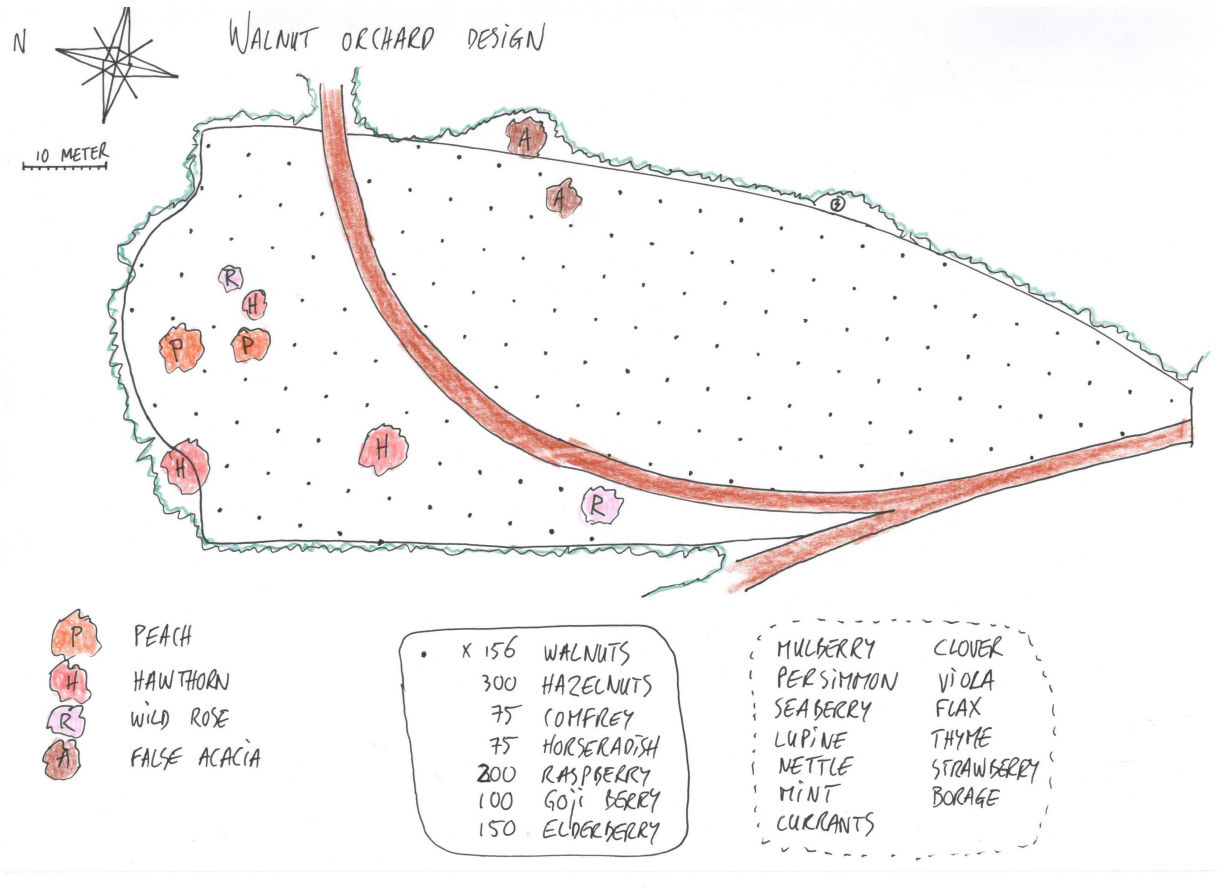


# Nut farm design

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2018-2023, Bogata Šuma, Vojnić, Croatia



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*The field when it was just a grass and wildflower meadow*

## ***Intro***

At Bogata Šuma we're happy to live a varied life with multiple income streams. We grow fruits, nuts and herbs for personal use. On the grass in between we host sheep and camping guests. The grass itself we turn into hay that we use as rabbit food. The herbs we use and sell as teas, kitchen herbs, oils, tinctures, creams and salves.

We grow a good part of our food, with which we feed ourselves, our visitors and volunteers.

Still we can do more with our land. More yield that is easy to store, and easy to make a high end product with. An investment in planting trees now, for protein sources for future generations, and added value to our land.

This nut orchard design (with its proteins and extra income potential) is part of our *Bogata Šuma overall design* and our *design for resilience* (both not public yet).

## **Design framework**

Deano Martin's E.G.A.D.I.M.E. (Establish aims & objectives, Gather info, Analyse, Design, Implement, Maintain, Evaluate) because the nut orchard is setup because of some aims and objectives.

## **Tools used**

Macnamara's Design Web (visioning, looking through the lens of principles, defining action points and keeping momentum (mainly in the appendices IV, V and VI), gratitude.

Holistic management as a basis for cyclic and systems thinking

Delvin Solkinson's Permaculture Design Deck

Google Maps, Google Earth, Arkod land register to analyze old and new maps and air pictures

Zoning for the map on page 7

Pen & paper, coloured pens and pencils to draw what is not there yet and to record observations since 2005 (when we bought the land)

SWOT analysis on page 13.

TOAST (from Robin Clayfield) as an evaluation tool on page 25

## ***Permaculture ethics***

**Earth care:** by planting trees in guilds with their companion plants, we contribute to biodiversity which makes a stronger system.

With planting diverse walnut tree guilds we aim to push back the monoculture of pseudo-acacia. We aim for a holistic management of our polyculture nut orchard which leads to regenerative land use.

**People care:** the world needs good sources of fats and proteins other than from animals. Our nut orchard contributes to human health and animal welfare. The extra income from the nut farm contributes to our family income which usually is spent back on the land (plants, animals, maintenance) or on our projects (swim pond, jungle gym) or time and money for education (Permaculture Diploma, embodied permaculture, Visionary Leadership program).

**Fair share:** the abundance of fallen nuts we share with squirrels and puh who in return plant new trees for us. In the future we will share our nuts with pigs. In the tree guilds we plant comfrey and other plants for bees and other insects. For them we will also build hotels and drinking spots.

# Establish aims & objectives

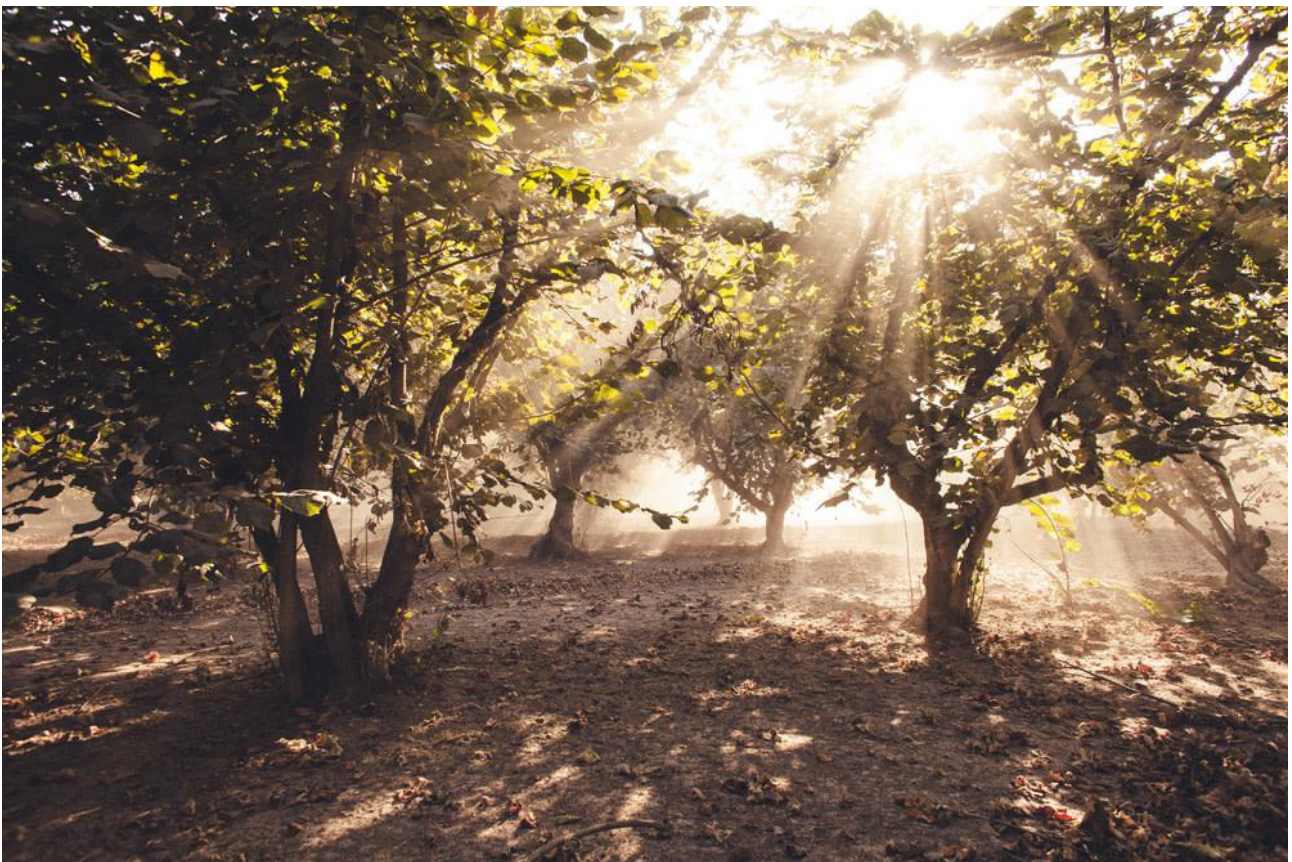
1. Get nuts as an alternative proteine source,
2. Produce more human and animal food,
3. Get an extra income stream,
4. Keep the pseudo-acacia out,
5. Create camping spots in the shade of a mosquito repelling tree.

## ***Vision for our land***

Our terrain is a beautiful park-like edible landscape with an abundance of food for humans and animals. The diversity makes a healthy and balanced ecosystem.

