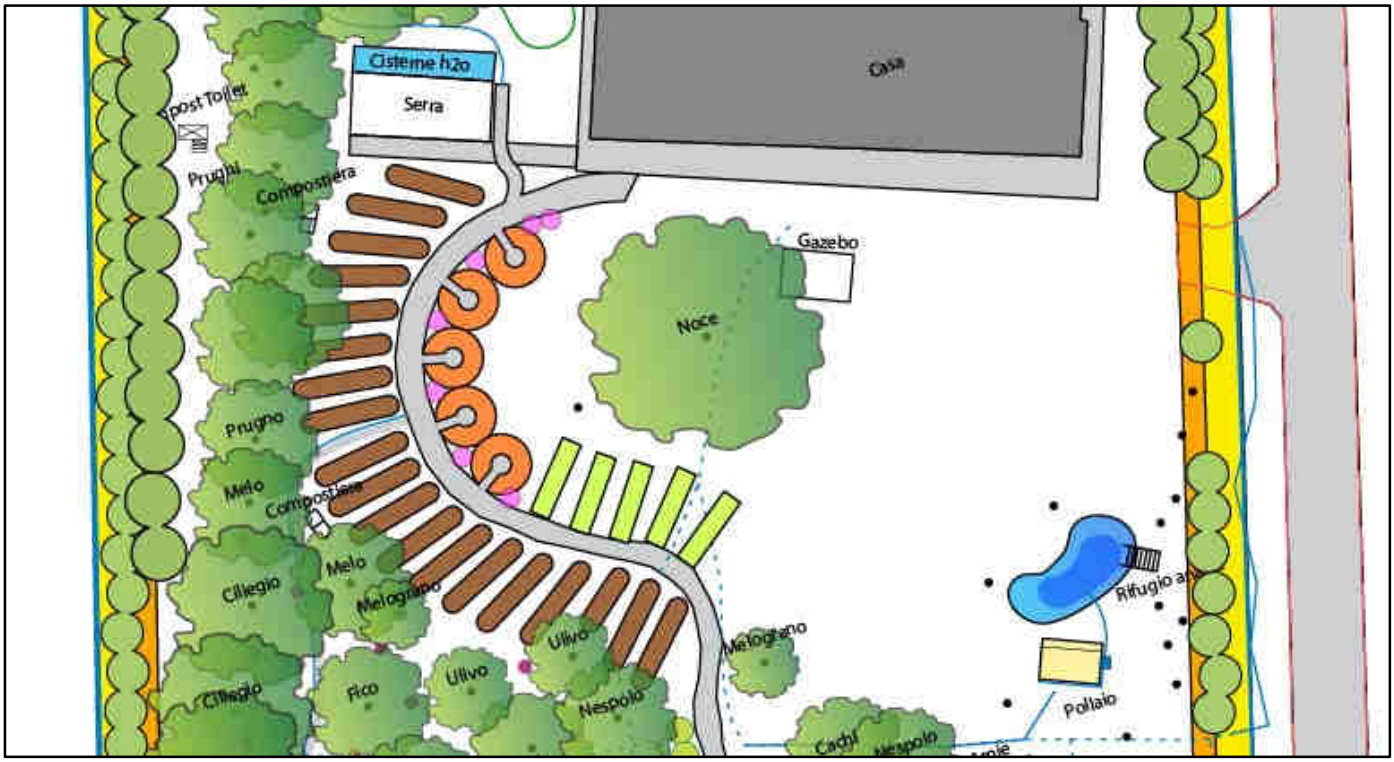
DESIGN of MARCO CASANOVA



Crocetta road, Bagnacavallo (RA) - Italy

November 2015

Summary

I INTRODUCTION

Marco Casanova asked me for a design to organise and regenerate his homestead in Bagnacavallo. At the moment the client is still taking time in restructuring the house in the property, therefore this design is not yet implemented.

For this design I have chosen the S.A.D.I.M. framework: Survey, Analyse, Design, Implement and Maintenance

I.1 ETHICS

Earth Care: One of Marco Casanova's needs is to establish a more natural system as an oasis between the desert of the conventional agriculture fields. To meet this need I plan to regenerate the land and soil first and therefore to take care to the earth.

People care: the design is also suited to create a sustainable homestead in which Marco and his family will stay and live well. I have tried to design in order to satisfy the needs and wants of the client and I hope, with the suggested solution, to have achieved the scope.

Fair Share: The production of a regenerated soil will be abundant, the production of food will be enough for the family and also for friends. If the system will be ok and well organised the client will spend less time for maintenance and will share it's free time with friends and helping the community of Bagnacavallo to get stronger and more connected (to people and nature).

I.2 PERMACULTURE PRINCIPLES

- **Observe and interact**: the client is still not living in the homestead but he and his family have been spending their weekend at the field for more than three years. He observed the field a lot a I have use these useful information for the design
- **Catch and store energy**: this principle has been applied with the design of the greenhouse, the orchard, the agroforestry field, and the lake.
- **Obtain a yield**: the suggested solution will produce yield in term of food, of energy, and also in term of time.

- **Use and value renewable resources and services**: the house will use solar panels for electricity, wood chips for central heating
- **Produce no waste**: the different system have been designed in the way that the waste of a system is a source for the following system. This design will reduce the production of waste, in particular water and food.
- **Design from patterns to details**: to achieve the need for self-sufficiency we start from a bare soil field and design a polyculture system in order to produce different typologies of food, from fruit to veggies to nuts to berries to flowers to leaves.
- **Integrate rather than segregate**: I like to follow the idea to put the right thing in the right place (permacultureprinciples.com), if systems work relationships develop between elements and they support each other.
- **Use small and slow solution**: the polyculture system of food production is a slow solution but can be not very small. But, it can be done a piece at a time. Transforming the big into a series of smalls.
- **Use and value diversity**: the garden and the agroforestry system are two example of design for diversity. Several different elements together to enrich and create diversity in every system.
- **Use edges and value the marginal**: this principle has been applied within the design of the hedges between the field and the surrounding fields, between different zones of the field and between elements inside every system.

I.3 DESIGN TOOLS USED

- Client interview
- Base maps
- Function, System and elements
- Flowchart
- Input-output analysis

- Zones
- Sector analysis
- PMI

II OVERVIEW

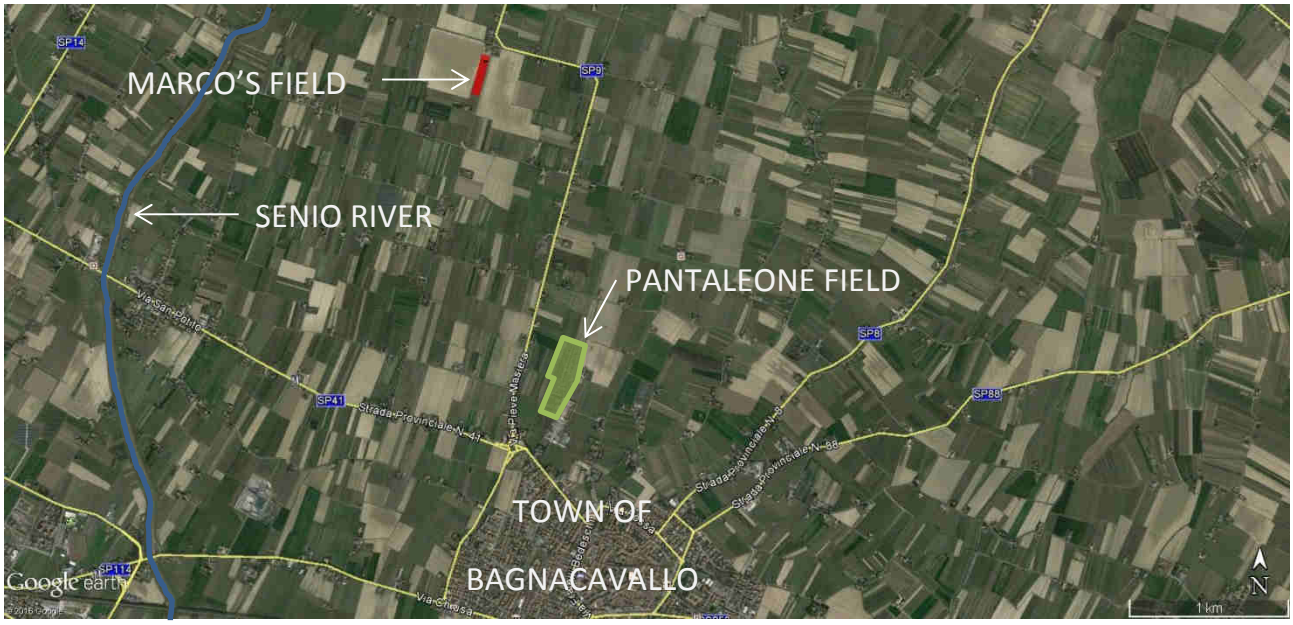


Figure 1: Area overview.

The client's field was an agricultural field and extends for about 15,000 square meters. It is set in a context of conventional agriculture fields with intensive use of chemical treatments with strongly degraded environment and soil. On the west side (one kilometer) flows the Senio river which can be considered as an important corridor of biodiversity, but also a hypothetical source of risk in case of river flooding. And as an additional source of wealth and biodiversity is the Pantaleone farm (an old farm that now has become a wild wood) which is located approximately two kilometers to southeast.

The client's field is an elongated strip that is about 56 meter wide and 270 meter long, oriented approximately north-south. The house on the land is served by a paved country road (via Crocetta) while the adjoining land in all directions are cultivated farmland in conventional way and heavily treated with pesticides, fertilizers, herbicides and chemicals and deeply processed with plow and other mechanical processing.

