

Backyard Community Garden - Final PDC Project

Permaculture Design Course - Final Project - Mark Bost

San Kampheng, Chiang Mai, Thailand, December 2019

Preamble	2
Project Vision & Outline	2
Project Site & General Conditions	3
House & Backyard	3
Climate	5
Soil	6
Water	6
Municipal Waste Disposal	7
Design	7
Zones & Elements	8
Using and redesigning existing major elements	10
Replacing large trees by small fruit trees	10
Apple Guild (also for Pear, Quince, Dessert Plum, Cherry)	12
Mulberry / Goumi Guild	13
Walnut / Hackberry Guild	13
Efficient tree planting patterns	14
Water: Catching rainwater, chimney as water tower, pond & irrigation	14
Greenhouse	15
Keyhole beds / Mandala garden	15
Herb spirals	17
Composts & worm farms (vermicompost)	17
Window planting boxes	18
Lawns	19
Rabbits	19
Energy	20
Community Building & Organization	21
Time plan	21
Appendix: List of symbols	22

Preamble

My name is Mark Bost, I am 39 years old, and studied Environmental Engineering at the Technical University of Berlin, Chalmers University of Technology (Göteborg), and NOVA University Lisbon. After completing my studies I worked in the field of sustainability research, focussing on sustainable energy and climate change. I am single, currently sharing a 50 m² flat with my best friend in Berlin Weißensee, Germany, who is also very interested in Permaculture. His name is Christian and he has a professional background as industrial designer and special education related to sheltered workshops.

Project Vision & Outline

The project's main focus is to convert the backyard of our living place into a productive permaculture garden, with a strong emphasis of building up a community among the tenants of the building, who are currently living quite anonymously next to each other. The project should offer all tenants the possibility to participate in it, thus creating the opportunity for cross-generational interactions, community belonging, escape of isolation, creativity, exchange of knowledge and skills, learning, meaningful leisure activities, and - of course - healthy and nutrient-dense local food supply. It should also raise awareness about the problems of industrial agricultural systems and its alternatives, especially the principles of permaculture - earth care, people care & fair share (return of surplus), as well as the 7 R's (Rethink, Refuse, Reduce, Reuse, Repair, Recycle, Rot) - and to spread this awareness beyond the boundaries of the house.

We are living for rent in a large apartment building in the suburbs of Berlin. The building has a backyard of $51 \times 10 = 510 \text{ m}^2$ which would serve as the main site for the Permaculture project. The total backyard is actually twice this size, but it is divided in half by a low stone wall and a fence because the other half belongs to the opposite buildings which are accessed through the parallel street (Meyerbeerstr.). In the long run, it would be preferable to include the whole backyard in the project, but that might complicate the project significantly because these buildings are likely to belong to another landlord and it would double the number of potentially involved inhabitants to about 180. Furthermore, this southern part of the backyard is less attractive for gardening because it receives far less sunshine. Hence, the first stage of the project aims to transform half the backyard and to possibly incorporate the other half later on.

The building has a height of about 22 meters, 5 stories, 45 flats and approximately 90 inhabitants of all age and social background. Accordingly, the realization of the project faces

many obstacles and it's final design might differ greatly from this first draft because many people might influence it substantially. Therefore, the function of this first design draft is to draw a vision of what might be possible, of the potential benefits and preconditions, in order to gain the consent, support, and commitment of the landlord and the tenants. Apart from that, this design draft should also show that I understand the principles of permaculture and can apply them to real world projects.

Right now, the backyard serves mainly as a recreational retreat for the tenants. It is used mainly by children to play during daytime and by adults for barbecue in the afternoon or evening. It is quite obvious, that these recreational functions must be sustained or enhanced to gain consent of all inhabitants. Furthermore, the use of animals is quite restricted, because people might have concerns about hygiene, smell and noise (esp. shift workers), and because proper treatment of the animals must be ensured.

Project Site & General Conditions

This chapter describes the status quo of the project site as well as important framework conditions like climate, soil, water, etc.

House & Backyard

As described in the outline above, the project site consists of half the backyard. The orientation of the site deviates from a west-east orientation by 19.5° towards west, hence the backyard is accessed through the SSE-wall of the buildings Bizetstr. 104 a/b/c. The buildings have a height of about 22 m, hence shading the backyard significantly, especially the southern part of it. The building is divided into three compartments (104 a/b/c, see figure 1), each of which 15 apartments. The ground floor features only storage facilities and passways into the backyard, hence each compartment has its own passway into the garden. The height of the lowest apartment windows is about 3 meters above ground levels. In front of building part 104c, there is a small area with a concrete **surface sealing**, which limits plating options in this part (edged in orange in figure 4).

Four big **trees** (one *Tilia intermedia* ("linde", T1 in figure 4) and three *Betula papyrifera* ("Birken", T2-4 in figure 4) are shading the yard. Apart from that, there are a few medium sized trees (*Chamaecyparis lawsoniana* ("Scheinzypresse", T5), *Carpinus betula* ("Hainbuche", T6), *Taxus baccata* ("Eibe", T7), and a *Prunus laurocerasus* ("Kirschlorber", T8)). The north-east corner of the yard contains an old **chimney [Ch]** which is not in use anymore. It is located about 4 m away from the walls, has a diameter of 1.4 m and a height of about 15 m. In this corner of the yard there is a small space of 0.6 m between in between the buildings, allowing air to pass through (yellow ellipse in figure 2).

