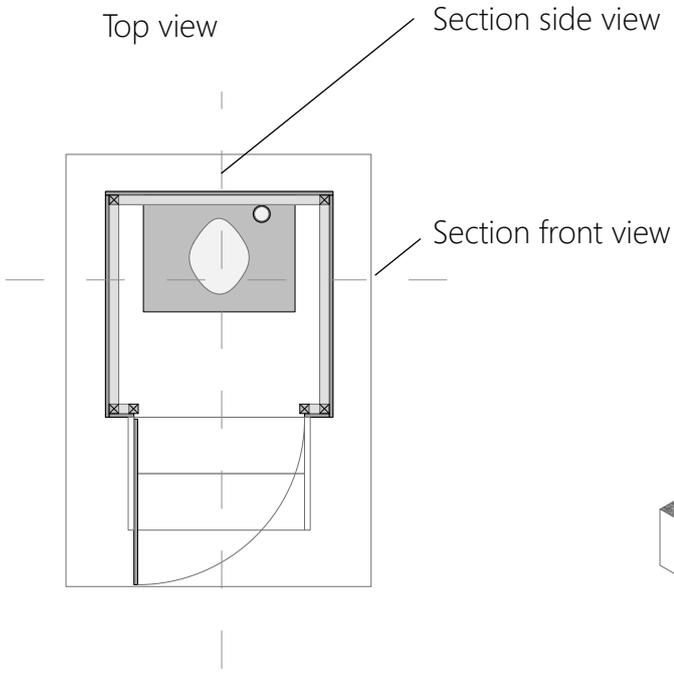
Section front view



Section side view



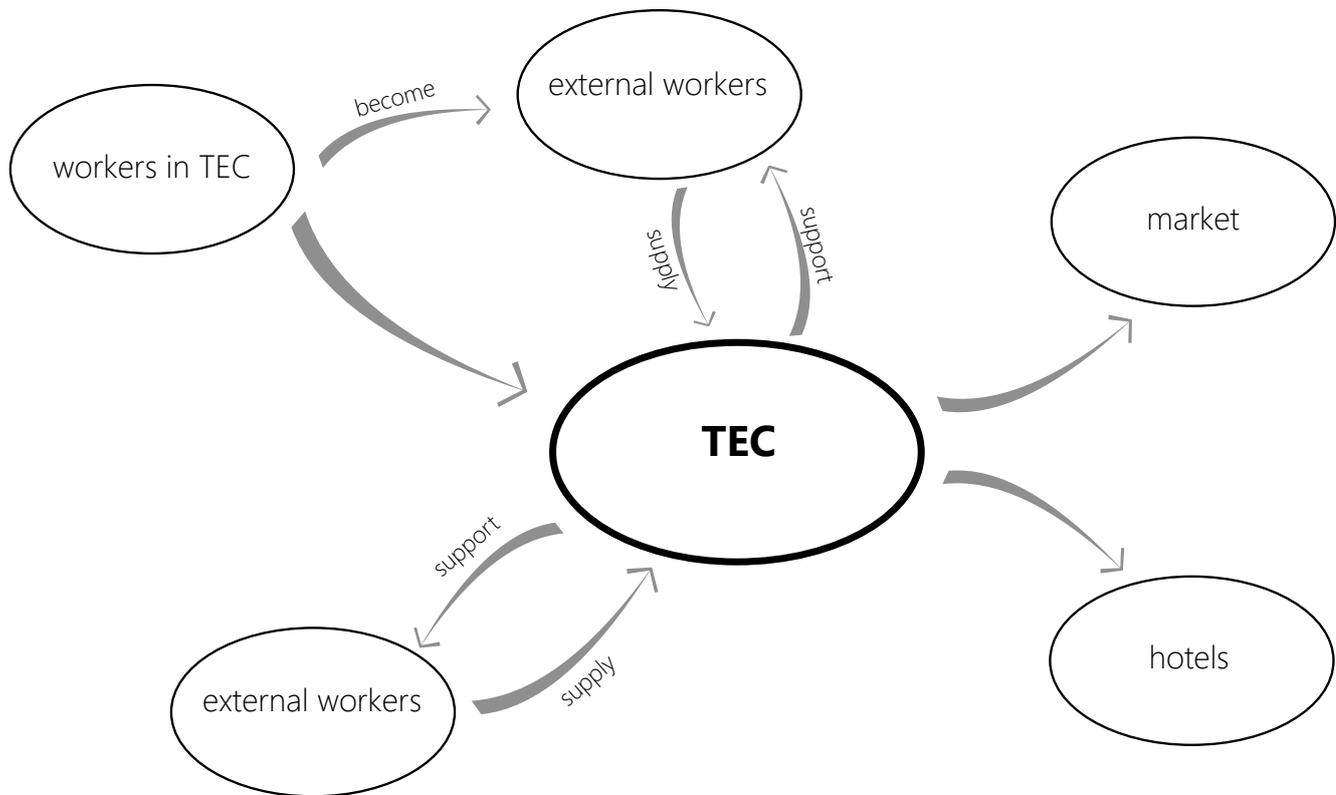
Top view



The construction consists of wood on a concrete slab. It can also be clad with sheet metal or other materials. The separation of urine and waste is not absolutely necessary, but enough wood chips or ash must be spread after each use.

Independence through decentralised farming

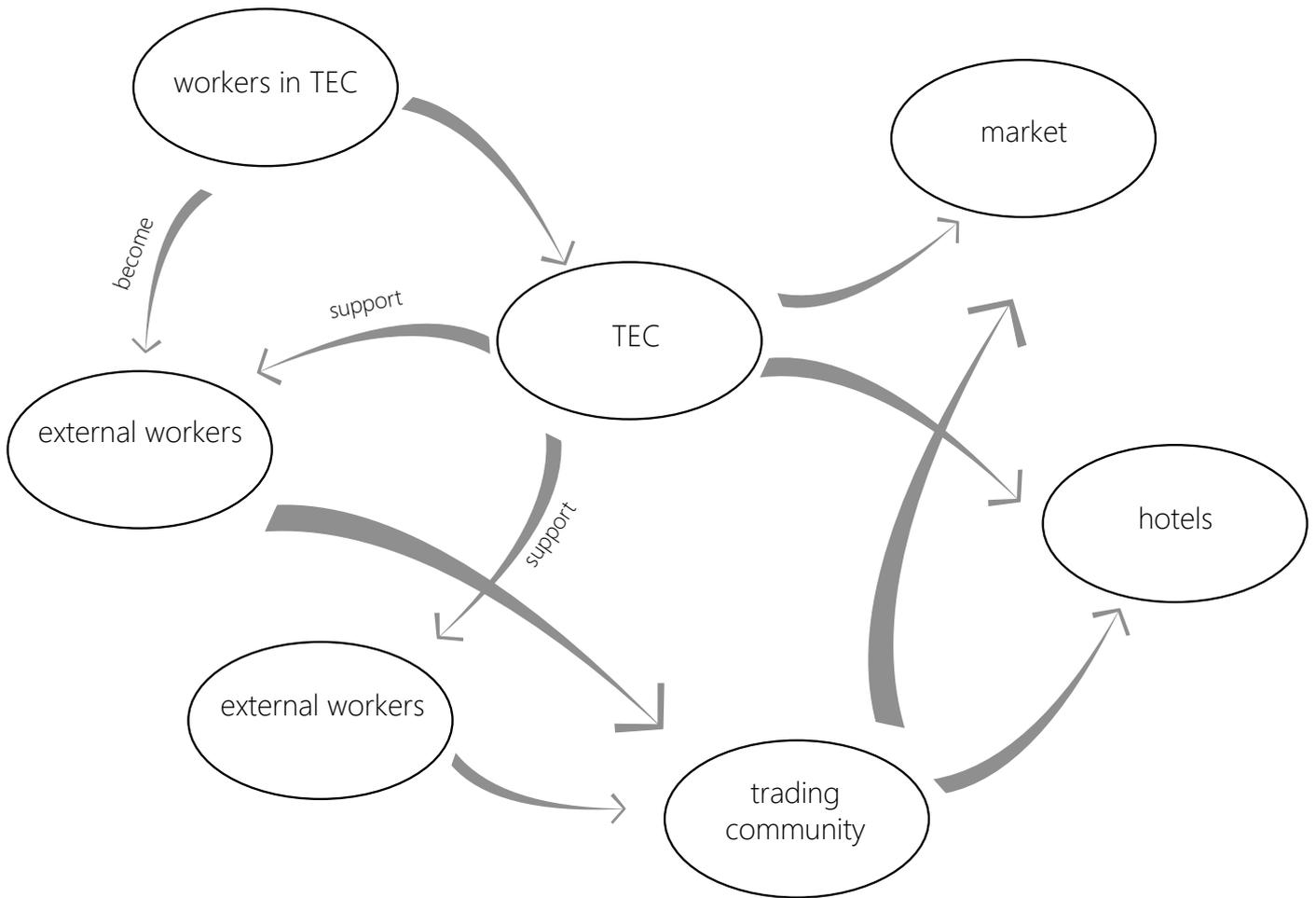
Start of decentralised farming



TEC trains workers, who can become self-sufficient with further support (material, seeds, water). In return, they give part of their harvest to the TEC for a certain period of time -> trade off, receive profit participation. After a few years they become independent.

External persons are also supported by the TEC according to the same principle.

Future with independence



The TEC supports the formation of trading communities consisting of people supported by it. These trading communities gain independence from the TEC and supply markets and hotels.

The TEC is only at the centre at the beginning and helps to set up the structures. As time goes on, the influence of the TEC decreases and the individual actors become more independent.

Further information

Terra Preta:

www.juckerfarm.ch. Terra Preta – Zaubererde mit Pflanzenkohle. Call date: 05.06.2022.

<https://www.juckerfarm.ch/farmticker/bauern-lexikon/terra-preta-zaubererde-mit-pflanzenkohle/>

Kompost Tee:

www.rodaleinstitute.org. Compost tea – a how to guide. Call date:: 05.06.2022.

<https://rodaleinstitute.org/blog/compost-tea-a-how-to-guide/>

Pflanzenkohle:

www.permakulturtipps.de. Pflanzenkohle selberrachen. Call date:: 05.06.2022.

<https://www.permakulturtipps.de/blog/permakulturgarten/pflanzenkohle-selberrachen/>

Companion Planting:

www.organicseed.co.za. Companion planting chart. Call date:: 05.06.2022.

<http://www.organicseed.co.za/content/15-companion-planting-chart>

Image sources indicated in each case to the right of the image.

Food forest:

<https://aflorestanova.wordpress.com/2016/04/09/designing-the-forest-succession/>

Bees:

<https://www.africabeecause.org/>

<https://www.youtube.com/watch?v=fFeG8UIFPU>

<https://teca.apps.fao.org/teca/pt/technologies/7274>

<https://www.beekeepingnaturally.com.au/natural-beekeeping/the-kenyan-top-bar-hive/>

Chickens:

<https://www.isa-poultry.com/en/product/isa-brown/>

Snail:

<http://videa.ca/wp-content/uploads/2015/07/Snail-farming-manual.pdf>

Fish:

<https://www.aquanet.com/small-scale-tilapia-farming>

https://www.aquanet.com/gambia_country

<https://www.accessgambia.com/information/aquaculture.html>

<https://thefishsite.com/articles/nile-tilapia-could-fight-malariacarrying-mosquitoes>

<https://www.fao.org/3/i4021e/i4021e.pdf>

Rabbits:

<https://www.animalbreedersfarm.com/rabbit-farming-gambia/>

Gambian pouched rats:

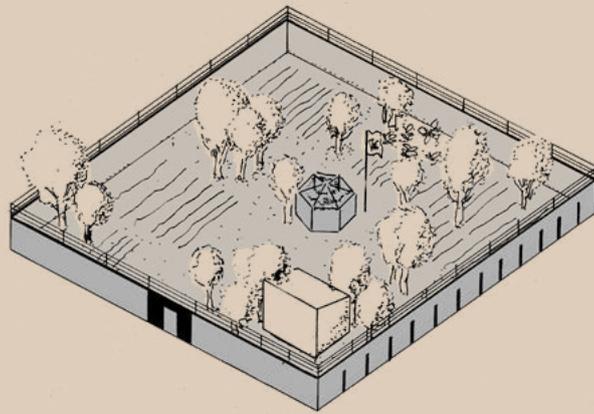
https://animaldiversity.org/accounts/Cricetomys_gambianus/

Compost toilet:

<https://aflorestanova.wordpress.com/2016/04/09/dry-toilets/>

murals & bantaba

Jael Germann



The main objective of the project is to establish the TEC among various target groups, as a place of learning and encounter.

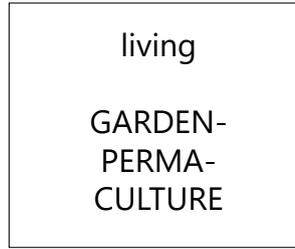
The place should provide a framework to live and experience the culture.

living
GARDEN-
PERMA-
CULTURE

Content

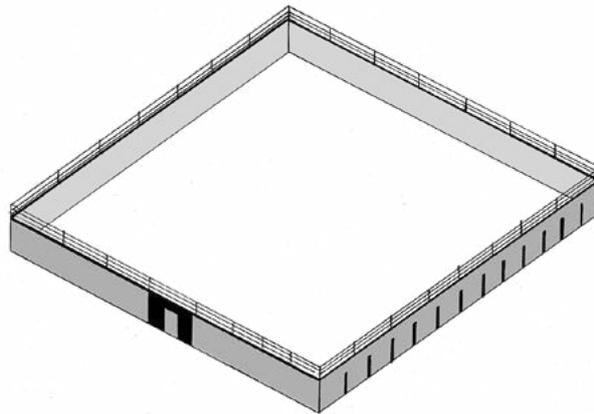
Cultural definition

- garden culture
- permaculture
- culture



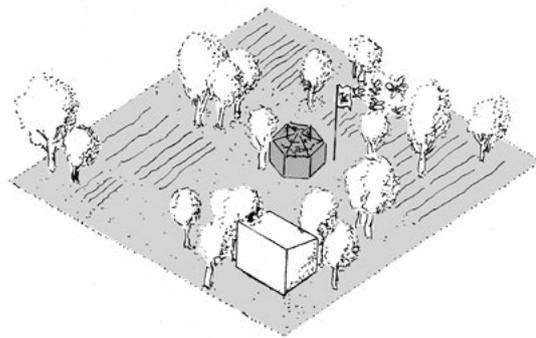
The outside world

- The flagship project WOW
- Mural concept for the TEC
- Mural themes and slogans



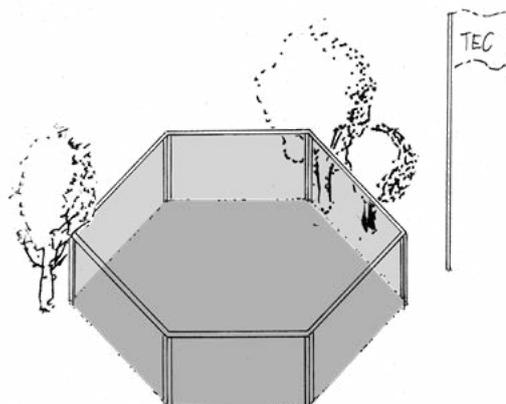
The inside world

- Movable Bench with integrated storage box



Bantaba

- Examples
- Materials
- Basics
- Proposals
- Possible location
- Implemented Bantaba and House of Skills



garden culture

Gardens, are and have always been a place for meetings and recreation. They are shaped by different cultural ideas and historical circumstances.

A look back at the beginnings of garden culture shows that people were initially primarily concerned with the satisfaction of basic needs and hardly with aesthetic concepts. Gardens only came into being when people began to settle down, and were even an important basis for this. Hardly surprising, therefore, that horticulture in its original forms was primarily functional, since it had to solve the problem of resource scarcity that arose as a result of sedentarization.

Source: <https://www.wissenschaft.de/geschichte-archaeologie/eine-kleine-geschichte-der-gartenkultur/>

permaculture

Permaculture is the short term for permanent agriculture which means a permanent food production in agriculture and gardens. At the same time, it also stands for achieving a permanent land use and relationship between humans and nature.

Permanence is a central theme in permaculture.

Source: Script Landscape Ecology 5, Christoph Küffer, University of Applied Sciences East

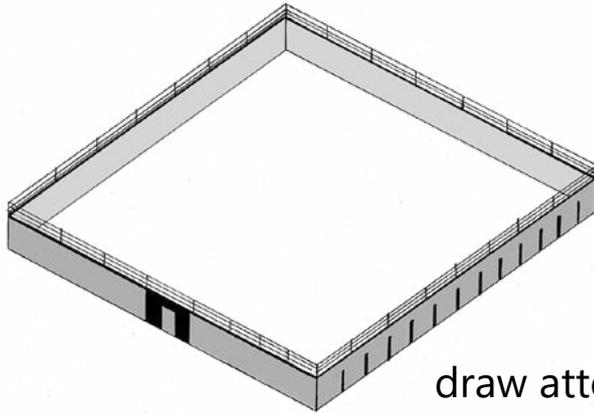
culture

Everything created by man is summarized in the Latin word „cultura“. Culture includes the subjects such as knowledge, faith, art, law, morals, customs and others of a society. The culture describes learned behavior, which is passed on from generation to generation.

The culture changes. Different cultures enrich each other and rub off on each other. The members of a society live the culture and shape it. The personality of each member can be realized through the culture. Respect for personality and respect for culture are closely connected.

Spaces are shaped by the culture people live in. Cultural problems can be solved by emphasizing values.

Source: Geography Knowledge and Understanding, Hans-Rudolf Egli and Martin Hasler, 2nd edition 2010 p.179-180



draw attention to space

The project WOW (Wide Open Walls) was realized in 2010 in Kubuneh, Maskasutu, The Gambia. It serves as a showcase project for the murals of the TEC.

A collaboration between Lawrence Williams (English) and local artist Njogu Toray led to the initiation of this project.

The goal of the project was to create a permanent art installation while promoting The Gambia as a tourist destination. The village of Kubuneh was to be transformed into a living art object.

In 2009, Lawrence spoke with world-renowned street artist Eelu, who in October 2010, organised eight of the world's leading street artists to come to Kubuneh to create artwork for two weeks. The village served as a canvas for these works.

"The primary goal of this extraordinary art campaign is to draw global attention to a rural region in The Gambia, to promote this region through soft tourism, and to raise funds for the construction of schools in this region."

Förderverein Humanitas provides non-material support for WOW and donated a substantial amount in 2016 to ensure the continuation of this inspiring project.

In 2011, the project was repeated with Ricky Lee Gordon of Write On Africa from South Africa as curator. Artists included Will Barras, C215 and Ben Eine.

Sources:

<https://www.mandinalodges.com/makasutu-forest/wide-open-walls>

<https://fvh.ch/projekte/seit-2014-tanji-education-center-tec/>

concept	The outside walls of the TEC are to be attractively designed by street artists. The murals are supposed to point to permaculture and to show that by cultivating one's own soil, one's own self-sufficiency is within reach.
goal	The murals are intended to arouse interest in passers-by and draw their attention to the TEC campus as a place of learning and knowledge. At the same time, the murals on the wall serve to inform Gambians about current workshops.
adapted variant	Instead of flying in artists, it would make more sense to carry out the project with "Tanjians". However, it would have to be clarified beforehand how realistic this way of implementation would be. The next step is to seek contact with potential artists. The artists from the showcase and copycat project are ideal for this.
procedure	<p>Possible artists are:</p> <p>From the flagship project WOW: Lee Eelus, Xenz, Logan Hicks, Will Barras, Broken Crow [John Girder & Mike Fitzsimmons], Lucy McLauchlan and Mysterious AI, TIKA</p> <p>From the Copycat Project: Will Barras, C215 and Ben Eine</p> <p>If appropriate, it would be possible for an artist to act as curator. For specific questions and support Njogu Touray with his great experience should be asked.</p>
budget and schedule	<p>A budget needed for the realization should be prepared with the curator.</p> <p>In parallel, a schedule should be prepared so that the project can be realized in the near future.</p>
fundraising	A good possibility would be an auction of artworks by the artists to raise the necessary money for the realization of the murals.
proposals murals	On the next page, slogans and themes for the murals are suggested. The list can well be supplemented.

themes

UPCOMING WORKSHOPS

Once a month there will be a workshop. There should be a workshop for all age categories.

INDEPENDENCE THROUGH SELF-SUFFICIENCY

BANTABA AS A PLACE OF LEARNING AND EXCHANGE

with shelter, mat, cupboard

LIVING GAMBIAN CULTURE

Gambian culture includes, for example, singing, dancing and playing the djembe.

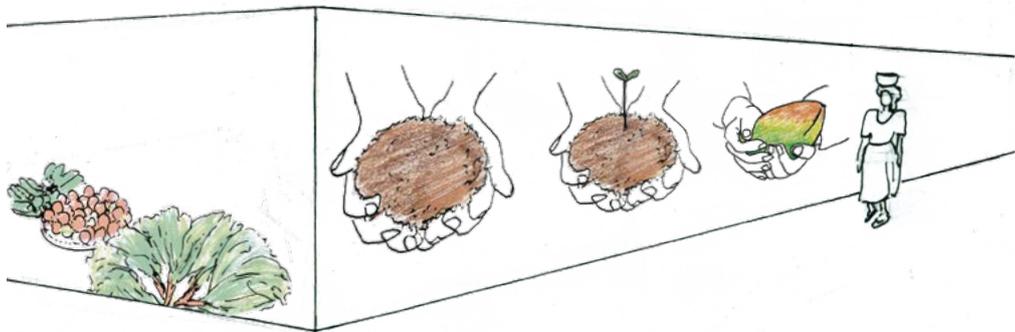
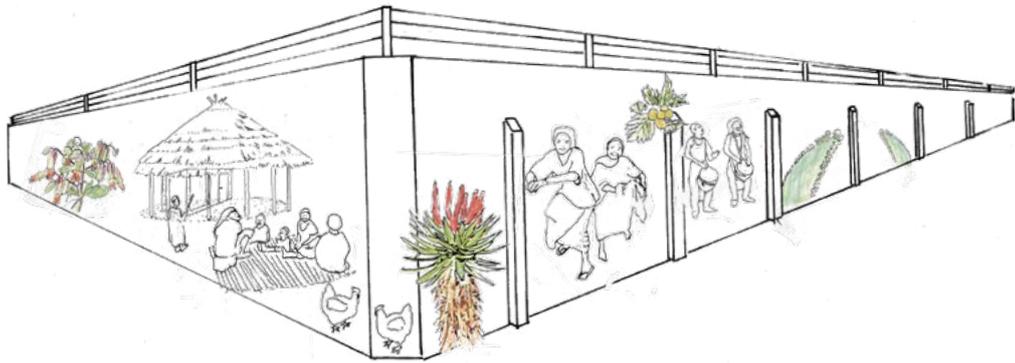
slogans

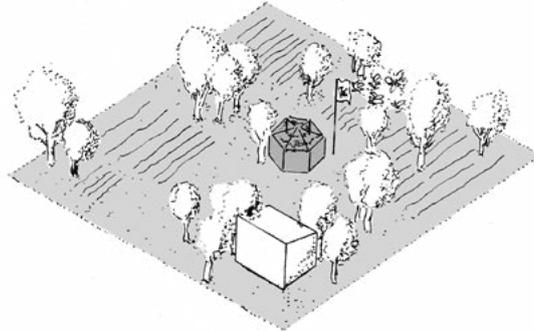
WE THE SEEDS OF GAMBIA

SOIL IS THE GOLD OF GAMBIA

These examples only serve to generate first impressions of possible murals.