We earn money with the crops or products we make with it.

Our permaculture farm inspires people to work more *with* Nature.



# Gather info

## *People using our land*

For now only our family lives here permanently. We are growing a village though; there might be more people living here in the future (Growing a Village design).

We host volunteers from March to October. They come here to learn about permaculture and how to live a sustainable life in Nature.

Camping guests camp under our trees all year round, but mainly in the summer months.

## *Income from the land*

We host camping guests on our land. The campsite provides half of our income.

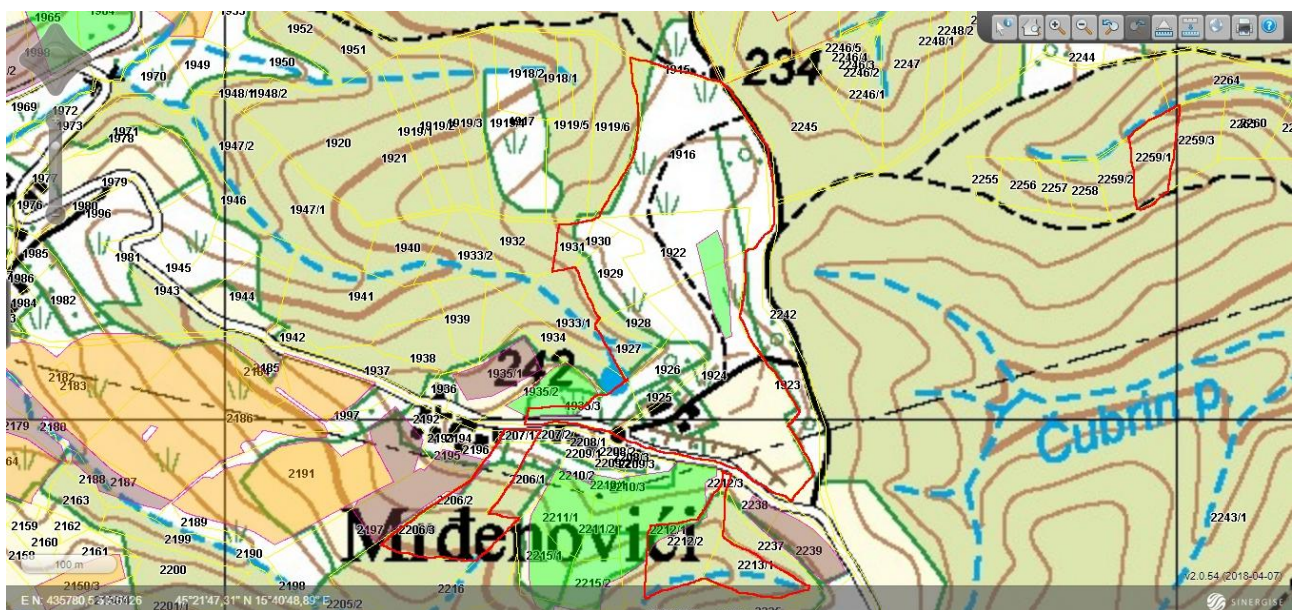
We have small income drippings from courses and from selling trees, plants and seeds.

Until now (2023) we're not professionally growing a crop to sell, but we do grow a variety of fruits and nuts for personal use. We sell produce incidentally to camping guests.

## *The land of Bogata Šuma*

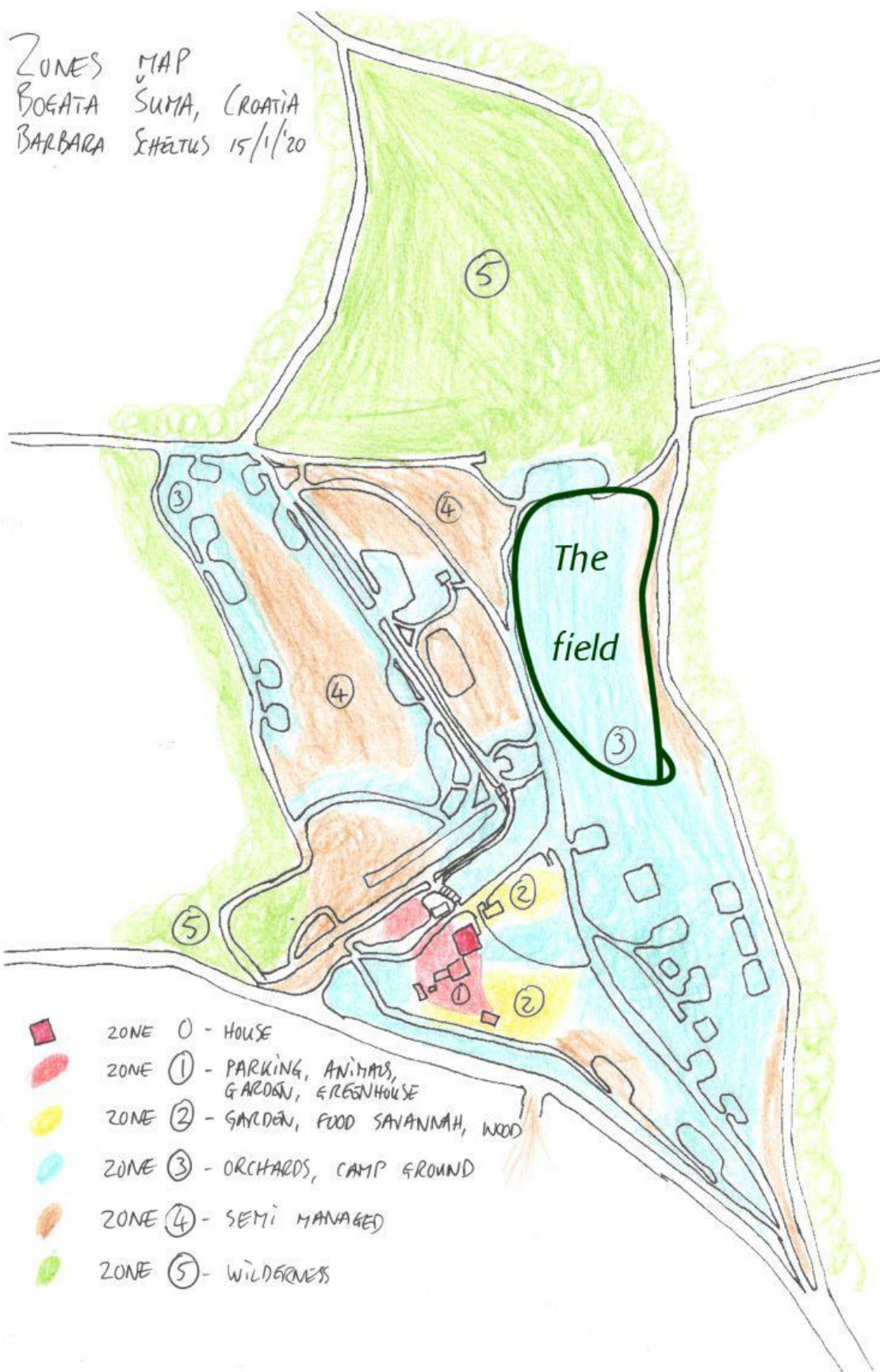
Bogata Šuma owns 12 hectares of land (because we, as Dutch citizens in Croatia, cannot own farmland yet). Bogata Šuma is the name of our company. It means "Rich Forest".

We have an unused field that is too hot (microclimate) for hosting camping guests. It is quite close to the house (100 meters) in our permaculture zone 3 (see map on page 7). It is a flat area and it has beautiful deep soil, just slightly compacted, where lots of wild grasses, herbs and flowers are growing. The field is well protected against winds with the dense growth of high (pseudo acacia) trees around.