Key facts of the project site:

- Half backyard, accessible through Bizetstr. 104 a/b/c
- Dimensions: $51 \times 10 \text{ m} = 510 \text{ m}^2$ (red square in figures 1-4)
- Connected households: 45
- Inhabitants: approx. 90
- Additional rooftop rainwater catchment: 400 m^2 (blue square in figures)
- Orientation is 19.5° towards west

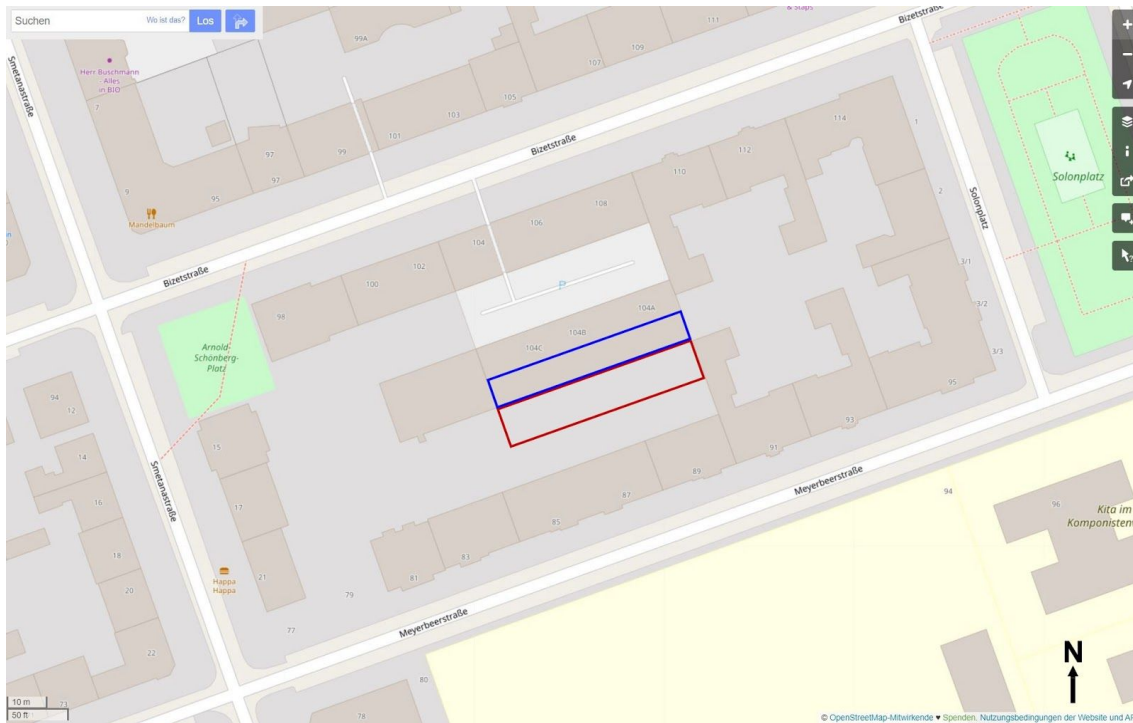


Figure 1: Map of the project area (red square) and additional water catchment (blue square)



Figure 2: Satellite view of the project area (red square)



Figure 3: Satellite view of the project area (red square)



Figure 4: Satellite view of the project area (red square)

Climate

Due to its location in the European Plain, Berlin (52°31'00"N, 13°23'20"E) is influenced by a temperate seasonal climate with a continental effect (180 km south of the Baltic Sea). About one-third of the city's area is composed of forests, parks, gardens, rivers, canals and lakes.

Summers are warm and sometimes humid with average high temperatures of 22–25 °C and lows of 12–14 °C. Winters are cool with average high temperatures of 3 °C and lows of –2 to 0 °C. Spring and autumn are generally chilly to mild. Berlin's built-up area creates a microclimate, with heat stored by the city's buildings and pavement. Temperatures can be 4 °C higher in the city than in the surrounding areas. Annual precipitation is 570 mm with moderate rainfall throughout the year. Snowfall mainly occurs from December through March.

The wettest month on record is July 1907, with 230 mm of rainfall, whereas the driest are October 1866, November 1902, October 1908 and September 1928, all with 1 mm of rainfall.

Table 1: Climate data for Berlin (**Tempelhof**, elevation: 48 m, 1971–2000 normals, extremes 1878–2018)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high [°C]	15.5	18.7	24.8	31.3	35.5	38.5	38.1	38	34.2	28.1	20.5	16	38.5
Average high [°C]	3.3	5	9	15	19.6	22.3	25	24.5	19.3	13.9	7.7	3.7	14
Daily mean [°C]	0.6	1.4	4.8	8.9	14.3	17.1	19.2	18.9	14.5	9.7	4.7	2	9.7
Average low [°C]	–1.9	–1.5	1.3	4.2	9	12.3	14.3	14.1	10.6	6.4	2.2	–0.4	5.9
Record low [°C]	–23.1	–26.0	–16.5	–8.1	–4.0	1.5	6.1	3.5	–1.5	–9.6	–16.0	–20.5	–26.0
Average precipitation [mm]	42.3	33.3	40.5	37.1	53.8	68.7	55.5	58.2	45.1	37.3	43.6	55.3	571
Rainwater of 400 m ² [m ³]	16.9	13.3	16.2	14.8	21.5	27.5	22.2	23.3	18.0	14.9	17.4	22.1	228.4
Average precipitation [days] (≥ 1.0 mm)	10	8	9.1	7.8	8.9	7	7	7	7.8	7.6	9.6	11.4	101

Soil

The soil in and around Berlin is very sandy with high drainage and no clay. It is usually characterized as “medium to strongly sandy loam”, “medium to strongly loamy sand”, “weakly to medium silky sand”, “sandy silk” or sometimes just “fine sand”. Many minerals are easily available, but to grow sufficient yields of edible plants, carbon and nitrogen sources like humus or compost have to be applied.

More details about the soils in Berlin:

https://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/edinh_01.htm

<https://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/edb10601.htm>

Water

Berlin receives about 571 mm of precipitation per year (see table 1). The public tap water supply in Berlin is based on bank filtration and groundwater, hence it is considered a hard water rich in minerals like calcium, bicarbonate, etc (see table 2). Since the water is not chlorinated, it can be used safely as drinking water and also to water plants. However, some

plants don't like such a hard calcium rich water. Furthermore, energy is required to pump up, purify and distribute the tap water. Hence rainwater or greywater is the more sustainable alternative for the irrigation of plants.

Table 2: Tap water quality in Berlin

As of 2015	Indicated in mg/l	Threshold value in mg/l	Recommended daily allowance in mg
Calcium	110	-	800
Iron	< 0.03	0.2	14
Potassium	5	-	2000
Magnesium	10,4	-	375
Sodium	37	200	-
Chloride	54	250	800
Bicarbonate	250.44	-	-
Sulfate	109	250	-

Source: <https://www.bwb.de/en/1592.php>

Municipal Waste Disposal

Waste in Germany is separated on site. In front of the building there are huge waste containers for 7 different fractions of waste:

1. Biodegradable waste, which is fermented into biogas and solid and liquid fertilizers
2. Paper & cardboard: recycling
3. White glass: recycling
4. Brown glass: recycling
5. Green glass (and all other colors): recycling
6. Recyclable materials (plastics & metals): recycling & incineration
7. Residual waste, which cannot be placed into the recycling bin: incineration

The price for waste disposal is included in the rent.