On the South, West and North boundary a deep ditch has been dug in 2015, about 1 meter deep, that drains the polluted water of the neighboring field toward the ditch along Via Crocetta.

III SURVEY

III.1 CLIENT INTERVIEW

- **Date**: 8/11/2015
- **Name:** Marco Casanova
- **Address:** Crocetta road, Bagnacavallo (RA)
- **Dimension of the field**: 1,5 hectares
- **Number of people in the field**: 2
- **People visiting and living the field** : friends and relatives in the week end.
- **Physical disabilities**: No
- **Works and skills:** Marco has a bulldozer for earth works and he is able to do almost every little manual work.
- **Time to dedicate to the project:** in the weekends, in two years Marco wants to come and live in the house in the field project.
- **Values**: sustainability as much as possible.
- **Food attitude**: Omnivorous, no animal food from intensive animal farm.
- **Age**: 42.
- **Resources:** tap water, lights and wall sockets.
- **Type of property**: Marco owns the house and the related fields
- **Restrictions**: boundaries, groundwater table very low. Some restrictions on the aspect of the house, some for the lake.
- **Limiting factors**: time and chemical spray.
- **Potential weather adversities**: river flooding, strong rain events, industrial and chemical agriculture all around.
- **Maps:** land register maps, Google map/ Bing
- **Requested products:** homestead.
- **Priorities:** house, water management, garden, plant management.

- **WANTS:** bees, water management, wood, garden animals, Nuts, seeds to eat, nests for reptiles and toads, scented garden.
- **NEEDS:** self-sufficiency, natural system, dryer, hedges, material for basketry.

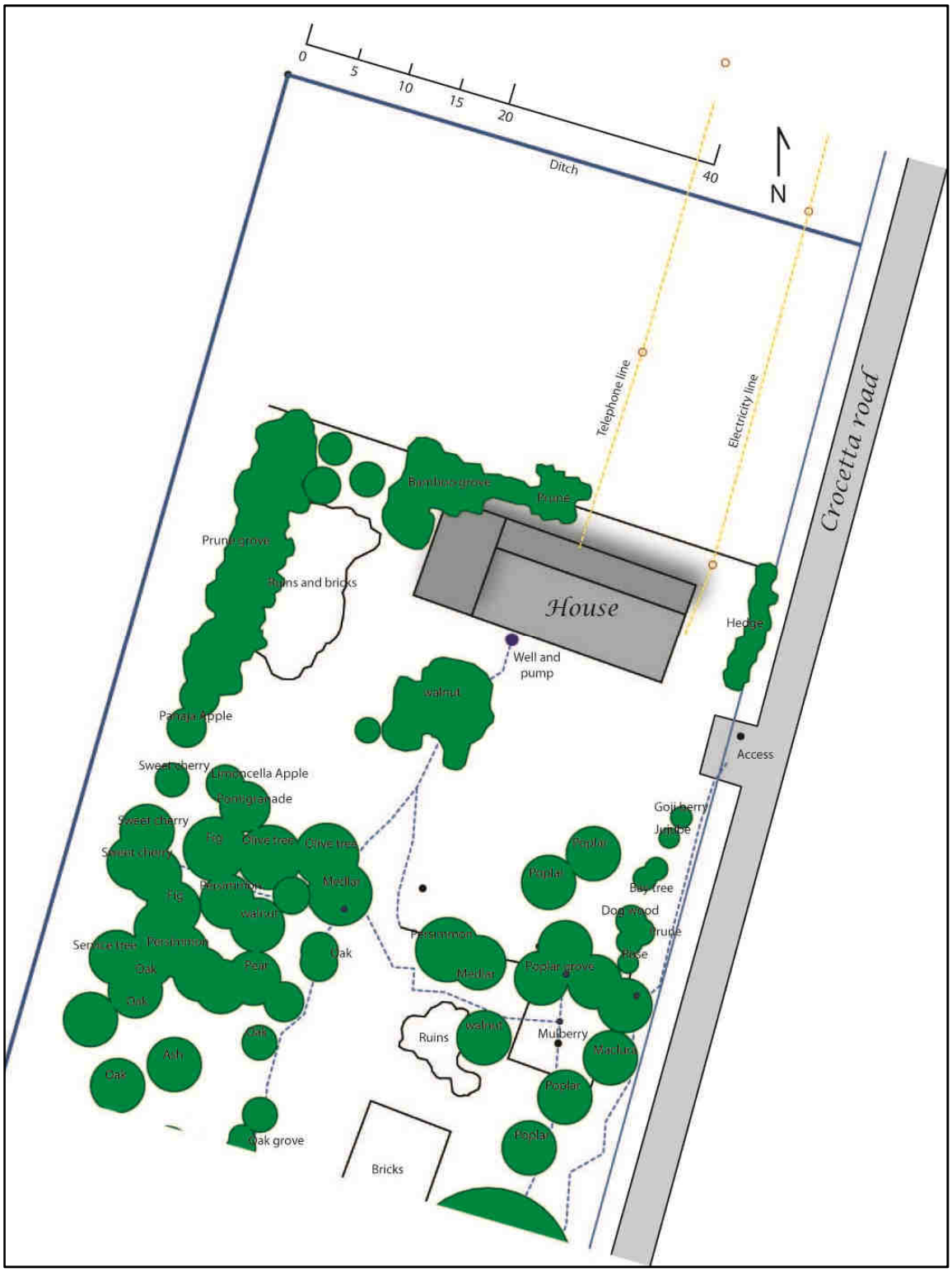


Figura 1:Survey ymap.

To have some information at the beginning of the design process I have surveyed the field of the client using a GPS to take the position of the plants and of the different existing elements. After the survey on the field I have superimposed the field data to the satellite images downloaded from Google Earth and mapped some other elements (ruins, bricks, bamboo grove, etc..). The result can be seen in the survey map. The green circles are the expected canopy coverage, the point are the surveyed plants and trees, the blue lines are connected with water (can be ditches, canals or watering system) while the yellow lines are connected with utilities lines.

III.2 NEEDS, WANTS AND VALUES

NEEDS	WANTS	VALUES
Food self-sufficiency Water management A natural system	Bees Wood Vegetable garden Animals Walnuts, almonds hazelnuts Seeds in general (pumpkins, sunflowers, etc...) Insect shelters Reptiles shelters Scented plants management	Sustainability Rainwater management No animal foods from factory farms Attention to Nature Attention to energy saving

III.3 LIMITING FACTORS

- Time
- Chemicals spray in the neighboring farms fields
- Hunters

III.4 RESTRICTIONS

- Boundaries normatives
- Superficial groundwater lever very low

- Relative to the house
- For the lake

III.5 POTENTIAL RISKS

- Senio river flooding
- Strong rain events
- Heavy snow

III.6 METEO CLIMATIC ANALYSIS

Altitude: circa 20 m on sea level

Precipitations:

- **769.2** mm/year average of the period 1960-1999;
- **546.4** mm year average of the period 2000-2010

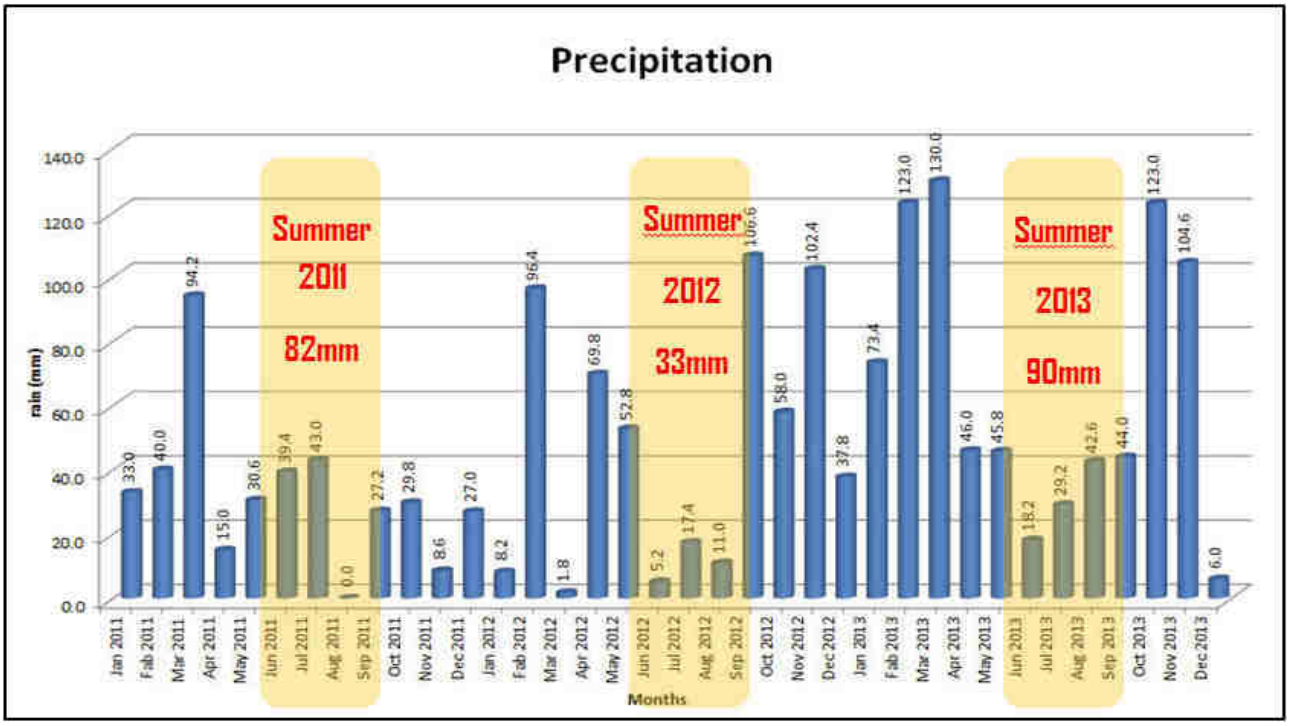


Figure 2:Precipitation (year 2011, 2012 and 2013) with highlighted the small amount of precipitation during the summer time.