However, the artists are to be given complete artistic freedom. They are only asked to generate content for the specific themes and slogans





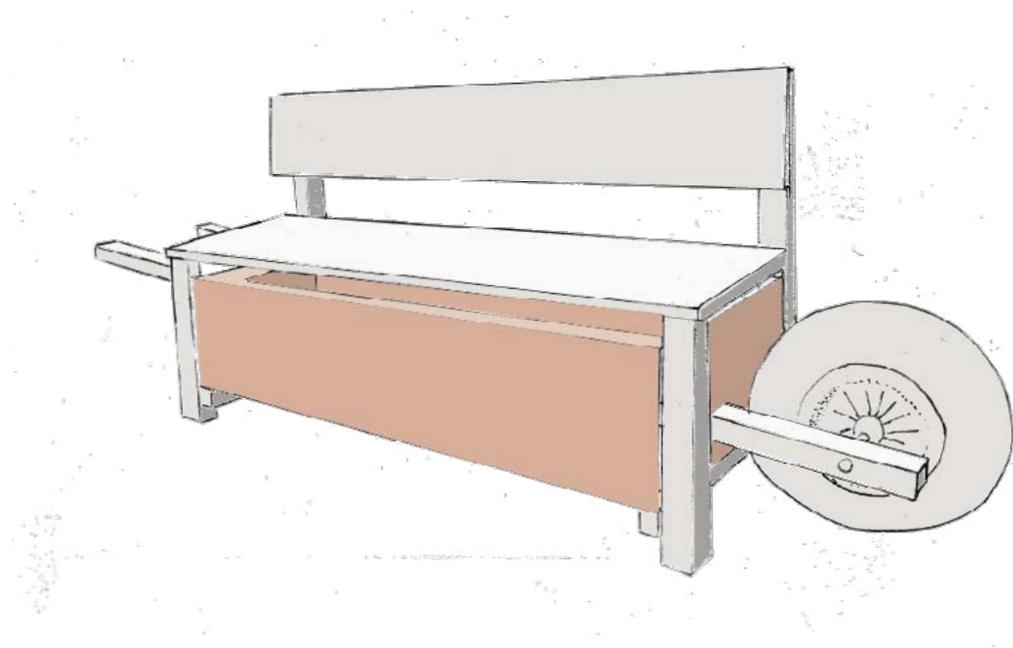
experience and live culture

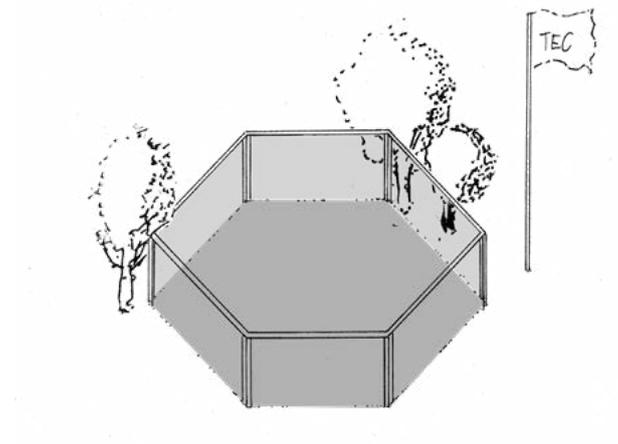
A place for exchange, getting together experiencing culture

- A "safe harbor"
- Textbooks
- Knowledge library
- Healing garden
- Interactive posts
- Movable benches
 - Bantaba
 - Workshops
 - etc.

For the inside world of the TEC, benches can be built and distributed around the campus.

This bench was inspired by a wheelbarrow. It can be transported like a wheelbarrow. At the same time, the bench contains an integrated storage box.





a place of learning and encounter

origin of the term

The word is composed of Bant and Aba. Bant is derived from the word Bentennie, which means a large tree in the Mandinka language.

Traditionally, the men of the village meet under this tree.

The second part of Bantaba is Aba. Aba means meeting place.

Today, bantaba is understood to mean a garden pavilion larger than an arbor.

The bantaba is a steel, wood or cement structure with a roof of grass or corrugated metal and columns of wood/bamboo, concrete or similar.

The structure itself has no walls.

Source: <https://www.accessgambia.com/msite/m-bantaba.html>

vision

A Bantaba is projected as the first building on each of the decentralized farming sites or when more land is purchased.

The photos show examples of Bantabas. The top left photo shows the most original form of a bantaba.

Source: The four photos were provided by TEC from Patrick Müller.



Wood is a suitable building material. At present, resistant hardwood from sustainable sources is scarce. At a later date, this should have improved.

This means that currently the two materials galvanized steel and compacted stabilized earth block are particularly suitable for the construction of bantabas.

For roofing "Rhun palm leaves" are recommended.
Rolled palm leaf mats are suitable for furnishing.



https://www.ibzstore.com/?product_id=113459253_44

CSEB
(=Compressed stabilized earth blocks)



<https://www.ebay.de/itm/271783852812>

Galvanized steel



<https://bit.ly/3KErTbm>

Rhun palm roofing



<https://bit.ly/3vEPkD>

Palm leaf mats

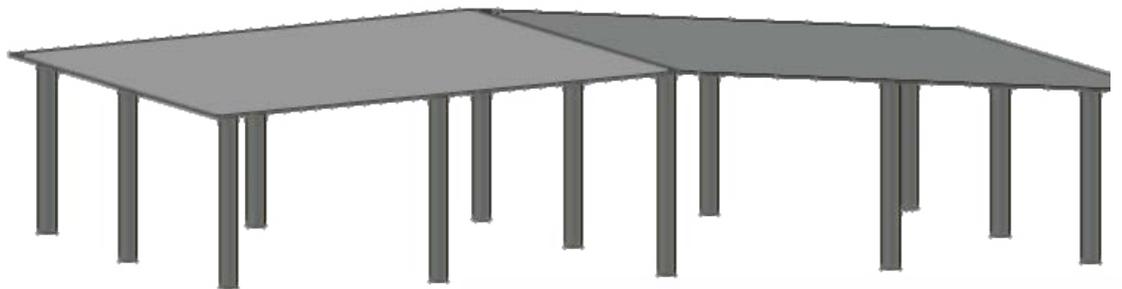
Alternative roofing: A traditional grass roofing -> Fire hazard!

The bantaba of the TEC should consist of at least these four elements:

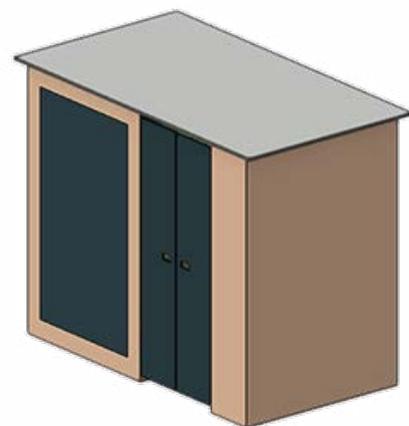


Landmark

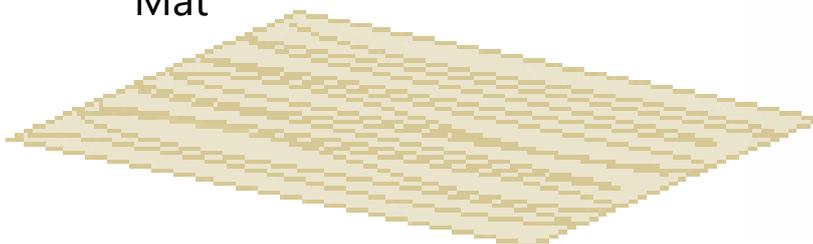
Shelter



Cupboard



Mat



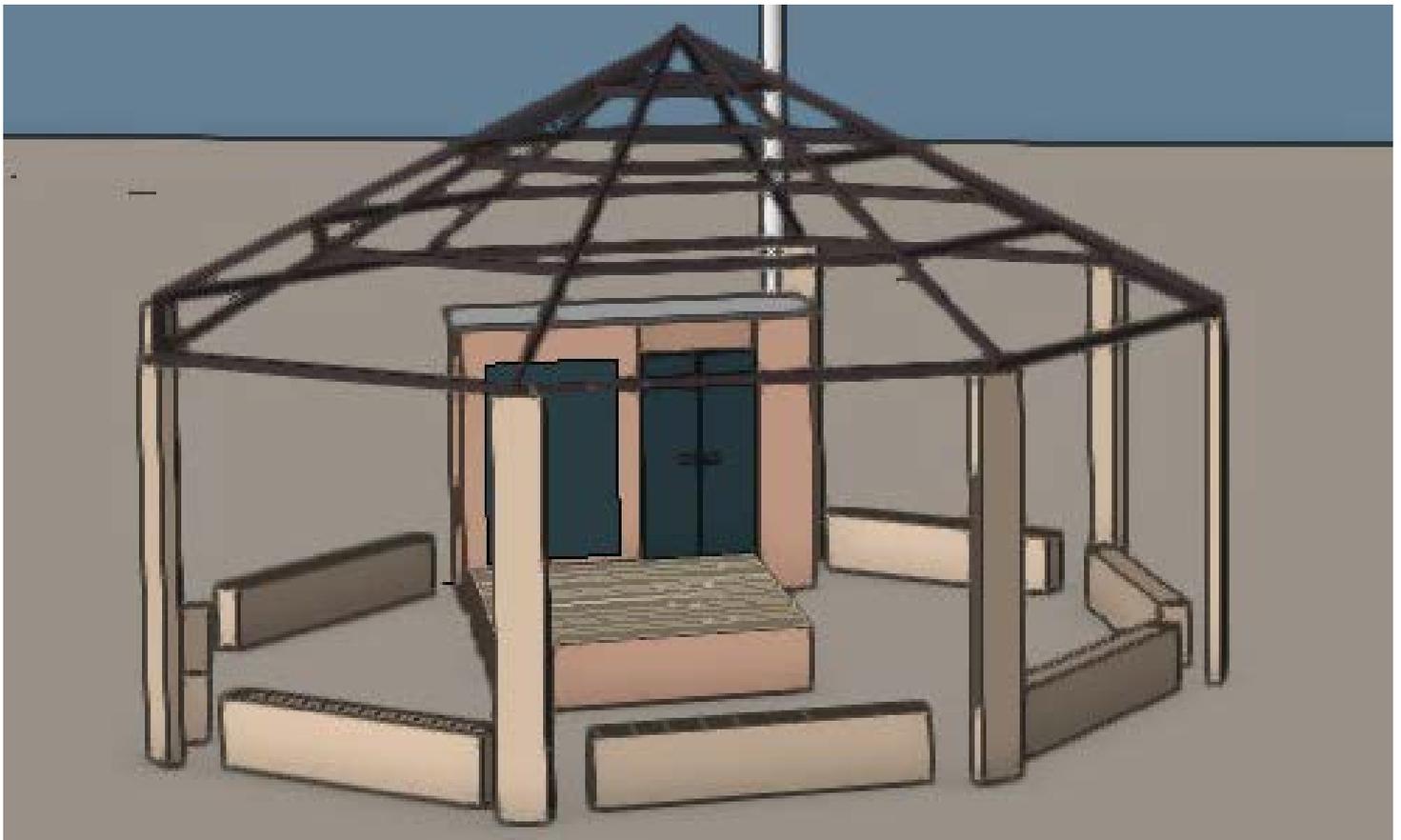
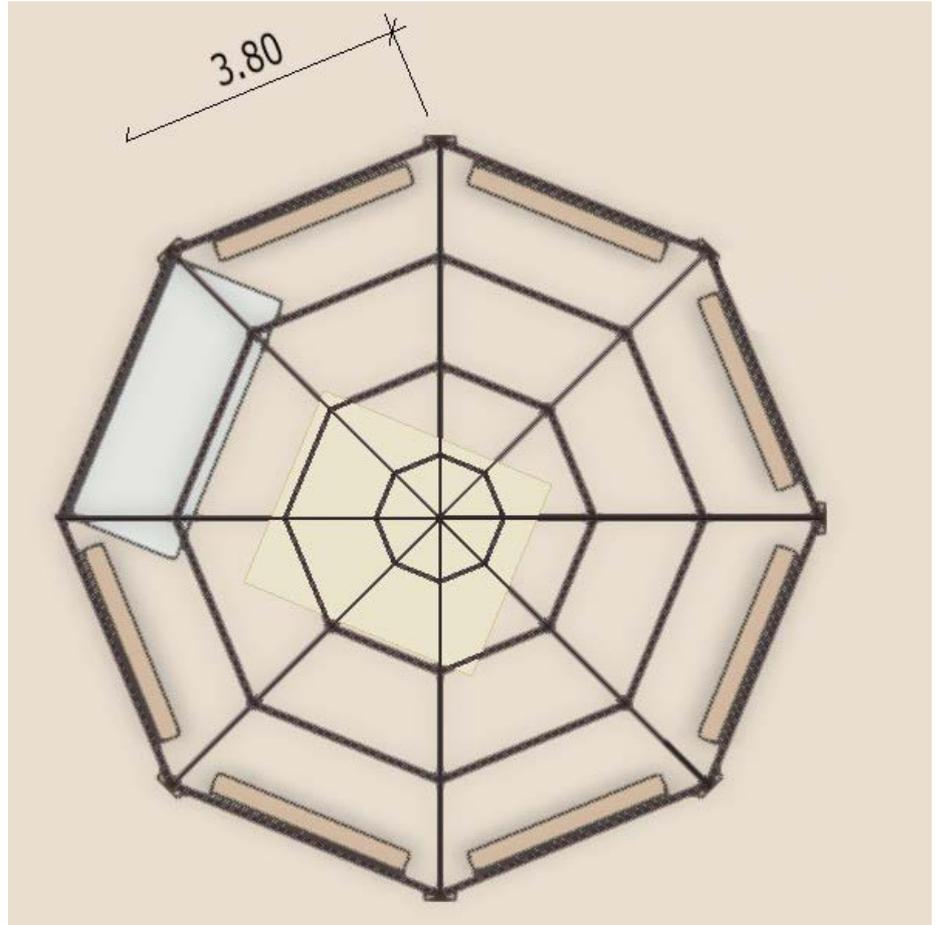
The eight columns are made of compacted stabilized earth blocks.

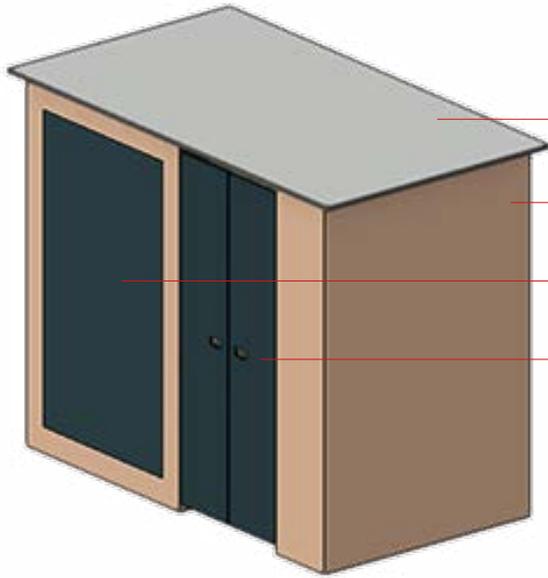
The floor plan is an octagon and measures about 40 m².

The roof structure is made of galvanized steel. The roof should exceed the footprint by at least half a meter.

For support please contact Felix Wenk, head of the civil engineering program at the university of Applied Science OST:
felix.wenk@ost.ch

He will find a student, who accurately measures the structure and determine the connections as part of a term paper.





Corrugated metal roof

CSEB walls

Wall with wall panel paint

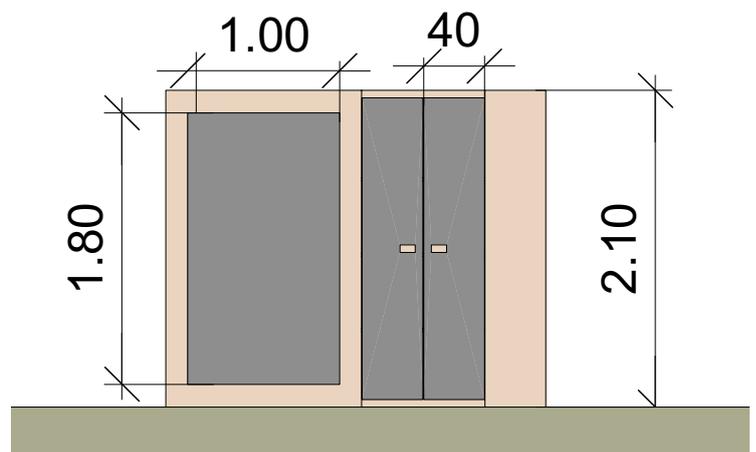
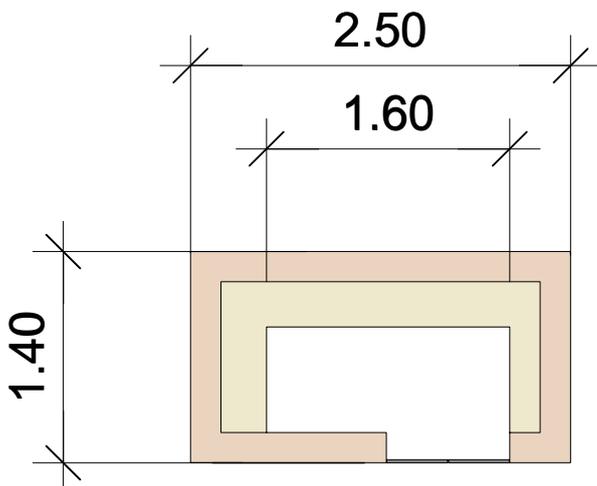
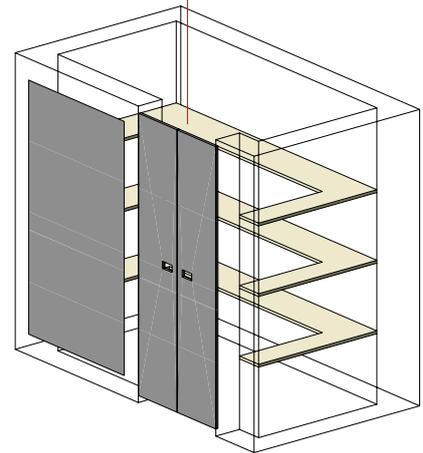
Metal door with lock

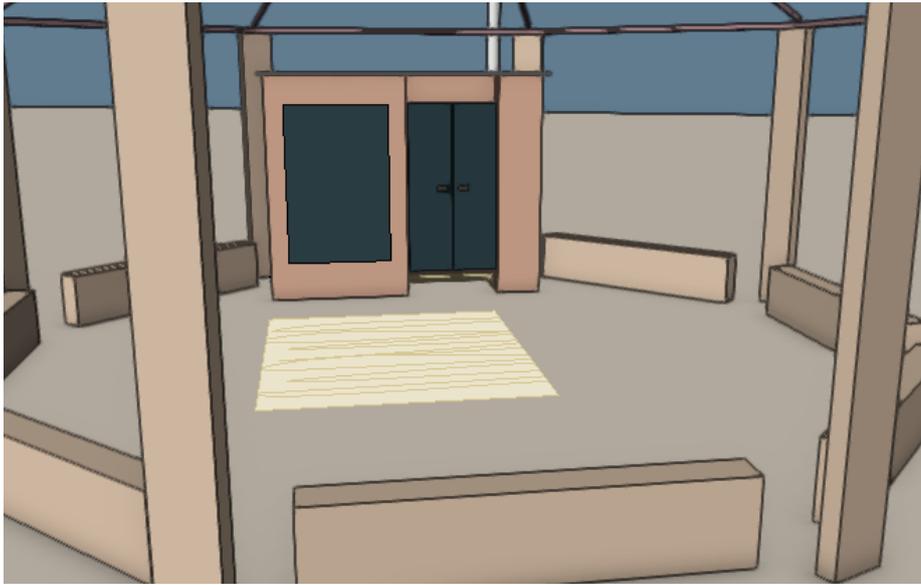
Wooden shelves on three heights

The cupboard is rather large in size, so that it provides enough storage space.

The storage space can be useful for safe keeping of the following:

- textbooks
- a "knowledge" library
- the palm leaf mat when not in use
- utensils for workshops
- any tables and chairs



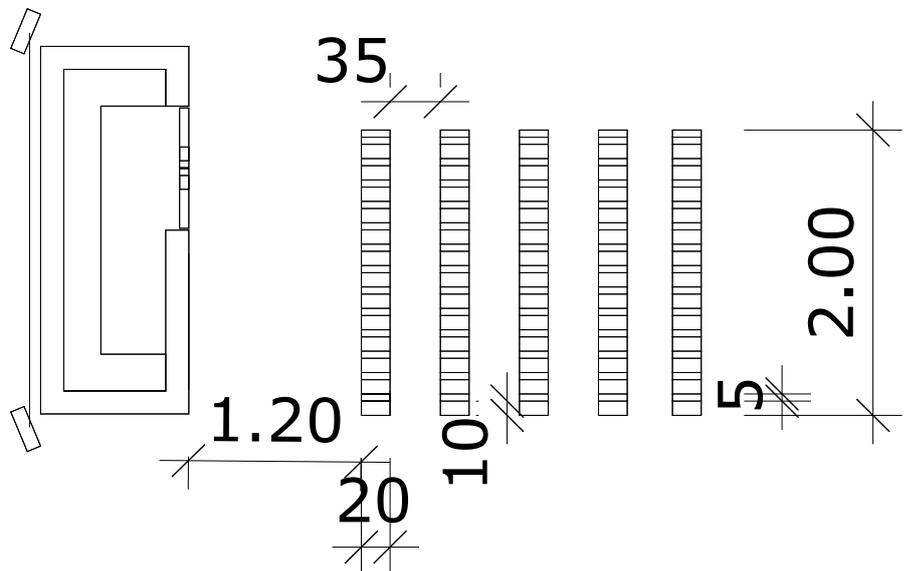
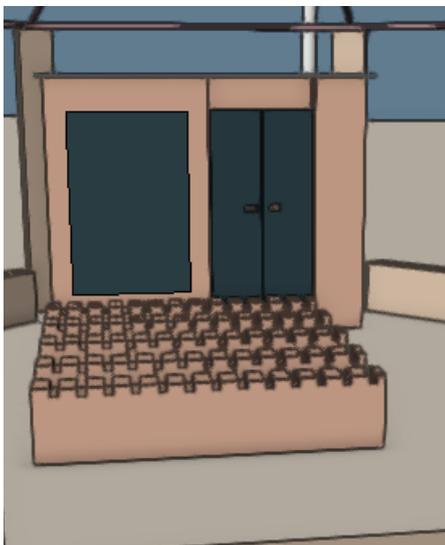
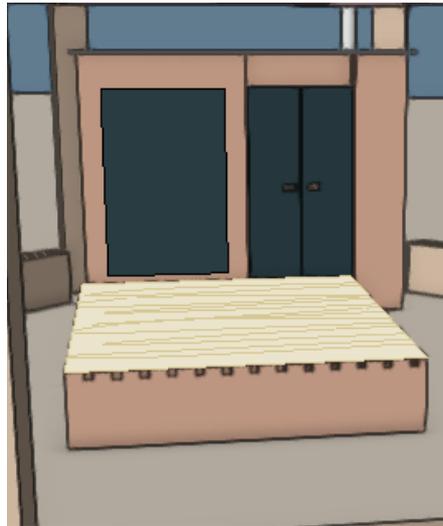
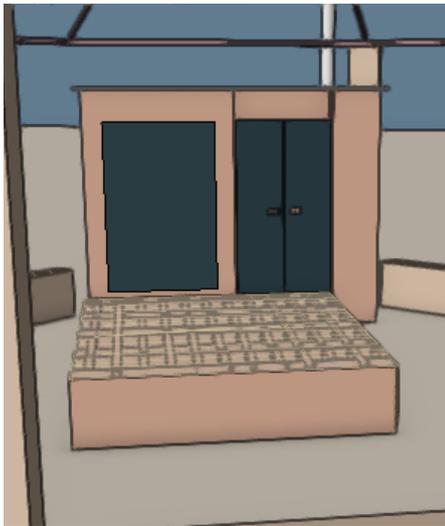


The simplest and plainest variant is that the palm leaf mat is placed on the floor in front of the cup-board with the integrated blackboard.