Design

This chapter describes the design and it's elements which have been identified to be beneficial for the project site and how and where they will be realized.

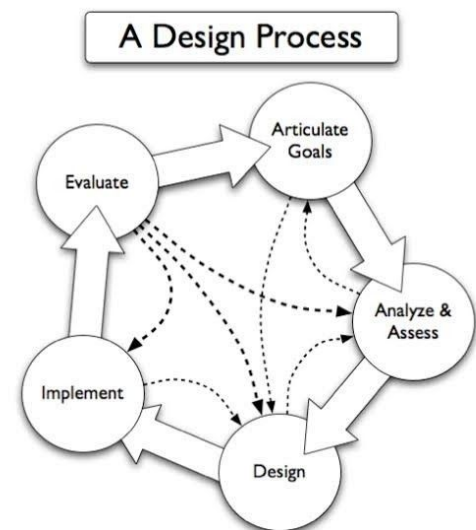
The design process was conducted following the 14 design principles of permaculture:

1. Observe
2. Connect (create useful relationships between elements)
3. Catch and Store Energy and Materials

4. Make Each Element Perform Multiple Functions
5. Have Each Function Supported by Multiple Methods
6. Make the Least Change for the Greatest Effect
7. Start with Small-Scale, Intensive Systems
8. Optimize Edges (intersections between elements)
9. Collaborate with Succession
10. Use Biological Resources & Diversity before Technological Ones
11. Turn Problems into Opportunities & Solutions
12. Get a Yield
13. Recognize that Lack of Creativity Is the Greatest Limit
14. Learn from Mistakes

It should be noted that the design process is an ongoing iterative process and never really finished. Thus, this design is only a starting point which will be continuously further developed.

In many cases, this design plan will mention many potential plants which could be combined to be beneficial for each other. The final selection of this plants will have to be double-checked by local knowledge from experienced gardeners, local garden centers, and tree nurseries/arboretums.



Zones & Elements

Zones and sectors are usually determined by slope and orientation. For this specific project without major slopes, microclimate zones and shading plays a major role.

Since the space is very limited, the whole site will be a ZONE 1, with several sectors for fruit trees, vegetables, recreation, playground etc. The following figure 5 presents the design, which will be explained in detail in this chapter. Figure 6 (Layer 1) shows the microclimate zones of the full backyard.

A technique to discover elements and creative connections between them is to list all possible elements and to randomly combine these elements by spatial prepositions (e.g. in, under, above, ...), resulting in combinations like “tank on roof” or “tree in swale” etc. The most promising results of this process are described below.