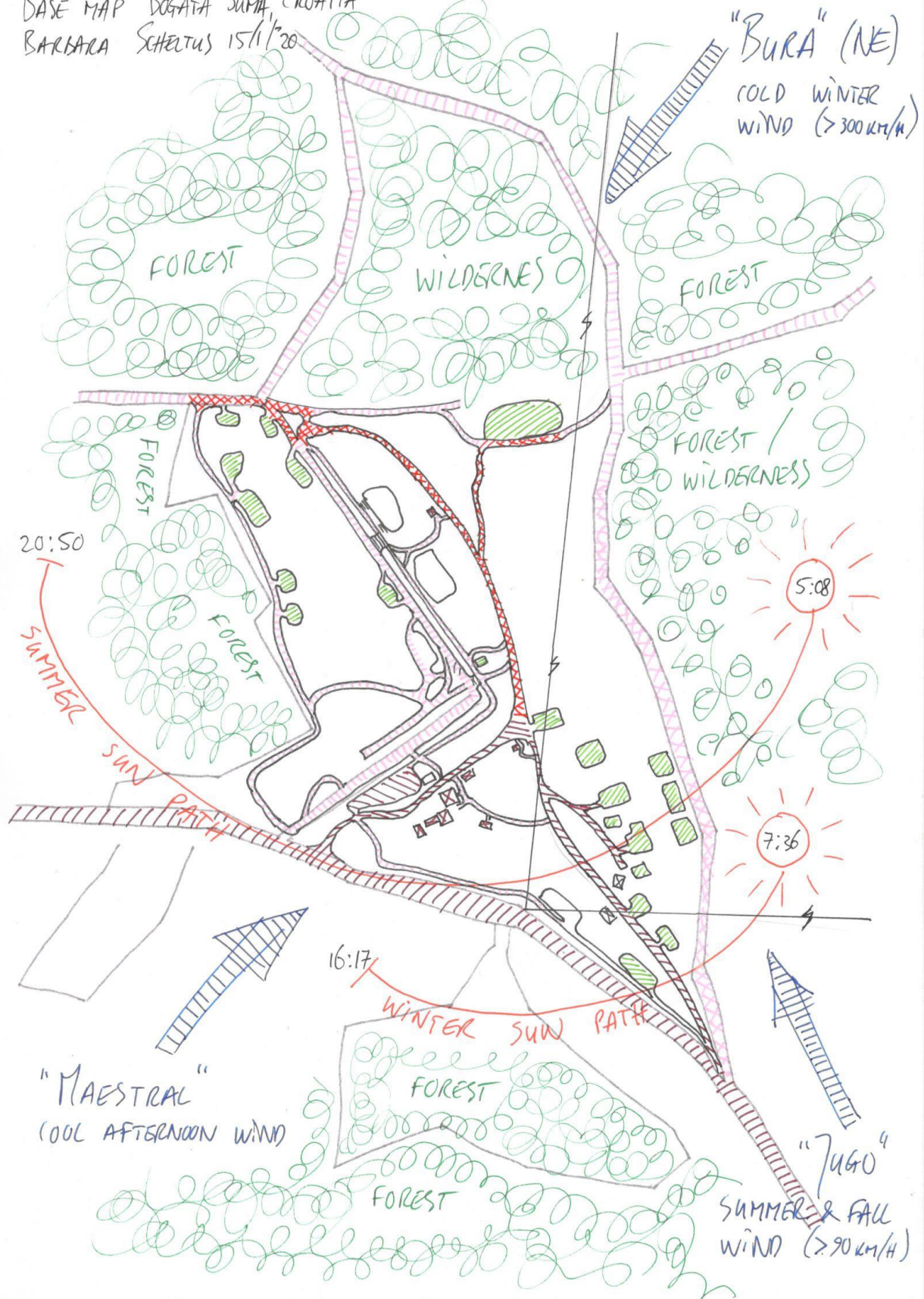


*The majority of our land, within the thin red line*

## Zones on the land of Bogata Šuma



BASE MAP BOGATA ŠUMA CROATIA  
BARBARA SCHELTUS 15/1/20





*"The field" is the area in the white line*

## Data about the field

Coordinates: 45.363471, 15.689532

Field: flat, 300 square metres on our parcels 1924 and 1922.

There is a few meters slope going down to the field. The height difference is 3 meters; the slope is 5 meters long.

Electricity line over the field; we're not allowed to plant trees under the line and 5 meters from it.

**Aspect:** the field runs almost north-south; slightly more NNW-SSE.

**Height:** 234m above sea level

**Climate:** temperate

Hardiness zone 6 to 7: winters with an average minimum temperature of -10 with exceptionally cold nights up to -20.

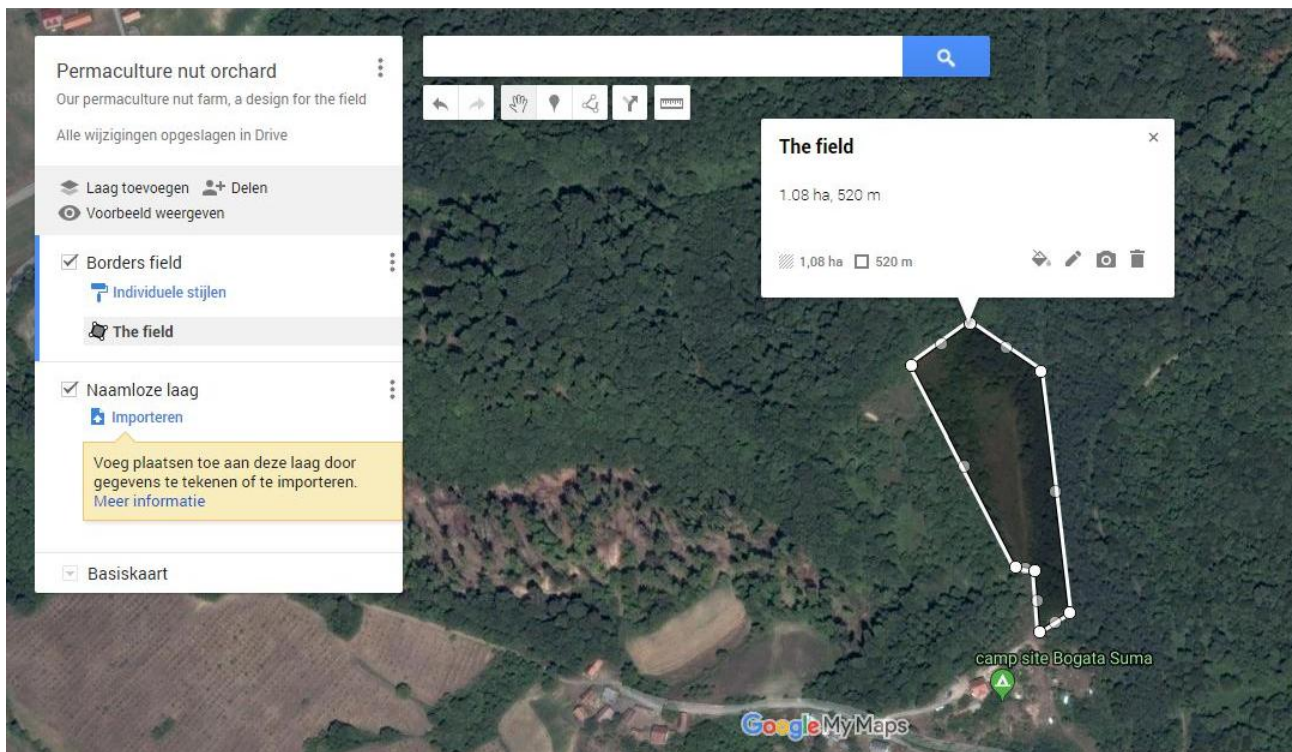
The field has a slightly warmer micro climate since it is sort of a bowl, protected by high pseudo acacia trees around.

**Rain:** 1100 mm per year. The driest month is February, with 69 mm of rainfall. In November, the precipitation reaches its peak, with an average of 121 mm.

**Growth:** grasses and wild herbs (thyme, agrimony, St john's wort, goldenrod), some shrubs (wild rose, hawthorn), 2 peach trees and the pseudo acacias from the edge are "walking in". In the pseudo-acacia edge are probably also wild cherry trees and maybe an incidental oak or sweet chestnut tree growing.

**Soil:** rich and deep. Undisturbed for at least 25 years, except that a neighbour had his horse on the field for 1 season (in 2003), 2 lumberjacks stored a few hundred cubic metres of wood on the field (in 2005) and we drive over the field every now & then.

There is a deep layer of soil before you find rocks. I don't know how deep; I never found rocks in the field.



*The field, marked in Google maps*



In the history of Google maps you can see that the field grows smaller and smaller: the trees "walk in".

## Analyse

### *Land*

We would like to be an example permaculture farm, but we do not farm (yet)!

We have a big terrain with smaller micro climates that we can setup as a variety of intensive systems. This would fit in with designing for disaster, or designing for stability.

Our field is slowly taken over by wilderness (pseudo-acacia and brambles mainly). We want to take it back so we can grow produce on it and host camping guests in between.

Walnut trees love our climate, they pop up everywhere, the current nut trees on our terrain seem healthy and are happy to provide us with heaps of nuts every year. And at the end of their life the wood can be used to make beautiful furniture.

### *Income*

We can use an extra stream of income, and especially an income stream from the land. We have 12 hectares, and no income from produce.

We want to layer and stack functions and grow a crop that doesn't interfere with the camp ground. A crop that cannot be destroyed or eaten by camping guests. And it should be a crop that is easy to store and possible to turn into a high end product.

## **People**

In general people need healthy proteins and fats. More and more people eat vegetarian or even vegan. They can benefit from nuts as a protein and/or fat source. People care & respond to needs.

Barbara as a permaculture facilitator is the most interested in farming, setting up an example farm and making beautiful & delicious things with the harvest.

Peter is interested in selling beautiful products; he can make things with wood and he can be a good sales person.

Our kids Nol and Fleur are interested in planting trees for the future and having an extra income stream.

We cannot be full time farmers because we have various roles and tasks that come with the roles, for our multiple income streams.

There are so many things going on on our farm that it is hard to commit to getting a harvest in in the right time.

