



# Backyard Community Garden - Final PDC Project

PERMACULTURE DESIGN COURSE - FINAL PROJECT - MARK BOST

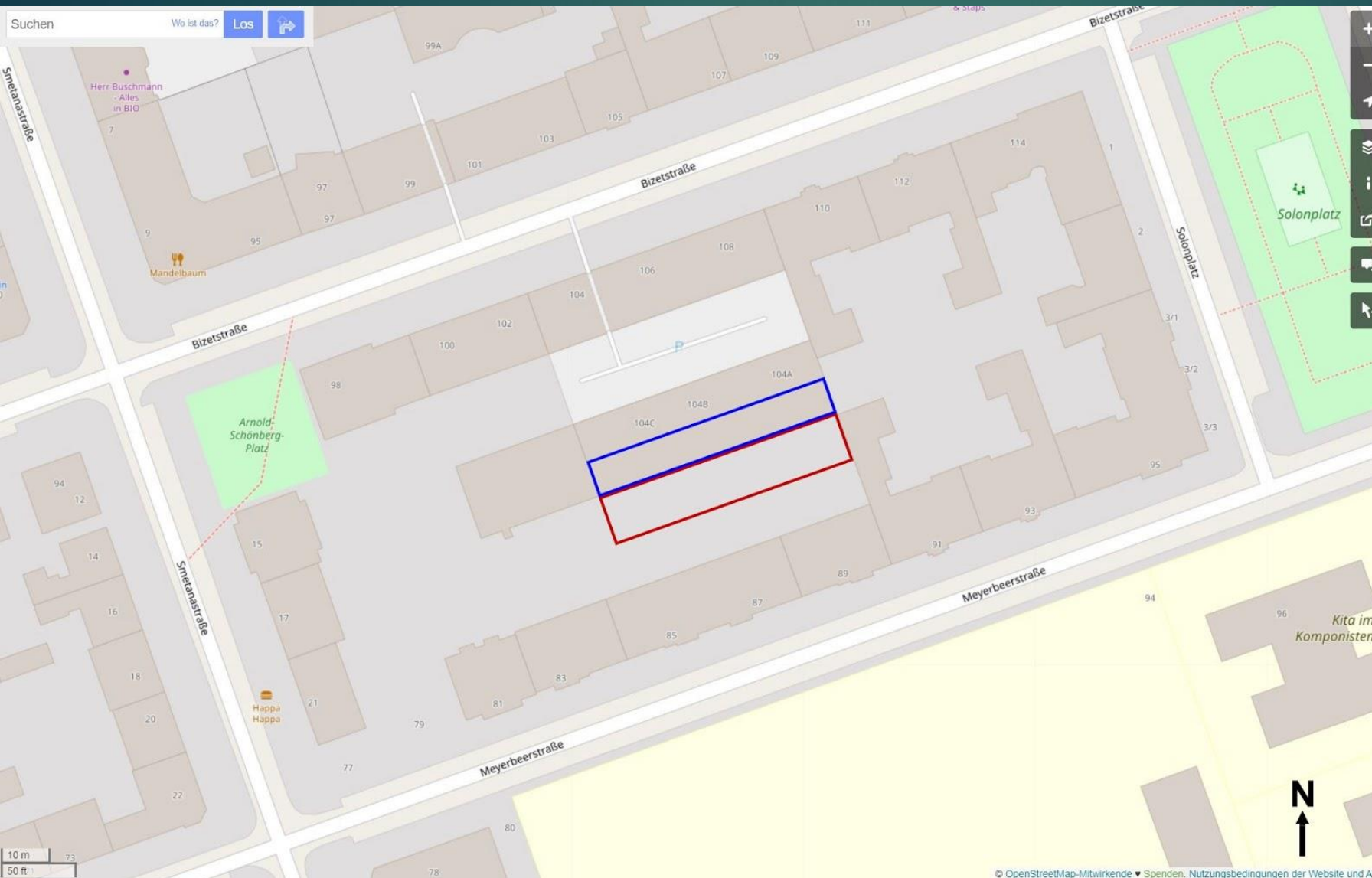
SAN KAMPHENG, CHIANG MAI, THAILAND, 12/2019

# Project Vision & Outline

- ▶ Convert existing backyard into a productive permaculture garden
- ▶ Building up a community among the tenants
- ▶ Creating the opportunity for
  - ▶ cross-generational interactions,
  - ▶ community belonging & escape of isolation,
  - ▶ creativity & meaningful leisure activities,
  - ▶ exchange of knowledge and skills, learning,
  - ▶ and healthy and nutrient-dense local food supply
- ▶ Raise awareness about the **problems of industrial agricultural systems** and its alternatives → **PERMACULTURE**
  - ▶ 7 R's: Rethink, Refuse, Reduce, Reuse, Repair, Recycle, Rot