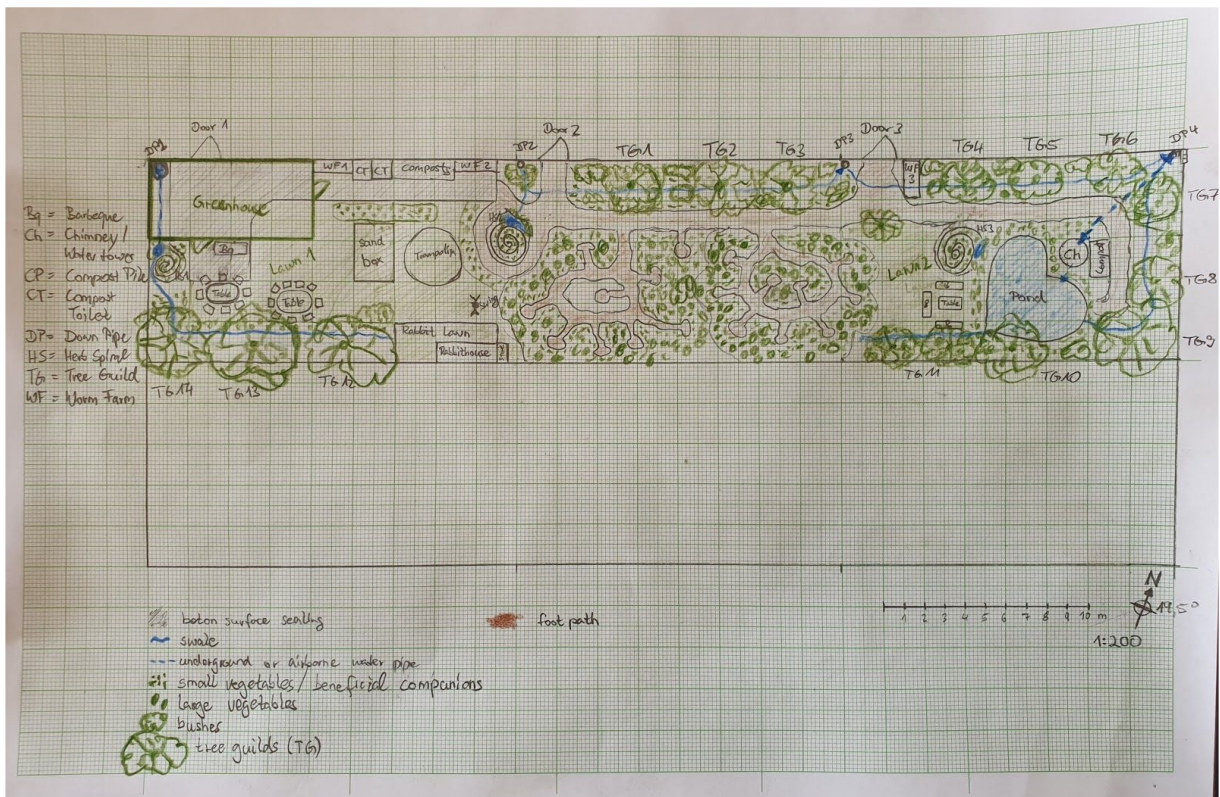


Figure 5: Design of the project

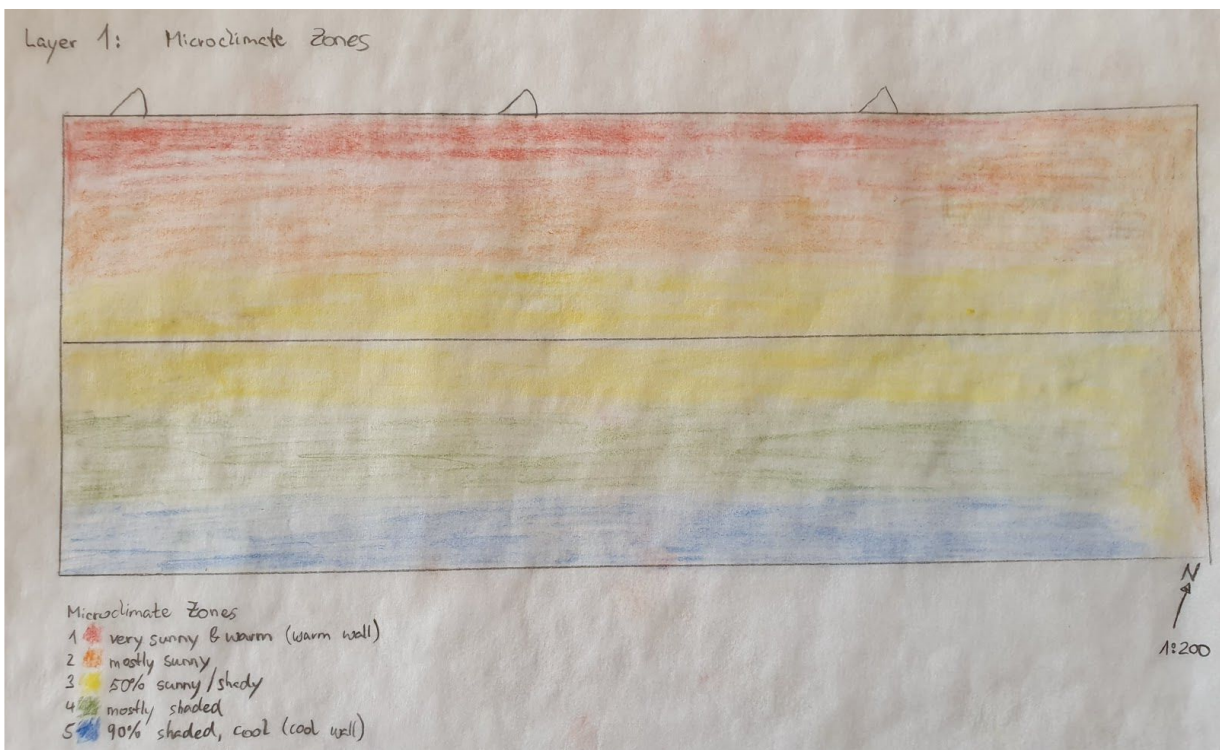


Figure 5: Microclimate zones of the full backyard (Layer 1)

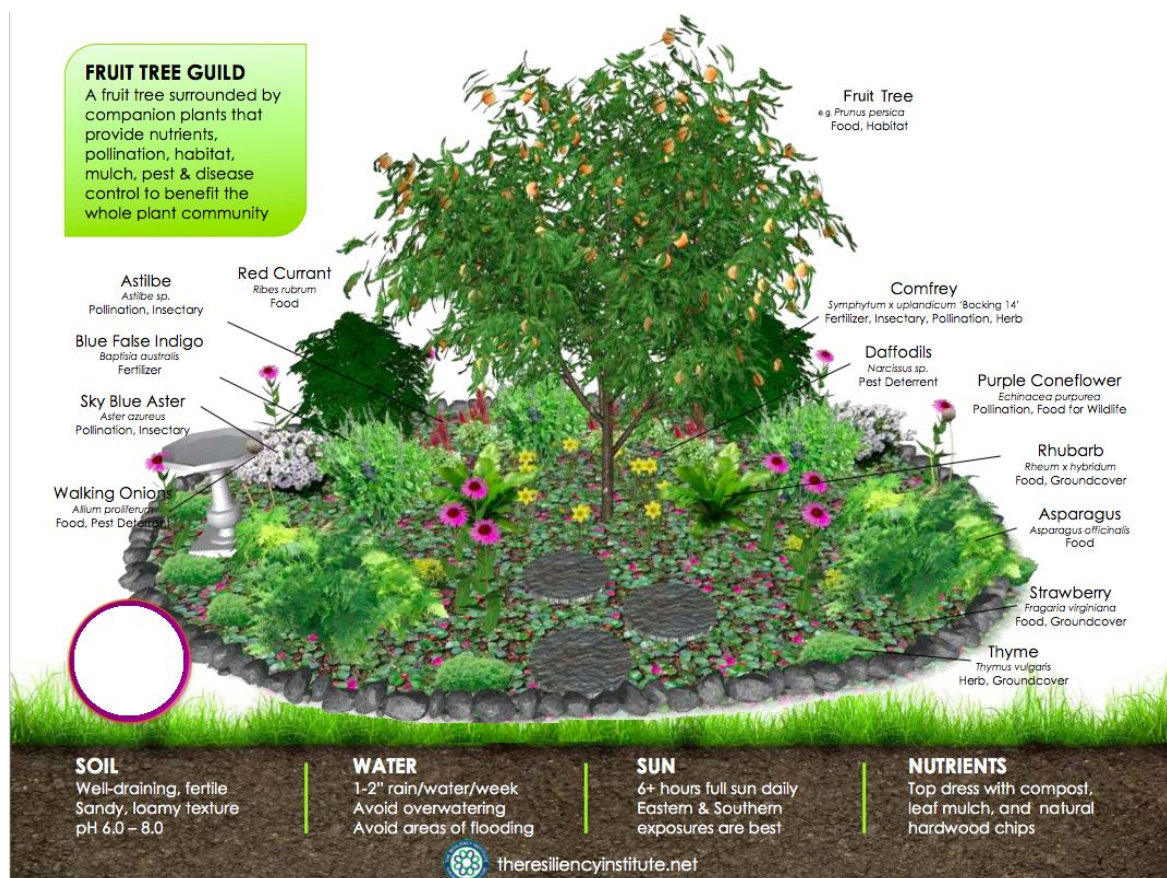
Using and redesigning existing major elements

Using and redesigning existing elements is one of the key principles in permaculture design (esp. principles 1-6 in the list above) - making the least change for the greatest effect.