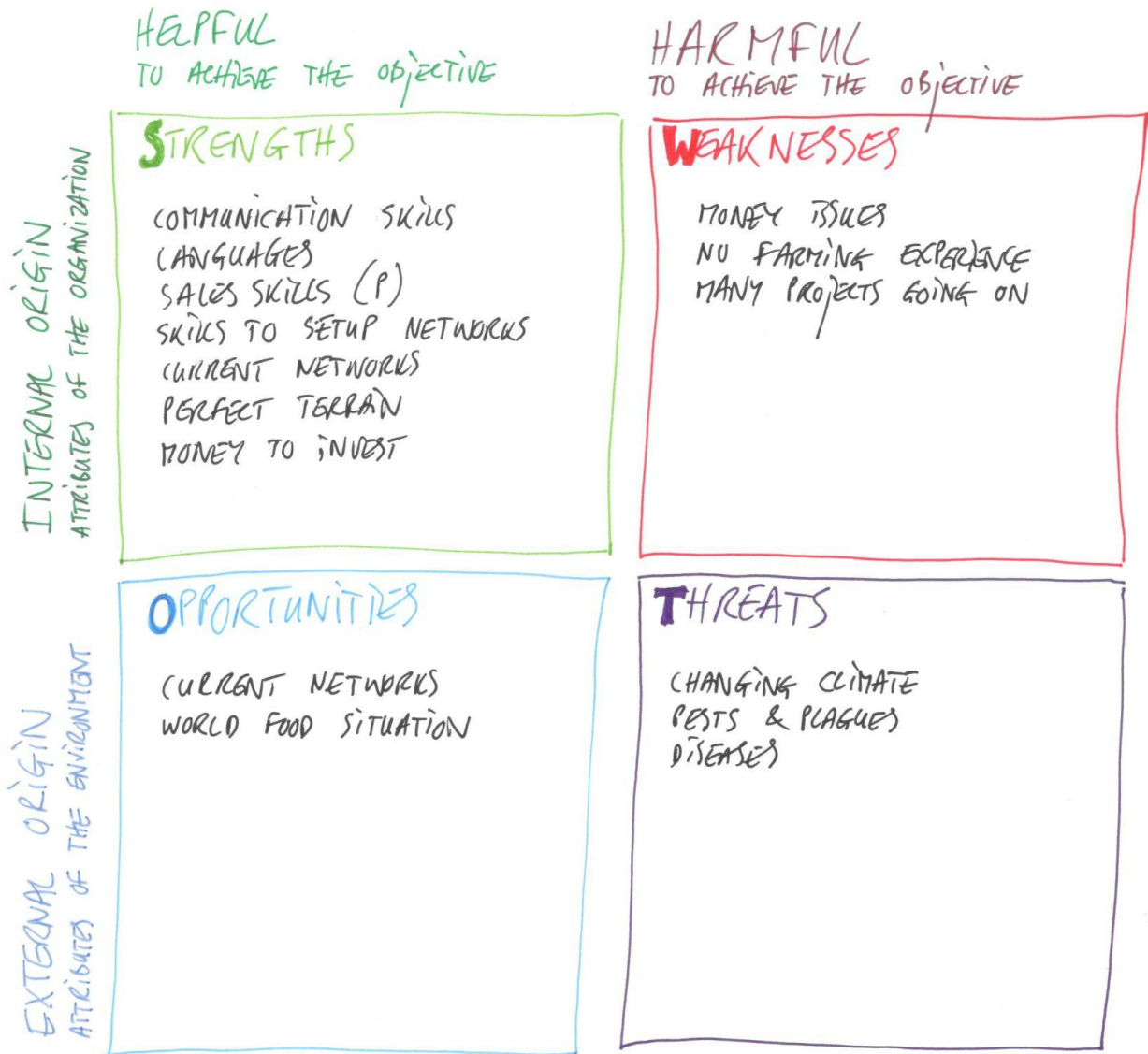
Volunteers can do light jobs; they cannot be regarded as workers. They can do special jobs & fun things, like fertilizing plants and trees, pruning, companion planting, making bird and bat boxes...

We (the family) drive to The Netherlands maybe once a year. If we could combine this trip with selling our produce somewhere along our route (Croatia, Slovenia, Austria, Germany, The Netherlands), we lower our travel expenses.

We speak the languages in all these countries, and also French and English. So our selling market is easy to reach.

Barbara has setup various web shops for clients, and she knows how to do online marketing. So our selling market is not restricted to the countries that we can drive to.

## SWOT analysis



All items in this SWOT analysis are covered in more detail in this design, except the world food situation and a changing climate.

## ***Traditional versus permaculture nut orchard***

|                                                        |                                                                                                                      |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| walnut trees                                           | a variety of nuts and helpers, intercropping, companion planting, tree guilds and beneficial “weeds” and plants      |
| Design = plant distance                                | Design = holistic approach for a healthy ecosystem                                                                   |
| Artificial weed and insect control                     | Plant and animal helpers for a healthy ecosystem                                                                     |
| Vulnerable to market influences                        | Diversity of crop gives more possibilities                                                                           |
| Vulnerable to pests and plagues                        | Diversity confuses pests and plagues, hosts more predators, and if 1 species is destroyed you still have others left |
| Vulnerable to weather influences                       | Spread risk because of varied timing of blooming and ripening                                                        |
| Big workload in 1 period: harvesting time              | Spread workload over the various harvest periods                                                                     |
| 1 Yield, limited possibilities for (high end) products | Many yields and many possible combinations for (high end) products                                                   |
| Traditional maintenance by humans                      | Possible animal helpers to dig and scratch, clean up fallen fruits and nuts, eat pests                               |

The main weakness of a traditional walnut orchard is its monoculture and the vulnerability that comes with that. If 1 thing goes wrong, it might all go wrong. Like a late night frost just when the walnuts are blossoming, or a specific walnut disease, or inability to harvest when it is time. A variety of plants spreads the risk and increases health. Planting companions (like horseradish with its antimicrobial properties) repels pests and increases soil health. Earth care.

A traditional orchard might work more with people care because a tractor can drive between the trees. In our case people would have to walk a bit further.

A permaculture nut orchard is good for people care in a different way: with a variety of nuts the workload is spread. And we can share fairly with animal helpers, where all (except pollinating) animals are banned in a traditional system.

Prime directive; we as a family take responsibility for an ethical life. Our decisions align with permaculture ethics to make the world a better place.

## ***Layering & stacking functions***

A list of functions for the trees and shrubs in our nut orchard:

1. All give yields (for us, for our livestock and/or for beneficial wildlife) in nuts, berries, leaves and wood
2. Trees and shrubs offer habitat to birds, insects, small mammals etc.
3. Trees, shrubs and undergrowth offer food to creatures directly (fruit, leaves, wood, pollen)
4. They offer food indirectly (predators eat those who feed on the tree)
5. Trees offer wood for construction, furniture, tools, instruments, firewood
6. Foliage for the soil/mulch
7. Herbs fertilize the soil

8. All produce oxygen
9. All plants raise the water table
10. Hazels and elderberries slow down the wind / act as wind break
11. Ground cover and mulch reduce the impact of rain
12. Roots, ground cover and mulch protect soil from erosion
13. All growth regulates evaporation
14. Walnuts keep out unwanted plants (pseudo acacia)
15. Trees provides camping spots with shade
16. Walnut trees help to repel mosquitoes

## ***Looking through the lens of permaculture principles***

Originally developed by Allan Savory, **Holistic Management** is now being adapted for use in managing other systems with complex social, ecological and economic factors. It is a systems thinking approach to managing resources like rotational grazing with the ecosystem for water, minerals, energy flow, and community dynamics in mind.

### **Mollison's & Holmgren's principles:**

Mollison's *small-scale intensive system*: stacking plants, time and functions. We have lots of land and we stack functions by growing trees to host camping guests under, while our sheep mow the grass in between. A variety of trees and shrubs that go well together, spread risk and harvest time.

We *observed* that nut trees love it here, so we *interact* by giving them the space they need and *obtain a yield* by *stacking functions* (growing nuts, beautiful wood for furniture, human and animal food, money by extra income streams, more useable land by keeping the pseudo-acacia out, camping spots in the shade of a mosquito repelling tree).

We *catch and store energy* by using Nature's cycles. Trees capture sunlight to power the process of photosynthesis. During photosynthesis, the light energy from the sun powers the chemical reaction to combine carbon dioxide in the air with water. This creates oxygen and starchy carbohydrates, which are the energy-packed building blocks of all trees. Trees create clouds (and rain) and falling leaves mulch and feed the trees. *Cycle and Recycle Energy*.

We *value diversity* in nature that brings more balance, diversity for the health of the plants and diversity in our income.

We *integrate rather than segregate* those walnut trees that pop up everywhere, by re-planting them as a barrier against false acacia that wants to take over. Mollison's principle *Cooperation instead of competition*, focus on systems and relationships. And with that we *stack functions*: barrier, more diversity, more yield, more income.

*Small and slow solutions* prevent big mistakes and save money. Grow from seeds.



*Tree growing from a walnut – small & slow*

# Design

## ***Functions***

1. To prevent the pseudo acacia from walking into the field,
2. To make good use of the land and not let wilderness take over,
3. To invest for the future,
4. To create an extra income source,
5. To positively influence the climate on the heat trapping field,
6. To give us an easy, low maintenance crop that stores well,
7. To create possibilities for future expansion of the camp site,
8. To be an example permaculture farm.

## ***The choice for nuts***

Walnut leaves excrete a substance (juglans) that makes it hard or impossible for seeds to germinate or other plants to grow. Therefore it can be a good barrier against the pseudo-acacia that walks into our field (functions 1 and 2) and create balance again. Design for stability.

Work with Nature rather than against it: nut trees love our climate. What I see on our terrain, is that walnut trees, sweet chestnuts and hazelnut shrubs grow easily. They seem to love our soil and our climate. And we love them. They are healthy and are happy to provide us with heaps of nuts (and shade) every year. And at the end of their life the wood can be used to make beautiful furniture. (functions 3, 5)

When washed and dried, nuts are easy to store and keep for a while.

Nuts can be sold as they are, right after harvesting, or later when dried. We can sell them peeled, or make oil out of them, or a nut spread or other product. The wood can be sold, or turned into beautiful products and then sold. (functions 4 and 6)

Nuts are ripe when camping season is almost over so we will not lose many nuts to guests. Walnut trees repel mosquitoes so it is nice to camp near them. (function 7)

Farming nuts is an excellent example (function 8) of permaculture because of all of the above and because it is an answer to the growing demand of organic protein-rich food as an alternative to meat. This helps with the aim of growing more food for humans and animals, and grow nuts as an alternative protein source. (see appendices 1 and 2 on pages 28 and 29)

## ***Companion plants for walnut trees and hazelnut shrubs***

**Comfrey** (symphytum): a fast growing perennial with deep tap roots. Rich in potassium, but also phosphorus, calcium, copper, iron and magnesium. Leaves can be chopped and dropped as mulch up to 6 times a year. Leaves can be used in liquid fertilizer and the plant acts as ground cover. General insect (especially bees) nectar and pollen plant, lacewings and spiders prefer to lay eggs on comfrey and spiders prefer to overwinter on it.

**Horse radish** (Amoracia rusticana: General insect (especially bees) pollen plant, edible leaves and root, antifungal, confuses garden pests with its scent.

**Elderberry** (Sambucus nigra): attracts birds, can act as wind break for walnut

**Nettle** (Urtica dioica): rich in minerals like calcium, potassium, phosphorus, magnesium and traces

of iron, sodium and zinc.