Snow: between december and march, a maximum of 50 cm.

Late frost: they could occur between the 16th of March to the second half of April due to cold winds coming from the Balcans. The minimum temperatures are registered at dawn and the duration can be from a few hours (normally 1 or 2 after dawn) to a max of 10 hours in extreme situations.

Drought: strong from April to May, medium from May to July

Temperatures: Min -5° C, Max 35°C.

Winds: in winter from North-West, in Spring from North-East, in Summer from East and in Autumn from North and North-East.

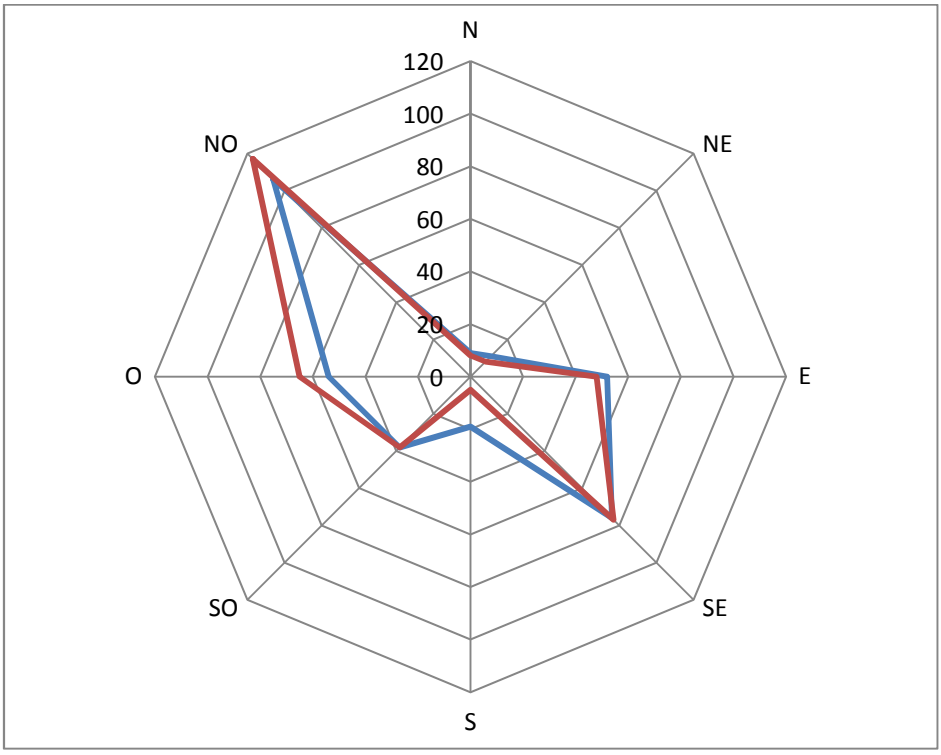


Figure 3: Direction and frequencies of the winds (red for 2013 and blue for the average 2000-2010)

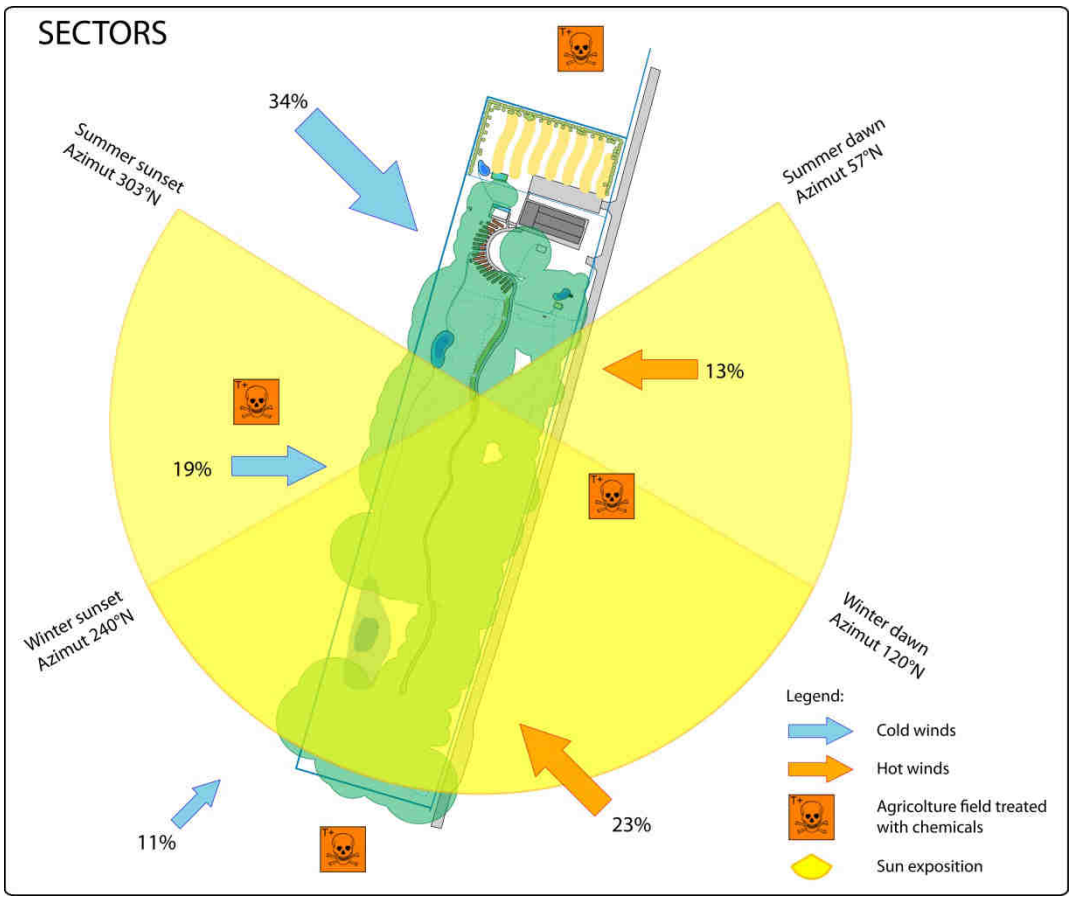


Figure 4: Sector map.

IV ANALYSIS

IV.1 FUNCTIONS, SYSTEMS ed ELEMENTS

FUNCTIONS	SYSTEMS	ELEMENTS
Food self-sufficiency	Vegetable garden with permanent or semi-permanent slightly raised beds.	Raised and mulched beds Mulch Compost Irrigation system Seeds Seedlings
	Hedges in vegetable garden	Berries (blackcurrant, chokeberry, goji, blackberries, etc..) Fruit trees of small sizes or kept pruned Nitrogen fixers shrubs (typically eleagnus , coronilla emero, brooms, etc ...) Aromatics and flowers
	Food forest	Trees, shrubs and plants Aromatics and flowers Mulch Compost
	Low maintenance vegetable garden	Mulch Potatoes, chickpeas, beans, soybeans, corn, artichokes, cardoons, etc..
	Greenhouse	Soil and compost Wood and methacrylate sheets

		Seeds and plants Pots and containers Irrigation system
Natural ecosystem	Small lake	EPDM layer Fish to control mosquitos Water plants (*Phragmites Australis, Typha Latifolia, Scirpus Lacustris, etc..)* Plants for ducks
	Wood	Just add some trees (to manage color and perfume – see list of plants)
	Food forest	Fruit trees, shrubs and plants Aromatics and flowers Mulch Compost
Hunter management	Dense edge with rustic shrubs	Trees:, Elm, Ash, Field Maple, Beech, Plum, Crab Apple, Holly, Primrose, Sweet, Beech, Hornbeam, Whitebeam, Wild privet, Spindle, Balm-leaved Figwort, Bastard Balm, Campions, Cranesbills and Vetches Shrubs: Hawthorne, Blackthorn, Hazel, russian olive, etc… Climbers: *Clematis vitalba, lonicera caprifolium*
	Indication plaques	Wood poles Iron wire plaques
Protection against chemicals from neighbors	Dense edge with rustic shrubs	Trees:, Elm, Ash, Field Maple, Beech, Plum, Crab Apple, Holly, Primrose, Sweet, Beech,

		Hornbeam, Whitebeam, Wild privet, Spindle, Balm-leaved Figwort, Bastard Balm, Campions, Cranesbills and Vetches Shrubs: Hawthorne, Blackthorn, Hazel, russian olive, etc… Climbers: *Clematis vitalba, lonicera caprifolium*
Car management	Park lot	Defined spaces for car Trees with wide canopy Grass management
Water management	Rain water harvest	Tank Tubes Support
	Bio-rolls	Long brunches (from coppiced trees or from canes or from pruning) Natural twine Spade

IV.2 SELF-SUFFICIENCY

Below is a list of products that can be obtained from the field in its various forms and how the harvested product can be maintained and preserved . NOTE : the symbol →∃ means that it is necessary to use energy.