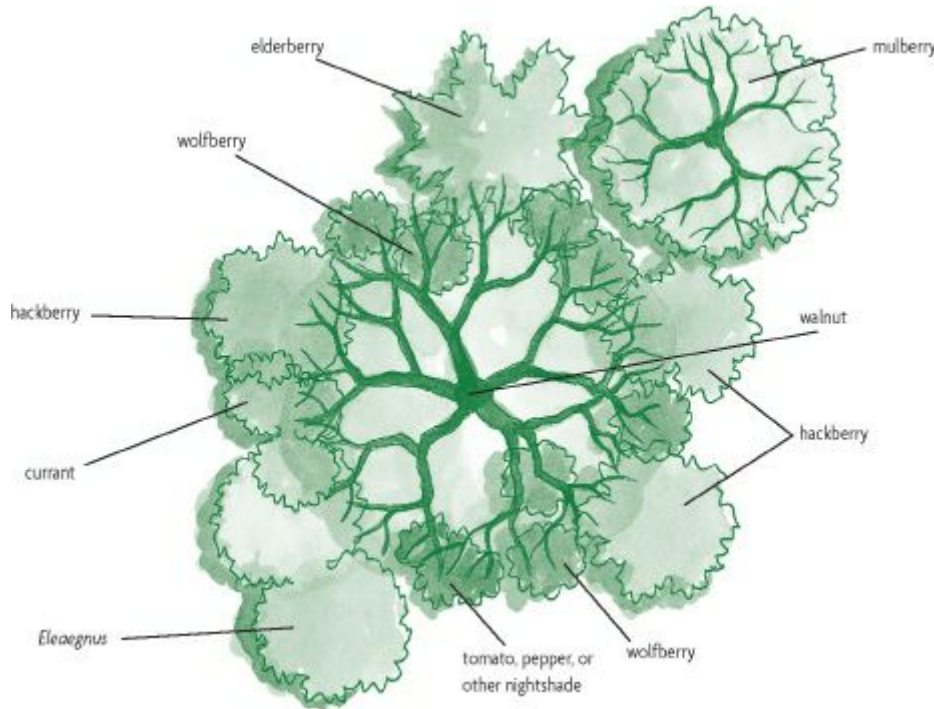
Replacing large trees by small fruit trees

Since the 4 large trees are shading most of the yard significantly, they should be felled. Several small fruit trees will be planted throughout the garden as replacement for these trees. These trees (apple, plum, pyrus, walnut) will be kept low, so that they can be harvested without the use of a ladder and don't provide too much shade. Furthermore, many different species will be planted which ripen at different times of the year to provide fruit over a long time. The timber of the felled trees can be used to build constructions, tools or window boxes (see below), as well as for mulching, firing, and creating biochar.

Under or in between trees, beneficial and **nurturing multifunctional companion plants** will be planted, which include nutrient accumulators (e.g. yarrow, chicory, plantain, gromwell), insectary plants (e.g. dill, fennel), mulch plants (e.g. comfrey, artichoke), and grass suppressing bulbs (e.g. daffodils, garlic chives). This approach is called “**guild-building**”, where trees provide shade for sun-sensitive plants which in turn provide the above services to the tree. At the same time, edge effects are used and designed in a beneficial way.



A typical example is the **walnut/hackberry guild**: Ornamental yet habitat-providing shrubs such as elderberry, hackberry, and wolfberry grow well under the stately walnut tree. Currants, tomatoes, and peppers supplement the walnut harvest. The mulberry and *Elaeagnus* create a transition to other plantings in the yard, protecting neighboring plants from the walnut's allelopathic effects.



The following **tree guilds [TG]** are chosen to be realized in the sunny parts of the garden (for more examples and information see <https://projectfoodforest.org/pledge>). They can be interplanted with beneficial berries (strawberry, wild strawberry, blackberry, raspberry, mulberry, [hardy kiwi](#), etc.):

Apple Guild (also for Pear, Quince, Dessert Plum, Cherry)

- **Starring:** Apple (*Malus pumila*) as the center tree with edible fruit (two varieties needed)
- **Optional star choices:** Pear (one or two trees needed depending on variety), Cherry (one or two trees needed depending on species and variety), Quince (only one tree needed, but two will increase fruit production), Dessert Plum (one or two trees needed depending on variety)
- **Featuring:** Silver Buffaloberry (*Shepherdia argentea*) as the nitrogen fixing shrub, native with edible berries; alternatively goumi (*Elaeagnus multiflora*) as the nitrogen fixing shrub with edible berries
- **Supporting cast:**
 - Bee Balm (*Monarda didyma*) as native, edible, medicinal, insectary, and mulch maker
 - Garden Sorrel (*Rumex acetosa*) as edible and soil improver
 - Chives (*Allium schoenoprasum*) as edible, insectary, and pest confuser

- Thyme (*Thymus vulgaris*) as edible, medicinal, insectary, and pest confuser
- Greek Oregano (*Origanum vulgare*) as edible, medicinal, insectary, and pest confuser
- Bronze Fennel (*Foeniculum vulgare* 'purpureum') as edible, medicinal, insectary, pest confuser, and beneficial insect attractant
- Rhubarb (*Rheum rhabarbarum*) as edible, mulch maker, and soil improver
- Anise Hyssop (*Agastache foeniculum*) as native, edible, medicinal, mulch maker, and insectary
- Asparagus (*Asparagus officinalis*) as edible, and beneficial insect attractant
- Wild Strawberry (*Fragaria virginiana*) as native, edible, medicinal, insectary, soil improver, and ground cover
- Lovage (*Levisticum officinale*) as edible, insectary, soil improver, and beneficial insect attractant