In the other two variants, the palm leaf mat can be placed on a substructure.

The first of these two variants has a fixed substructure grid made of CSEBs.

In the second variant, several seat walls are built parallel to each other. Each seat wall has many recesses in which poles or something similar can be placed. The palm leaf mat can then be placed on the grid thus created.



In order to establish the TEC as a place of learning and meeting in Tanji, it is important to make the TEC highly visible to the population.

To this end, it would be a good idea to create an eye-catching landmark that towers over the wall.

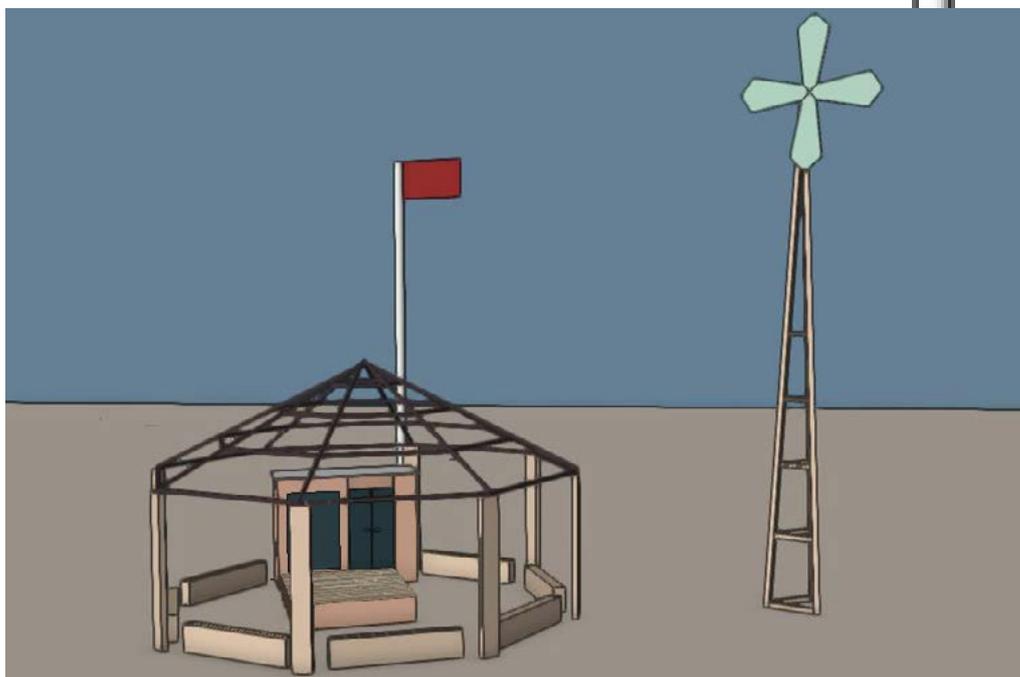
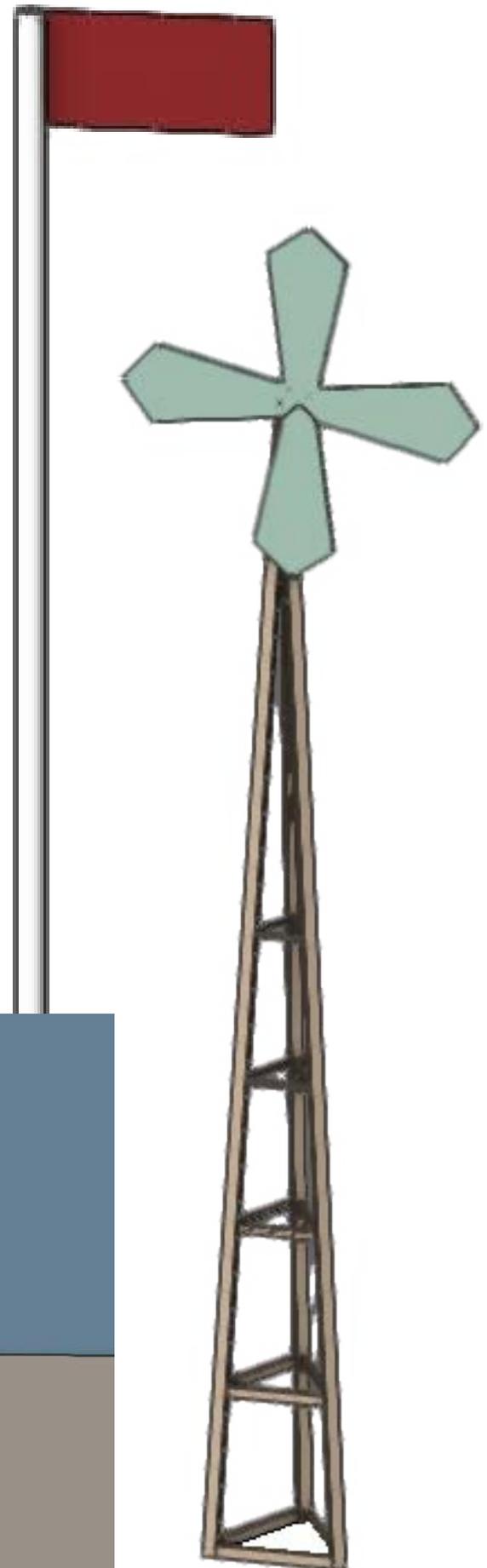
One possibility would be a windmill. The windmill could symbolically generate a small amount of electricity via a generator and power a small device on the ground, such as an air conditioner. The electricity thus generated would be primarily of symbolic value.

It would also be conceivable that the kinetic energy generated by the wind in the air could simply be transferred to the ground. For example, other small wind turbines could be mounted on the ground to be powered by the large wind turbine.

Another option is to mount a flagpole. Flags in different color codes could be raised on the flagpole. The purpose of the flags would be to inform about what is happening at the moment in the TEC (workshop/lessons, classes, etc.).

It is quite conceivable to use both options as landmarks.

By the way, the existing water tanks are perfect for attaching landmarks, art installations, pinwheels, etc. to them.



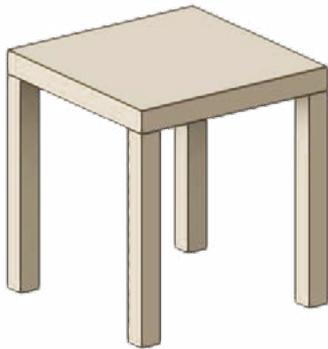


In addition to the four basic elements for a Bantaba that I have suggested, there are now further elements with which the Bantaba could be equipped.

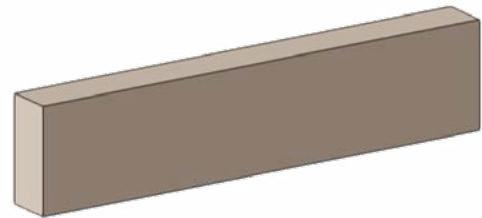
On the one hand, these are chairs and tables, whereby the individual parts of the respective pieces of furniture can be inserted into each other.

On the other hand, seat walls can serve as zoning to separate the inside of the Bantaba from the outside.

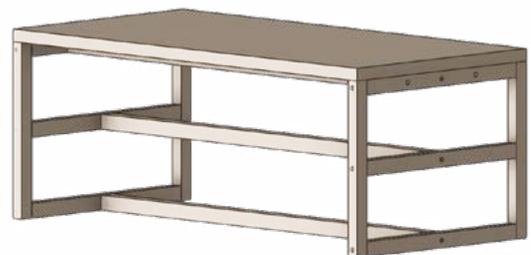
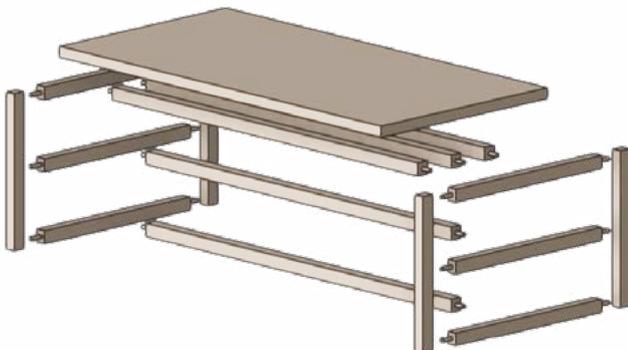
chair



seatwall

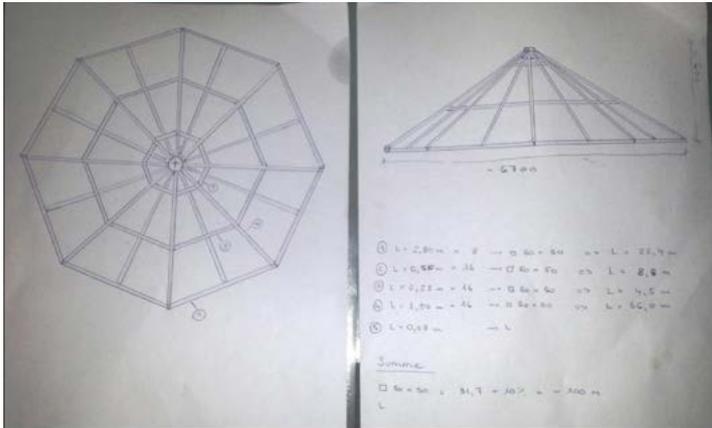


table



A possible positioning of the bantaba on the TEC's property has been marked with a red rectangle in this map. However, it should be noted that the exact and optimal location of a bantaba can only be determined correctly on site.

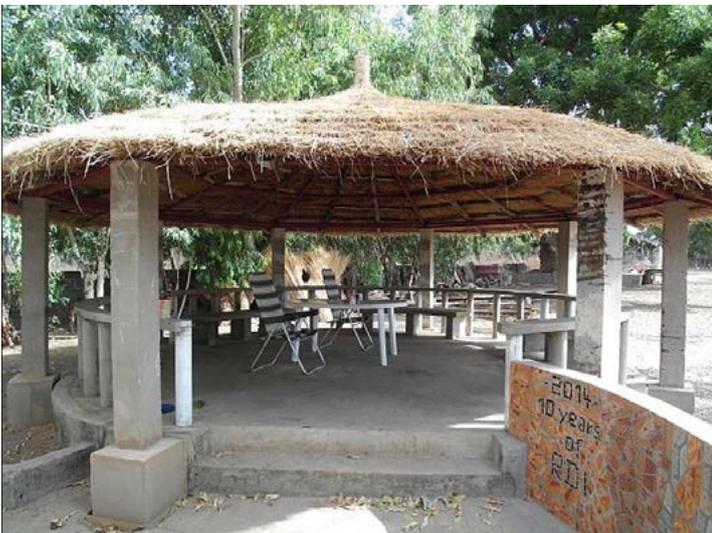




<https://bit.ly/3klFzaG>

The organization Riverboat Doctors International runs a small health centre in Buniadu, The Gambia. They have already implemented a Bantaba with a footprint of about 40 m² on their property. This example serves as further inspiration.

House of Skills is another organization located near the TEC. It trains Gambians in professions such as bricklaying. It is therefore a good idea to contact them and involve them in the construction of the Bantaba.



<https://bit.ly/3klFzaG>



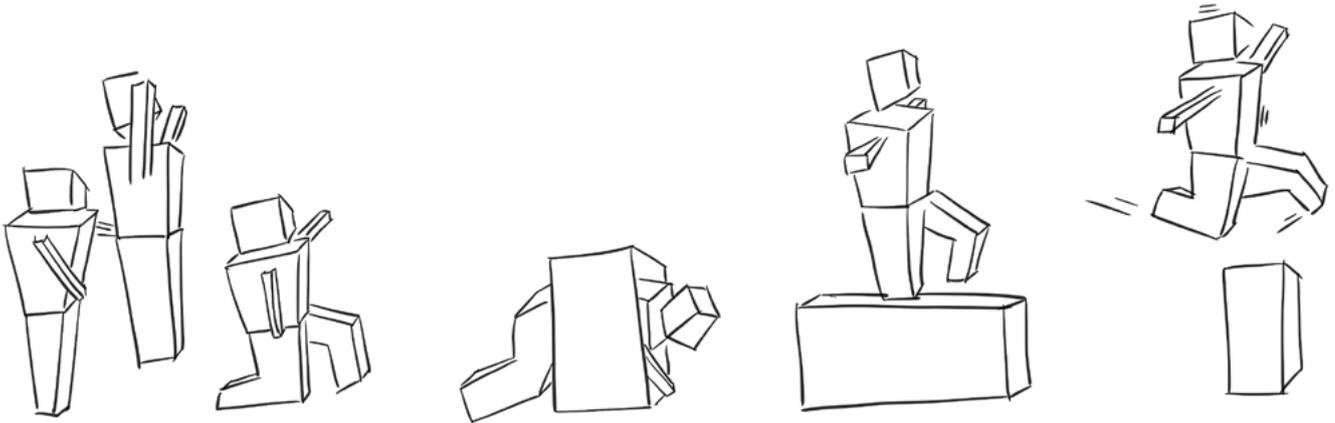
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TEC learning course event

Stefan Enzler

TEC

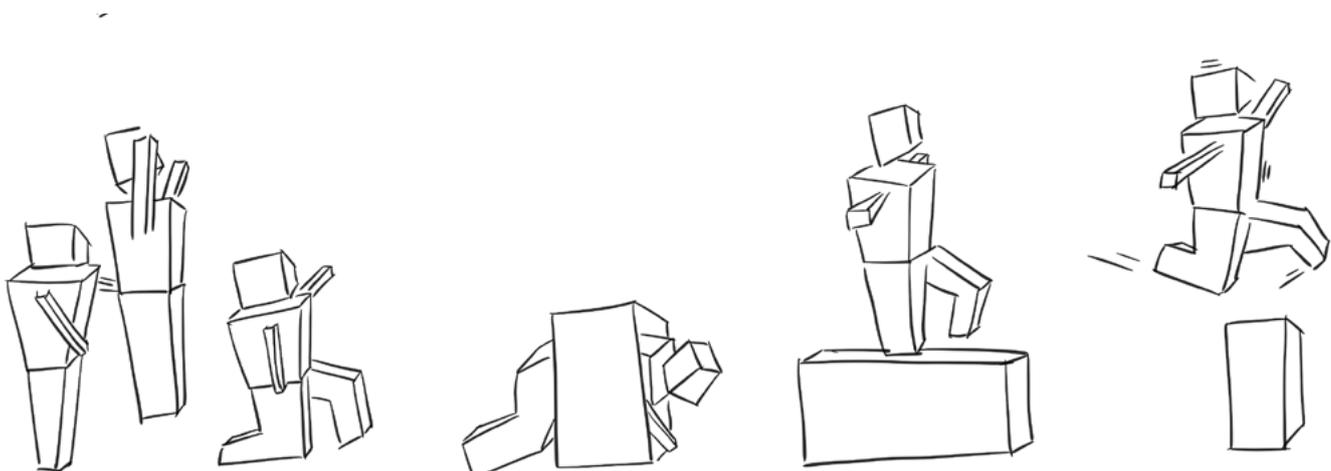
LEARNING COURSE



EVENT

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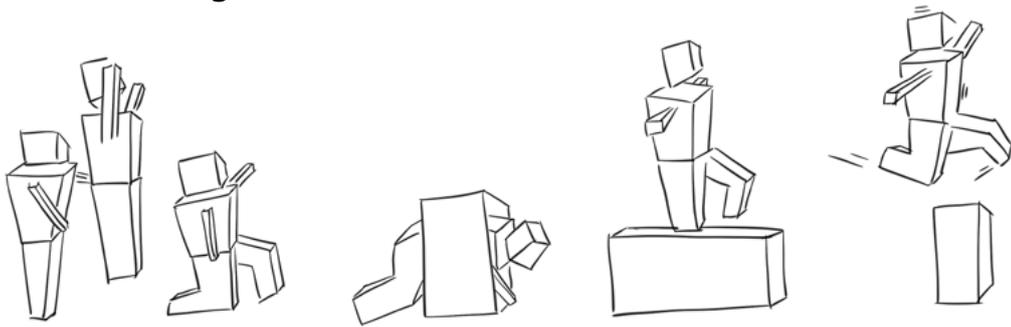


TEC

LEARNING COURSE

→ idea:

- Children learn about the knowledge of permacultur
by solving different tasks inside the TEC area
in kind of a learning course

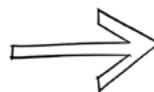
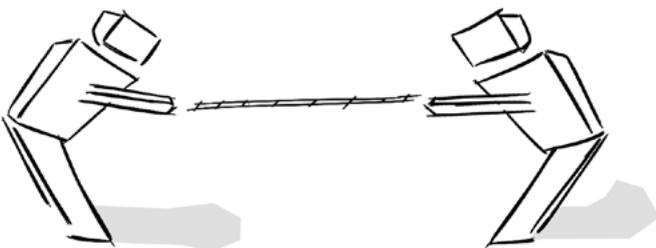


- exercising in motion



highly
motivating
activating

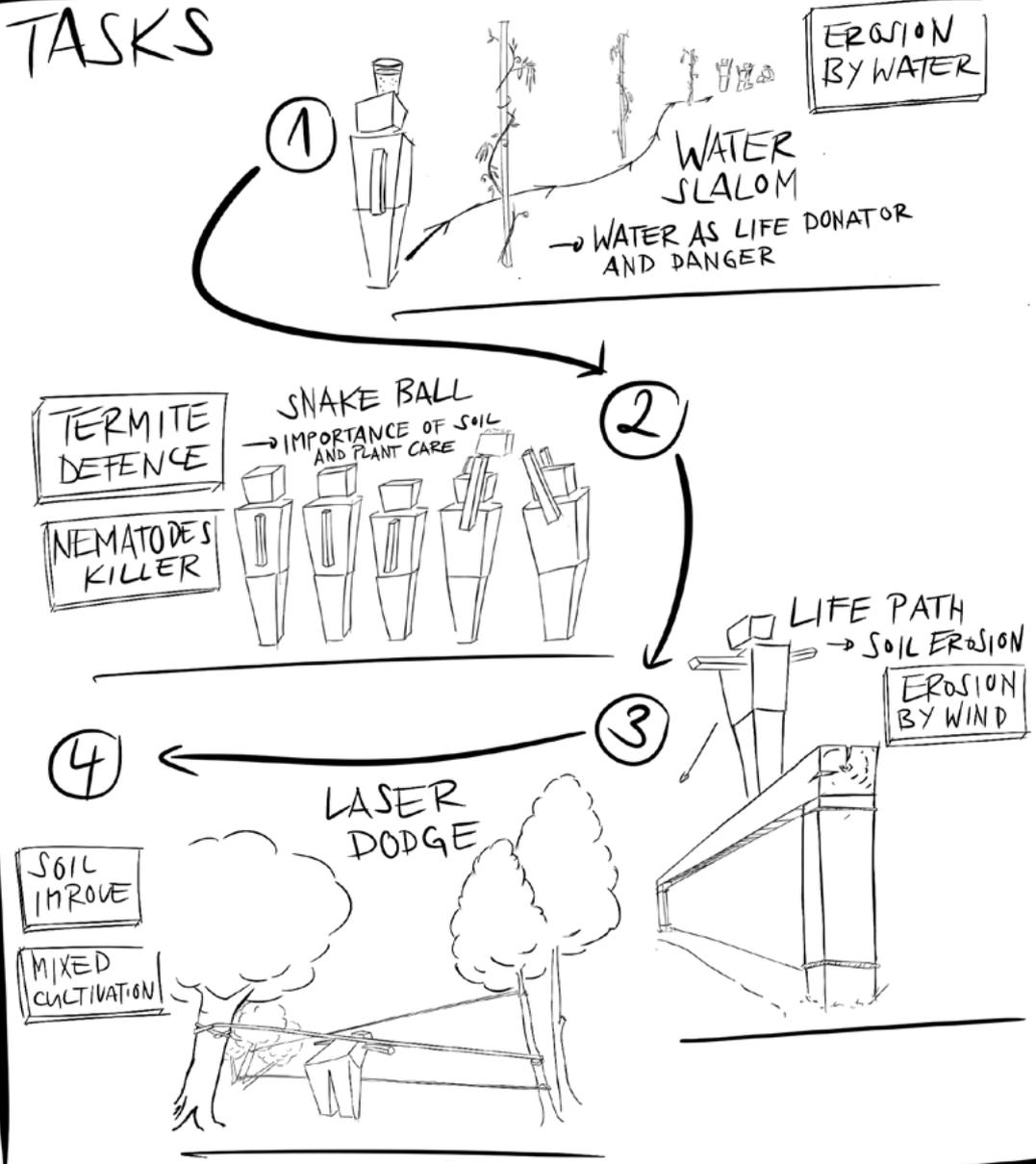
- competitiv situation



COURSE OVERVIEW

1 INPUT PHASE

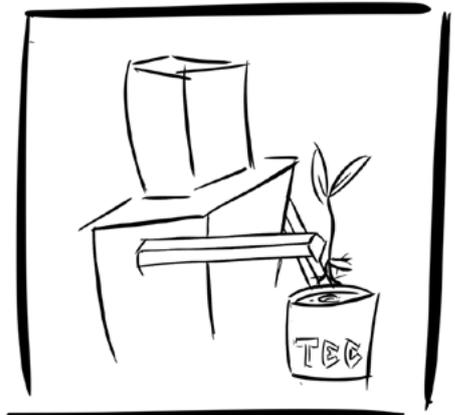
TASKS



2 REPETITION PHASE



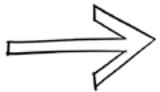
3 INDIVIDUAL PROCESSING PHASE



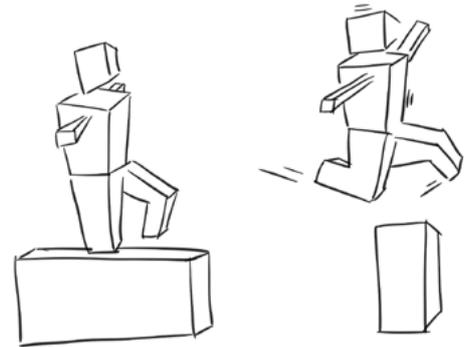
3 PHASES

the learning course event consists of 3 phases

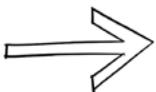
- input phase



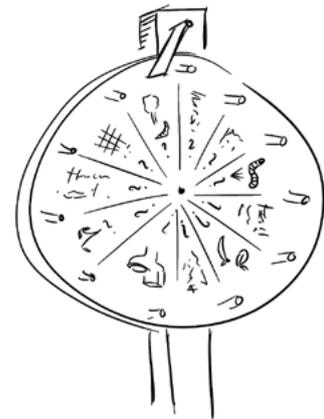
- learning course
- in 2 groups
- > see p.5



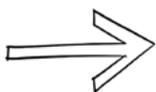
- repetition phase



- wheel of fortune
- all together
- > see p.6



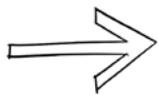
- individual processing phase



- planting a cajanus cajan (can be taken at home as a trophy)
- everybody on it's own
- > see p.7



INPUT PHRASE LEARNING COURSE



- at the beginn of the course
AND bevor each task:

- make sure that the children...