- **GARDEN** (veggies for 9 to 10 months per year)
- **PRESERVED VEGETABLES**
    - FREEZER →∃
    - WITH OIL
        - FIRE →∃
        - OIL AND A COOL BASEMENT TO STORE THEM
        - JARS
    - WITH STRAW
        - A COOL BASEMENT
        - STRAW
    - UNDER SAND
        - CONTAINERS
        - A COOL BASEMENT
        - SAND
    - DRYED
        - DRYER →∃
        - SUN
        - JARS
        - A COOL BASEMENT
    - PRESERVES
        - JARS
        - FIRE →∃
        - SALT

- BRINE
  - WATER
  - SALT
  - FIRE →∃
- LACTO-FERMENTED PRODUCTS
  - SALT
  - WHEY
  - STARTER CULTURE
  - JARS

- **FRUIT**
  - FRESH (from May to December)
  - STORED
    - CONTAINERS
    - A COOL BASEMENT
  - IN WATER AND SUGAR
    - JARS
    - SUGAR
    - WATER
    - COOL BASEMENT
    - FIRE →∃
  - JAMS
    - JARS
    - SUGAR
    - COOL BASEMENT
    - FIRE →∃
  - DRYED
    - DRYER →∃
    - SUN
    - JARS

- A COOL BASEMENT

- WITH ALCOHOL
  - ALCOHOL
  - JARS/BOTTLES
- JUICES
  - JUICER →∃
  - BOTTLES
  - COOL BASEMENT

IV.3 WATER

Different solution need to be design in order to manage the water in the field, the most important are related to the management of discharges (bathrooms, kitchen and laundry) and rainwater harvesting.

WASTE WATER AND PYTOPURIFICATION

Water is a resource widely used in every house in everyday life, the main uses we make of it are highlighted in the image below. On average, the consumption of water is about 250-300 liters per day. This consumed water ends in two different waste eater: gray water and sewage waters.

Both come from the house and end up in one little well and then convey into pytopurification zone and in the pond.

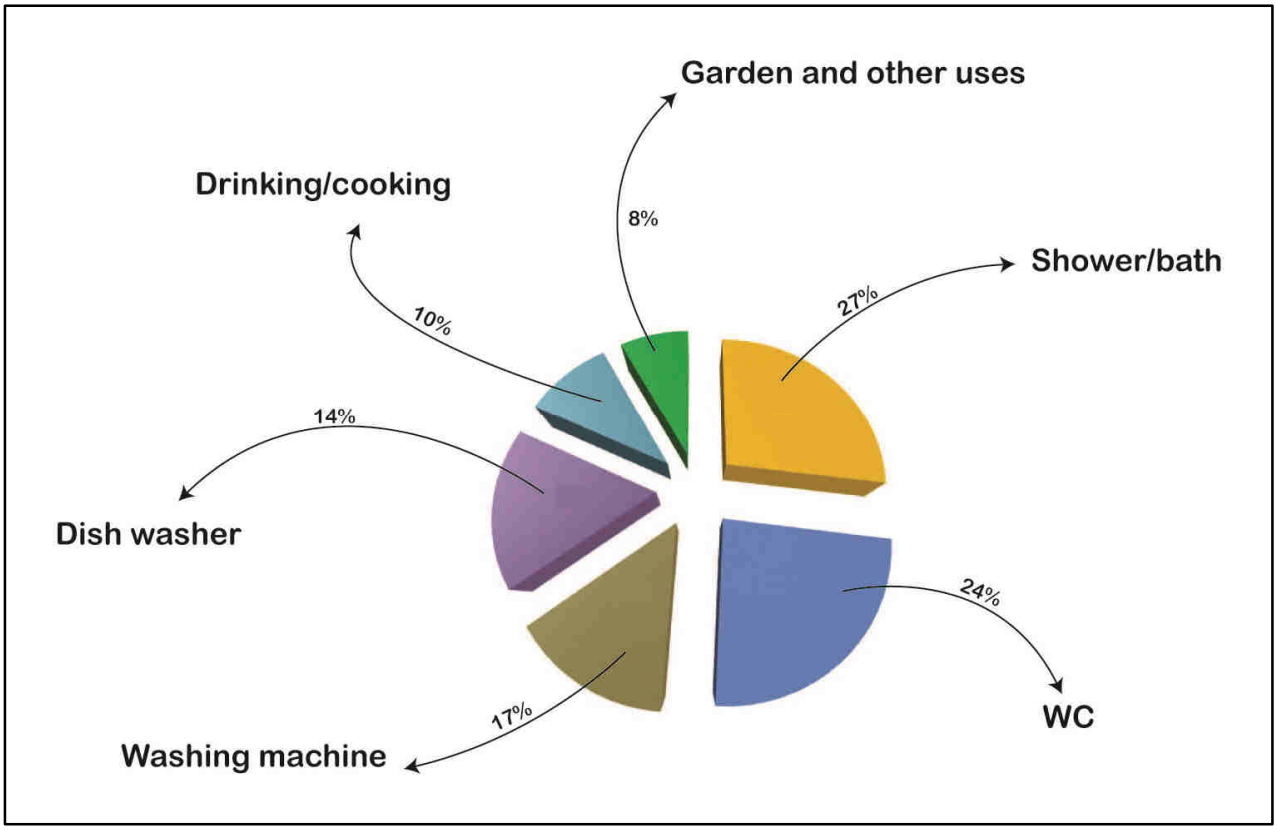


Figure 5:Domestic water use.

The drinkable water (tap water) flow through the toilet and become a slurry to be managed. The slurry in the tubes ends in a Imhoff tank than exit from it and continues till the phytopurification system and then to the pond .

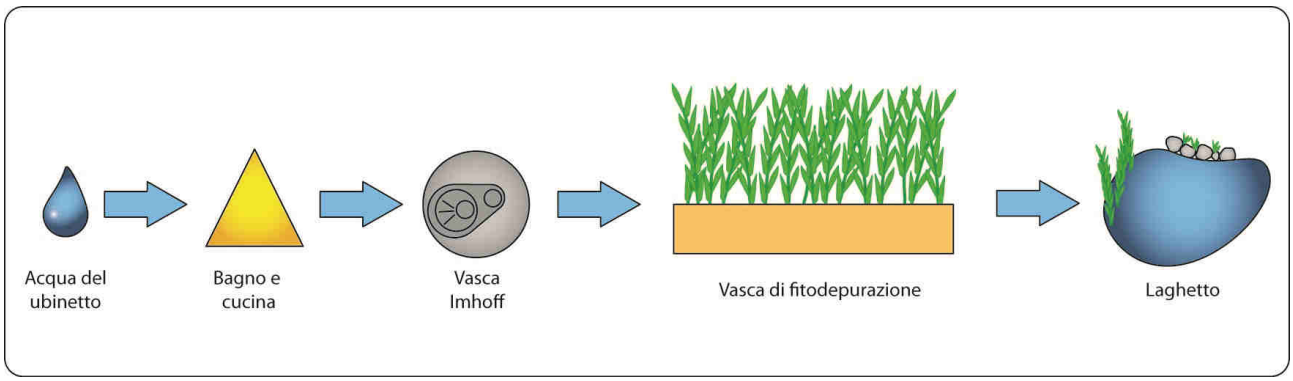


Figure 6: Flowchart related to water flow in the house from the tap to the pond.

There are 2 main pytopurification systems that can be used: the free flow system (FW or FWS) and the horizontal subsurface flow system (HF).

The two systems are similar in terms of features but have some substantial differences .

FWS	HF
EPDM layer A layer of water (0,3 – 0,6 meters) on the surface No fixed geometry Length/wide ratio from 2:1 to 10:1 From 2,5 to 5,0 square meters for population equivalent (PE) For 5 PE: 30 square meters basin	EPDM layer Depth depends from the suggested plants Elevated edges Fixed geometry (rectangular) Length/wide ratio from 1:1 to 3:1 From 2,0 to 4,0 square meters for population equivalent (PE) For 5 PE: 18 square meters basin

The system which best suits the needs is the HF system, as it has no need of additional water, it is smaller and easier to manage. You can however think of providing a pond that collects water from the phytopurification basin which can be considered as a free-flow system (the pond).

Other functions of pytopurification system could be:

- Nesting for birds
- Wind or dust stop
- Source of useful material for mulching
- Source material for basketry
- The poles of *fragmites australis* can be used as supports for the plants and construction.

Plants to be used:

Phragmites Australis	*Typha Latifolia*	*Scirpus Lacustris*
		

Carex Aquatilis	*Juncus Effusus*	*Iris Pseudacorus*
		

Instead of creating mono-plants systems it is suggested to use different types of plants in such a way to make the basin a more natural environment, nicer and more functional. Working with the characteristics of the plants suggested in fact, it's possible to create a much richer kind of basin than the following examples:

WATER MANAGEMENT

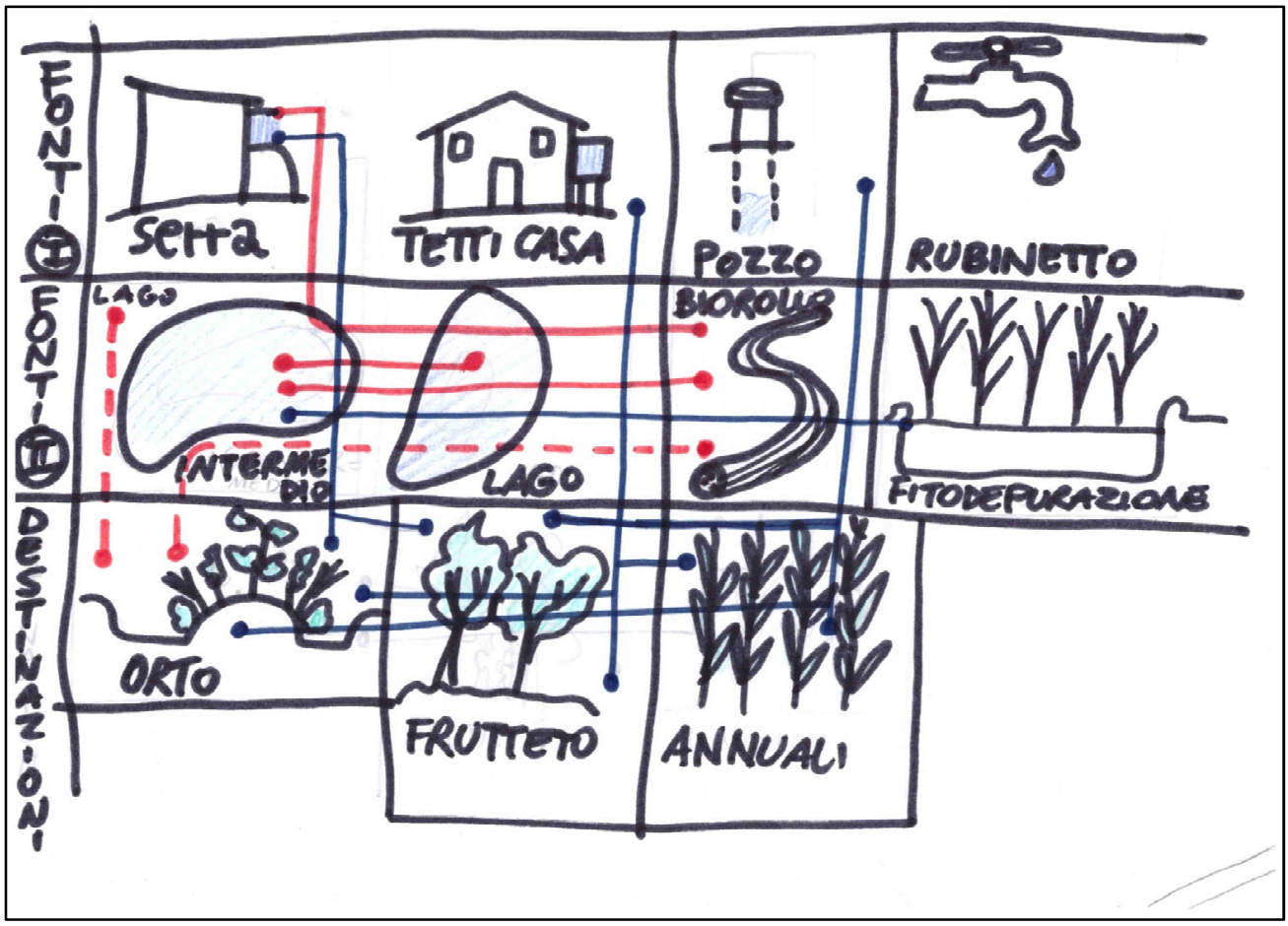


Figure 7: simplified scheme of the water management. Blue lines are direct connections, the red lines are indirect connections. Translation of text (from left to right): top boxes: SOURCES, GREENHOUSE, HOUSE ROOF, WELL, TAP; middle boxes: SOURCES, MIDDLE LAKE, LAKE, BIOROLL, PYTHOPURIFICATION BASIN; lower boxes: DESTINATIONS, GARDEN, ORCHARD, ANNUALS.

- **GARDEN WATER**
  - GREENHOUSE: from greenhouse to tanks, from tanks to garden. Tank overflow to bio-rolls system;
  - PYTOPURIFICATION SYSTEM: from basin to pond, from pond to bio-roll system or from pond to where is necessary using pumps;
  - HOUSE ROOF: from the roof to a tank, from the tank to garden. Tank overflow to pond and to lake;

- WELL: water of the well can be used for the watering system of the garden; energy needed →∃
- TAP →∃

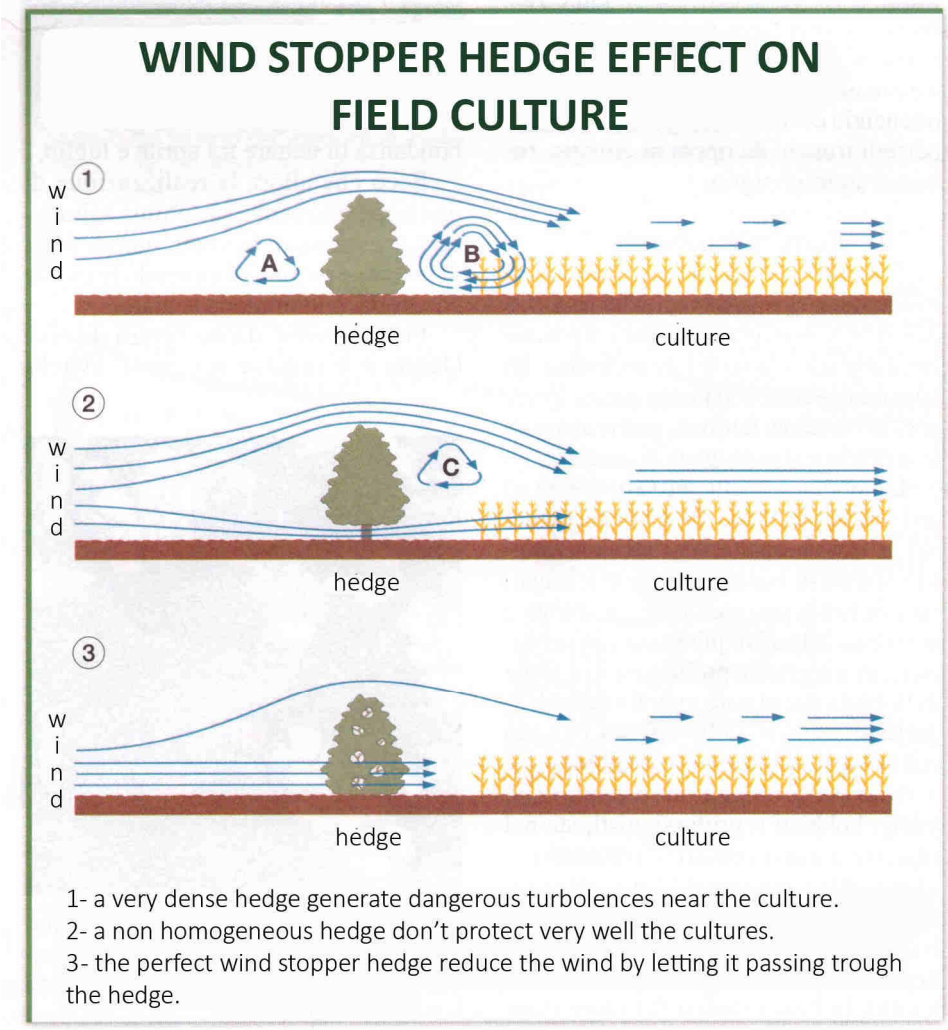
- **WATER FOR ANNUAL CULTURE IN ZONE 2**
  - HOUSE ROOF: from the roof to the tank, from the tank to annual cultures, tank overflow to pond and then to lake.
  - WELL: water of the well can be used for the watering system; energy needed →∃
  - TAP →∃
  - SPONGE SOIL: regeneration of the soil make it able to adsorbe and retain more water, a mulching layer helps even more.

- **WATER FOR ORCHARDS (ZONE 1 e 3)**
  - HOUSE ROOF: from the roof to the tank, from the tank to trees system, tank overflow to pond and then to lake.
  - WELL: water of the well can be used for the watering system; energy needed →∃
  - SPONGE SOIL: regeneration of the soil make it able to adsorbe and retain more water, a mulching layer helps even more.

Figure 8: Bio-roll system. This system brings water and humidity in the garden area.

IV.4 HEDGES

It is a fundamental system for the protection of soil and plants from chemicals sprayed in the neighboring fields and the one coming from the road traffic. Plants that are planted will be hardy plants in the sense that they're going to stop on their leaves and branches poisonous substances, thorny plants are suggested to discourage hunters. Currently both boundaries are bordered with a ditch, and several hundred hedge plants have been already planted. It's necessary to create a 3D system that blocks the chemicals carried by the wind.



If not already used, it is suggested the inclusion of evergreen plants in such a way as to have greater protection even in autumn and early spring. To minimize watering the following is suggested:

• mulch the plants with thick layers of straw

• use water plants in the ditches

planting ditches with water pints (cattail, straw , water mint , soapwort , etc ...) . these plants will play many vital functions including maintaining the water and/or humidity in the ditch, increase biodiversity, attract aquatic animals, create a first barrier filter, provide plants materials.

Figure 9: Example of hedge

IV.5 GARDEN SYSTEM

This system is formed by permanent or semi-permanent garden beds (in any forms) with perennial hedges. The hedges could be made of berry shrubs, small fruit trees, aromatics, flowers, etc…