Mulberry / Goumi Guild

- **Starring:** Mulberry (*Morus rubra*) as the center tree, native to the U.S. with edible berries
- **Optional star choice:** Medlar (*Mespilus germanica*)
- **Featuring:** Goumi (*Elaeagnus multiflora*) as the nitrogen fixing shrub with edible berries
- **Supporting cast:**
 - Chives (*Allium schoenoprasum*) as edible, insectary, and pest confuser
 - Russian Comfrey, Bocking 14 (*Symphytum Uplandica*) as medicinal, mulch maker, insectary, and soil improver
 - Roman Chamomile (*Chamaemelum nobile*) as medicinal, ground cover, and insectary
 - Winecup or Purple Poppy Mallow (*Callirhoe involucrata*) as native, edible, insectary, ground cover, and soil improver
 - Japanese Giant Red Mustard (*Brassica juncea*) as edible, medicinal, soil improver, and insectary
 - Purple Coneflower (*Echinacea purpurea*) as native, medicinal, insectary, and wildlife food
 - Lovage (*Levisticum officinale*) as edible, insectary, soil improver, and beneficial insect attractant
 - Yarrow (*Achille millefolium*) as native, medicinal, edible, insectary, soil improver, and beneficial insect attractant

Walnut / Hackberry Guild

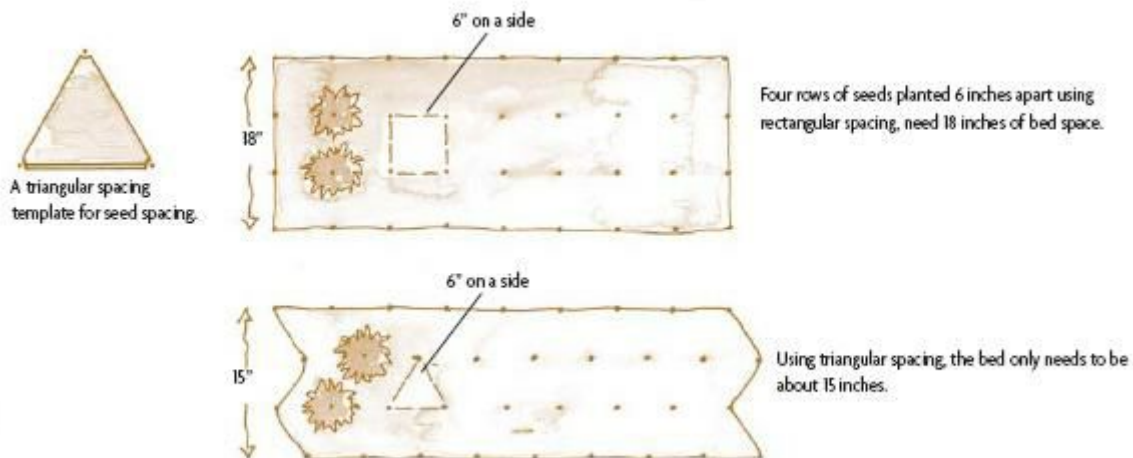
- **Starring:** Walnut (*Juglans regia*) as the center tree, native to the U.S. with edible nuts (two trees needed)
- **Optional star choice:** Bur Oak (*Quercus macrocarpa*, two trees needed, edible nuts), Sugar Maple (*Acer saccharum*, one tree needed, edible sap)
- **Featuring:** Silver Buffaloberry (*Shepherdia argentea*) as the nitrogen fixing shrub, native with edible berries, or Hackberry

- **Supporting cast:**

- Bee Balm (*Monarda didyma*) as native, edible, medicinal, insectary, and mulch maker
- Calendula (*Calendula officinalis*) as edible, medicinal, and insectary
- Chives (*Allium schoenoprasum*) as edible, insectary, and pest confuser
- Lovage (*Levisticum officinale*) as edible, insectary, soil improver, and beneficial insect attractant
- Wild Bergamot (*Monarda fistulosa*) as native, edible, medicinal, and insectary
- Yarrow (*Achille millefolium*) as native, medicinal, edible, insectary, soil improver, and beneficial insect attractant
- Russian Comfrey, Bocking 14 (*Symphytum Uplandica*) as medicinal, mulch maker, insectary, and soil improver
- New Jersey Tea (*Ceanothus americanus*) as native, medicinal, nitrogen-fixer, mulch maker, insectary, and soil improver
- Hazelnut (*Corylus americana*) as native, edible, mulch maker, and wildlife food
- Black Raspberry (*Rubus occidentalis*) as native, edible, medicinal, mulch maker, and wildlife food
- Clove Currant (*Ribes odoratum* 'Crandall') as native, edible, insectary, mulch maker, wildlife food, soil improver, and provider of very fragrant blooms

Efficient tree planting patterns

A triangular net pattern allows more seeds to be planted in the same space than the more commonly used rectangular pattern.



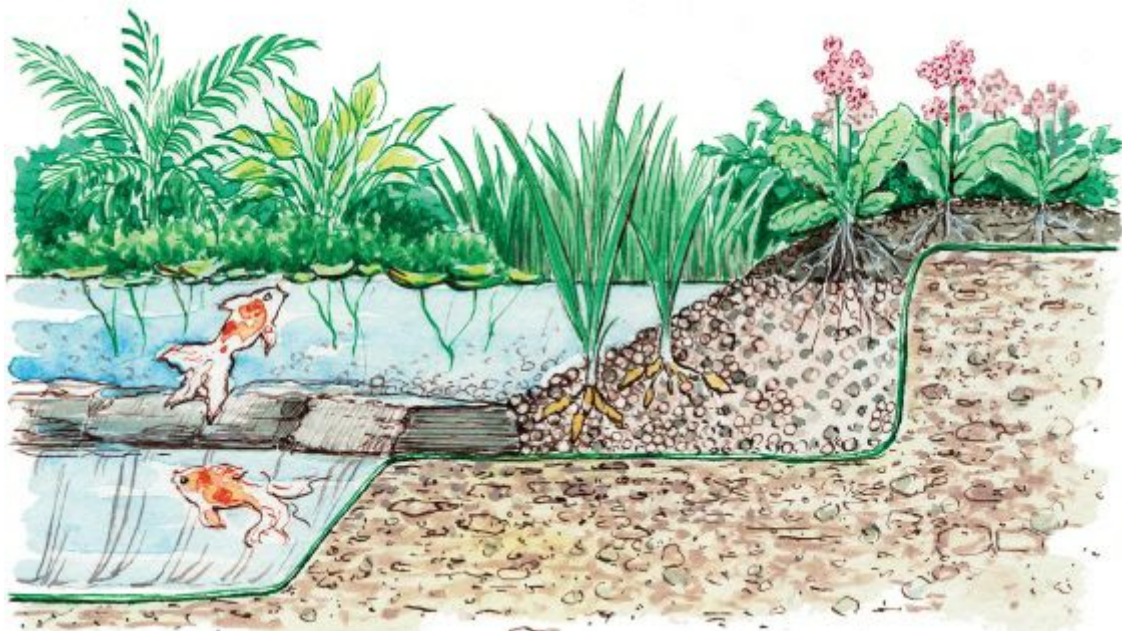
Water: Catching rainwater, chimney as water tower, pond & irrigation