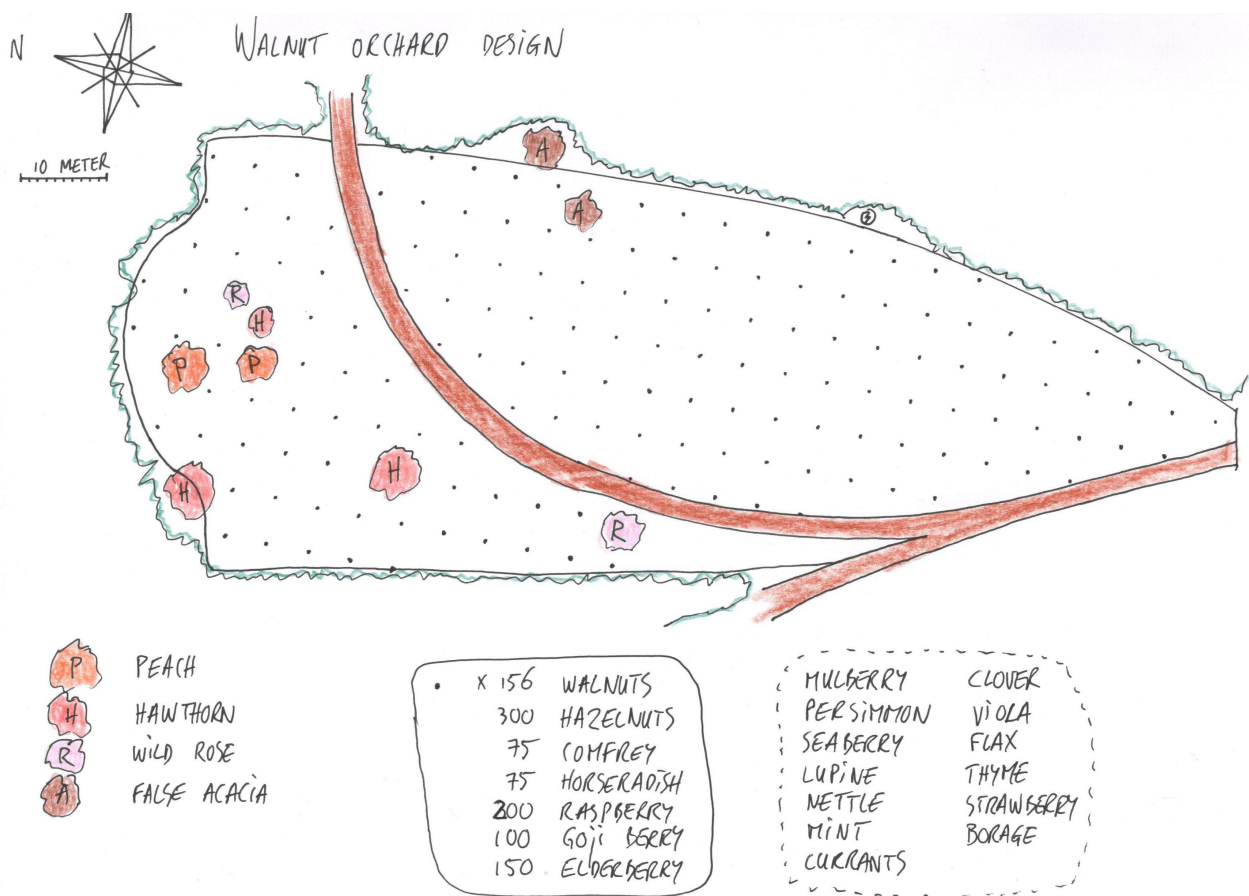
**Lupine** (Lupinus): nitrogen fixing green manure with edible seeds. And what we cannot harvest, the chickens can eat from the ground.

**Clover** (trifolium): a nitrogen fixing ground cover.

## Planting pattern design

The main pattern will be **walnut** trees, planted 6 meters apart.

If walnut trees die or get damaged by deer, we can replant mulberry trees, persimmons, occasionally a sweet chestnut or new walnut trees in that vacant spot.



## Pattern design walnut guild

Every walnut tree gets 2 **hazelnut** shrubs, in a 2.5 meter diagonal distance on the south-east and south-west side.

An **elderberry** shrub will be placed 2 meters north of the walnut tree, acting as a wind break and bird shelter.

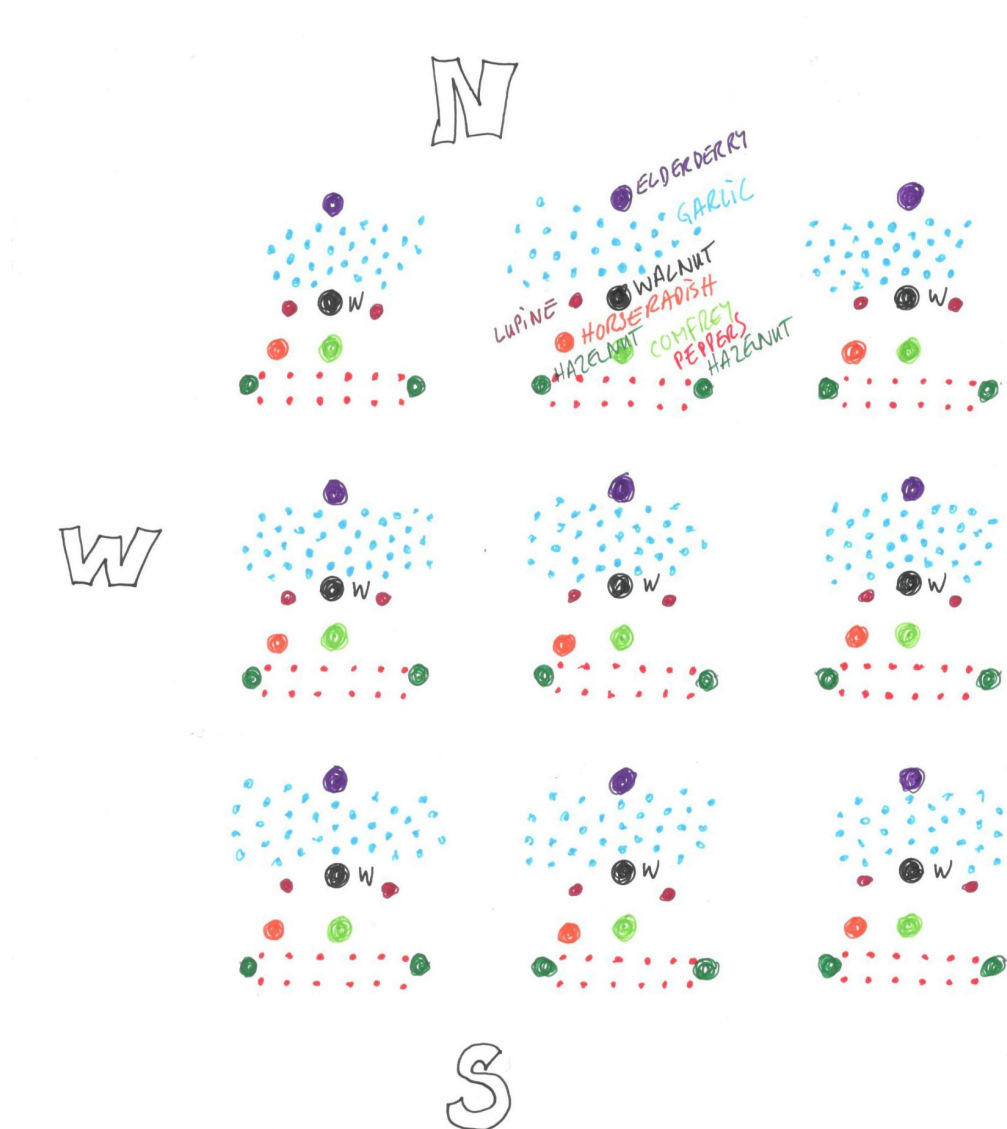
Every walnut tree will get a **comfrey** plant 1 meter south, as a ground cover, pollinator attractor,

fertilizer and mulch provider.

Next to the comfrey, south-west of the walnut tree, a **horseradish** will be planted for its anti bacterial and anti fungal properties (isothiocyanate) and for the big leaves that cover the soil.

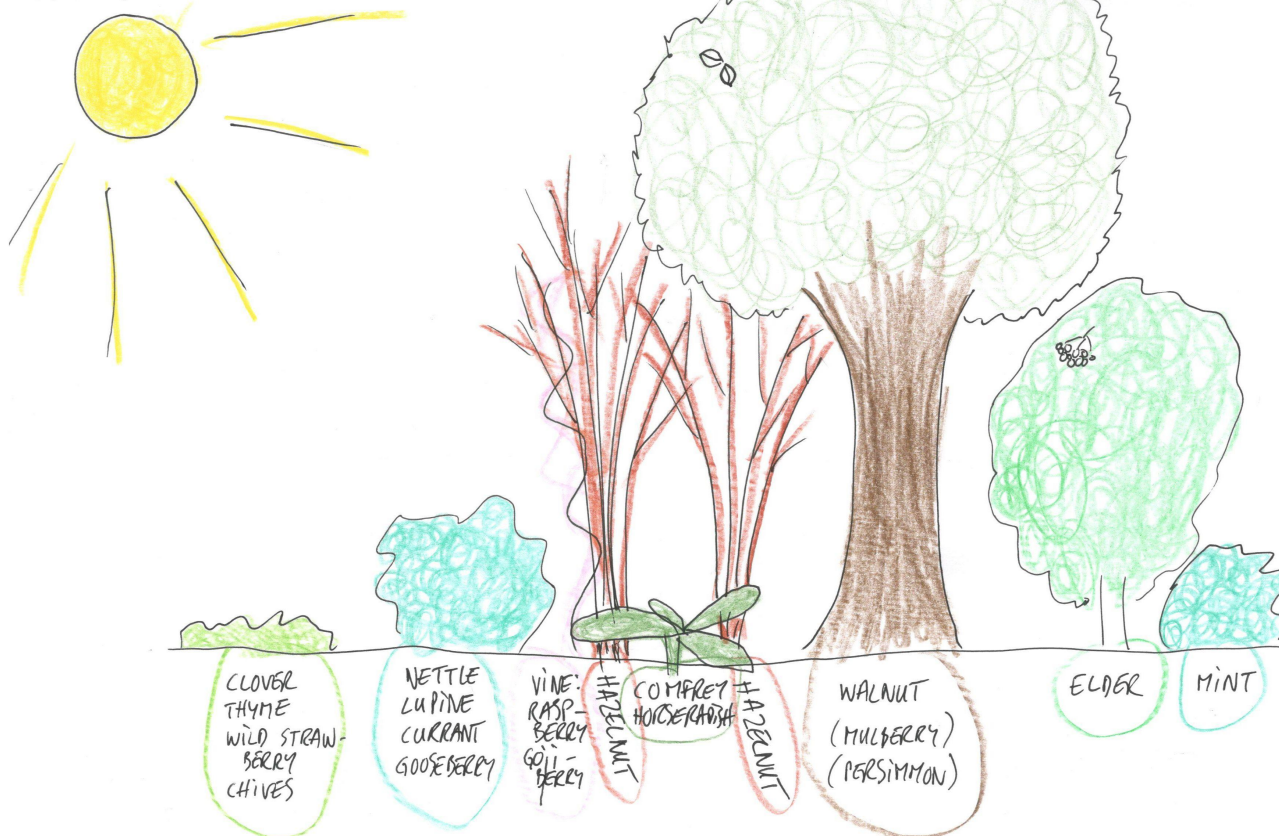
Nitrogen fixing **lupine** will go east and west of the walnut.