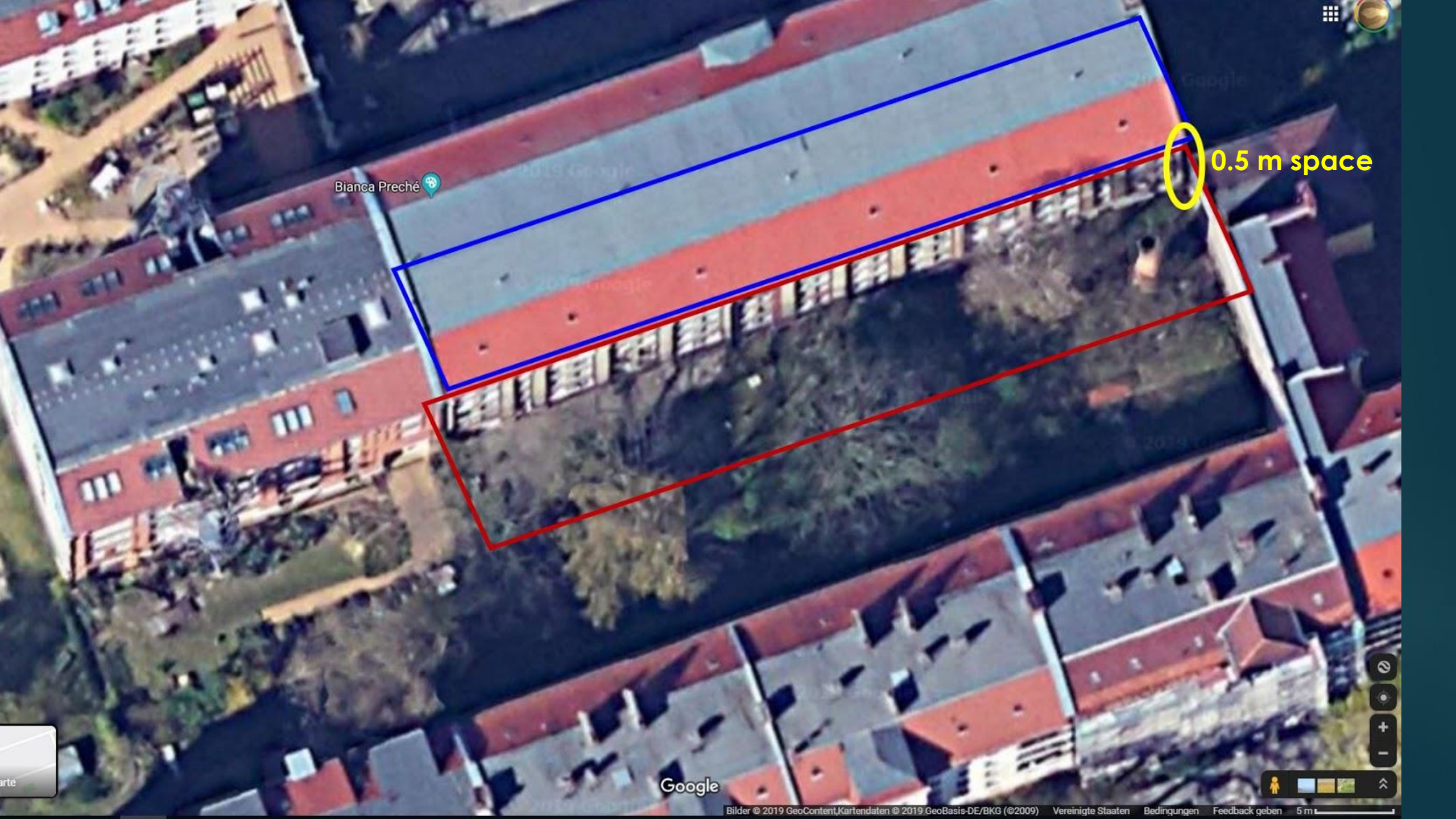


# Project Site



- ▶ Half backyard
- ▶ Dimensions: 51 x 10 m = 510 m<sup>2</sup>
- ▶ Connected households: 45
- ▶ Inhabitants: ≈90
- ▶ Additional rooftop rainwater catchment: 400 m<sup>2</sup>
- ▶ Orientation is 19.5° towards west
- ▶ 5 stories (22 m high)
- ▶ Ground floor only storage