... sit in front of you

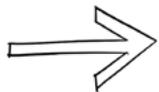
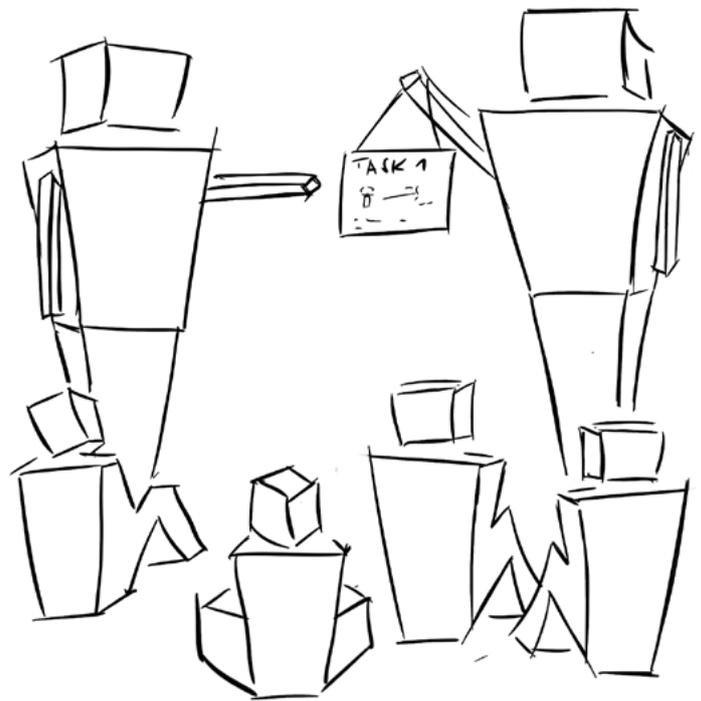
... are quiet

... look at you

- give the instrucion

- let them repeat from
a child

- start the task



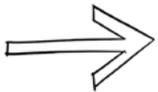
needed:

- at least 2 instructors (better more)

- 2 groupes of children of the same size

- material needed for the task
(see the task instrucion)

REPETITION PHASE

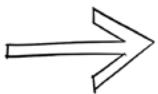


- make sure that the children...

- ... sit in front of you
(in the same 2 groups as in phase 1)
- ... are quiet
- ... look at you

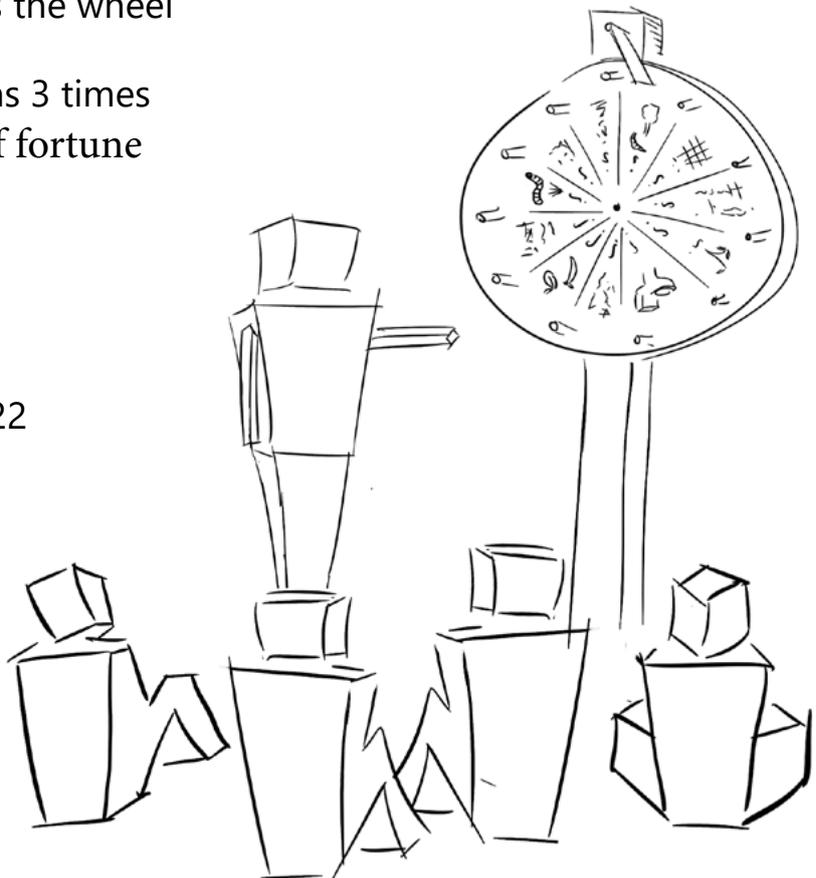
- explain the rules:

- first child turns the wheel of fortune
- the group that first give the correct answer gets 1 point
- next child turns the wheel and so on
- every child turns 3 times the wheel of fortune

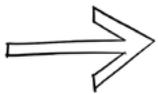


needed:

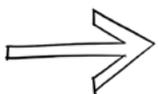
- wheel of fortune
- > see construction manual p. 22
- question / answer catalog
p. 23 / 24



INDIVIDUAL PROCESSING PHASE



- at the end of the event every child plants silencely it's own cajanus cajan applying the knowledge gained during the course and takes it home as a trophy.
- make sure that the children...
 - ... work quietly
 - ... prepare the material they need:



needed:

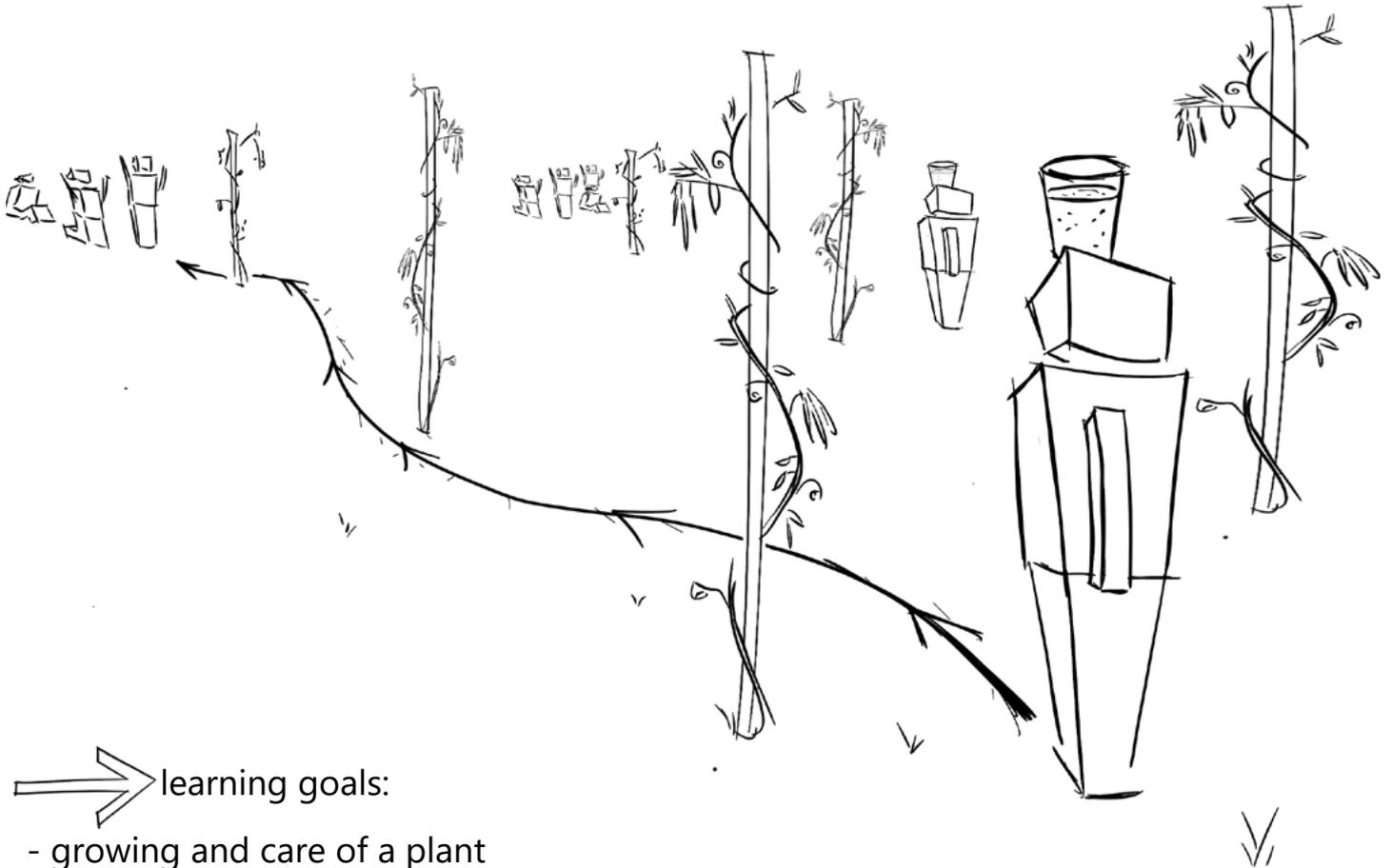
- plant pots, soil, cuttings of cajanus cajan, water



Water Slalom

→ idea:

- by carrying a cup on the head filled with water (exactly the quantity of water a cajanus cajan needs a day for the first month) the children walk/run through a track, in slalom passing the sticks (at least 5 of them) of pole beans.



→ learning goals:

- growing and care of a plant

→ material needed:

- cups, 2 buckets (one with water), sticks, pole beans

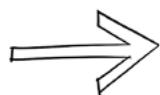
→ rules:

- it's not allowed to stabilize the cup with the hands
- if the cup falls down: kid has to go back to the start, fill the cup again with water and restart.
- the group that finishes first wins / gets a point



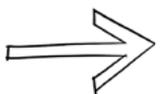
basic learning content, growing and care:

- regular water supply is essential for growing
- too much water can damage the plant
 - > to avoid the drowning of the plant make holes into the nursery bags or make sure that the water can flow away through a hole in the bottom of the plant pot



remember the children:

- as every living creature plants need water to live in many cultures and religions water is a kind of holy thing
- with sunlight, oxygen, water (and some nutrients in the soil, e.g. nitrogen) plants build their "bodies" (plant structure)



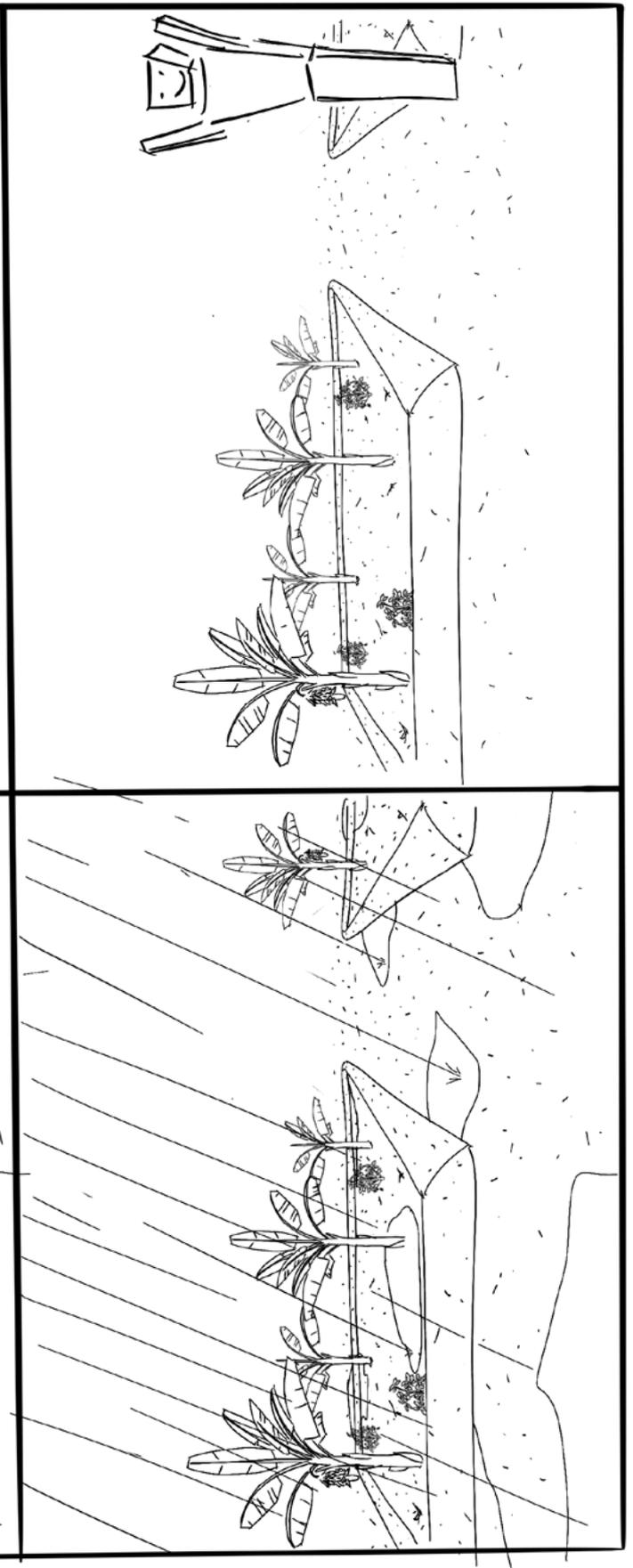
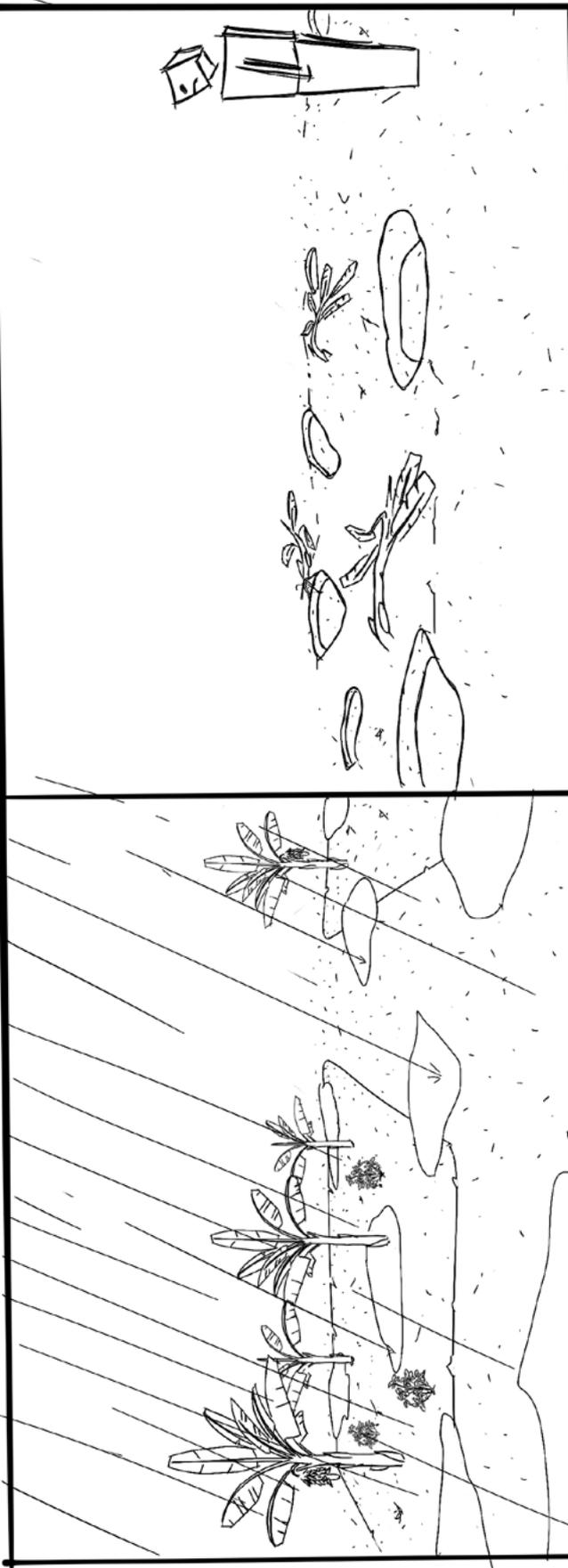
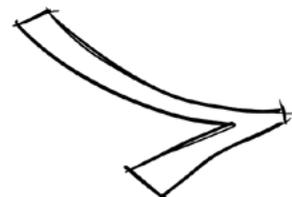
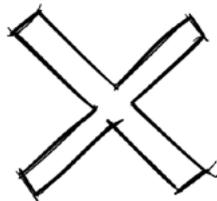
Fairy Tale:

Give some life - Fairy tale from North Africa

Once upon a time there was a severe drought in an area south of the Sahara. The steppe grass wasted away, the animals couldn't find no more water, the desert was constantly advancing. Even thick trees faced their end.

The wells and rivers had dried up a long time ago. Only a single flower survived the drought. She grew up near one tiny source. But the source was also close to despair and said: "Why am I struggling because of this single flower, where everything around is already dry?" Then an old tree bent over the small spring and said before it died itself: "Dear little spring, no one expects you to make the whole desert green. Your task is one to give life to a single flower, nothing more."

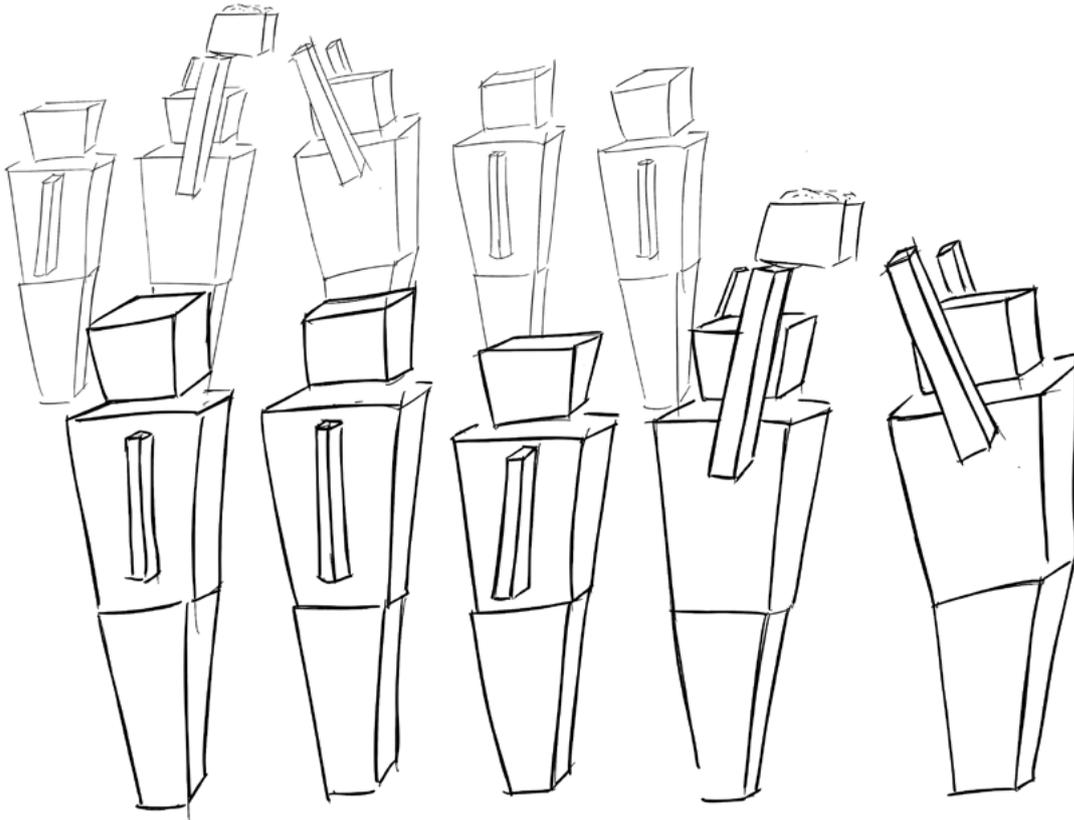
EROSION BY WATER



Snake Ball

→ idea:

- children give a bucket of soil (exactly the quantity of soil a cutting needs to be planted in a pot) over the head from one to the other forward and back again.



