Backyard Community Garden - Final PDC Project

PERMACULTURE DESIGN COURSE - FINAL PROJECT - MARK BOST
SAN KAMPHENG, CHIANG MAI, THAILAND, 12/2019
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 it’s alternatives ➔ PERMACULTURE
  - 7 R’s: Rethink, Refuse, Reduce, Reuse, Repair, Recycle, Rot
Project Site

- Half backyard
- Dimensions: 51 x 10 m = 510 m²
- Connected households: 45
- Inhabitants: ≈90
- Additional rooftop rainwater catchment: 400 m²
- Orientation is 19.5° towards west
- 5 stories (22 m high)
- Ground floor only storage
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

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record high [°C]</td>
<td>15.5</td>
<td>18.7</td>
<td>24.8</td>
<td>31.3</td>
<td>35.5</td>
<td>38.5</td>
<td>38.1</td>
<td>38</td>
<td>34.2</td>
<td>28.1</td>
<td>20.5</td>
<td>16</td>
<td>38.5</td>
</tr>
<tr>
<td>Average high [°C]</td>
<td>3.3</td>
<td>5</td>
<td>9</td>
<td>15</td>
<td>19.6</td>
<td>22.3</td>
<td>25</td>
<td>24.5</td>
<td>19.3</td>
<td>13.9</td>
<td>7.7</td>
<td>3.7</td>
<td>14</td>
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<tr>
<td>Daily mean [°C]</td>
<td>0.6</td>
<td>1.4</td>
<td>4.8</td>
<td>8.9</td>
<td>14.3</td>
<td>17.1</td>
<td>19.2</td>
<td>18.9</td>
<td>14.5</td>
<td>9.7</td>
<td>4.7</td>
<td>2</td>
<td>9.7</td>
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<tr>
<td>Average low [°C]</td>
<td>−1.9</td>
<td>−1.5</td>
<td>1.3</td>
<td>4.2</td>
<td>9</td>
<td>12.3</td>
<td>14.3</td>
<td>14.1</td>
<td>10.6</td>
<td>6.4</td>
<td>2.2</td>
<td>−0.4</td>
<td>5.9</td>
</tr>
<tr>
<td>Record low [°C]</td>
<td>−23.1</td>
<td>−26.0</td>
<td>−16.5</td>
<td>−8.1</td>
<td>−4.0</td>
<td>1.5</td>
<td>6.1</td>
<td>3.5</td>
<td>−1.5</td>
<td>−9.6</td>
<td>−16.0</td>
<td>−20.5</td>
<td>−26.0</td>
</tr>
<tr>
<td>Average precipitation [mm]</td>
<td>42.3</td>
<td>33.3</td>
<td>40.5</td>
<td>37.1</td>
<td>53.8</td>
<td>68.7</td>
<td>55.5</td>
<td>58.2</td>
<td>45.1</td>
<td>37.3</td>
<td>43.6</td>
<td>55.3</td>
<td>571</td>
</tr>
<tr>
<td>Rainwater of 400 m² [m³]</td>
<td>16.9</td>
<td>13.3</td>
<td>16.2</td>
<td>14.8</td>
<td>21.5</td>
<td>27.5</td>
<td>22.2</td>
<td>23.3</td>
<td>18.0</td>
<td>14.9</td>
<td>17.4</td>
<td>22.1</td>
<td>228.4</td>
</tr>
<tr>
<td>Average precipitation [days] (≥ 1.0 mm)</td>
<td>10</td>
<td>8</td>
<td>9.1</td>
<td>7.8</td>
<td>8.9</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7.8</td>
<td>7.6</td>
<td>9.6</td>
<td>11.4</td>
<td>101</td>
</tr>
</tbody>
</table>
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 m²) ➔ ALL ZONE 1
  (small, near house, great value, often visited & harvested, much hardware, intense elements, usually ≤ 1 ac ≈ 4047 m²)
- 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 well)
2. mostly sunny
3. 50% sunny/shady
4. mostly shaded
5. 90% shaded, cool (cool well)
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:
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 m² ➔ 228 m³/year) collected by gutters, disposed by 4 downpipes (DP)
- Redirecting DP4 into chimney
- Sealing chimney (15 m) at 5 m ➔ head pressure avoids pumping
  - Overflow into pond with edible fish and natural edge design
  - ➔ 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)
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
<table>
<thead>
<tr>
<th>Month</th>
<th>MM/YY</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5/20</td>
<td>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.</td>
</tr>
<tr>
<td>2</td>
<td>6/20</td>
<td>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.</td>
</tr>
<tr>
<td>3</td>
<td>7/20</td>
<td>Presentation of the idea and design to the landlord. Revising the design according to feedback and resources (financial, hardware, manpower).</td>
</tr>
<tr>
<td>4-8</td>
<td>8-11/20</td>
<td>Restructuring the garden: felling existing trees, earth work, setting up composts, building facilities (e.g. greenhouse, worm farms, compost toilets, ...)</td>
</tr>
<tr>
<td>9-11</td>
<td>12/20-2/21</td>
<td>Winter activities with to build up the community and exchange with other communities (baking, cooking marmalade, christmas &amp; new year parties, …). Workshops to build window boxes. Revising the design according to feedback.</td>
</tr>
<tr>
<td>12-14</td>
<td>3-5/21</td>
<td>Preparation of beds, seeding, planting trees and supporting succession plants</td>
</tr>
<tr>
<td>14-16</td>
<td>5-7/21</td>
<td>Transplanting seedlings, seeding next generation</td>
</tr>
<tr>
<td>15-19</td>
<td>6-10/21</td>
<td>Harvesting, reseeding, composting etc.</td>
</tr>
</tbody>
</table>