Bianca Preché

0.5 m space

Google



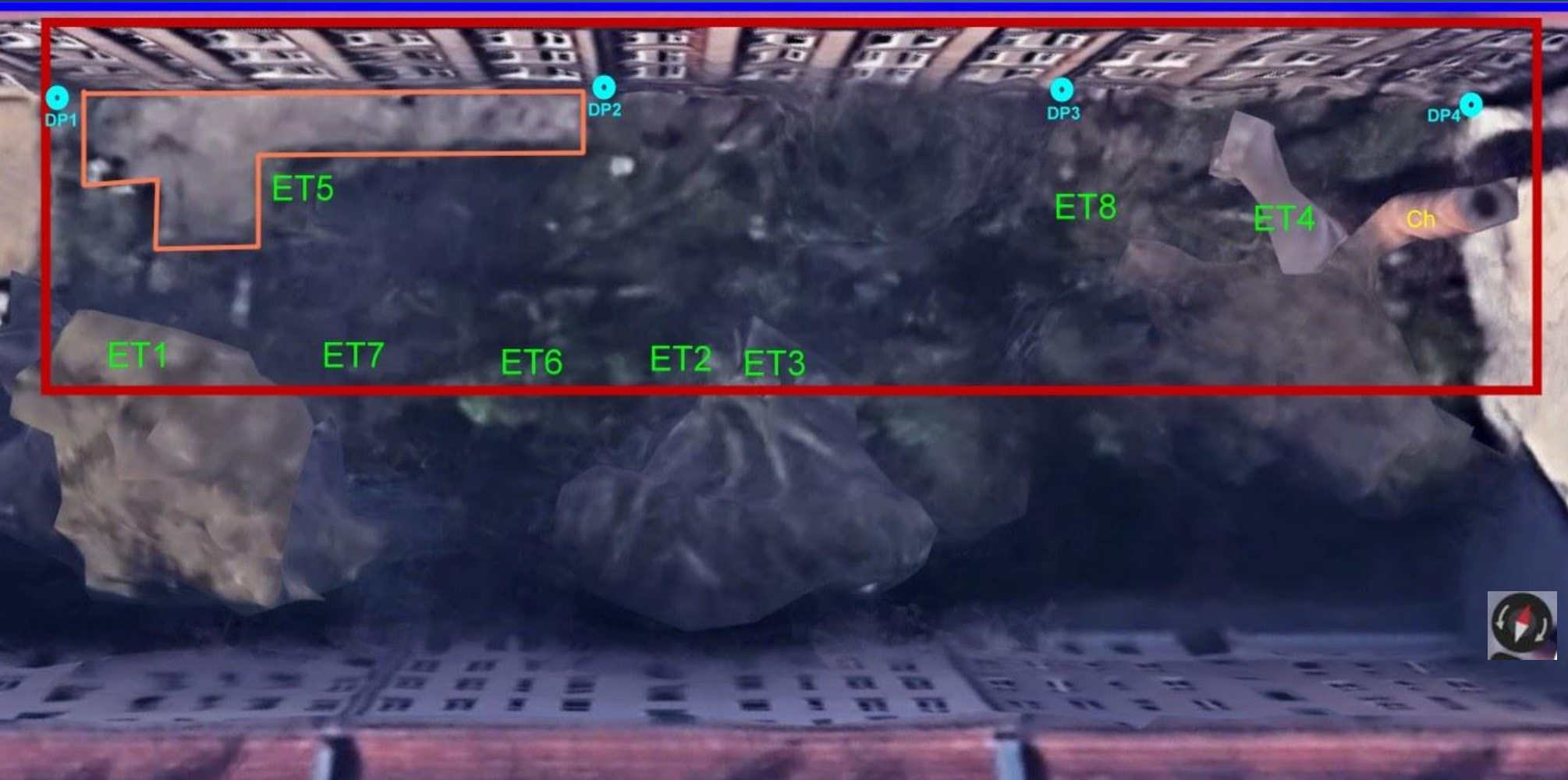


Bianca Preché

Google



# Project site (4)



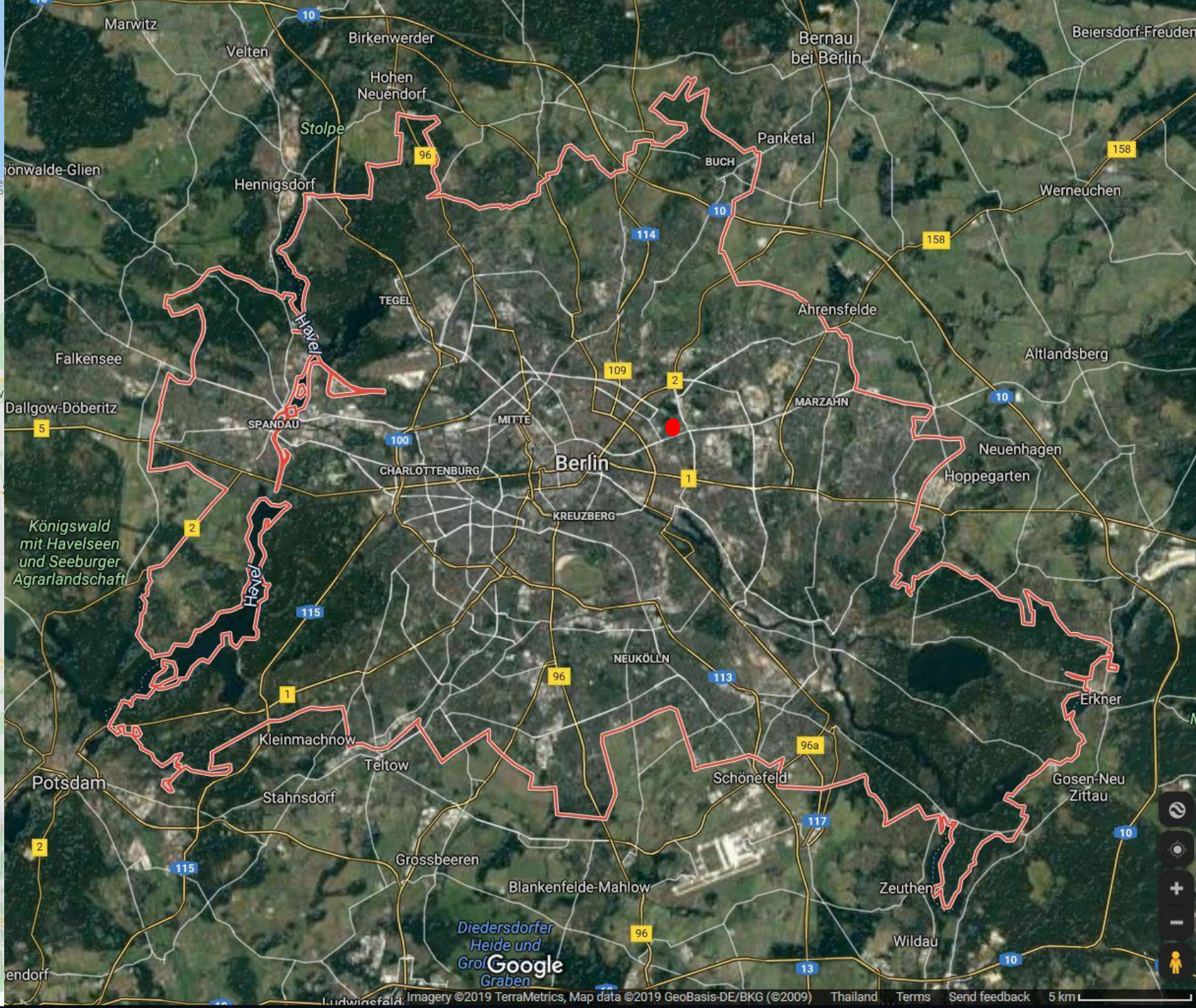
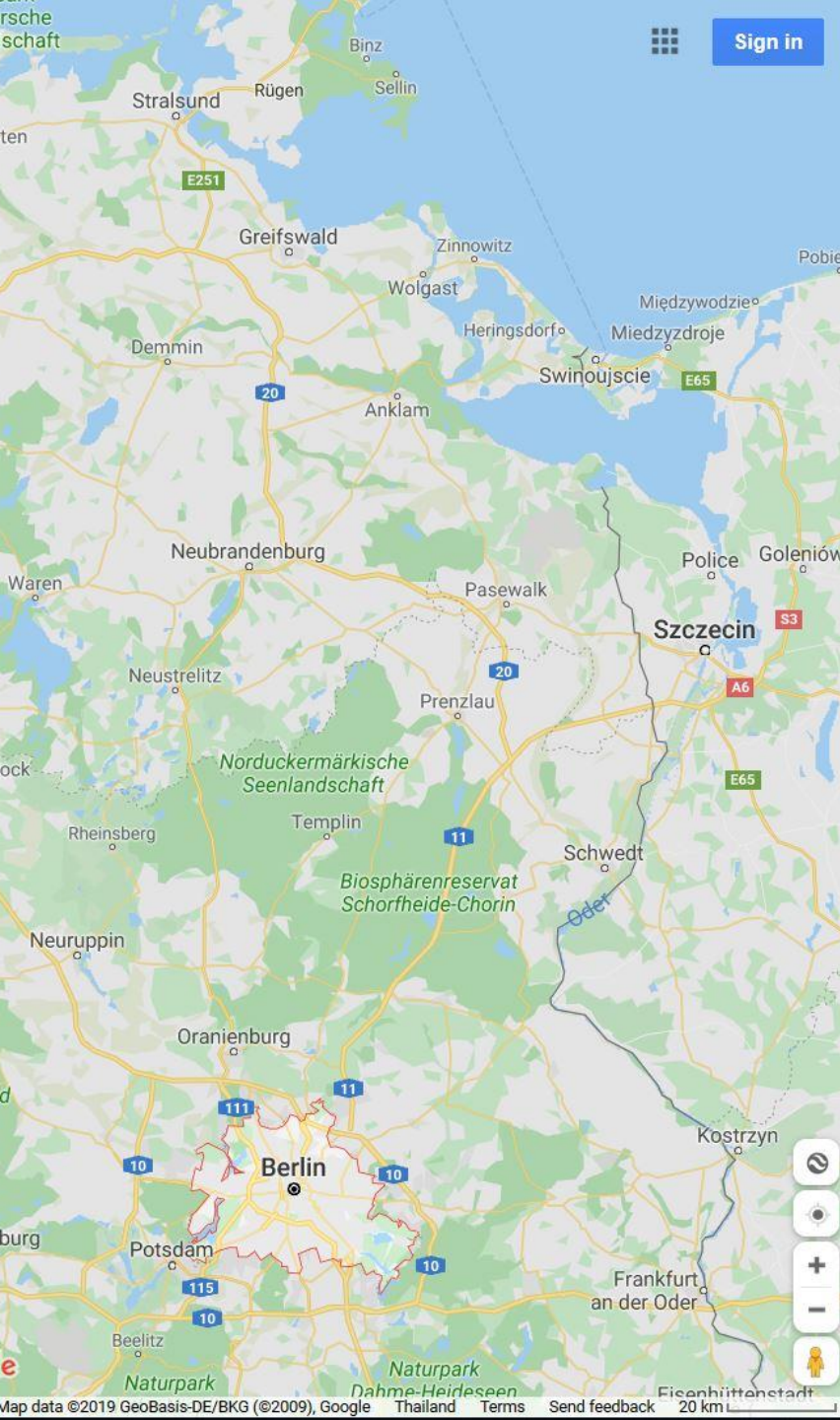
- ▶ **ET** = existing trees
- ▶ **DP** = downpipes for rooftop rainwater
- ▶ **Ch** = Chimney
- ▶ Orange area: concrete surface sealing

# Climate

- ▶ Location: 52°31'00"N, 13°23'20"E, altitude: 48 m
- ▶ 180 km south from Baltic Sea
- ▶ temperate seasonal climate with a continental effect
- ▶ About one-third of the city's area is composed of forests, parks, gardens, rivers, canals and lakes
- ▶ Summers: warm, sometimes humid, av. 22–25 °C / 12–14 °C
- ▶ Winters: cool, av. 3 °C / -2–0 °C
- ▶ Spring & autumn: chilly to mild
- ▶ Microclimate (heat stored in buildings & pavement) → +4 °C
- ▶ Precipitation: 570 mm, moderate rainfall all year
- ▶ Snowfall possible: December to March