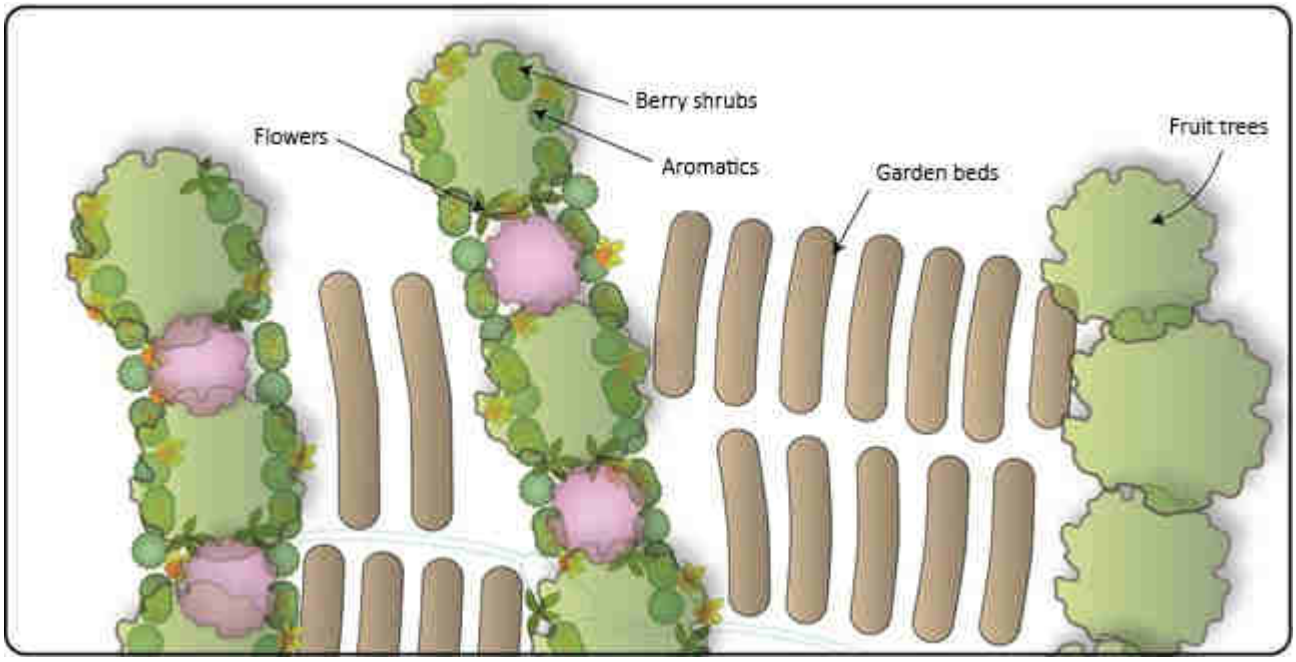


Figure 10: Simplified sheme of the garden system.

Permanent or semi-permanent garden beds means that the shape of the garden bed will not change. The soil in the beds could be enriched with compost, green mulch or mulch. These kind of beds tend to grow in height due to the contribution of mulch and organic matter from the garden veggies. Beds of perennial within the vegetable beds will contribute to create edges, to create microclimates and to enrich the biodiversity of the garden. The perennials will also produce food and compostable material.

To get a clear idea of the elements is needed for this system , we can perform an input-output analysis.

VEGGIE-GARDEN INPUT-OUTPUT SYSTEM

INPUT	OUTPUT
Field preparation	Food
Compost	Biodiversity
Mulch	Seeds
Seeds	Plans
Seedlings*	Fruits
Water*	Berries
Watering system	Pests control
Shrubs	Protection
Protection (wind, pests, sun, etc…)	Microclimates
Microorganisms	Edges
Food (for plants and soil)*	Compostable material
	Mulch

The asterisked words offer some food for thought , let's see in what sense :

Seedlings→ The seedlings can be easily prepared at home, to facilitate the operation is useful to have a secure and controlled place where moisture and water are easily manageable and where it may have a slightly higher temperature at the end of winter/beginning of spring. This environment can be for example a **greenhouse.**

Water→ the irrigation system for the vegetable garden request a certain pressure, otherwise it would not be able to flow all the system pipes and nor to flow out of the holes; the water with these characteristics may have two origins:

1- the tap water
2- water collected from the roofs and stored in tanks.
3- From the pond

A system that can collect rain water is the roof of the house but also the roof of a lower structure such as a **greenhouse**. Behind the greenhouse (to the North) it is possible to put the tanks that will collect and store the water and provide it for any system. Another way to gather water is from the pond.

Food→ the food will be mainly: Nitrogen (N), potassium (K) and microorganisms. Nitrogen can be obtain from nitrogen-fixing plants, (legumes, shrubs such as *Eleagnus*, broom, *Coronilla Emerus*, or flowers such as lupine, sweet peas, vetch, and many others). Potassium source can be: ash, sea algae, or comfrey. Comfrey and nettles could be planted in order to prepare excellent macerated that will provide nitrogen and potassium to the vegetables. As for the microorganisms the best source is a good quality compost or vermicompost, possibly a self-produced and on site produced compost to be used as inoculum of microorganism in the garden beds.

Figure 11: from left to right: Coronilla Emerus, Lupine e comfrey.

IV.6 GUILDS

Under trees and shrubs it is suggested to plant plants that help the tree and shrub to protect from pests and to thrive.

There are 6 categories of plants to be planted:

Insect attracting plants: These are plants that produce flowers that attract beneficial insects, pollinators (bees, hoverflies, butterflies) to predators (carnivorous wasps) some examples are: Dill (*Anethum graveolens*), coriander, fennel (*Foeniculum vulgare*), celery, anise, parsley, angelica, parsnip, carrot, chervil and yarrow (*Achillea millefolium*), these plants should be planted along in the sunny edge.

Cover plants: this type of plant is used to permanently protect the soil, shade and serve as a living mulch. Examples of these plants are: comfrey, violet, strawberry, dwarf clover, etc ...

Taproots plants: this type of plants has a long and deep tap root that is able to move the nutrients to the surface from the deepest layers. Some examples are: Comfrey, mallow, borage, dandelion, thistle, etc ...

Flowers: Some flowers attract bees, other attract butterflies, others produce root exudates that protect the plant and remove pests. Some are even edible: nasturtium, marigold and calendula are the three most important but also Echinacea, yarrow Millefolium, Zinnia, etc ...

Spring bulbs: The bulbs are planted in November and December and emerge in the form of beautiful flowers in early spring. It is believed that they are capable of retaining the surface humic substances normally washed away by spring rains and to control weeds. Some examples are: daffodils, crocus, hyacinth, allium, tulips, etc ...

Herbs: aromatic plants keep away pests, can be used in the kitchen and can be used to obtain valuable oils too. Some examples are: wormwood, tarragon, mint, lemon balm, oregano, etc ... Among the aromatic can also insert the garlic (*Allium sativum*) and chives (*Allium schoenoprasum*) that can be used both as a herb and as spray insect repellent in the orchard.

IV.7 ANIMALS

Chicken

Input:

- protection (pen)
- food (grass, insects, garden waste, etc…)
- sand
- dust
- straw, sawdust, wood chips, etc.. for the bedding
- water

Output:

- Enriched bedding
- Poo and pee
- Pest control
- Edges

Chickens are animals that scratch around looking for insects, seeds and herbs. The chickens can be held and managed in different ways:

1- **Fixed Henhouse**: the fixed chicken coop provides a fixed shelter area for the night and for the eggs and a fenced pasture area. The food of the chickens may partly come from kitchen scraps and grazing (if the pasture is well designed) but need to be integrated with a chicken food. The fenced-in area can be changed during the year to prevent bare soil formation. The fence may be electrified chicken net.

2- **Mobile chicken coop**: involves the construction of a small shed with wheels and chicken house that provides shelter for the night and nests for eggs. The chicken house can be moved in the desired areas. During the day the hens can graze in a fenced area.

3- **Chicken tractor**: this technique is suitable for broilers or to protect small chicks against aerial predators (hawks and buzzards). It's about building a cage made of

wood and net without the bottom and at least half of the roof area protected with a cover. The "tractor" is moved almost every day in the land and can be used as a tractor for weeding small areas of land. The cage must have a system to provide water and food to the chickens.

4- Free chicken: another solution is to leave the chickens to stay free in the part where there is no vegetable garden (or fence the vegetable garden). It is possible to create high perches unreachable from predators where the hens can spend the night and lay eggs.

Ducks

Input:

- Grass, insects, water plants, etc…
- Protection for the night
- water

Output:

- eggs
- meat
- feathers
- protection
- edges

Ducks are animals very useful for snails control, they can be used in the garden, with caution, for weeding. The ducks do not scratch around and therefore are not interested in digging under the mulch, usually they need a pond and can be used for waterproofing the pond. Some do not need water at all. If you set up a small pond for the ducks it’s possible to create a net cage with access from the water and inaccessible from the ground in order to protect the ducks from predators at night . Another solution is to make a small island in the middle of the lake accessible only by ducks .

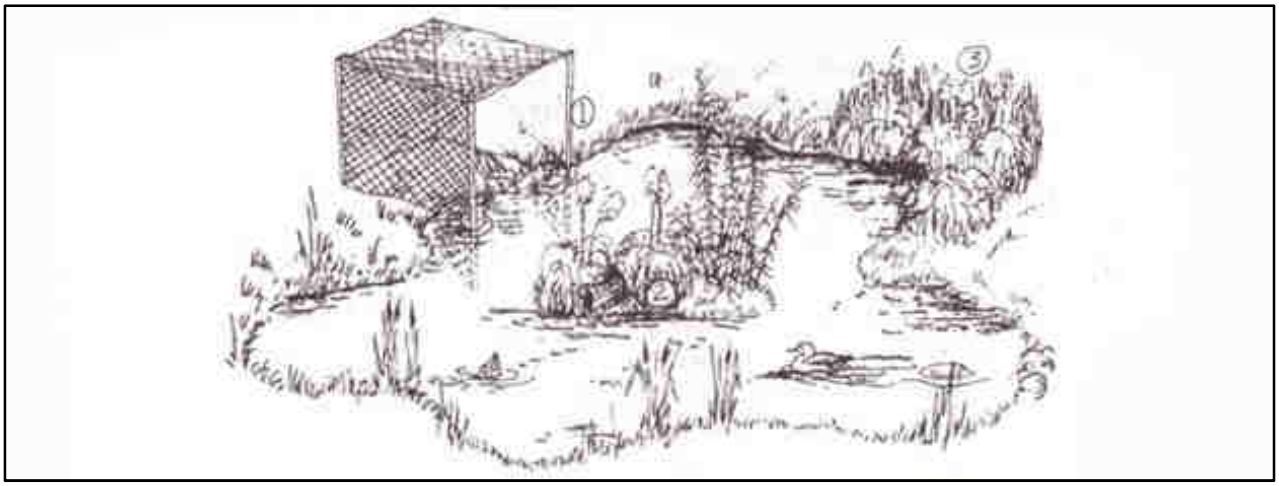


Figure 12: cage for ducks.