→ learning goals:

- growing of plants, valuable soil

→ material needed:

- 2 small buckets filled with the quantity of soil a cutting needs to grow
- soil for eventually refill

→ rules:

- if the cup falls down: kid has to go back to the start, fill the bucket again with water and restart.
- the group that finishes first wins / gets a point

➔ basic learning content, growing and soil:

- the soil has 2 important functions to the plants
 - > provider of nutrients as Nitrogen (N), Phosphorus (P), Potassium (K),
in a way comparable to the vitamins we need,
we obtain these vitamins in particular from fresh
fruits and vegetables
 - > the plant is anchored in the ground

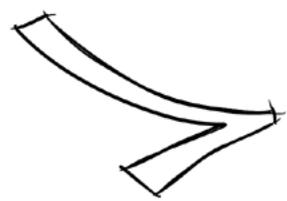
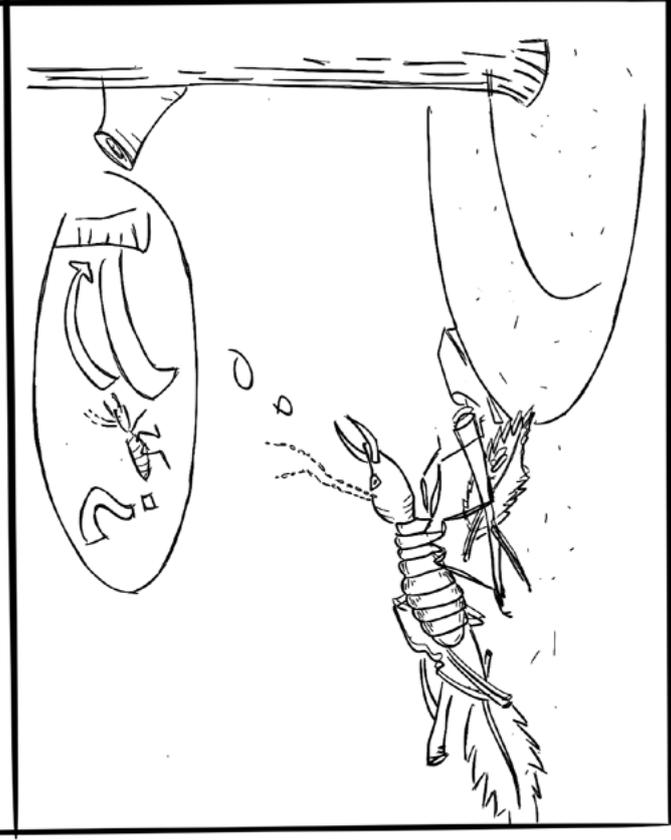
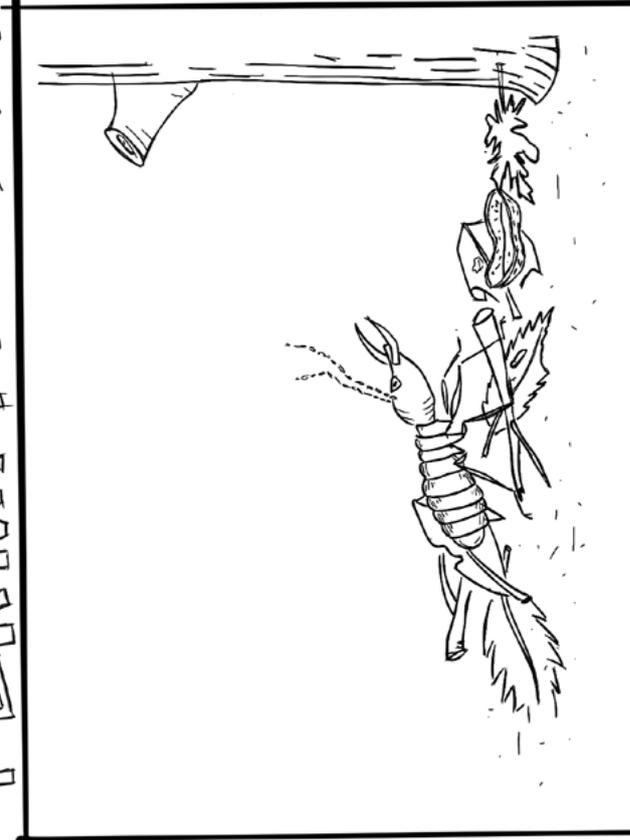
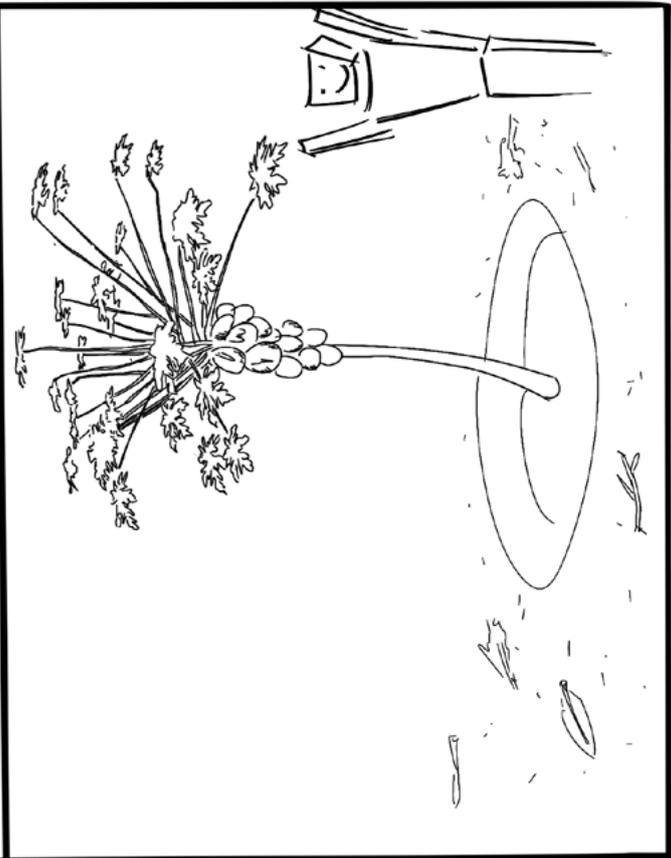
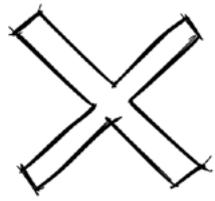
➔ remember the children:

- soil rich of nutrients is a very valuable good
- the bigger the plant the more soil it needs to for
optimal growth

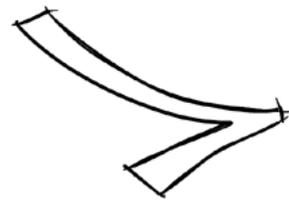
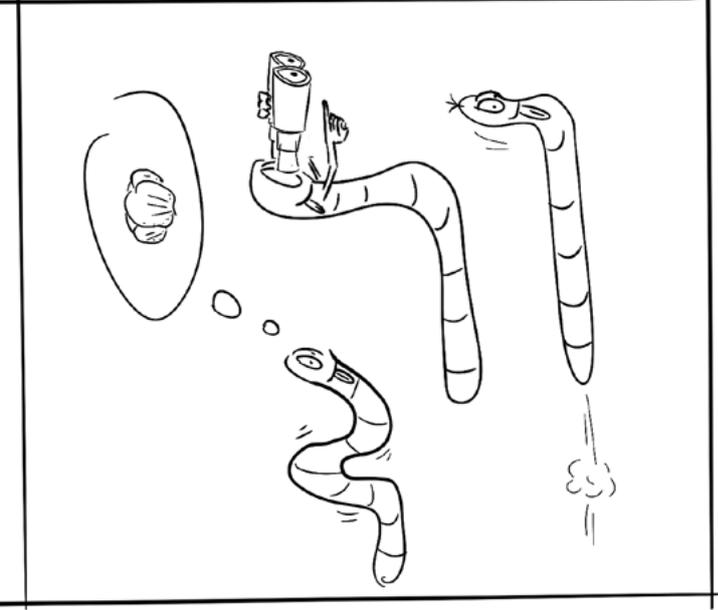
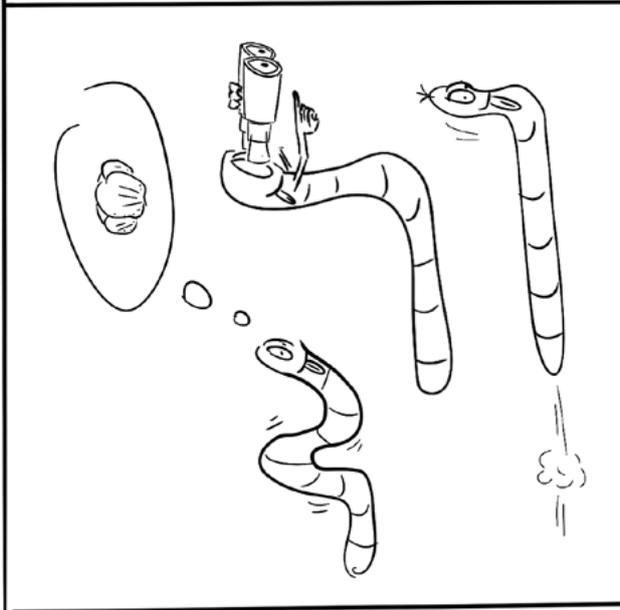
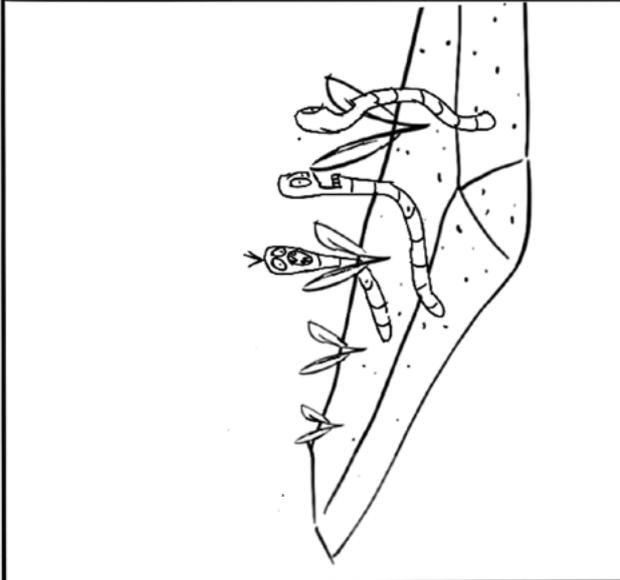
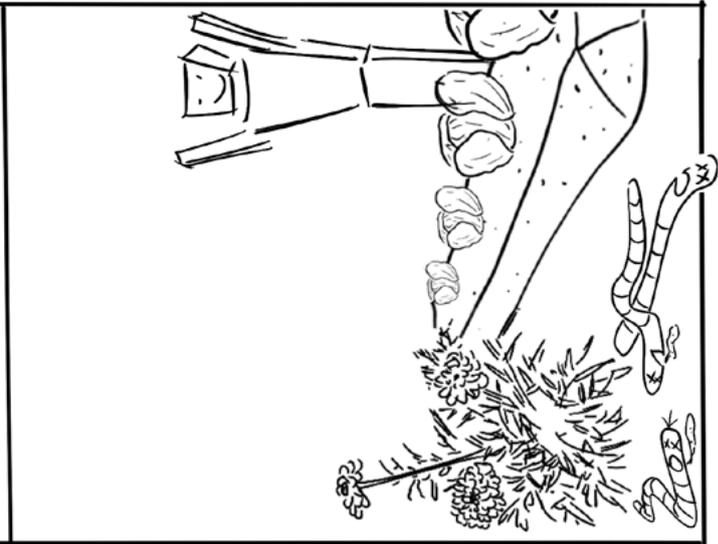
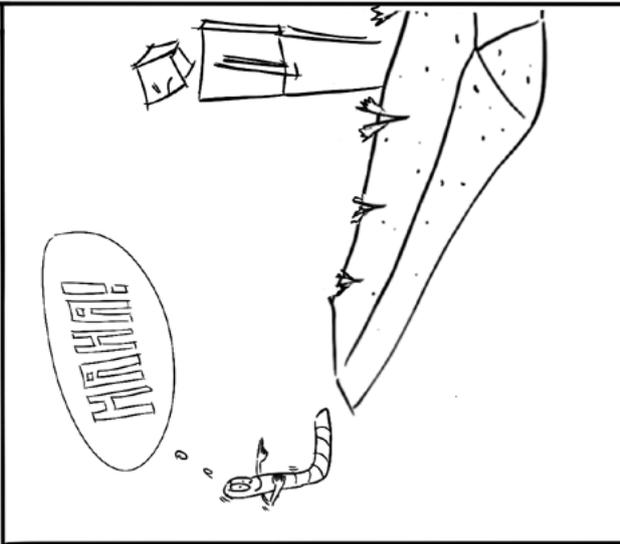
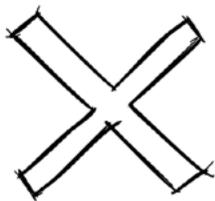
➔ importance of soil / earth in the past:

- we know that ancient civilizations had gods which were
a symbol for fertility of the soil and earth (people's
lives depended - and still depends on the fertility of
the soil)
- > indigenous peoples of South America as Incas, Aztec
and Mayans had a god called "Pachamama" (Mother
Earth)
- > neolithic people all over the world had a god in
form of a huge woman (see Venus of Willendorf or
similar)

TERMITE DEFENCE



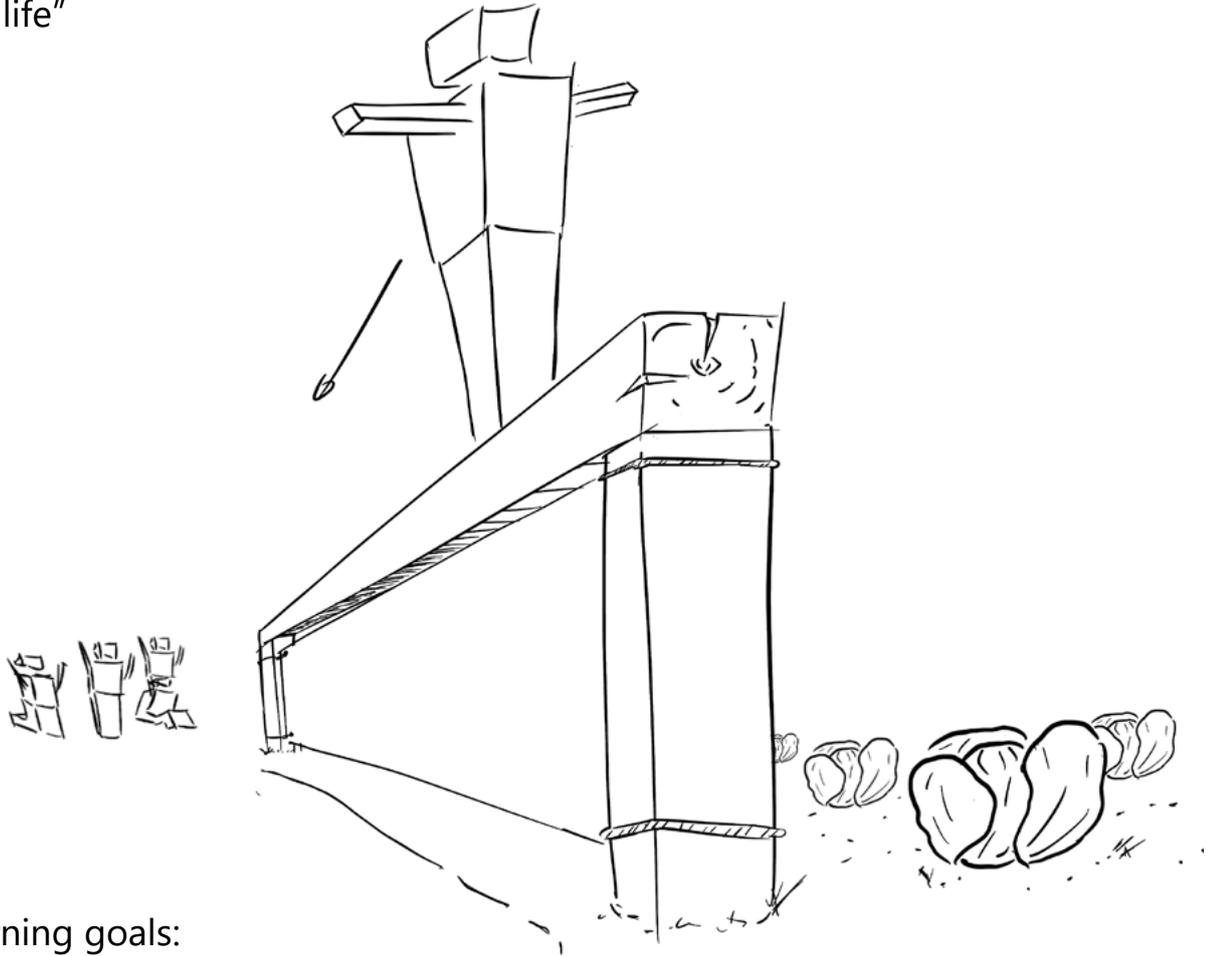
NEMATODES KILLER



Life Path

→ idea:

- children balance over a windbreak fence, without falling down, next to vegetable patches
- if they fall down, they "lose their life"



→ learning goals:

- soil erosion and how to avoid

→ material needed:

- windbreak fence, vegetable patch, that has to be sheltered from the wind

→ rules:

- if a child falls down, it has to go back to the beginning and restart the exercise
- the group that finishes first, gets a point

➔ basic learning content, erosion by wind:

- hot and dry winds can damage plants
 - > wind dries out leaves, and stresses the plant
- strong winds can erode the soil
 - > result: - lost of soil means a lost of the basic nutrients and anchoring of the plants
 - exposure of roots results in death of plant

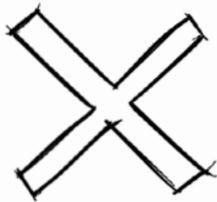
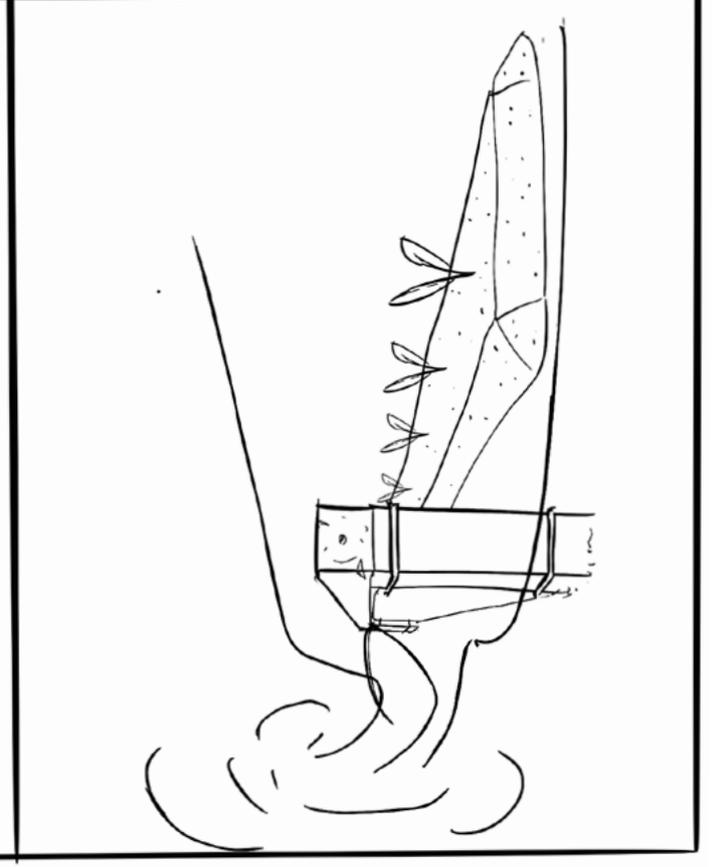
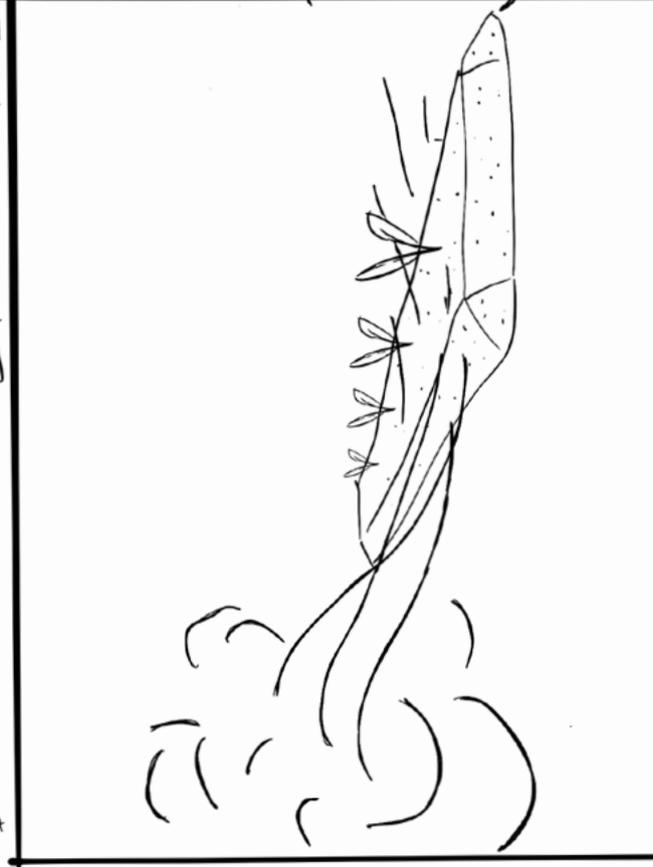
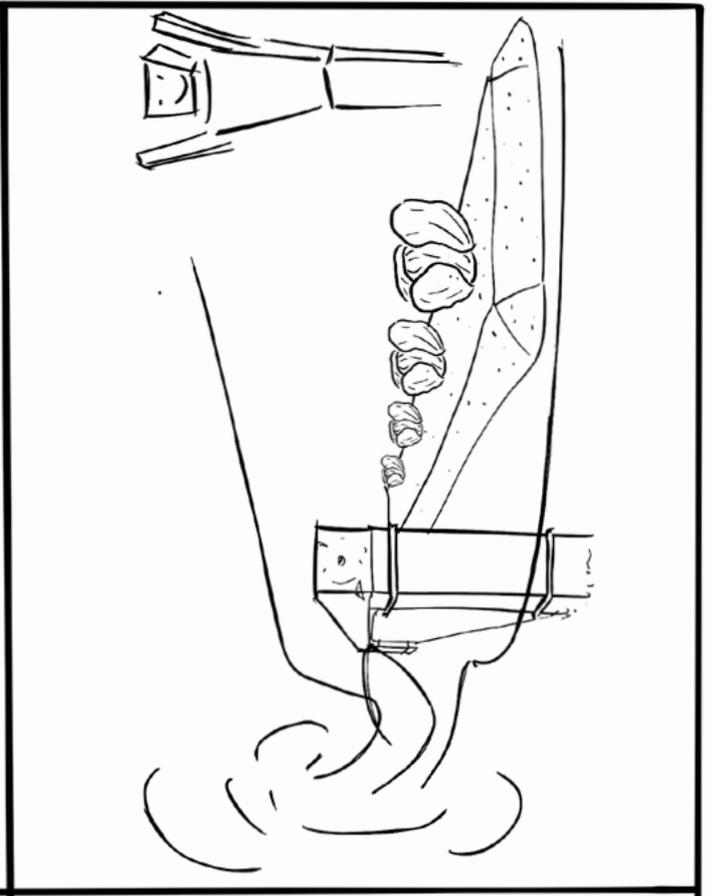
➔ remember the children:

- as every human loses moisture by inhaling and exhaling and through our skin, plants loses moisture over their leaves
- the mecanisme to transport water through the plant is called evapotranspiration

➔ Myths and tales:

- crocodiles appear in many Gambian folk tales
 - > tell some stories
 - e.g. Mandinka stories of the crocodile in the moon
 - > kidsaretheworld.com/the-crocodile-a-recurring-image/
 - the Bojang family of Kachikally
 - > wikipedia.org/wiki/Kachikally