# Climate

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
<u>Average precipitation [mm]</u>	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 <sup>2</sup> [m <sup>3</sup> ]	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

- ▶ Very sandy with high drainage and no clay  
*“medium to strongly sandy loam” / “weakly to medium silky sand”*
- ▶ Many minerals are easily available,
- ▶ Carbon & nitrogen needed to grow sufficient yields of edible plants  
→ humus / compost

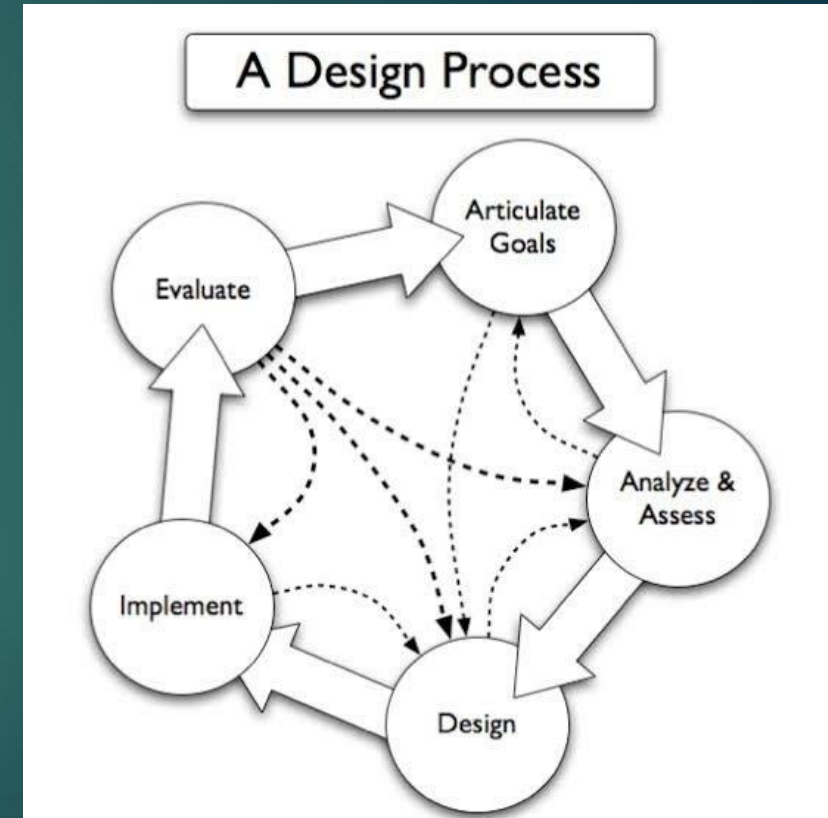
# Water

- ▶ Public tap water based on bank filtration & groundwater  
→ hard water rich in minerals, e.g. calcium, bicarbonate
- ▶ No chlorination → safe to drink
- ▶ Some plants don't like too much “hard water” (Ca)



# Design: Zone & Sector Analysis

- ▶ Design: ongoing iterative process → never really finished
- ▶ Very limited space (510 m<sup>2</sup>) → ALL ZONE 1  
(small, near house, great value, often visited & harvested, much hardware, intense elements, usually ≤ 1 ac ≈ 4047 m<sup>2</sup>)
- ▶ No slope, orientation 19.5° towards west
- ▶ High walls (22 m) provide much shade → micro-climates!
- ▶ Sectors (functions):
  - ▶ Recreational areas, playground for children
  - ▶ Productive areas (fruits & vegetables)
- ▶ Slope, orientation, shade & micro-climate determine sectors










# Layer 1: Microclimate Zones



## Microclimate Zones

- 1  very sunny & warm (warm wall)
- 2  mostly sunny
- 3  50% sunny / shady
- 4  mostly shaded
- 5  90% shaded, cool (cool wall)