Water is a valuable resource. Rainwater of about 228 m³/year is coming down on the 400 m² roof which is inclined towards the backyard. Momentarily, this water is collected with rain

gutters and disposed through 4 downpipes [DP in figure 4] into the canalisation system. Instead of this practice, the rainwater of DP 1-3 can be directed into small swales passing plants with high water demand before discarding potential overflow in the canalisation outlets at DP 2-4. The Rainwater of DP4 can be stored in a water tower and a pond to deliver irrigation water during dry periods instead of using tap water for this purpose.

The old chimney can be converted into a small **water tower** so that this water is delivered with natural head pressure avoiding the use on an electric pump. To do so, the chimney will be sealed in a height of 5 m and downpipe DP4 will be redirected from the roof into the chimney.

Overflow from the water tower will be delivered into a small **pond** near the chimney. The pond can feed a small swale watering the fruit trees, herb spirals and other plants with high water demand, ending at another overflow into the canalisation system. The pond will be stocked by edible fish. **Edge design** is another crucial element of permaculture design. The following pond edge, based on a design by Earle Barnhart of Great Work, Inc., allows animals and birds access to the water. At the same time, the gravel beach looks far more natural than ponds edged with rocks, a pattern rarely seen in nature.



Greenhouse

A small greenhouse will be used especially for seeding and growing vegetables which need a greenhouse climate (e.g. tomatoes). It can also house gardening tools to prevent them from corrosion. The greenhouse will be located at door 1 (in front of 104c) covering most of the existing concrete surface sealing next to one of the warm building walls to use the thermal radiation of the wall. Lawn 1 with barbecue area will be next to it so that it can serve a retreat for bad weather. If shade is needed in the greenhouse, it could be trellised by vine which provides shadow in summer but clear solar exposure in winter.

Keyhole beds / Mandala garden

Keyhole beds have the best bed-to-path ratio with only 25% of the space needed for pathways and are thus a perfect example of the use of advanced patterns in permaculture. Combining keyhole bed elements can result in a mandala garden pattern where growing & edge space are maximized while path space is minimized, thus allowing maximum production and aesthetics.



These keyhole beds will feature several vegetables and salads, e.g.:

- salads, chard
- cucumbers
- eggplant
- pumpkin
- tomatoe
- carrots
- beetroot
- rhubarb (pieplant)
- cauliflower, broccoli
- cabbage
- radish, horseradish
- beans, peas
- quinces
- parsnip
- legumes

All plants have different requirements regarding sunlight, warmth, soil, water, nutrients, etc. These requirements must be taken into account when positioning them, otherwise their yield would be reduced and they might get vulnerable to pests and diseases. This vulnerability

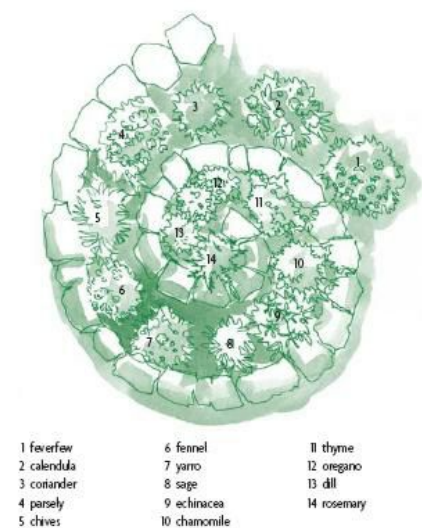
can also be reduced by planting proper **companions** which attract protective insects, enrich nutrients or repel pests. The final selection and location of the plants will be done by the community in an iterative process using **companion planting** tables and additional information about plant requirements. The following Google-Table presents such a companion planting table which can be easily supplemented with additional information: https://docs.google.com/spreadsheets/d/1iqkgplirqFt3LWN-1yiBIHsOc7308SxMOs8r_w3vPg8/edit?usp=sharing

Of each plant species, several sub-species should be considered, which might even ripe at different times to provide for a longer period time. This approach achieves also more diversity and thus stability - a key design philosophy in permaculture. Furthermore, seeds can be collected over several generations of the strongest plants with the biggest yield, thus **cultivating** plants which are perfectly adapted to the conditions on the project site.

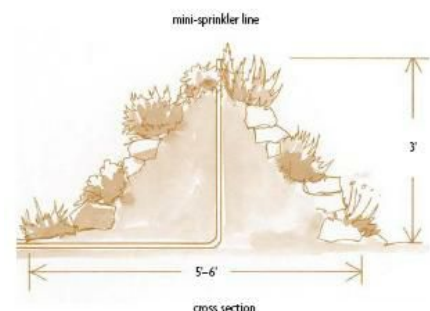
For organisational purposes, the beds will be divided in numbered sectors/zones, to make it easier to refer to them and to locate them for all community members.

Herb spirals

Another example for the use of advanced patterns are herb spirals, which combine the spiral and mound patterns into a three-dimensional helix with a diameter of 1.5-1.8 m and a height of 0.9 m, providing perfect habitats for 20-30 different kind of herbs. At the bottom, herbs with high water demand are planted, while water demand of plants decreases with increasing height. At the top and towards south and west herbs with high demand in sunlight will be planted while north and east sides contain plants with less sunlight demand. A small basin or tiny pond (0.3-0.9 m across) at the bottom of the spiral can allow to grow watercress, water chestnuts, and other edible pond plants.



At least three **herb spirals [HS]** will be created, which will be located near to the three doors accessing the yard in order to make them easily accessible for all inhabitants.



Composts & worm farms (vermicompost)

A core principle of permaculture is “earth care” by sustaining or enhancing soil fertility by cycling local resources instead of using artificial fertilizers. Hence, composts are a core

element of permaculture gardens. They allow to recycle all kinds of organic input material (chopped wood, weeds, manure, kitchen wastes, etc. One to three compost piles **[CP]** will be located throughout the garden, allowing for different composting stages and requirements, e.g. weeds with seeds should be disposed in a “hot compost” in order to destroy the seeds.