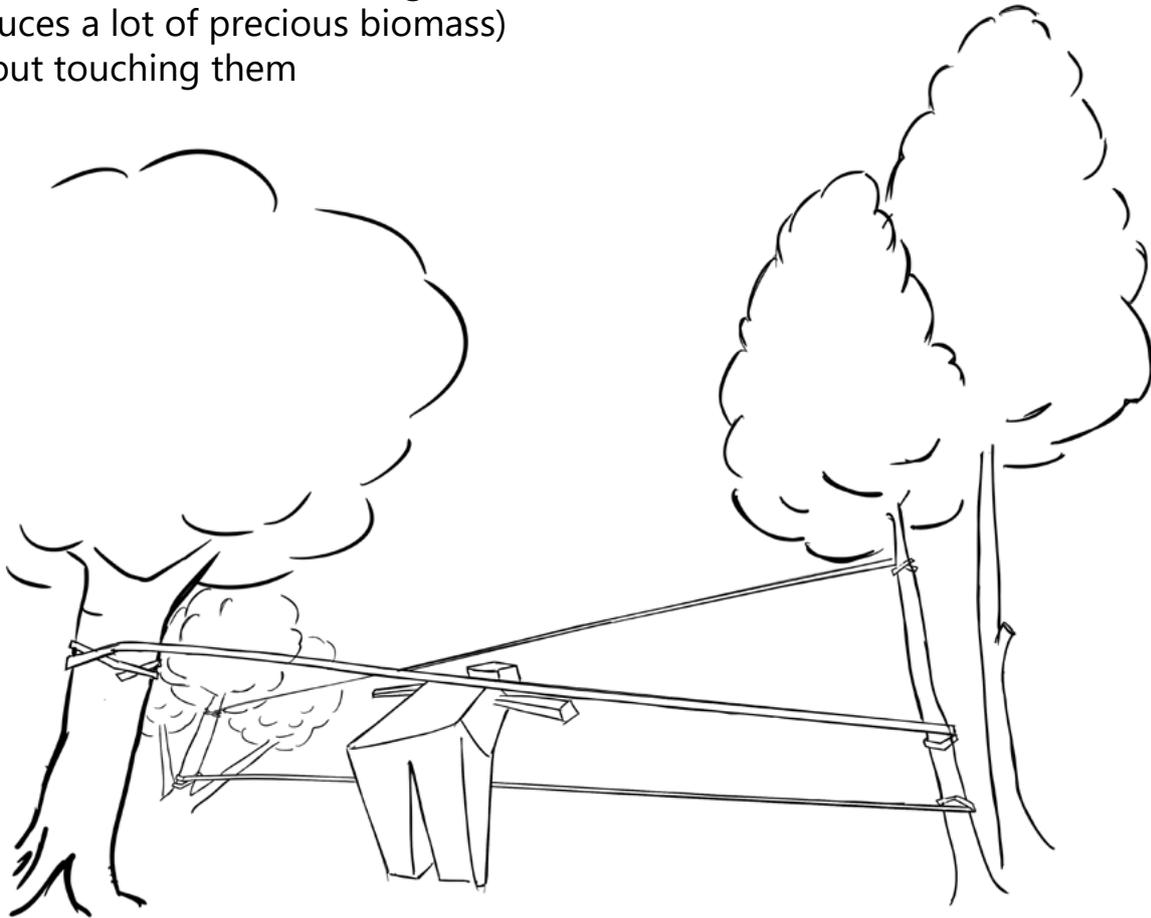
EROSION BY WIND



Laser Dodge

→ idea:

- children go through a jumble of belts tensioned between the trees (Delonix regia -> produces a lot of precious biomass) without touching them



→ learning goals:

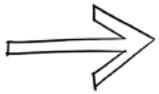
- soil improvement

→ material needed:

- Trees (e.g. Delonix regia)
- belts attached to the trees and their branches

→ rules:

- if a child touches a belt, it has to go back to the beginning and restart the exercise
- the group that finishes first, gets a point



basic learning content, soil improvement:

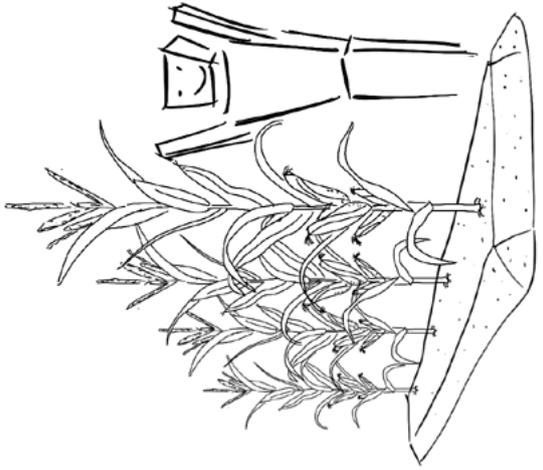
- to have a nutrient rich soil on the one hand you have to protect it against erosion but on the other hand you have to give him nutrients back
- > enrich the soil regularly by putting mulch, comopost and compost-tea on the ground
- compost
compost-tea: basically all organic materials can be used; organic waste like leaves, bushes or unused vegetables and fruits
 - > contains lots of important nutrients
 - > acts as a fertilizer

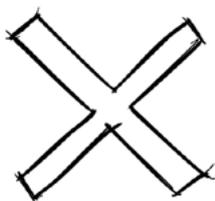


how to compost:

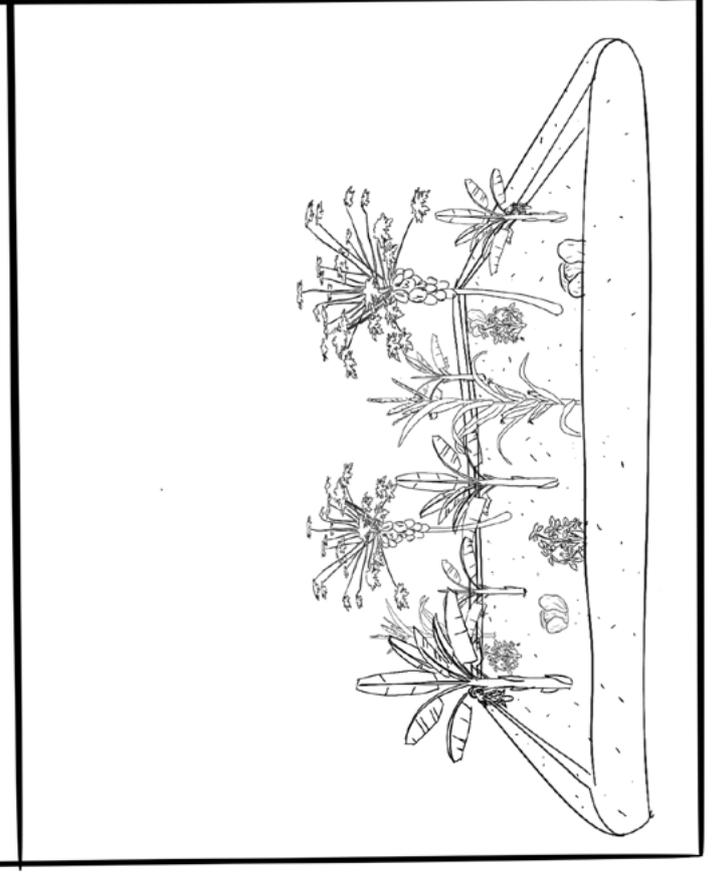
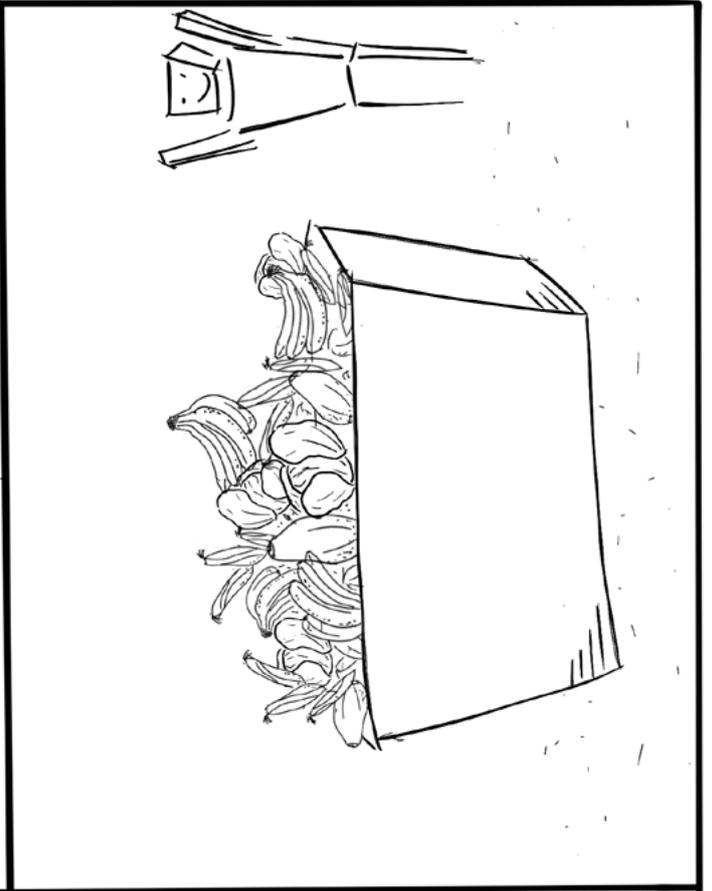
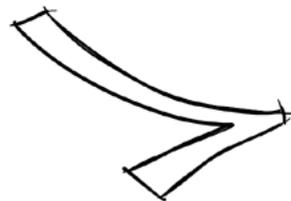
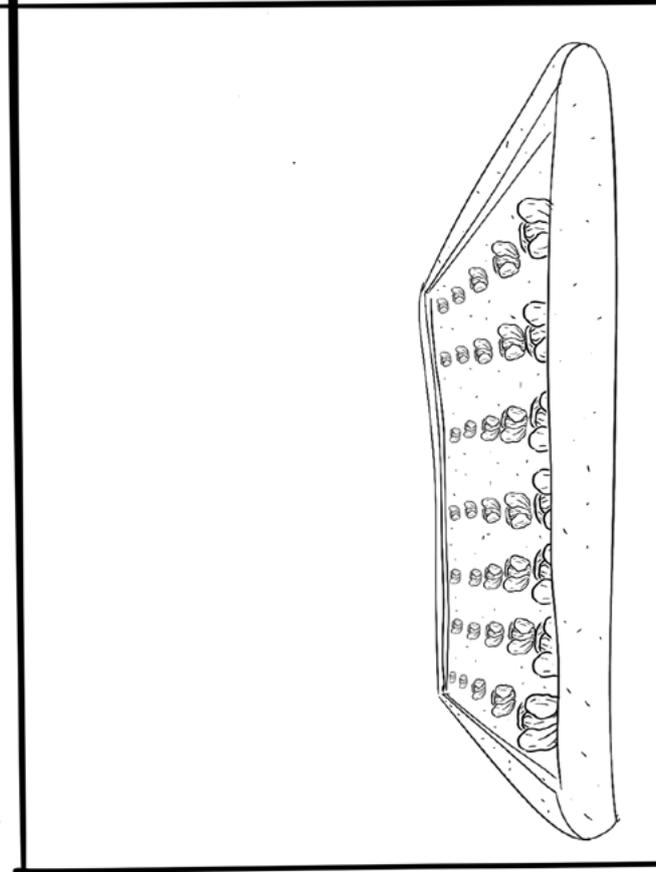
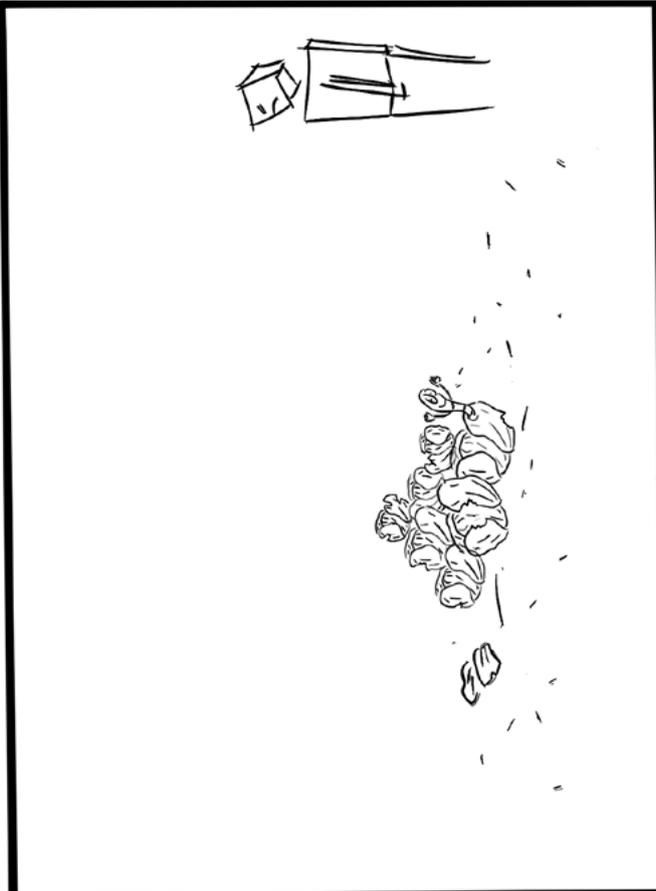
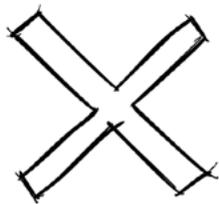
- compost:
 - 1] gather organic waste to form a pile
 - 2] keep the pile moisturised
 - 3] turn it around with a shovel every few days
- compost-tea:
 - 1] furl organic waste in a fabric
 - 2] fill a bucket with water and put the furlled fabric in
 - 3] let it 'brew' for 2 days

SOIL IMPROVEMENT

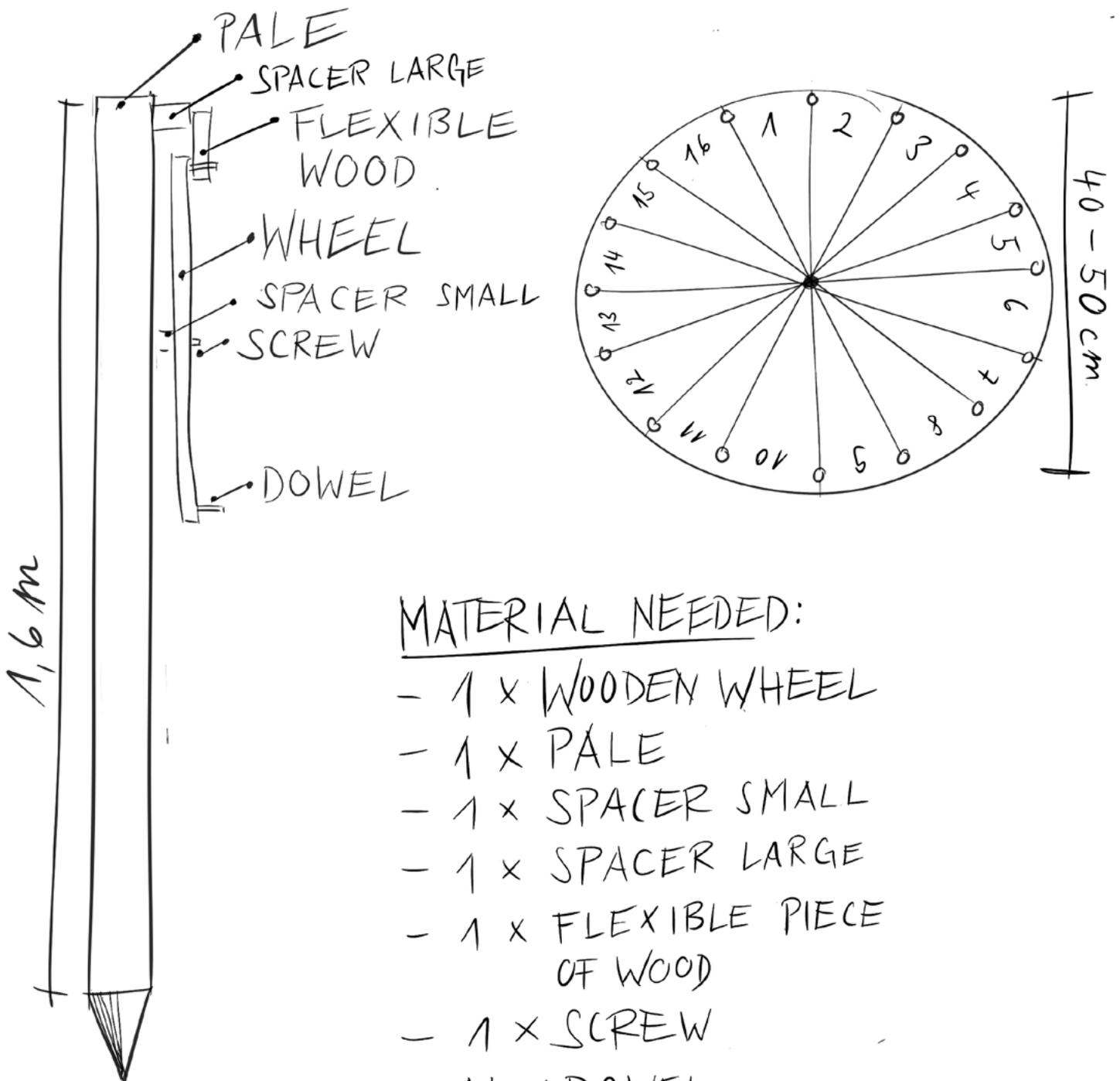
	
	
	



MIXED CULTIVATION



WHEEL OF FORTUNE



MATERIAL NEEDED:

- 1 x WOODEN WHEEL
- 1 x PALE
- 1 x SPACER SMALL
- 1 x SPACER LARGE
- 1 x FLEXIBLE PIECE OF WOOD
- 1 x SCREW
- 16 x DOWEL

Questions concerning Wheel of Fortune

- 1] What is the name of the 'nematode-killer plant?
-> Tagetes
- 2] Show us a Tagetes plant in the TEC garden.
- 3] Nitrogen: What is it, what does it in plants?
-> It is a nutritional element for plants as for us e.g. protein. Without nitrogen plants can not grow.
- 4] How do plants get nitrogen?
-> They absorb it from the soil via the roots and distribut it throughout the plant.
- 5] Why is mix-culture better then mono-culture.
-> Mix-culturing give a better harvest than mono-culturing.
- 6] Which plants fix nitrogen in soil?
-> Pigeon peas (e.g. cajanus cajan) and beans.
- 7] How do you avoid soil erosion by wind?
-> Build a windbreaker: plants or windbreak fence.
- 8] How do you avoid soil erosion by water?
-> Build small walls (soil banks) around a plant patch.
- 9] How do you keep termites away from living wood?
-> By keeping the mulch away from the tree.

medical plants at TEC

Janette Spörri

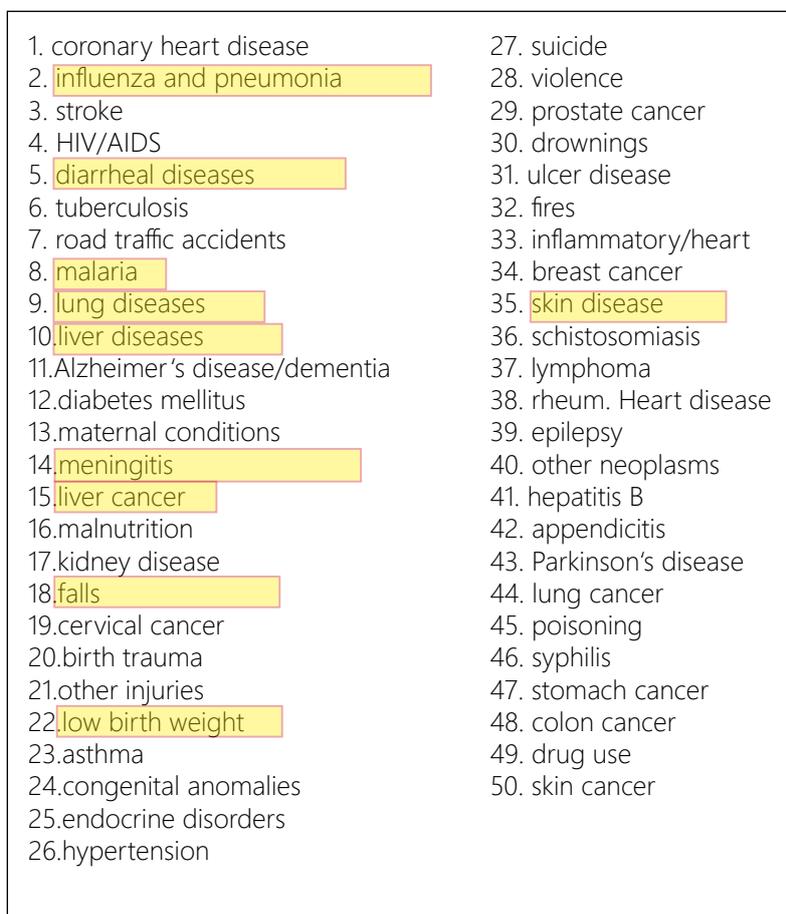
This chapter shows conceptually how medical plants can add value to people's health. The following pages contain basic ideas and concepts but no specific instructions on how to create a drug.

What are medical plants?

Medical plants are plants with a medicinal effect. They can soothe diseases and their symptoms and, depending on the disease, also cure them. However, it is important that they are an additional and cost-effective alternative to conventional medicine and don't replace it!

In West Africa physical integrity is very directly associated with the ability to work and earning money. Health is the prerequisite for providing the family with sufficient food. Also when you're sick you'll need fast, inexpensive and effective treatments, which medical plants can to a certain extent provide.

Causes of death in The Gambia - WHO data 2018



On the one hand, these data show how important it is to contribute to a better healthcare system, especially in developing countries. On the other hand, they also show that improvements in the treatment of just a few diseases can bring lower death rates substantially.

Goal

Offer medical assistance at TEC

Opportunity

More people come into contact with TEC, thereby increasing word of mouth Advertising. There is a greater opening of the TEC to the community at large.

Goal

Medical access for all

Opportunity

Low-income people should also be provided with medical help. Non-monetary financing could be based on a barter-type collaboration at the TEC. An indirect platform for the knowledge transfer of permaculture and the ideas of the TEC would be conceivable.

Goal

Establish education centre for medical plants

Opportunity

A further knowledge transfer and help to self-help can be offered. In workshop's everything from planting, to care, to processing and use is taught. Community building is supported.



Collector of medical plants, Mali

Source: Prof. Dr. Oskar Schimmer, Naturhistorische Gesellschaft Nürnberg, Die Verwendung traditioneller Gift- und Heilpflanzen in schwarzafrikanischen Gesellschaften-Ein Streifzug durch die ethnomedizinische Forschung

Goal

Expand nursery with medical plants and sell them

Opportunity

Buy the plants from the TEC and apply new knowledge in private gardens. Plant sales could help to cover operational costs of the TEC.

Goal

Medicinal plants fit into the existing permaculture system

Opportunity

The current permaculture system is complemented by medical plants and offer further opportunities for optimization.

Goal

Establish a show garden with medical plants

Opportunity

By means of a show garden, additional knowledge transfer and use can take place. Some of the most important medicinal plants are concentrated in one place and labelled and can thus be a helpful contribution to workshops. A show garden could also be attractive for tourists.

Goal

This knowledge could be used to support women in a targeted manner and enable them to earn their own living

Opportunity

Women in West Africa play a central role in family dynamics. With this knowledge, they can easily and quickly provide their families with medical care or sell the medical plants at the market.



Source: Prof. Dr. Oskar Schimmer, Naturhistorische Gesellschaft Nürnberg, Die Verwendung traditioneller Gift- und Heilpflanzen in schwarzafrikanischen Gesellschaften-Ein Streifzug durch die ethnomedizinische Forschung

1. Find and hire a suitable person who already knows about medical plants and local/traditional herbal medicine. (Similar to Mamadou Baldeh)

- Plants often have symbolic and spiritual meaning
- Diseases have a mystical basis --> are associated with disorder in the spirit world, with witches and sorcery

This is why it is vastly important to have a good and local mediator.