Nitrogen fixing **Clover** will go in empty spots.

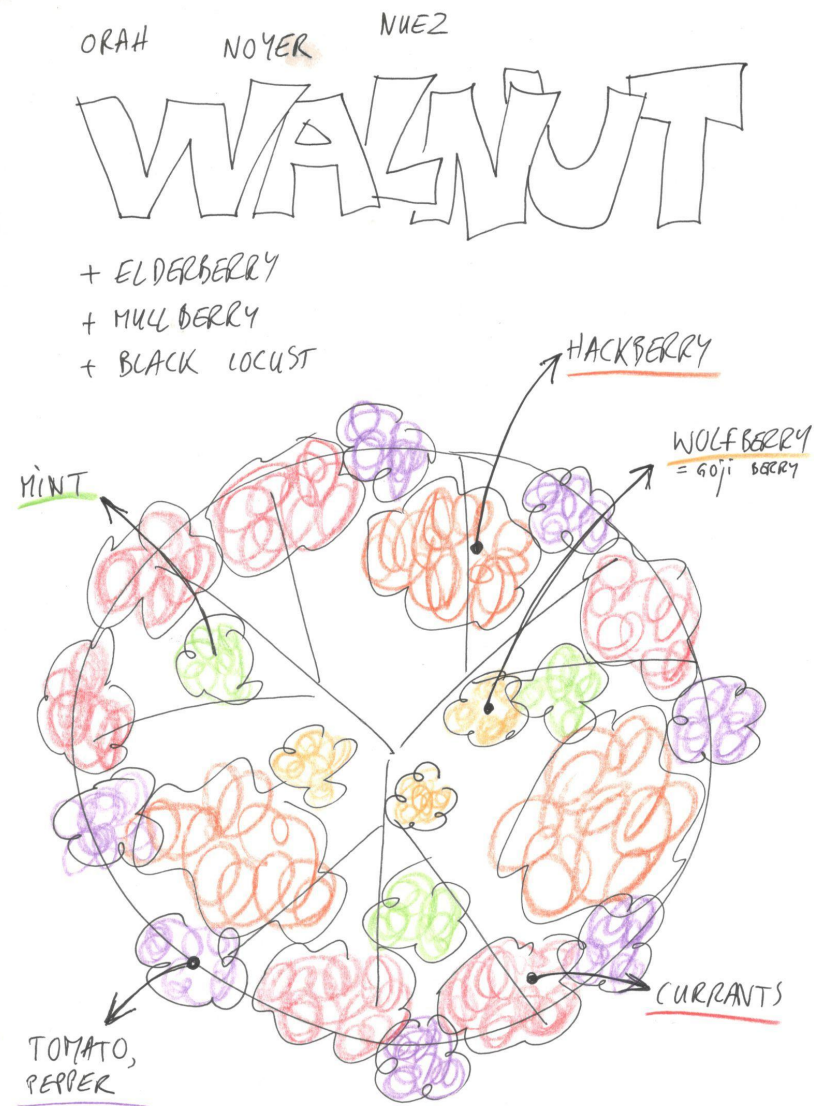


Pattern design

# PATTERN DESIGN WALNUT GUILD



Walnut guild seen from the side



*Drawing of a walnut tree guild*

## **Other possible crops**

**Mulberry** (*Morus alba*): nice canopy tree to attract birds and give delicious, bloodsugar level regulating berries in June. We can make jam with the berries, or dry them and sell the dried fruits. One of the few trees that grows well with walnuts.

**Sweet chestnut** (*castanea sativa*) can bring more diversity, although it already grows abundant on other parts of our terrain, the trees attract wild boar and most of our sweet chestnut trees have disease where the leaves swell up due to a parasite.

**Persimmon** (*Diospyros kaki*): smaller tree with delicious orange kaki fruits in late fall. One of the few trees that grows well with walnuts.

**Raspberry** (*rubus idaeus*): the vines can climb into the hazelnut poles.

**Goji berry** (*Lycium barbarum*): idem

**Redcurrant** (*Ribes rubrum*): a deciduous shrub, usually up to 1.5m high, that produces lots of sour berries in early summer. A jam from this berry goes well with meat.

**Mint** (*Menta piperita*): grows well in the shade, makes a delicious and healthy tea, lemonade

**Sea berry/sandthorn** (*hippophae*): grows well in partial shade, well drained soil.

**Red hot chilli pepper** is able to grow near walnut trees and it might be a nice annual crop to sell in the first years, when the trees are small.

**Garlic**, same as pepper, will do fine when the trees are still small. We can grow elephant garlic and sell that to friends & family who want organic garlic.

**Butternut squash** as a ground cover in the first years, when trees don't produce nuts yet.

**Violet** (*viola tricolor*): medicinal ground cover in spring. Grows in the forest.

**Flax** (*Linum usitatissimum*) already grows wild on that part of the terrain

**Wild thyme** (*Thymus serpyllum*) grows abundant in the dryer, sunny end of the terrain

## ***First year(s) yield***

Between the walnut and the elderberry, we can plant **garlic** in the first years. Later, when the trees and shrubs grow bigger, we can plant shade loving mint in that spot.

South of the walnut and the comfrey, between the hazels, we can plant **red hot chilli peppers** as a temporary yield from the field.

Also butternut squash can be planted, as ground covering crop to shade out the grass.

## ***The choice for swales on the slope***

The few meters of sloping land towards the field will get 2 swales on the contour line.

Earth care through slow, spread, sink & store: these swales will hold the runoff water longer, so it gets time to seep into the soil. This prevents gulleys and erosion.

The swales will also trap organic matter and increase habitat for insects and micro organisms.

By digging and hilling, we increase the planting area.

# **Implementation plan**

## ***Preparing the land***

We need a heavy mulcher to mulch all the shrubs, young false acacia's and strong herbs on the edges. Until the line of the older trees (5m from under the electricity line).

Before we can mow there, we need to pick up all the sticks, and hoe out the stumps.

The wild herbs need to be mowed before they produce seeds; that can be done with our "IMT".

Next we could shred the herbs with the trimmer if necessary, so they decompose easier and feed the soil (earth care).

## **Digging swales**

On the slope going down to the field, we dig 2 swales by hand to slow down water and organic matter runoff. (earth care)

## **Mulching, not ploughing**

Because we care for the earth, we mulch (shred & drop) the high grass on the field; not plough it. That will not only save time (because the soil doesn't need months to restore), it also saves us a lot of work in the future with weeds that keep coming back (people care).

Ploughing can help to turn organic matter (plant material and manure) into the soil, but adding organic matter on top of the soil will give Nature the chance to do it her way. Ants and beetles will work it in, the bacteria in the top layer of the soil will help with decomposing it. In the meantime the organic matter acts as mulch and prevents the soil from drying out, and weeds from germinating. Earth care.



*One beautiful winter day (December 2018) a mulcher from the electricity company showed up to mulch under the electricity line. We asked the driver to mulch a bit wider to get rid of all the pseudo-acacia's in the field.*

More about acquiring trees and shrubs, sowing, planting and propagating in Appendix VII on page 36.

## **Maintenance plan**

### ***Water plan***

There are no structures, so no rain water catchment close by.

There is a well water source nearby (50 metres) in the forest edge but no path to it.

For now watering was never necessary; if the climate changes we can open up the path to the well.

We will dig swales on the contour line of the slope to encourage water to seep into the soil.

### ***Fertilizer plan***

The field we will use, is probably rich in nitrogen because there were acacia's growing.

For extra nitrogen we can use diluted pee (1 part on 10 parts rainwater) from the nearby compost toilet.

Hazels don't need fertilizer

Walnuts like fermented manure as mulch & fertilizer. The humanure from the nearby compost toilet can be used and hopefully also scares away wild boar.

## Pests & plagues

**Squirrels** I have never seen on our terrain, but we do have a "puh" (pronounce as poohg) family, a Croatian version of a **dormouse**. They are almost as big as a squirrel but dark grey, with a fluffy straight tail. The orchard will be too far from the house for the cats as dormouse predators, so we might need to set traps if they become a problem and we can't share anymore.

**Crows** seem to steal nuts and they live in the area, but I have never seen them on our terrain. A solution/fun project: make scarecrows with the kids and volunteers!

Although I never saw the **hazelnut borer** and the **filbertworm** moth, I did see how it can destroy part of our hazelnut yield. The larvae are protected in the nuts or in the soil, so my plan is to leave no nuts on the ground (rake or let pigs clean them up).