Worm farms [WF] are efficient nutrient cyclers and provide solid and liquid nutrient-rich organic fertilizers - vermicast & worm juice. They are by far the easiest form of including animals into the system. Input materials are weeds and organic kitchen waste. They will be located near the doors accessing the yard in order to allow easy disposal of kitchen wastes. The project will start with one worm farm but aims at having a total of three (one next to each door).

Compost toilets [CT] can be used to access another potential stream of nutrients - human faeces and urine. They also offer a convenient alternative against climbing up several stories in order to reach on one's apartment toilet when working, relaxing or celebrating in the garden. However, the proper use of these toilets needs to be communicated and they need to be well maintained.

Using composts and worm farms will also reduce the amount of biodegradable waste which needs to be disposed by the municipal waste management, thus reducing costs which are included in the rent.

Window planting boxes

The planting zone can be extended onto the building's walls. The windows facing the backyard have a SSE-direction and thus perfect conditions to grow many herbs, vegetables and even strawberries. My flatmate Christian already built a self-made wooden planting box which is now sitting in front of the kitchen window. Regular workshops will be conducted to build and plant such window boxes for all interested people.



Lawns

In order to gain consent for the project from all stakeholders it is important to maintain or enhance also recreational and relaxing elements of the backyard. For that purpose, two lawns are planned for the backyard, one huge lawn next to the greenhouse (which also offers a good retreat for bad weather), with an area for barbecue, several tables / chairs shaded by fruit tree guilds, and a section for children to play (with a sand box, an already existing trampoline, and a swing, near to the rabbit house).

A second smaller lawn will be created as a place of calm retreat next to the pond, with some benches and hammocks between fruit trees. Here, people can meditate, practice yoga or tai chi or simply relax near the water site.

Rabbits

Rabbits are easy to breed and handle, cute and thus most interesting for children and might hence get most likely the consent of all inhabitants as animal element of the garden. They can easily be fed with weeds and kitchen remainders and their manure can be used as fertilizer (directly, in rabbit tractor, or in composts/ worm farms). An enthusiastic member of the community might even start to professionally breed bunnies, providing a stream of income into the community.



Rabbit tractor: a movable, bottomless pen that lets the bunnies graze and manure the soil while protecting them from predators and preventing them from munching garden veggies.

Energy

Saving, catching, preserving and distributing energy is one of the core principle of permaculture. Plants convert the sun's solar energy into biomass, from where the energy can be consumed through eating, mulching, composting, burning, etc.

Plants can also be used to optimize the energy efficiency of the building. The walls can be covered by **creepers / climbing plants** ivy (evergreen) or vines (which lose their leaves during autumn/ winter). The shade provided by the plants and their cooling effect by evaporation helps to reduce the need for air conditioning or ventilation in summer.

Solar panels can be installed on the roof in order to cover parts of the electricity demand of the inhabitants. Panels directed to east and west can help to cover the high urban electricity demand in the mornings and evenings, thus reducing the need of coal power from the grid. This can reduce the electricity bills of the tenants and provide an extra income to the landlord. They can also be combined with **heat pumps** and thus reduce the demand of district heating (mainly provided by coal and gas power plants in Berlin). The initial investment however is very high for such solutions and pays off after about 10-20 years. But such sustainable solutions can attract tenants with higher education and thus safer income and reduce tenant fluctuation by a binding effect.

Community Building & Organization

The community should be build up on a voluntary basis - whoever wants to commit and participate should be able to do so in a manner which suits him or her best as long as it is of benefit for the community. Instead of making decisions by democratic votes, the approach of consent of all should be applied wherever possible. Communication should be based on Marshall Rosenberg's approach of non-violent communication (NVC). For some fields of action like rabbit breeding, greenhouse, composts, planting guidance etc, competent contact persons should be appointed. Contact details of these persons together with portrait pictures should be displayed in the glass information displays in each building's entrance floor, as well as on a community webpage. To share information, task planning etc., online tools like google documents, google calendar and task planners can be used.

It seems quite crucial to convince the caretaker of the building to commit to the project, because he is at the moment responsible for taking care of the yard.

Since there are many ways on how to organize such a community in detail and since the consent of all participants to that is required, the final details have to be worked out together with the participants. This is also true for the principles about financial matters and how yields should be distributed. In general, people who are strongly committed and do a lot of

work should have first access to yields of the garden, but the details must be worked out and agreed by the whole community.

Time plan

The following table shows a rough time plan for the 18 month of the project, which are the most crucial for going into operation. Most elements will be set up during that time frame, but some will need several years before they give a yield, especially fruit trees. During that time, they need to be well maintained (supply of water and nutrients, weeding, mulching, pruning, etc.). Supplementary plant successions will facilitate this caretaking tremendously.

Month	MM/YY	Tasks
1	5/20	Connecting with similar communities for exchange of knowledge and experiences, esp. regarding shared machinery and source of plants, seeds, etc. Revising the design according to feedback.
1	6/20	Gatherings of lodgers to present the idea, gain consent, support, and commitment. Establishing a core group with assigned tasks and responsibilities, acting as contact person for all who want to become involved later on. Revising the design according to feedback.
2	7/20	Presentation of the idea and design to the landlord. Revising the design according to feedback and resources (financial, hardware, manpower).
3-7	8-11/20	Restructuring the garden: felling existing trees, earth work, setting up composts, building facilities (e.g. greenhouse, worm farms, compost toilets, ...)
8-10	12/20-2/21	Winter activities with to build up the community and exchange with other communities (baking, cooking marmalade, christmas & new year parties, ...). Workshops to build window boxes. Revising the design according to feedback.
11-13	3-5/21	Preparation of beds, seeding, planting trees and supporting succession plants
13-15	5-7/21	Transplanting seedlings, seeding next generation
14-18	6-10/21	Harvesting, reseeding, composting etc.

Appendix: List of symbols

Symbol	Element
Bb	barbecue
Ch	Chimney
CP	Compost Pile
CT	Compost Toilet
DP	Downpipe
ET	Existing Tree
HS	Herb Spiral
T	Tree
TG	Tree Guild
WF	Worm Farm