About gambiafriends.ch:

They already have a school that trains alternative practitioners. However, they have a focus on homeopathy. They also want to establish and maintain a medicinal herb garden, a small pharmacy and a consultation centre for traditional herbal applications. Here, too, there is potential for a lively exchange, where both organisations could help each other.



- An experienced herbalist, Salieu Puye, has been accompanying gambiafriends.ch for a long time.
- They offer excursions where they look for plants and identify them.
- Students learn basic knowledge about traditional herbal medicine and its possible applications (but with a focus on homeopathy)
- Salieu Puye is also the vice president of the Gambian Association for Traditional Medicine, this would be an interesting and promising contact.
- Teacher and 'herb man' Momodou Colley also teaches at gambiafriends and could also be an interesting connection.



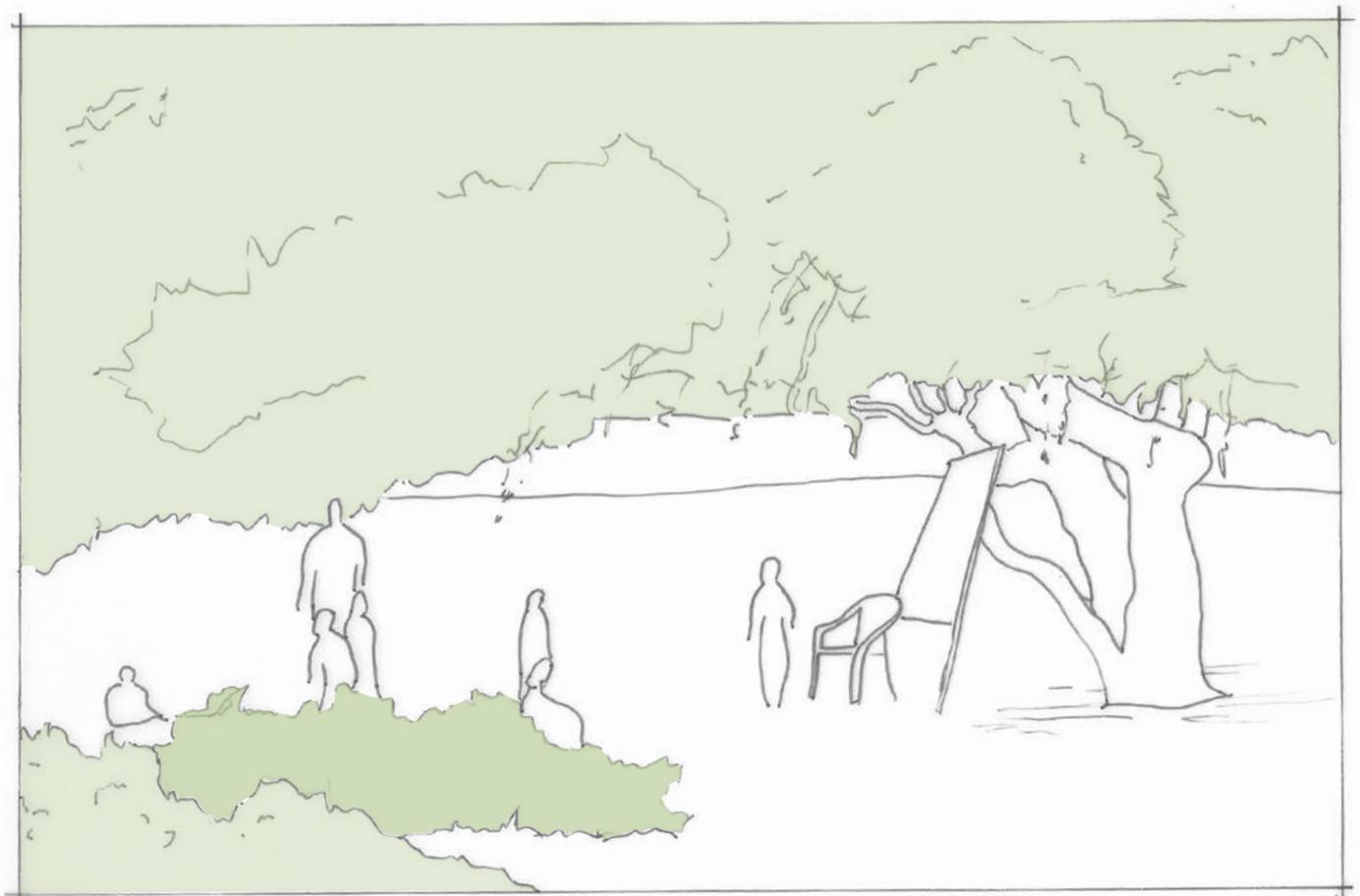
2. A platform on the TEC site, which provides space for the workshops and necessary utensils.

- Ideally, Jael Germann's platform could be used as a space to host.
 - Her design of the Bantaba is perfectly suited, it offers:
 - ° protection from the weather during the workshops
 - ° a big cupboard to store all the needed utensils
 - ° a wall that functions as a blackboard
 - ° tables and chairs

The workshops could also take place under the cool shade of the mango trees. However, there would need to be storage space for:

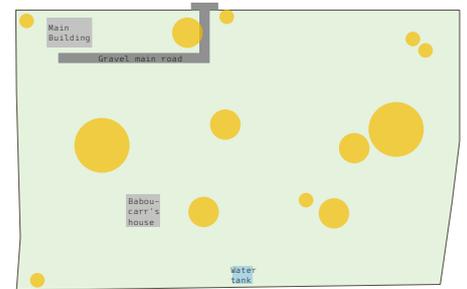
- Chairs
- (Folding) Tables
- Blackboard
- Pots
- Mortars
- Glass jars
- Paper
- Pens

Or a utility-case would also suffice and would be more convenient.



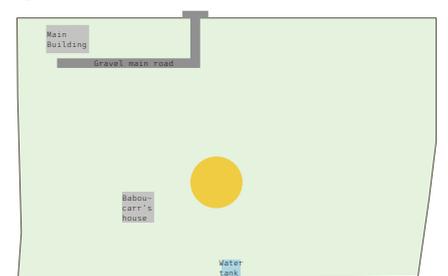
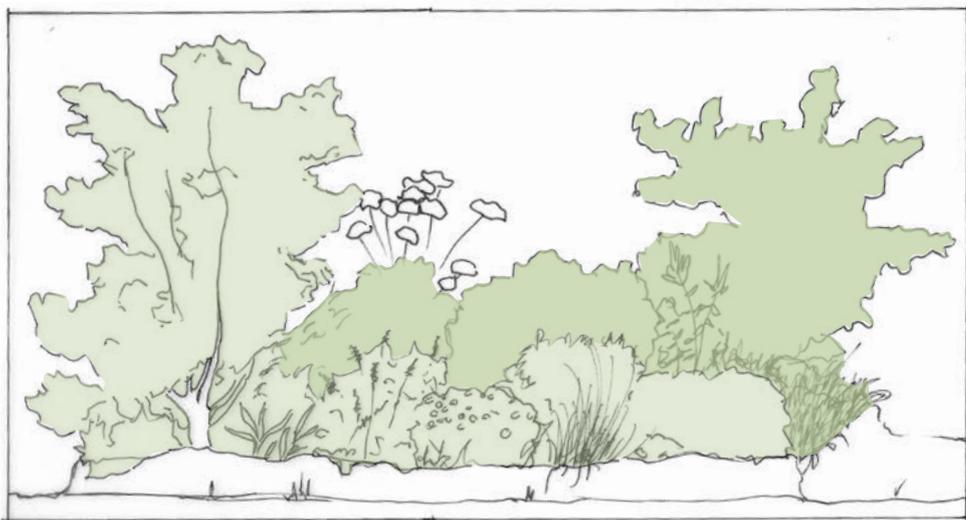
Plants distributed:

- Plants which already thrive on the TEC area
 - New plants that complement the permaculture-system
 - Plants can be shown living where they grow
- This way tours on the TEC site can be created and a multi-use site can increase TEC prominence.



Show Garden:

- 1 or more raised beds
- Planting combinations still open, as depending on location and situation (such as the location of the show garden itself)



The following plants show exemplary application examples and potential. They are also already present on the TEC site.

Cassia *Senna siamea*



Part of the plant
Bark and leaves

Ingestion form
Brew

Treatment
- Malaria

Keno *Pterocarpus erinaceus*



Part of the plant
Bark

Ingestion form
Brew

Treatment
- Antiseptic and wound healing properties
- Chronic diarrhea
- Bronchial infections
- Toothache
- Menstrual cramps
- Anemia
- Gonorrhea
- Postpartum bleeding
- Ringworm infection(fungal infection)
- Leprosy
- Tumors and ulcers

Red-Flowered Silk Cotton Tree *Bombax costatum*



Part of the plant
Bark and leaves

Ingestion form
Brew

Treatment

- Antiseptic effect for infections
- Skin diseases
- Headaches

Flambouyant *Delonix regia*



Part of the plant
Leaves

Ingestion form
Brew

Treatment

- Antiseptic effect for wounds
- Diabetes
- Diarrhea
- Fungal diseases
- Malaria
- Heart diseases
- Constipation
- Pneumonia

African Mahogany *Khaya senegalensis*



Part of the plant
Thin fiber pieces of the bark and wood

Ingestion form
Cold water extract

Treatment

- Abdominal pain
- Malaria
- Headaches
- Skin rashes
- Wounds

Mango *Mangifera indica*



Part of the plant
Flowers, bark

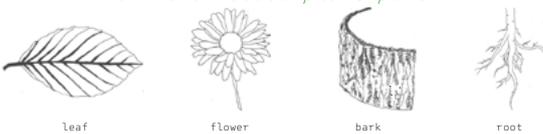
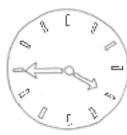
Ingestion form
Brew, in milled form, ointment

Treatment

- Diarrhea
- Bladder infections
- Rheumatism
- Diphtheria
- Toothache
- Fungal skin diseases

These following profiles can be printed and newly learned information about the way a drug is manufactured can be written down by the workshop participants as personal notes or can be filled in by the teacher.

There are three different fact sheets for the three most common types of production.

<i>Name of the plant</i>	
<i>Drawing of the plant or to paste a photo</i>	USE FOR: <i>To list the treatment options</i> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
WHAT TO USE: <i>Mark the needed plant part</i>	
 <div style="display: flex; justify-content: space-around; font-size: small;"> leaf flower bark root </div>	
HOW TO PREPARE: <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">    </div> <div style="text-align: center; margin-top: 5px; border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto;"> <i>Write down individual notes on the manufacturing process.</i> </div>	
NOTES: <hr/> <hr/> <hr/>	

For a brew:

For a milled form:

For a cold water extract:

	USE FOR: <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
WHAT TO USE: <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">     </div> <div style="display: flex; justify-content: space-around; font-size: x-small; margin-top: 5px;"> leaf flower bark root </div>	
HOW TO PREPARE: <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">    </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="border: 1px solid black; width: 40px; height: 15px;"></div> <div style="border: 1px solid black; width: 40px; height: 15px;"></div> <div style="border: 1px solid black; width: 40px; height: 15px;"></div> </div>	
NOTES: <hr/> <hr/> <hr/>	

	USE FOR: <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
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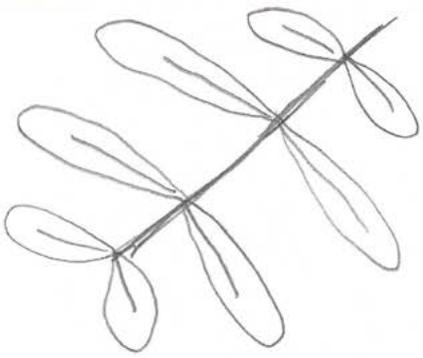
	USE FOR: <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
WHAT TO USE: <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">     </div> <div style="display: flex; justify-content: space-around; font-size: x-small; margin-top: 5px;"> leaf flower bark root </div>	
HOW TO PREPARE: <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">    </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="border: 1px solid black; width: 40px; height: 15px;"></div> <div style="border: 1px solid black; width: 40px; height: 15px;"></div> <div style="border: 1px solid black; width: 40px; height: 15px;"></div> </div>	
NOTES: <hr/> <hr/> <hr/>	

Here is an example of a completed profile. Traditional knowledge can be imparted by the new TEC mediator. Participants can record learned information and expand on notes in the future

With my half-knowledge, internet-infos and without know-how (concerning the spiritual and mystical backgrounds of the plants/diseases) it is also difficult to respond concretely to the needs on site and therefore I simply offer a basic outline with these profiles.

Example of a cold water extract production:

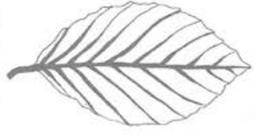
African Mahogany



USE FOR:

- Malaria
- Tummy ache
- Head ache
- Wounds
- Skin rashes

WHAT TO USE:



leaf



flower



bark

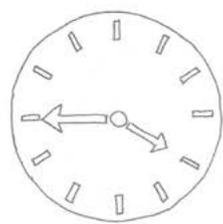


root

HOW TO PREPARE:



- put in cold & fresh water
- fresh plants! not dry



soaking
in the water
for 12-24 hours



strain

NOTES:

Blank header box

Large empty box for drawing or notes

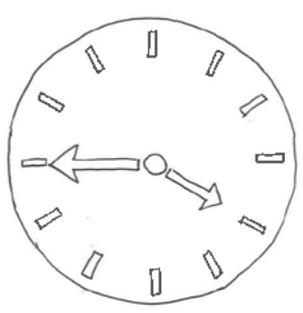
USE FOR:

WHAT TO USE :



leaf flower bark root

HOW TO PREPARE :



_____ _____ _____

NOTES :

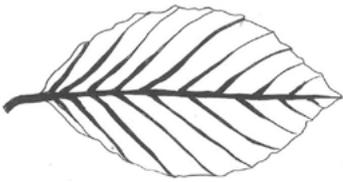
Blank header box

Large empty box for notes or drawing

USE FOR:

Seven horizontal lines for writing

WHAT TO USE:



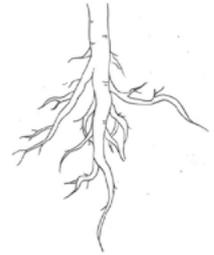
leaf



flower

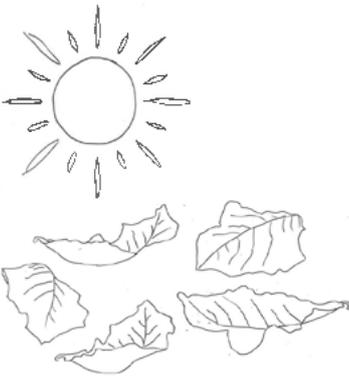


bark



root

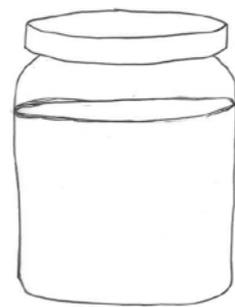
HOW TO PREPARE:



Empty box for preparation step 1



Empty box for preparation step 2



Empty box for preparation step 3

NOTES:

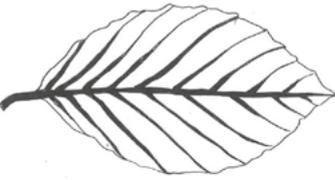
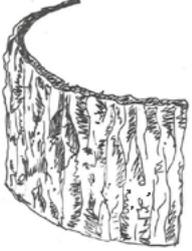
Three horizontal lines for notes

Blank rectangular box for title or subject.

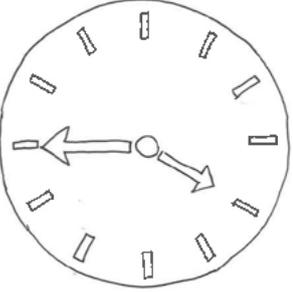
Large empty rectangular box for drawing or notes.

USE FOR:

WHAT TO USE:

			
leaf	flower	bark	root

HOW TO PREPARE:

		
<input type="text"/>	<input type="text"/>	<input type="text"/>

NOTES:

These leaflets are also printable. If you already know how a medicine is made and sell it, for example, you can give these leaflets to a customer and write down instructions to target the best possible recovery.

Example of a completed instruction leaflet:

LEAFLET – HOW TO TAKE

HOW LONG?	<i>for 5 days in a row</i>
WHEN?	<i>in the morning</i>
HOW MUCH?	<i>1 glass</i>
WHAT TO BE CAREFULL ABOUT	<i>do not come into contact with the eyes</i>
NOTES:	

LEAFLET - HOW TO TAKE

HOW LONG?

WHEN?

HOW MUCH?

WHAT TO BE
CAREFULL ABOUT

NOTES :



LEAFLET - HOW TO TAKE

HOW LONG?

WHEN?

HOW MUCH?

WHAT TO BE
CAREFULL ABOUT

NOTES :

Prof. Dr. Oskar Schimmer, Naturhistorische Gesellschaft Nürnberg,
Die Verwendung traditioneller Gift- und Heilpflanzen in schwarzafrikanischen
Gesellschaften - Ein Streifzug durch die ethnomedizinische Forschung, 2008

Ilona Bütler Diallo, Universität Zürich, Projektarbeit des Zertifikatsstudienganges
in Ethnobotanik und Ethnomedizin - Pflanzenbeispiele aus Ernährung
und Medizin, 2008

<https://uses.plantnet-project.org/en>

w

http://www.africanplants.senckenberg.de/root/index.php?page_id=78&id=1319

<https://tropical.theferns.info>

<http://www.gambiafriends.ch>

<https://www.afro.who.int>

the TEC-mobile

Nikola Knoll



What is the TEC-Mobile?

Mobile food stand

Has an integrated wood oven to cook or warm up food

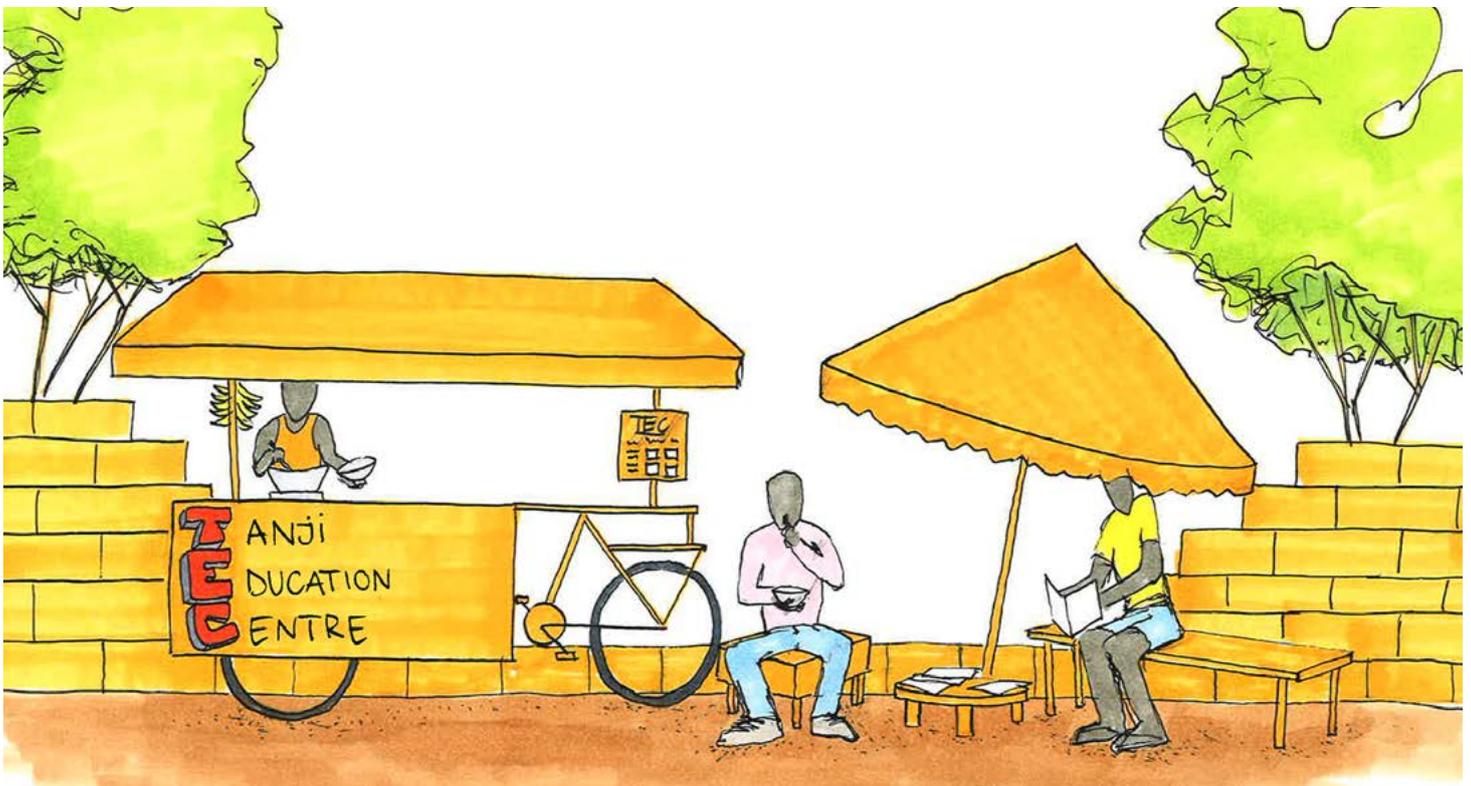
Is an information sharing point of the TEC and FVH

TEC-Mobile | Purpose of the TEC-Mobile

A mobile and sustainable distribution of TEC-products

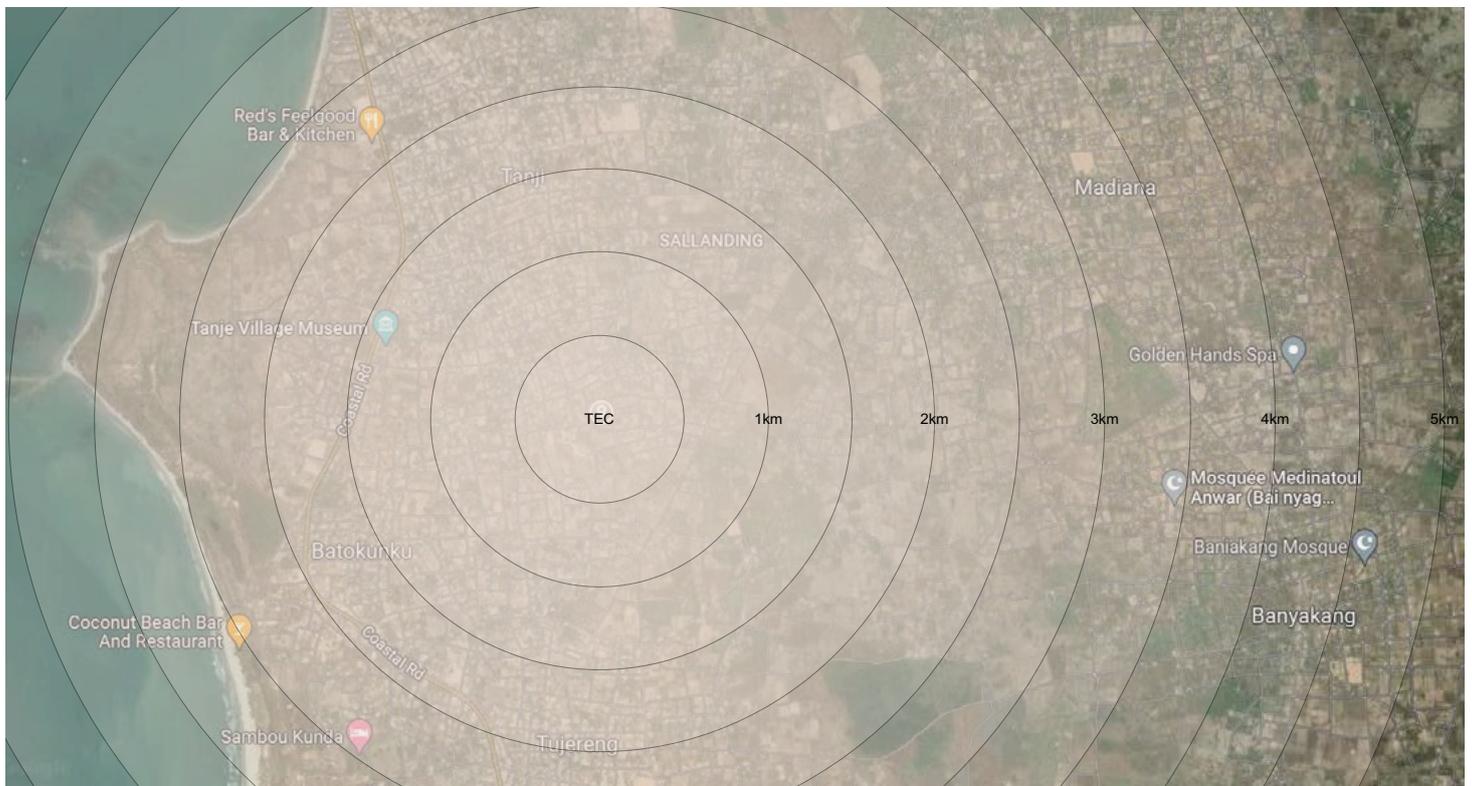
Create a space for gathering and exchanging ideas with each other