*Puh, or Croatian dormouse*



*Filbert moth*



*Filbert worm*

## Animal helpers

Fair share the land with chickens to find and eat the hazelnutborer larvae and moths. Put chickens under the hazelnuts when the nuts fall and again in spring when the moths hatch.

Hang nestboxes for bluetits and great tits who will eat the beetles of the hazelnutborer.

Attract bats to the nut orchard. Place 4 meter high poles with a bat box in the top. The bats can catch the moths.

Pigs to clean up the bad nuts

Snakes to hunt the dormouse and squirrels. Make wood pile for them.

## Nut tree diseases

The hazelnuts on our terrain seem to be disease free; I saw healthy shrubs over the last years.

We did have 2 old walnut trees die from **honey fungus**. You can detect this fungus by checking for indications on the trees: small yellowish leaves, early leave drop and shoot dieback.



Another walnut tree disease we have had, is **leaf blotch**. Another fungus that causes brown blotches on the leaves, early defoliation and blackening of the young green nuts. Spores overwinter on dead leaves on the ground, and can be killed by burning or hot-composting the leaves.

To avoid **walnut blight**, we can ensure the pH of the soil is over 6, not wet the foliage with irrigation, avoid excess nitrogen application and only light pruning if necessary.

Earth care: with all walnut diseases it helps to let animals (pigs, chickens) clean up the orchard.

## ***Pruning***

See also Appendix IV: Calender for the nut orchard on page 32

### **Walnut trees**

The best time to prune walnuts to avoid sap bleeding is mid-summer to early winter.

In the first few years you prune to have 4-6 main branches and you saw off low branches.

Later pruning (after 5-7 years) is only for allow good aeration of the tree and to bring in light.

### **Hazelnut trees**

Pruning in May to keep a maximum of 5 main trunks and remove suckers and crossing branches. Vigorous vertical shoots hardly grow nuts; it's the weaker horizontal shoots that carry the crop.

Female flowers are produced from buds of the past season's growth.

## ***Harvesting***

See also Appendix IV: Calender for the nut orchard on page 32

### **Walnuts**

Ripe walnuts fall in September/October.

As a rule of thumb, a walnut tree will give good yield only during 2 or 3 years per every 5 years period. And we need patience: walnuts can produce already after 5, but have their top produce after 25-30 years.

### **Hazelnuts**

After 3-4 years the shrubs will produce nuts.

Collect the ripe (fallen) nuts every 1-2 days

## **Evaluate**

I use T.O.A.S.T. as an evaluation tool: Trials and challenges, Opportunities, Assessments, Strengths, Transformations.

### ***Trials and challenges***

Most walnut trees we bought have bad roots. The ones that grew from seed on our terrain, have a deep tap root. The ones from the shop don't, or the tap root is damaged.

The window of time to plant walnut trees can be short. There were years that we had only 2 weeks between the trees going dormant and the ground freezing over.

For some reason also the elderberry shrubs all didn't make it. Maybe because of the wild boar. I

need to spend some time in investigating, observation and soil sampling.

In 2022 I waited too long with mowing the grass. It grew higher than most of the hazelnut shrubs and I didn't pay enough attention: a few of them died in the mowing process.

In 2023 it rained so much that I couldn't mow in time before the grass grew higher than the companion plants.

## **Wild boar/hog problem**

Besides the pseudo-acacia, also wild boar are a problem in the field. On their hunt for food they sometimes damage the young trees and shrubs or even dig them out.

We can scare them away by making loud noise but that only works when we are near the field when they are coming (usually dawn or dusk, in winter also possibly during the day). The local wild boar families aren't scared of our Labrador-Retriever barking at them.

I heard that the smell of humans/human hair throws them off but our hair supply is limited. A better option is to use the humanure from the nearby compost toilet. I have spread a few buckets in 2021 and 2022 but still I see tracks of them in the field.

A boar repelling method we haven't tried yet, is to soak cereals in fish oil (that we don't have) and spread them around. They don't like the smell of other animals so maybe sheep lard (which we do have) can work as well.

## **Opportunities**

The field still has too thick grass to grow annual crops. In fall 2023 I can collect lots of cardboard to put in the nut orchard so I can plant a crop in spring 2024.

I try to always have blue string in my pocket so that I can mark a walnut seedling when I see it on our terrain. Every November I collect all these free trees and transplant them to the nut orchard.

## **Assessments**

The walnut trees on our terrain that grew from seed / were planted by squirrels, seem to do much better than the ones that we plant in the field. There are no squirrel-planted walnut trees in our around the field, so there is a chance that that microclimate isn't ideal. Too hot? Too dry? Soil too poor? Or am I just impatient?

I need to find out if spreading the humanure from the compost toilet more regularly, will keep out the wild boar. How long will the smell-effect last?

## **Strengths**

Walnut trees do really well on our terrain. Further down the hill there can be heavy night frosts that damage the budding tree in spring, but we never had that.

Hazelnuts grow easily from seeds and are easy to transplant over a longer period of time.

Comfrey is doing really well in the field.

Young walnut trees are not damaged by our sheep.

## **Transformations**

Planting the nut trees with the kids made them realize that they can have a future income from the land.

The field itself seems to have transformed from a dry wildflower meadow into a more lush and 3D

landscape with much more diversity in plants and insects.

## ***Reflections on the design process***

Because I had an exhausting experience with adjusting an old (chicken garden) design to my new standards as a designer, I decided to use my old nut orchard design only as a resource. To write up a Diploma worthy design, I chose a fitting framework (EGADIME) and started fresh. This worked well; it didn't take much time to pour the old design into the new setup!

Using this EGADIME framework for the design was a good fit. Starting with *Establishing aims and objectives* makes much more sense to me than to start with a goal. Adding Vision to Establishing aims and objectives made it complete for me.

Using a SWOT analysis also worked well, and was a good alternative when I was longing for the Design Web's Helps and Limits. And for this design the 4 quadrants in the SWOT worked even better because it is more detailed and more business-oriented.

Looking through the lens of permaculture principles helped to clarify our choices. As a family we embrace permaculture ethics and these principles work as tools to live the ethics.

Besides this chapter with focus on a few principles, there are various permaculture principles from various sources used throughout the design.

TOAST is a nice evaluation tool to use mainly because of the last T: Transformations. It makes you think of the impact of choices.

This design made me dive deep into details of setting up a nut farm. Diving deep into details is a stretch of my edge but it taught me so much! It felt like setting us up for success. It also fulfilled a wish to go deeper into content, in preparation for teaching PDC's in my future.

This design also Wilf's feedback also taught me to communicate clear and concise about what tool/ is used with what reason and which ethics and principles are the underlying decision influencers. Clarity makes a design a better teaching tool.

Holistic management worked well as a principle for decision making. I didn't mention it much in this design, but holistic management ideas are behind all choices. It is a more complex decision making framework for regenerative land use that I am learning more about.

Seeing the yield as unlimited and stacking functions are 2 base principles that are strongly embedded in our life. Using chickens to keep the filbert moth under control is such a no-brainer: we have chickens, this feeds them for free and gives them fun and exercise while it keeps our orchard healthy and the system in balance.

Or: having camping guests under walnut trees that give their yield when camping season is (almost) over, and the smell of the leaves protects campers against mosquitos.

Or: creating a solution (walnut trees) for a problem (pseudo-acacia) while contributing to high quality food and an extra income stream for our family and future.

This design made me realise that we deeply care for the earth, for all life on it and for the future of planet and people.

# Appendix I: Nutritional value walnuts

Amount Per 100 grams, calories 654,      % Daily Value (based on a 2000 calorie diet)

|                     |        |      |
|---------------------|--------|------|
| Total Fat           | 65 g   | 100% |
| Saturated fat       | 6 g    | 30%  |
| Polyunsaturated fat | 47 g   |      |
| Monounsaturated fat | 9 g    |      |
| Cholesterol         | 0 mg   | 0%   |
| Sodium              | 2 mg   | 0%   |
| Potassium           | 441 mg | 12%  |
| Total Carbohydrate  | 14 g   | 4%   |
| Dietary fiber       | 7 g    | 28%  |
| Sugar               | 2,6 g  |      |
| Protein             | 15 g   | 30%  |
| Vitamin A           | 0%     |      |
| Vitamin B-6         | 25%    |      |
| Vitamin B-12        | 0%     |      |
| Vitamin C           | 2%     |      |
| Vitamin D           | 0%     |      |
| Calcium             | 9%     |      |
| Iron                | 16%    |      |
| Magnesium           | 39%    |      |

## Appendix II: Nutritional value hazelnuts

Amount Per 100 grams, calories 628,      % Daily Value (based on a 2000 calorie diet)

|                     |        |     |
|---------------------|--------|-----|
| Total Fat           | 61 g   | 93% |
| Saturated fat       | 4,5 g  | 22% |
| Polyunsaturated fat | 8 g    |     |
| Monounsaturated fat | 46 g   |     |
| Cholesterol         | 0 mg   | 0%  |
| Sodium              | 0 mg   | 0%  |
| Potassium           | 680 mg | 19% |
| Total Carbohydrate  | 17 g   | 5%  |
| Dietary fiber       | 10 g   | 40% |
| Sugar               | 4,3 g  |     |
| Protein             | 15 g   | 30% |
| Vitamin A           | 0%     |     |
| Vitamin B-6         | 30%    |     |
| Vitamin B-12        | 0%     |     |
| Vitamin C           | 10%    |     |
| Vitamin D           | 0%     |     |
| Calcium             | 11%    |     |
| Iron                | 26%    |     |
| Magnesium           | 40%    |     |

## Appendix III: Possible products with walnuts and hazelnuts

- organic walnuts in a shell
- peeled nuts
- peeled walnuts in honey
- mix of nuts as a healthy snack
- nut spread for bread (walnut butter, hazelnut/chocolate spread)
- walnut oil for salads
- hazelnut oil for salads, skin products, hair care, massage
- cereal ingredients (grow also grains)
- hard nut shells as mulch or for wood pellets?
- Tap the water/juice from walnut trees that will be pruned out
- walnut wood
- hazel rods for natural walls, bow and arrow
- hazel saplings, walnut babies tree nursery