N  
1:200

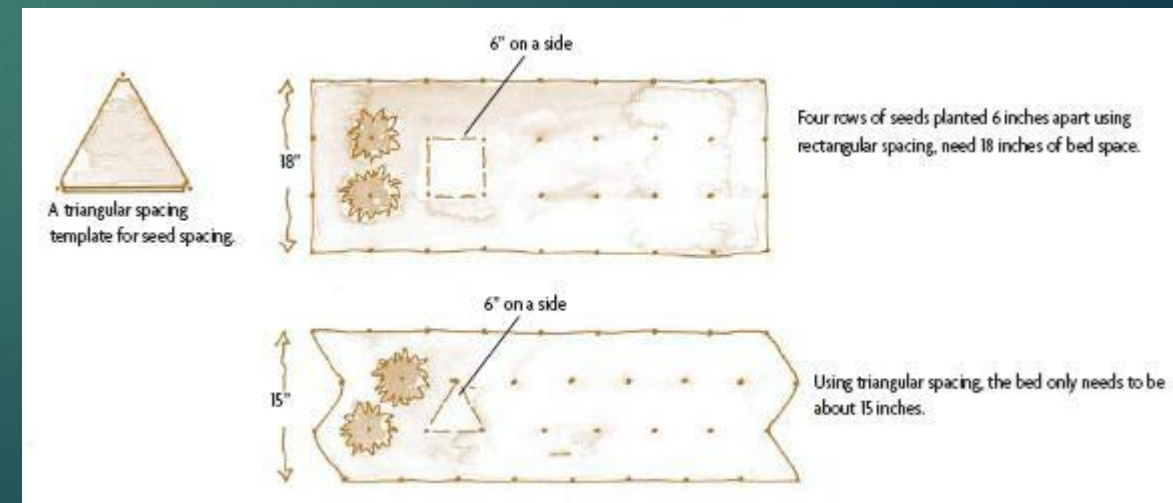
# Elements

- ▶ Technique: Listing possibilities, selection from random assemblies using spatial prepositions (in, under, above) → “tank on roof”
- ▶ Selected Elements:
  - ▶ Tree guilds
  - ▶ Catching rain water, chimney as water tower, pond & irrigation
  - ▶ Greenhouse, keyhole beds / mandala garden, herb spirals
  - ▶ Composts & worm farms
  - ▶ Window planting boxes
  - ▶ Lawns
  - ▶ Rabbits



# Tree Guilds → Diversity → Stability

- ▶ Existing large trees shade the garden too much  
→ felling; use timber to build constructions, tools or window boxes, for mulching, firing, biochar
- ▶ Planting fruit tree guilds
  - ▶ 1 fruit tree
  - ▶ 1-2 shrub(s) (often N-fixing with edible berries)
  - ▶ Several small nurturing companions:
    - ▶ Providing nutrients, mulch, herbs, berries
    - ▶ Attracting beneficial insects (pollination, pest & disease control)
    - ▶ Beneficial edge design (e.g. beneficial ground cover avoiding random weeds)
    - ▶ Protecting incompatible plants from each other
- ▶ Use many different sub-species which ripe at different times of the year to extend harvesting period
- ▶ Keep trees small for easy harvest, less spare requirement & less shading
- ▶ Use triangular planting pattern to maximize number of trees / area:





## FRUIT TREE GUILD

A fruit tree surrounded by companion plants that provide nutrients, pollination, habitat, mulch, pest & disease control to benefit the whole plant community



Fruit Tree  
e.g. *Prunus persica*  
Food, Habitat

Comfrey  
*Symphytum x uplandicum* 'Bocking 14'  
Fertilizer, Insectary, Pollination, Herb

Daffodils  
*Narcissus* sp.  
Pest Deterrent

Purple Coneflower  
*Echinacea purpurea*  
Pollination, Food for Wildlife

Rhubarb  
*Rheum x hybridum*  
Food, Groundcover

Asparagus  
*Asparagus officinalis*  
Food

Strawberry  
*Fragaria virginiana*  
Food, Groundcover

Thyme  
*Thymus vulgaris*  
Herb, Groundcover

Astilbe  
*Astilbe* sp.  
Pollination, Insectary

Red Currant  
*Ribes rubrum*  
Food

Blue False Indigo  
*Baptisia australis*  
Fertilizer

Sky Blue Aster  
*Aster azureus*  
Pollination, Insectary

Walking Onions  
*Allium proliferum*  
Food, Pest Deterrent

## SOIL

Well-draining, fertile  
Sandy, loamy texture  
pH 6.0 – 8.0

## WATER

1-2" rain/water/week  
Avoid overwatering  
Avoid areas of flooding

## SUN

6+ hours full sun daily  
Eastern & Southern  
exposures are best

## NUTRIENTS

Top dress with compost,  
leaf mulch, and natural  
hardwood chips



theresiliencyinstitute.net

## Selected tree guilds:

- ▶ Apple/ Pear/  
Quince/ Plum:
  - ▶ Goumi /  
Buffaloberry (N-  
fixing shrubs with  
edible berries)
- ▶ Mulberry
  - ▶ Goumi
- ▶ Walnut
  - ▶ Hackberry /  
Buffaloberry



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

- ▶ Rooftop rainwater ( $400 \text{ m}^2 \rightarrow 228 \text{ m}^3/\text{year}$ ) collected by gutters, disposed by 4 downpipes (DP)
- ▶ Redirecting DP4 into chimney
- ▶ Sealing chimney (15 m) at 5 m  $\rightarrow$  head pressure avoids pumping
  - ▶ Overflow into pond with edible fish and natural edge design
  - ▶  $\rightarrow$  irrigation channels / swales
- ▶ Redirect DP 1-3 into swales / channels for irrigation
  - ▶ Overflow into canalisation (DP 2-4)