Promote the TEC through use of logos and branding, create recognition



Create sustainable and self-supporting jobs

Recruit new persons of interest for the TEC and take advantage of the mobility



1. Somebody from the TEC, Babucar's wife, for example

or

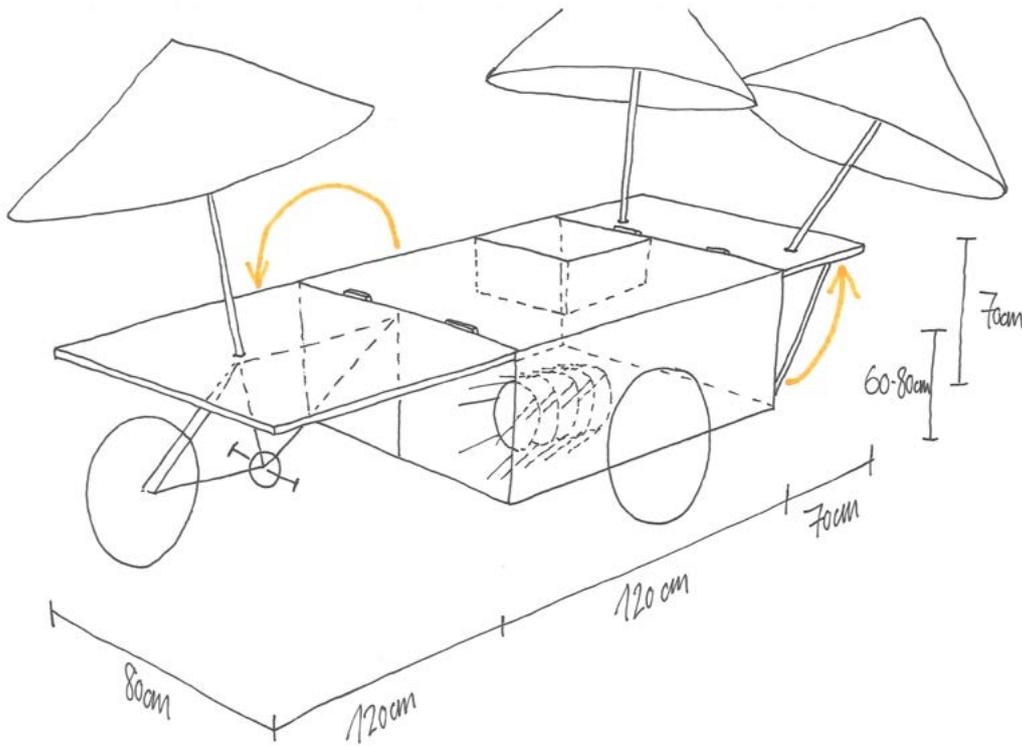
everyday someone else from the TEC could go around and recruit new people while serving already cooked dishes

2. Get a new employer

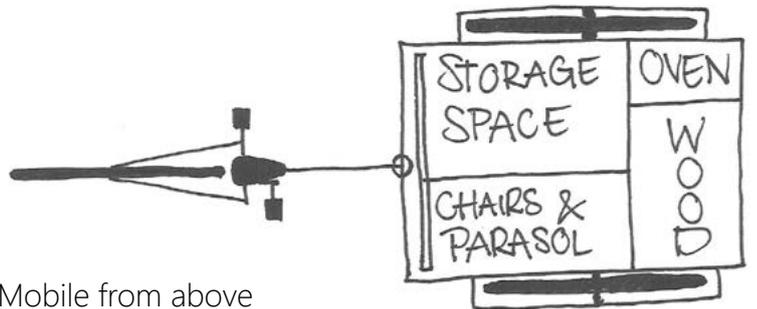
recruit → hire → develop → transfer of knowledge

3. Possibility of a phased development of the operators

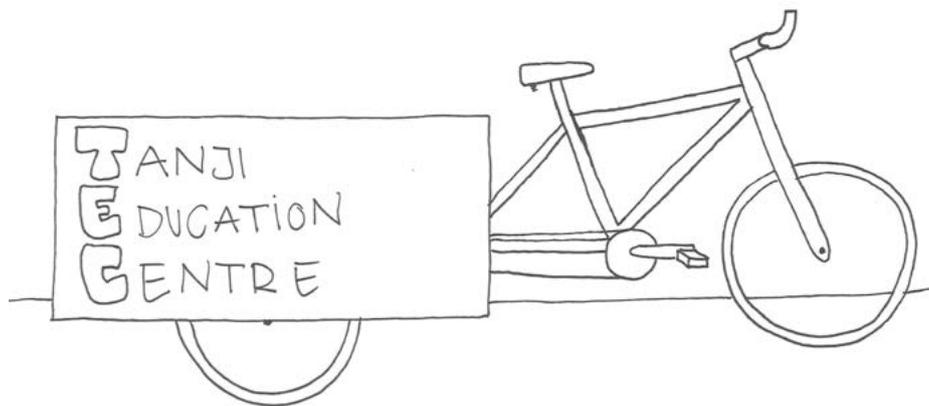
TEC-Mobile | What does the TEC-Mobile look like?



- Working surface to fold out
- Integrated oven
- A lot of storage room

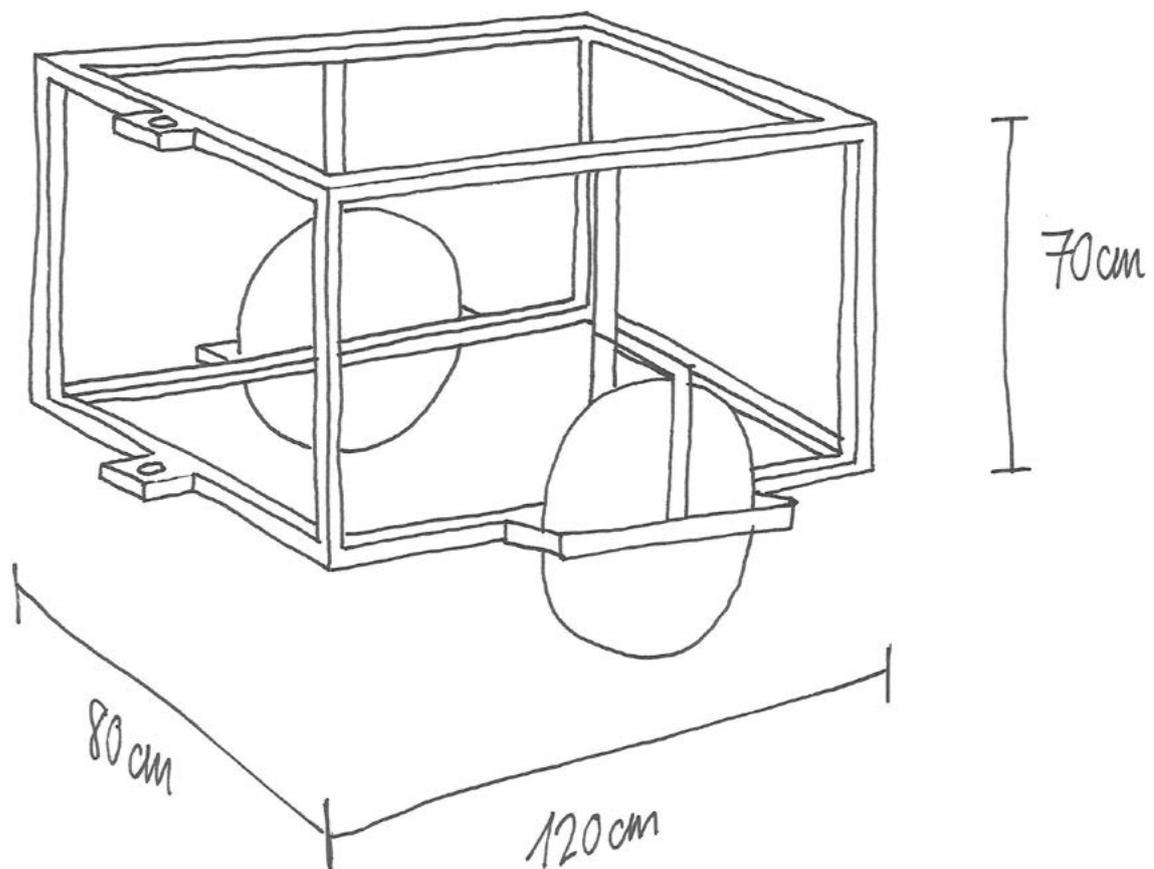


TEC-Mobile from above

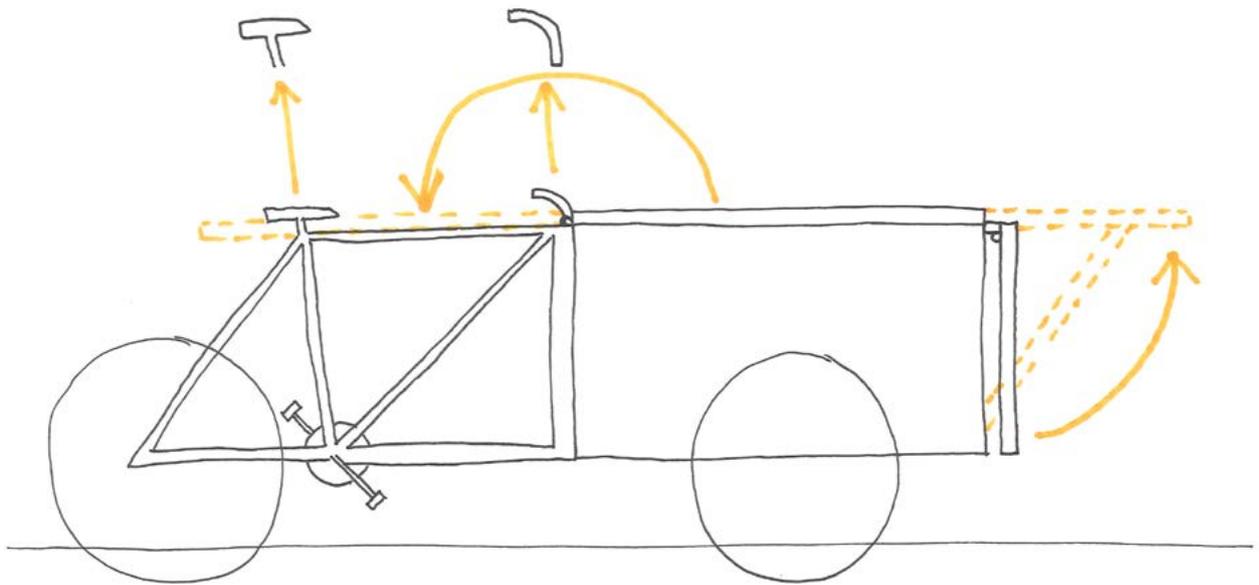


Alternative set up of the TEC-Mobile with the load on the rear axis

TEC-Mobile | Basic framework of the TEC-Mobile



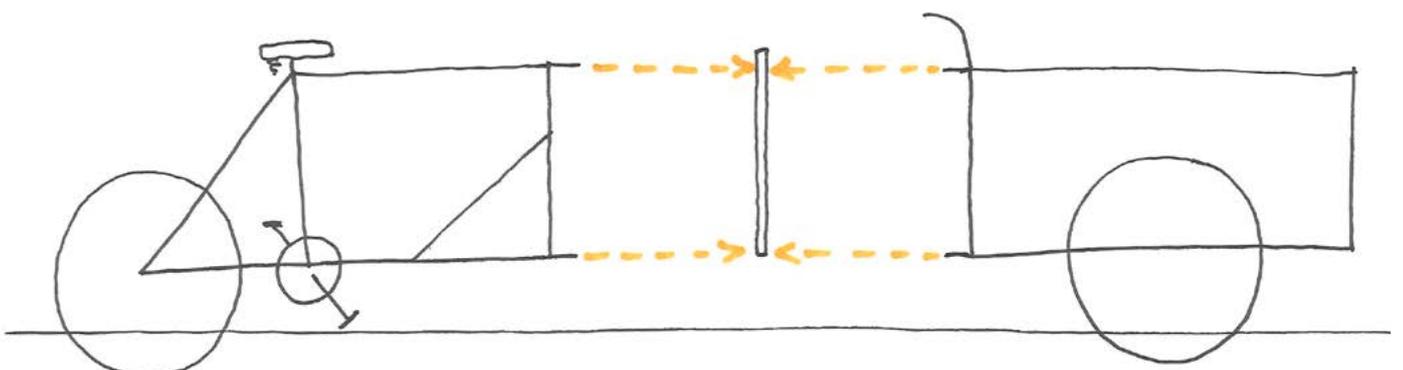
- Basic size of a europalette
- A welded frame out of any metal
- Cover the frame with wooden boards
- Fat tires for rough terrain



- Weak spot is the transition of the front and back part of the bike

- Seat and saddle can be taken out

- reinforcement of the basic axis



TEC-Mobile | Possible uses of the TEC-Mobile

1. Busy streets where people meet each other

Target group: young and old



2. In front of a market

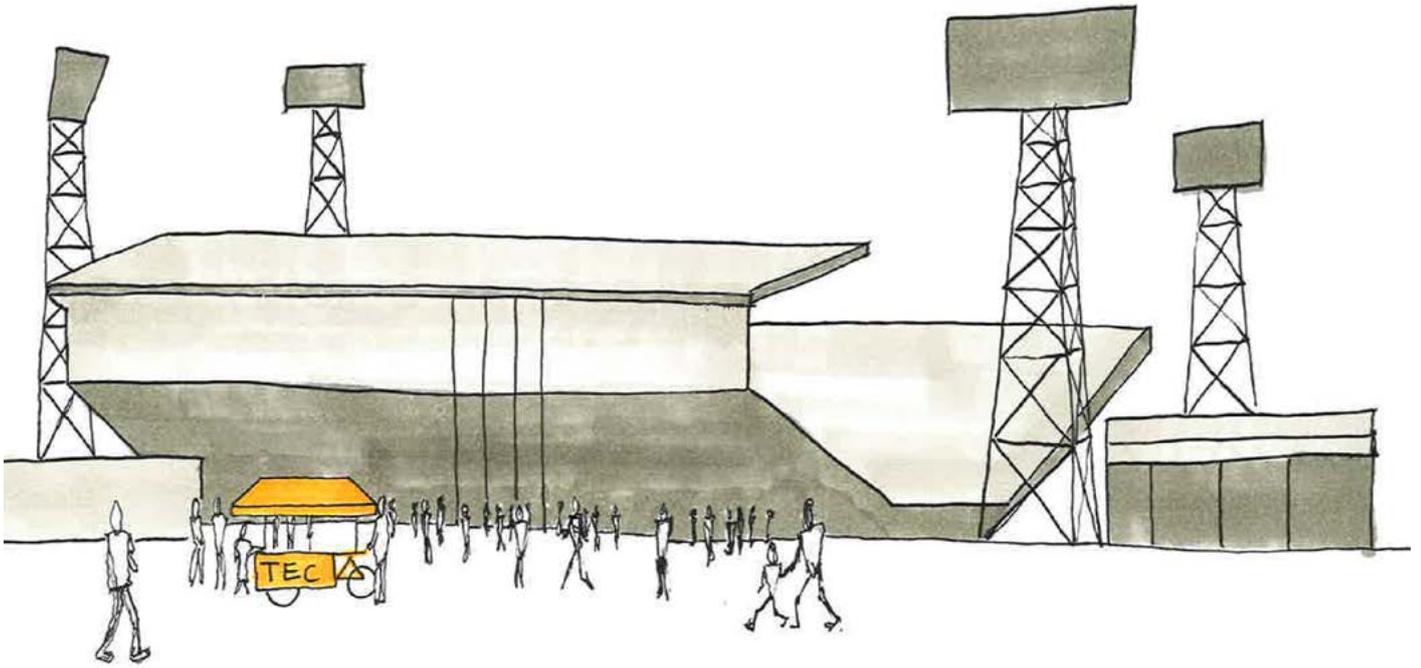
Target group: People from agricultur



TEC-Mobile | Possible uses of the TEC-Mobile

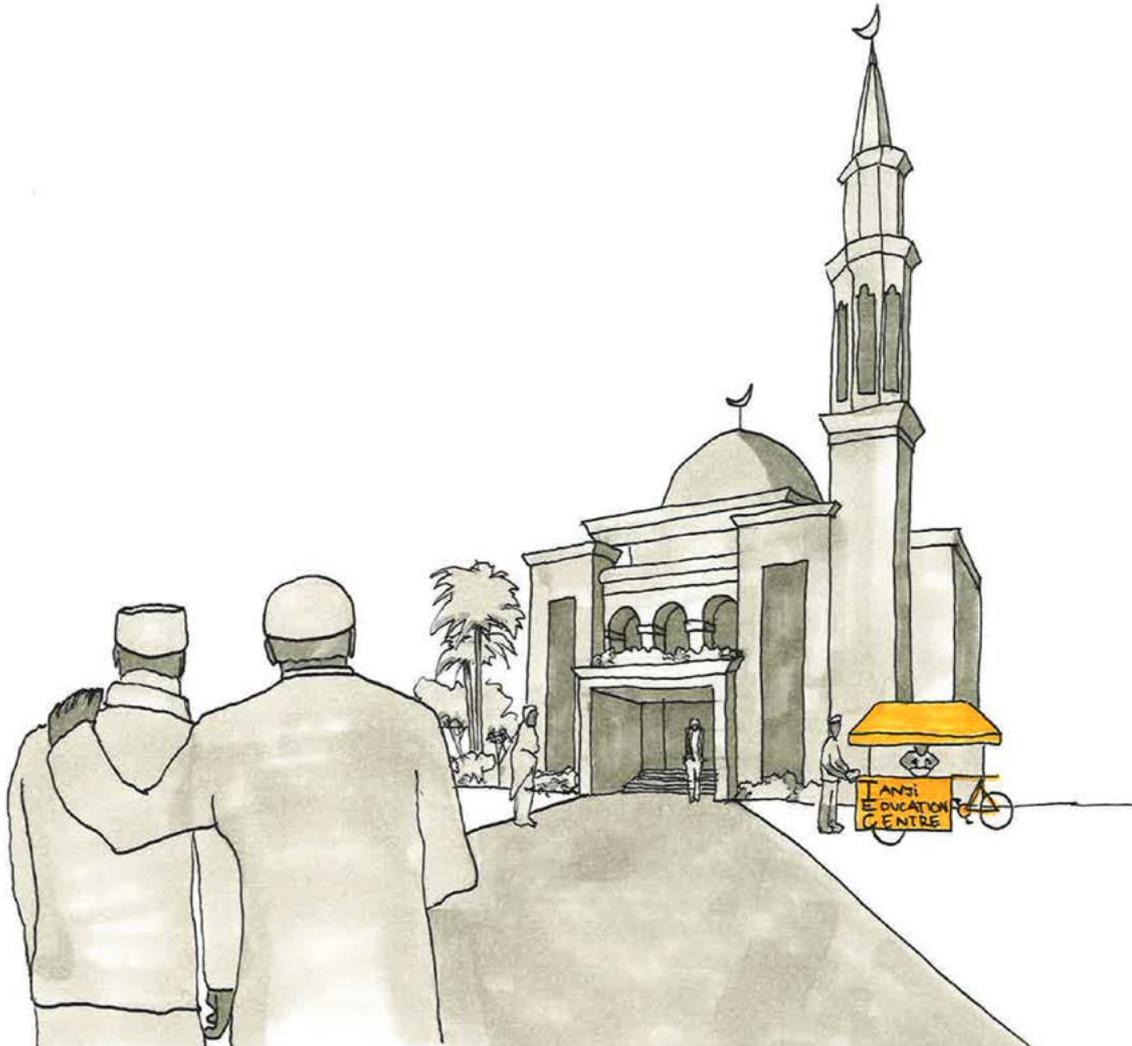
3. At football games

Target group: General public



4. Interested tourists at the beaches. Introduce them to permaculture and local agriculture through soft tourism concepts.

5. Expansion of a TEC-Mobile fleet with a few more mobiles



TEC-Mobile | Who can build a TEC-Mobile?

Everybody can build a TEC-Mobile, the only pre-conditions are:

1. a welding machine
2. some kind of robust, corrosion resistant metal
3. Hinges, screws and wooden boards
4. Wide tires with good profile
5. Skills

In Tanji for example there is the House of Skills, which is a training centre. They would have access to all of the upper points. Next to the House of Skills there would also be a possibility to include MEC-SAC. The organisation offers self-sustaining mechanical education and basic workshop management.

Web-site House of Skills:

<https://house-of-skills.com/>

Web-site MEC-SAC:

<https://mec-sac.gm/>

authors:

students of landscape architecture, architecture and life science
OST, university of applied sciences of eastern switzerland,
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qualified draftsman in the field of architecture
intern landscape gardener

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apprenticeship as draftsperson specialized in architecture
internship in architecture

Jael Germann

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foundation course in art and design
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high school diploma with specialization in economics and law
two semesters of economics studies
intern polydesign and landscape architecture



TEC BOOK Vol 1. is a work book that brings together knowledge and culture of Gambian agriculture and horticulture and encourages application. It includes building instructions, instructions for workshops and playful learning courses. Every woman, every man, every child will gain knowledge from this book and will enjoy the success of these hands-on projects. The individual pages can be copied and reproduced as leaflets or posters. The basis of this book is to understand the implementation of value chains. It shows how The Gambia can recover from the commitment of individuals in the community to a strong agriculture and prosper economically.

The TEC BOOK continues to be written.