### ***Price of a kilo peeled walnuts in European supermarket***

|             |         |                                                |
|-------------|---------|------------------------------------------------|
| August '18  | € 13.95 | Albert Heijn, The Netherlands                  |
| Januari '21 | € 21,10 | Albert Heijn, The Netherlands                  |
| May '23     | € 23,30 | Albert Heijn, The Netherlands                  |
| August '18  | £ 15.60 | Tesco, United Kingdom                          |
| Januari '21 | £ 12.50 | Tesco, United Kingdom                          |
| May '23     | £ 12.00 | Tesco, United Kingdom                          |
| August '18  | € 12.50 | Aldi, Germany ("Trader Joe", Californian nuts) |
| January '21 | € 12.45 | Aldi, Germany ("Trader Joe", Californian nuts) |
| May '23     | € 11.93 | Aldi, Germany (Farmer nuts)                    |

### ***Price of a kilo of peeled hazelnuts***

|             |          |                                                |
|-------------|----------|------------------------------------------------|
| August '18  | € 24.50  | Albert Heijn, The Netherlands                  |
| Januari '21 | € 16.71  | Albert Heijn, The Netherlands                  |
| May '23     | € 13,97  | Albert Heijn, The Netherlands                  |
| August '18  | £ 14.00  | Tesco, United Kingdom                          |
| January '21 | £ 13.00  | Tesco, United Kingdom                          |
| May '23     | £ 13.75  | Tesco, United Kingdom                          |
| August '18  | € 11.50  | Aldi, Germany ("Trader Joe", Californian nuts) |
| January '21 | € 9.95   | Aldi, Germany ("Back Family")                  |
| May '23     | not sold | Aldi, Germany                                  |

### ***Price of a liter walnut oil***

|             |          |                                                |
|-------------|----------|------------------------------------------------|
| August '18  | € 19,16  | Albert Heijn, The Netherlands (La Tourangelle) |
| Januari '21 | € 19,96  | Albert Heijn, The Netherlands (La Tourangelle) |
| Januari '21 | € 10,-   | Albert Heijn, The Netherlands (AH brand)       |
| May '23     | € 23,96  | Albert Heijn, The Netherlands (La Tourangelle) |
| August '18  | £ 07.60  | Tesco, United Kingdom                          |
| Januari '21 | £ 08,-   | Tesco, United Kingdom                          |
| May '23     | £ 08,-   | Tesco, United Kingdom                          |
| August '18  | not sold | Aldi, Germany                                  |

## Appendix IV: Calender for the nut orchard

|          | JAN                                                          | FEB | MAR | APR                    | MAY | JUNE                                                  | JUL | AUG                                                                                                                | SEP | OCT | NOV | DEC |
|----------|--------------------------------------------------------------|-----|-----|------------------------|-----|-------------------------------------------------------|-----|--------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|
| SOWING   | Stored seeds: do the same as hazelnuts seeds without soaking |     |     | OR                     |     | Fullbloomed (as soon as possible after harvest seeds) |     | Ceanotic                                                                                                           |     |     |     |     |
|          | After 3m. in fridge                                          |     |     | Walnuts                |     | Clover                                                |     | Stored seeds need high 50% propagation level. Start filtration hazelnuts (as soon as possible after harvest seeds) |     |     |     |     |
| PLANTING |                                                              |     |     | Lupine                 |     |                                                       |     | Walnuts                                                                                                            |     |     |     |     |
|          |                                                              |     |     | Pepper (indoor)        |     |                                                       |     | Hazelnuts (in a place protected from frost because flowers come in winter)                                         |     |     |     |     |
|          |                                                              |     |     | Mint                   |     |                                                       |     | Fullbloomed (better season)                                                                                        |     |     |     |     |
|          |                                                              |     |     | Redcurrant             |     |                                                       |     | Walnut → just 1 time in the 3rd year of the tree                                                                   |     |     |     |     |
| PRUNING  | (old wood)                                                   |     |     | Hazelnuts (young wood) |     | Ceanotic                                              |     |                                                                                                                    |     |     |     |     |
| HARVEST  |                                                              |     |     |                        |     | Walnuts                                               |     |                                                                                                                    |     |     |     |     |
|          |                                                              |     |     | Mint                   |     |                                                       |     | Hazelnuts                                                                                                          |     |     |     |     |
|          |                                                              |     |     |                        |     | Pepper                                                |     |                                                                                                                    |     |     |     |     |
|          |                                                              |     |     |                        |     | Mulberries                                            |     | Redcurrant                                                                                                         |     |     |     |     |

## Appendix V: Example hazelnut tree administration

Data to collect (at same time every year)

|                    | NAME/NUMBER OF SHRUB |       |
|--------------------|----------------------|-------|
| Height             |                      | Date: |
| Width              |                      | Date: |
| Number of clusters |                      | Date: |
| Nuts per cluster   |                      | Date: |
| Weight of a nut    |                      | Date: |
| Disease presence   |                      | Date: |

|                    | NAME/NUMBER OF SHRUB |       |
|--------------------|----------------------|-------|
| Height             |                      | Date: |
| Width              |                      | Date: |
| Number of clusters |                      | Date: |
| Nuts per cluster   |                      | Date: |
| Weight of a nut    |                      | Date: |
| Disease presence   |                      | Date: |

|                    | NAME/NUMBER OF SHRUB |       |
|--------------------|----------------------|-------|
| Height             |                      | Date: |
| Width              |                      | Date: |
| Number of clusters |                      | Date: |
| Nuts per cluster   |                      | Date: |
| Weight of a nut    |                      | Date: |
| Disease presence   |                      | Date: |

# Appendix VI: Plan for the first 10 years

## *Year 1*

### **August**

Select best hazelnuts and walnuts and put them in the fridge

Mow the field with the IMT (& shred herbs with trimmer?)

Buy lupine, white clover

### **September**

Make and mark plant holes for walnut trees and hazelnut shrubs

Apply a good layer of compost and add straw mulch on the patches for garlic and pepper.

Sow white clover

### **October**

Make and mark plant holes for walnut trees and hazelnut shrubs

Transplant horseradish and comfrey

Plant garlic

Sow lupine

### **November**

Transplant our walnut trees and hazelnut shrubs

Put nuts from fridge in the water for 3 days

Sow the nuts in a nursery after their 3 days soak

### **January**

Sow red hot chili peppers indoors

### February

Sow red hot chili peppers indoors

### March

Sow red hot chili peppers

Take 30cm cuttings from 1-year old redcurrant wood & put in sand

### May

Sow white clover

Plant pepper plants from half of May (when temp is  $>18^{\circ}$ )

June

Plant the last pepper plants

Year 2

November: Plant redcurrant shrubs

December: Cut out the badly growing trees and sell as timber

Year 4

August: Harvest of the first hazelnuts?

Year 5

August: Harvest hazelnuts

September: Harvest of the first walnuts?

Year 7

Cut out the bad trees and sell as timber

# Appendix VII

## ***Acquiring trees & shrubs***

Part of the trees and shrubs we can sow and propagate ourselves, and for more diversity it is a good idea to also buy some of them.

A young walnut tree, *Juglans Regia*, costs € 4,- in 2018.

## **Propagating berry shrubs and companion plants**

All the plants we want to grow in our nut orchard, we already have. So we're able to sow and propagate a lot, to lower the costs. Besides that: those plants did already prove that they can handle our climate.

## **When & how to sow walnuts**

Sow walnuts after 12-15 weeks in the fridge in moist sand with chalk, and 2-3 days soaking in water, when they have sprouted.

Or: sow in bucket without bottom, and mesh on top (against rodents).

Plant sprouted seeds 3 cm deep in sand + compost (soil molds) in the glasshouse. Keep the pots moist.

See also Appendix IV: Calender for the nut orchard on page 32

## **Planting walnut trees**

Walnuts like well drained soil in which their roots can grow to 3 meters deep. The pH can range from 5-8 but 6.5 is ideal.

The planting hole should be 45x45cm wide and 60cm deep. Plant the tree (6 inches) when the last frost passed, as deep as it was in the nursery and gently close the planting hole again.

Water the newly planted tree.

Add well rotted manure as mulch and fertilizer.

**Earth care:** if we contour the soil a little bit and make **mulched basins** in which the trees are planted, the "basins" catch and hold runoff rainwater so it has time to deeply soak into the soil.

We should protect the young trees by putting a pole in front and a pole behind it, and wrap mesh around. That also saves us the trouble of finding them first before mowing (**people care**).



## **When & how to sow hazelnuts**

Sow in autumn after 12-15 weeks in the fridge and soaking in water for 3 days. Sow the hazels 1 inch deep, 1.5 inch apart.

You can try taking cuttings, dipping them in growth hormone powder and plant in sawdust.

See also Appendix IV: Calender for the nut orchard on page 32

## **When & how to (trans)plant hazelnuts**

When the leaves are off.

Hazels like well drained soil that doesn't dry out too much. A wide

### **Insect hotels**

Place high and low insect hotels in the orchard, for a wide variety of beneficial insects!

range of soil pH: 5.5 to 7.5, with an optimum around 6.0.

Plant on 2.5m<sup>2</sup> each at least, better 5-6 meters apart.

Don't fertilize; that will only grow more leaves. Only a bit of nitrogen.

Good companions: rhubarb, comfrey, thyme

### **Red hot chilli peppers as 1<sup>st</sup> year crop: sowing, transplanting and care**

Start hot pepper seed indoors 6 to 8 weeks before the plant date. Peppers can be seeded in the garden or transplanted out 2 to 3 weeks after the last frost in spring, when the soil temperature has risen to at least 18°C. Transplant when the plant is 10-15cm tall. Keep 60cm between the plants.

Hot peppers grow best where the air temperature ranges from 21°C to 35°C.

Hot peppers mature in 60 to 95 days.

Avoid high nitrogen fertilizers which will create large leafy plants with few or no fruits.