Geese

Input:

- Grass,water plants, etc…
- protection
- water

Output:

- fertilization
- protection
- eggs
- meet
- feathers

Geese are grazers that feed on grasses, have webbed feet and move in search of grass. Geese do not scratch around and are not interested in vegetable and broadleaf plants. They can be left free to roam as they are able to protect themselves from predators. For the night they need a basic shelter that can be join to the chicken hen . Geese can replace part of the watchdogs .

Bees

The bees need pasture and can fly up to 3 km to search for it. The pasture will consist of flowery meadow and flowers of any kind that they will be able to find all over the year. Bees can be put in zone 3 but not too far from the house as they require weekly visits.

IV.8 INPUT/OUTPUT EXTENDED

This is the input/output analysis for every system analysed, it is useful to see connections and integrations.

Paths

Input:

- Cover material: wood chips, cut grass, straw, etc…
- digging
- plants to be planted in the edge of the path.
- Brunces, canes, pruning material, etc…for the bioroll.
- Cardboards
- Geo-textile or similar as semi-final layer over the bioroll and under the cover material

Output:

- Path
- Moving of water and humidity by walking on it
- Edge creation

Veggie garden

Input:

- seeds and plants
- mulch materials

- garden beds
- tutors for climbing plants
- water
- weed control

Output:

- veggies, flowers, herbs
- mulching material
- plants and seeds
- edges
- biodiversity

Greenhouse

Input:

- construction materials (wooden board, glass, metacrylate, etc…)
- mulch
- heavy material to accumulate the winter heat from the sun

Output:

- heat
- protection
- rain water harvesting

Animals

Input:

- sand
- dust
- bedding materials (straw, shavings, etc…)
- water

Output:

- bedding enriched with poo and pee good for composting
- protection
- edges

Hedges

Input:

- Young trees and shrubs
- Mulch
- Water
- Pruning
- Watering system (for the first 2-3 years)

Output:

- Protection from the North winds and chemicals
- Edges
- Nesting site for birds
- Berries, fruits and nut yields

Car park

Input:

- rouins, bricks, stones, gravel, etc…
- geotextile layer
- gravel
- shade
- maintenance (grass cut, leaves collection, addiction of gravel ,etc..

Output:

- Edge
- Place for the cars

Pythopurification basin

Input:

- Excavation of the basin (with elevated edges)
- LDPE, HDPE, EPDM layer at least 30m^2
- Geotextile or similar
- Tubes and accessories
- Sun
- plants

Output:

- water treatment and water purification
- edges
- nesting for birds
- wind or dust barrier
- biodiversity source
- source of basketry materials
- tutors for climbing plants

Pond

Input:

- water
- Water plants
- Maintenance

Output:

- Purified water
- Mulch material
- Nesting site
- Source of biodiversity

Agroforestry system

Input:

- Field preparation for sowing
- Muching materials
- Trees, shrubs and plants
- Watering system
- maintenance (pruning, set up of perennial stripes, watering system testing, etc…)
- fruit and berries harvesting

Output:

- fruits, seeds, nuts, flowers, etc…
- leaves
- seedlings
- wind protection
- nesting birds site
- pruning materials
- flowers for bees

IV.9 SCENTED PLANTS

See annex 1.

V DESIGN

V.1 ZONES e SECTORS

- **Zone 0**: the house.
- **Zone 1**: vegetable garden, animal coops, spiral of aromatics, relax zone.
- **Zone 2**: Agroforestry system, hedge system, car park, pytopurification basin and pond.
- **Zone 3**: food forest
- **Zone 4**: lake, bamboo wood, wood trees.

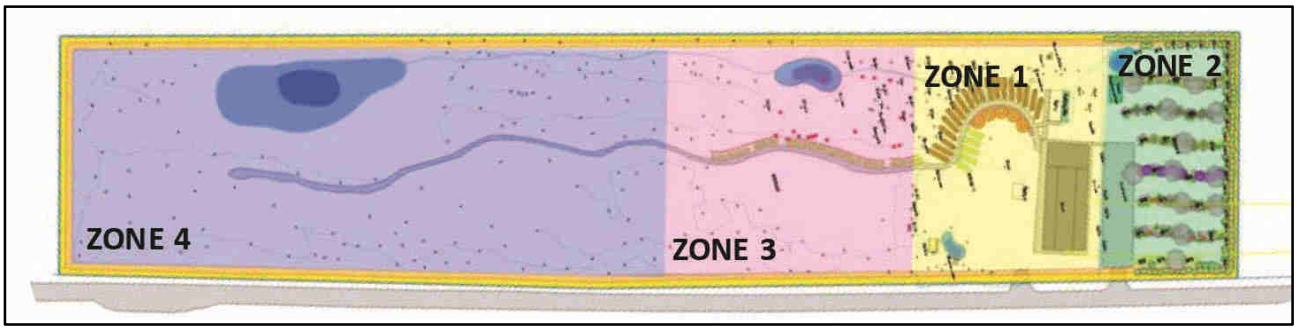


Figure 13: Zone map.

The main elements of the sector analysis are: the winds, the insolation and any existing constraints; in this case the field slope are practically negligible. For the development of this project the winds are important. From autumn to late spring winds blow from the west, North-West and North; they are cold winds but not strong. From late spring to autumn instead, blows warm winds from the Southeast; in full summer (july and august) they can dry up very quickly the culture. During the summer some strong and warm wind from the south may occur.

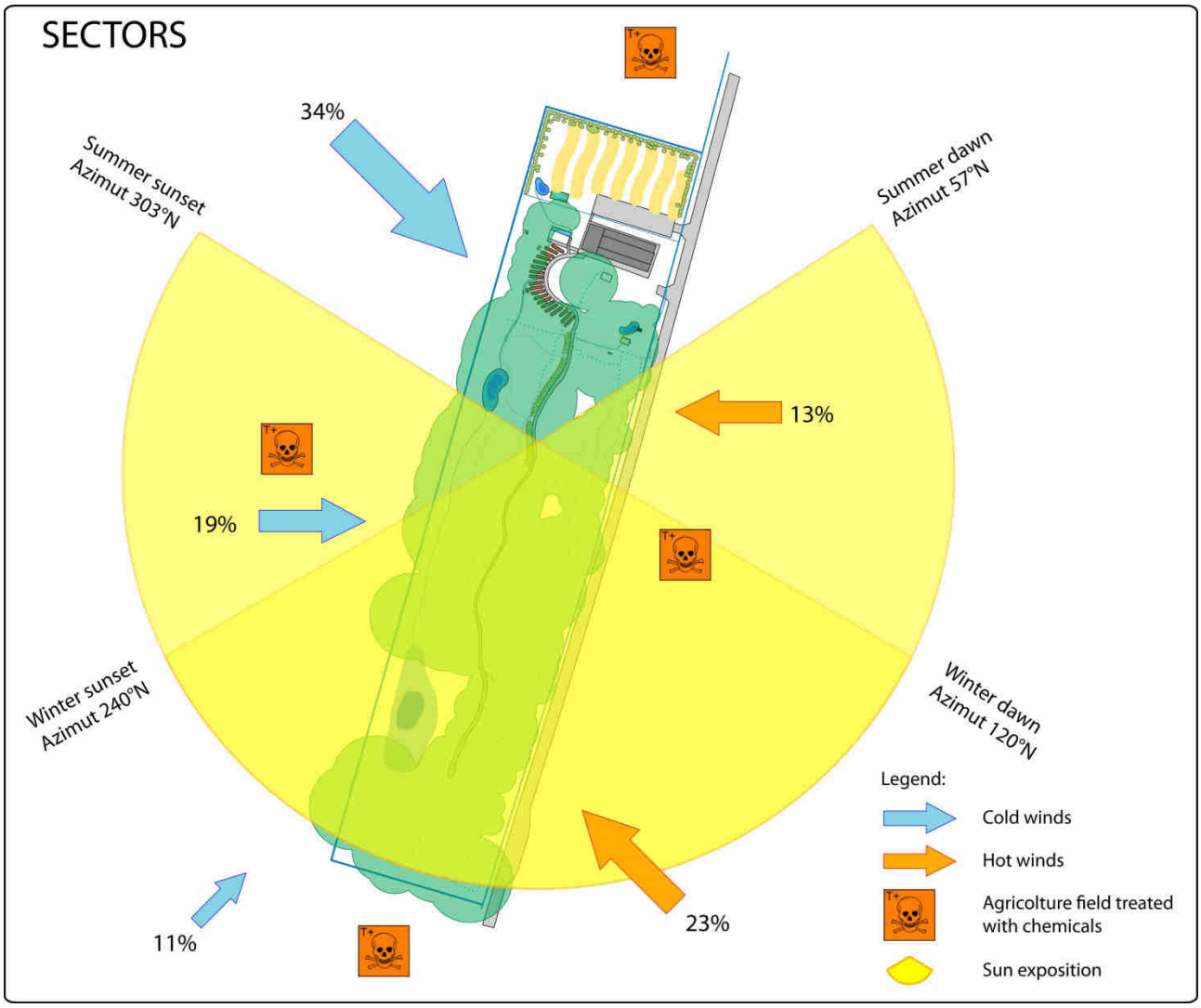


Figure 14: Sector map.