# Combine keyhole beds to mandala garden

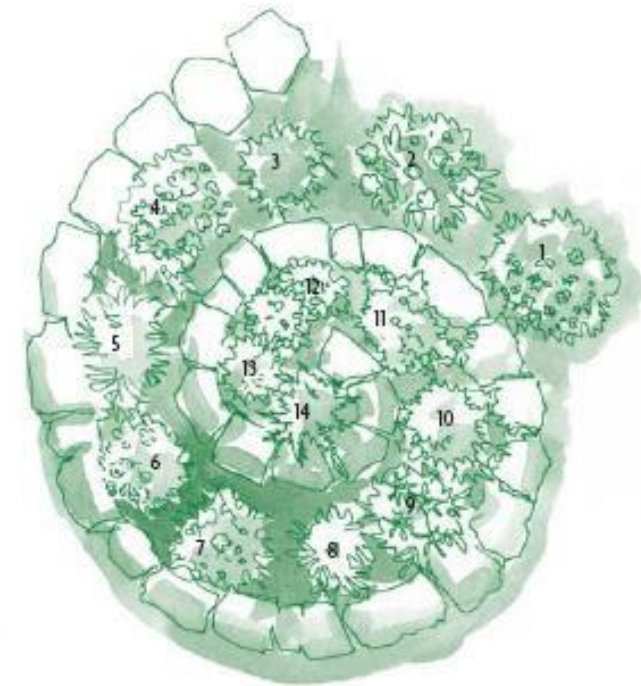
- ▶ Best bed-to-path ratio (25 % paths)
- ▶ Planting several vegetables and salads, e.g.:
  - ▶ salads, chard, cucumbers, eggplant, pumpkin, tomatoe, carrots, beetroot, rhubarb (pieplant), cauliflower, broccoli, cabbage, radish, horseradish, beans, peas, quinces, parsnip, legumes, ...
- ▶ Place plants according to their **requirements** regarding sunlight, warmth, soil, water, nutrients, etc.
- ▶ Use **companion planting** (diversity) to avoid pests and diseases
- ▶ **Collect seeds of best plants to cultivate** plants which are perfectly adapted to the conditions on the project site
- ▶ Final selection of plants: use local knowledge from experienced gardeners, local garden centres, and tree nurseries



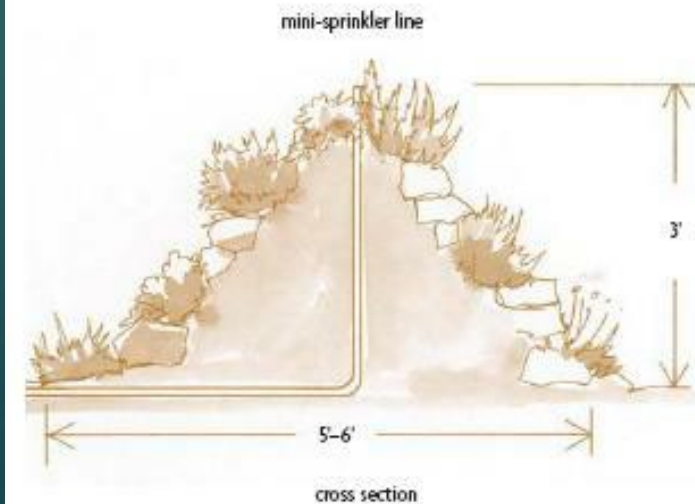


# Herb spirals

- ▶ Spiral mound (diameter 1.5-1.8 m, height 0.9 m) with small basin/pond at bottom provides all possible conditions regarding sunlight & humidity
- ▶ Can grow 20-30 different herbs
- ▶ Placement near the 3 doors (to be easily accessible for everyone)



- |             |              |             |
|-------------|--------------|-------------|
| 1 feverfew  | 6 fennel     | 11 thyme    |
| 2 calendula | 7 yarrow     | 12 oregano  |
| 3 coriander | 8 sage       | 13 dill     |
| 4 parsley   | 9 echinacea  | 14 rosemary |
| 5 chives    | 10 chamomile |             |



# Composting

- ▶ **“Earth care”** by sustaining or enhancing soil fertility by cycling local resources instead of using artificial fertilizers
- ▶ **1-3 compost piles**
  - ▶ Input: mainly green & dry material + manure + urine
  - ▶ Output: solid compost (humus)
- ▶ **3 worm farms** next to the 3 doors
  - ▶ Input: mainly green material + kitchen waste
  - ▶ Output: solid worm casting + liquid worm juice
- ▶ **1-2 compost toilets + urine collection**



# Greenhouse

- ▶ Greenhouse on concrete surface sealing (door 1, warm wall, radiation)
- ▶ Next to lawn 1 → retreat for bad weather
- ▶ Seeding and growing vegetables which need a greenhouse climate
- ▶ Storage for gardening tools
- ▶ Optional trellised by vine (shade in summer, clear solar exposure in winter)

## Lawn 1 (large): social

- ▶ Next to greenhouse: barbecue, tables, playground (sandbox, trampoline, swing)

## Lawn 2 (small): calm retreat

- ▶ Next to pond: benches, hammocks, yoga & meditation place

# Window planting boxes

- ▶ Extend productive zone to sunny wall
- ▶ Easy access / harvest
- ▶ Plant herbs & vegetables, esp. with high demand in sunlight & warmth
- ▶ Regular workshops to build and plant these boxes for all inhabitants





# Rabbits

- ▶ Easy to breed & handle, cute → interesting for kids
- ▶ Can be fed with weeds & kitchen waste
- ▶ → animal most likely to gain consent from all inhabitants
- ▶ Manure as fertilizer (C:N - 8:1)
- ▶ Grazing & fertilizing in rabbit tractor
- ▶ Enthusiastic member might professionally breed → income stream



# Energy

- ▶ Cover walls with creepers / climbing plants (ivy, vines)
  - ▶ Shade & cooling effect of evaporation reduces AC / ventilation needs
- ▶ Rooftop solar panels → covering partly electricity demand
  - ▶ Reducing electricity costs & generation of coal power
  - ▶ Income stream for landlord
- ▶ Electric heat pumps
  - ▶ Reduce demand of district heating (coal/gas power)

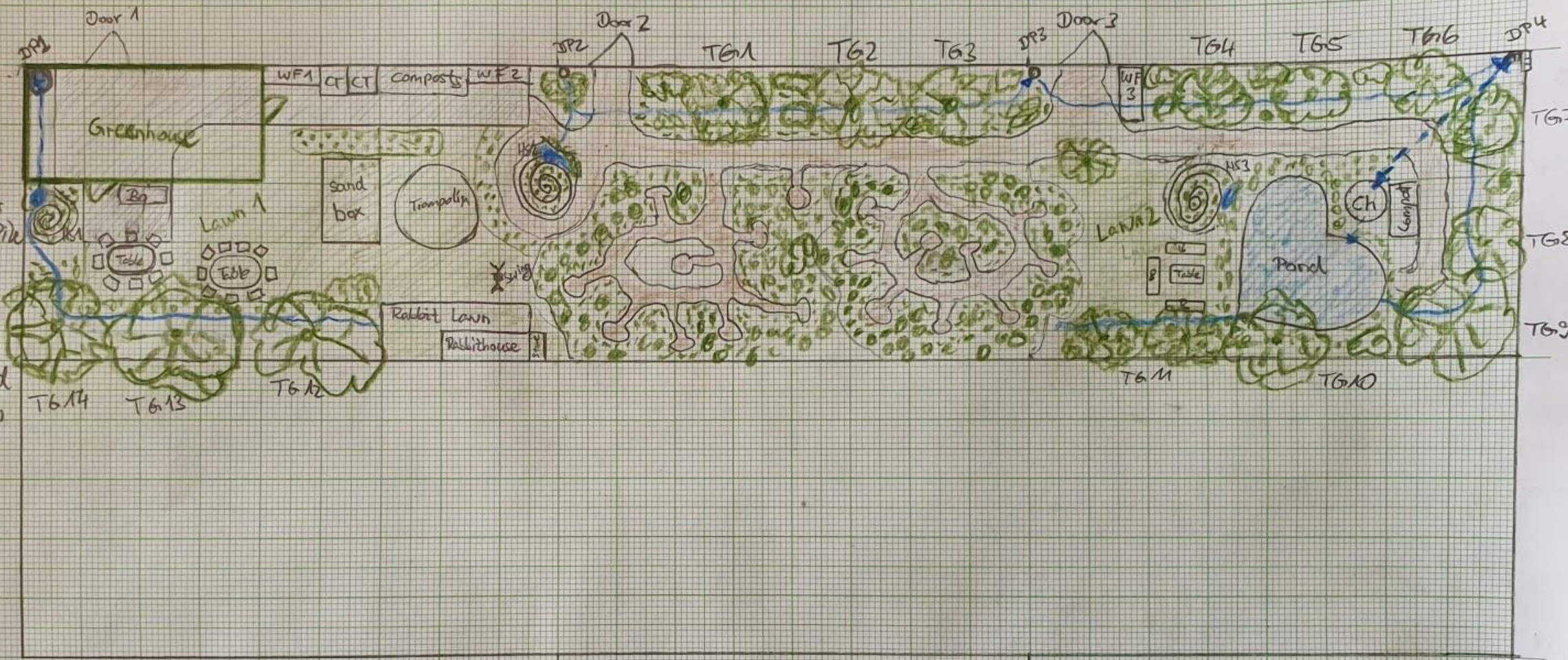


# Community & Organisation

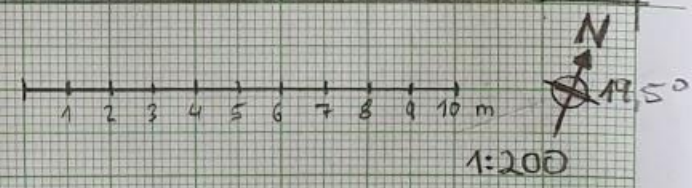
- ▶ Open for everyone, but focus on tenants
- ▶ Participation / commitment voluntary
- ▶ Principles: Non-violent communication (NVC) & consent of all
- ▶ Appointment of competent contact persons for certain fields ( e.g. rabbit breeding, greenhouse, composts, planting guidance)
  - ▶ Contact details & portrait pictures displayed in the glass information displays in each building's entrance floor, as well as on a community webpage
- ▶ Consent of all stakeholders required (landlord, tenants, caretaker)
- ▶ Organisation of many community activities (e.g. knowledge exchange talks, workshops, cooking, barbecue, yoga, meditation, NVC, ...)
- ▶ Further details have to be worked out by community
- ▶ Legal form: most likely non-profit association



- Bq = Barbeque
- Ch = Chimney / Water tower
- CP = Compost Pile
- CT = Compost Toilet
- DP = Down Pipe
- HS = Herb Spiral
- Tb = Tree Guild
- WF = Worm Farm



- beton surface sealing
- swale
- underground or airborne water pipe
- small vegetables / beneficial companions
- large vegetables
- bushes
- tree guilds (T6)
- foot path





# Time plan for starting phase



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.
2	6/20	Gatherings of lodgers to 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.
3	7/20	Presentation of the idea and design to the landlord. Revising the design according to feedback and ressources (financial, hardware, manpower).
4-8	8-11/20	Restructuring the garden: felling existing trees, earth work, setting up composts, building facilities (e.g. greenhouse, worm farms, compost toilets, ...)
9-11	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.
12-14	3-5/21	Preparation of beds, seeding, planting trees and supporting succession plants
14-16	5-7/21	Transplanting seedlings, seeding next generation
15-19	6-10/21	Harvesting, reseeding, composting etc.