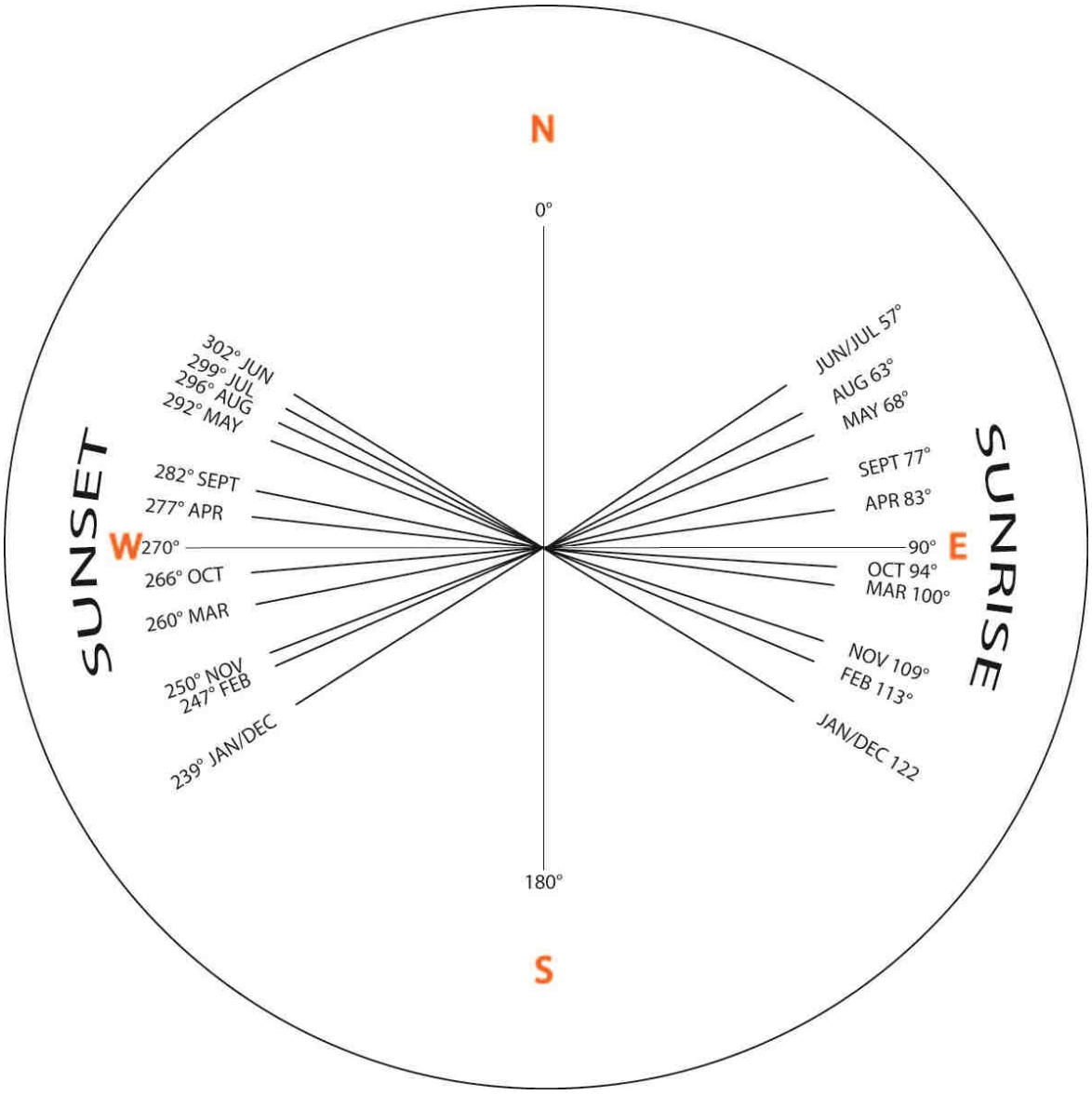


Figure 15: **Angles of sunset and sunrise for the area.**

V.2 ZONE 1

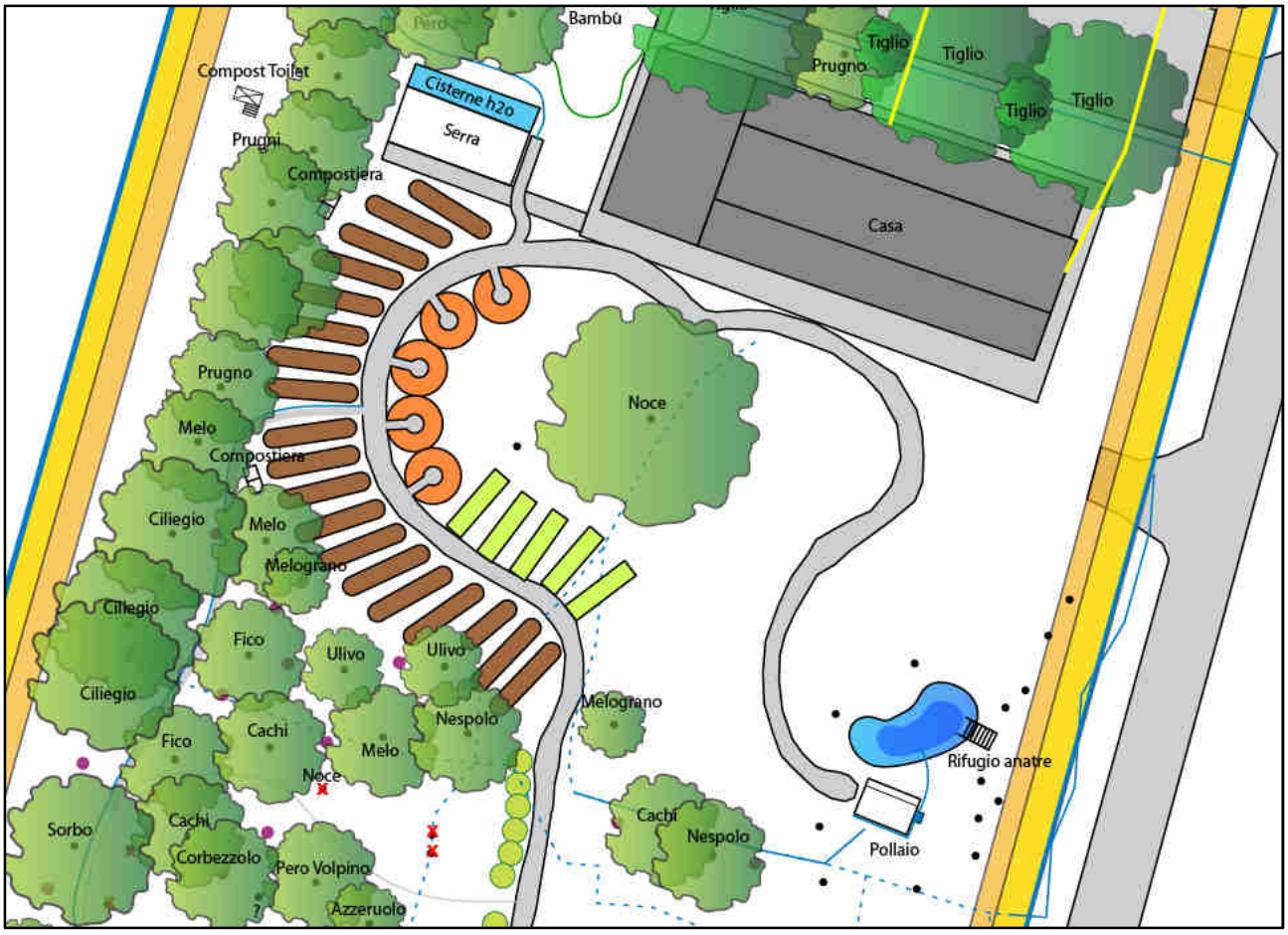


Figure 16: Map of zone 1.

Currently, the area has a grove of pear trees, plum trees and various fruit trees on the west side, a very large walnut at the center and a number of hedge trees and shrubs on the east side.

To fertilize adequately the grove of fruit trees, some nitrogen fixing trees and shrubs should be introduced (perhaps replacing the diseased trees) and associations of beneficial plants under the canopy (see paragraph on guilds [III.11]). N-fixers trees and shrubs could be:

Trees:

- *Cercis Siliquastrum*: 4 to 6 meters high and 3 to 5 m. wide; rose to violet flowers appear in may followed by legumes. Flowers are edible and legumes are good for animals.
- A*lbizzia Julibrissin*: 6 to 12 m. high and 5to 8 m. wide.

Shrubs:

- *Eleagnus* species
- *Coronilla Emerus*
- Broom

The bamboo groove should be moved in zone 4 near the lake.

Paths

In front of the house in the yard it's possible to create two small paths that serve to reach the greenhouse, the garden, zones 2 and 3 and animals. The paths can be realized in the following way:

- dig a trench 30 cm depth ,

- Covers the bottom of the trench with cardboards,

- put the bioroll (bundle of branches made with pruning material and fixed with biodegradable twine) of 15/20 cm in diameter,

- Covers the bioroll with non-woven fabric (geotextile or similar),

- Covers everything with wood chips or similar in abundance.

The earth resulting from excavation is mounded on the side of the path and are planted with various plants taking care to create alternating between higher and lower plants to promote the "zebra effect" and facilitate the flowing of air, humidity and water.

Veggie garden

The veggie garden will take place at the margins of the path, and will benefit from the water and humidity transported and stored inside the bioroll system. It is suggested to use semi-permanent flower beds where they change the crops but where the shape remains

unchanged . This management combined with mulch improves soil fertility not compressing it with the passage and the trampling . The flower beds you can make an irrigation system with drip .

Greenhouse

The greenhouse will be used to produced plants seedlings to be transplanted into the garden beds, and to plant vegetable to anticipate. The roof will harvest rainwater to be stored inside tanks positioned on the north side of the greenhouse. Overflow of the tanks will feed the biorolls system.

Animals

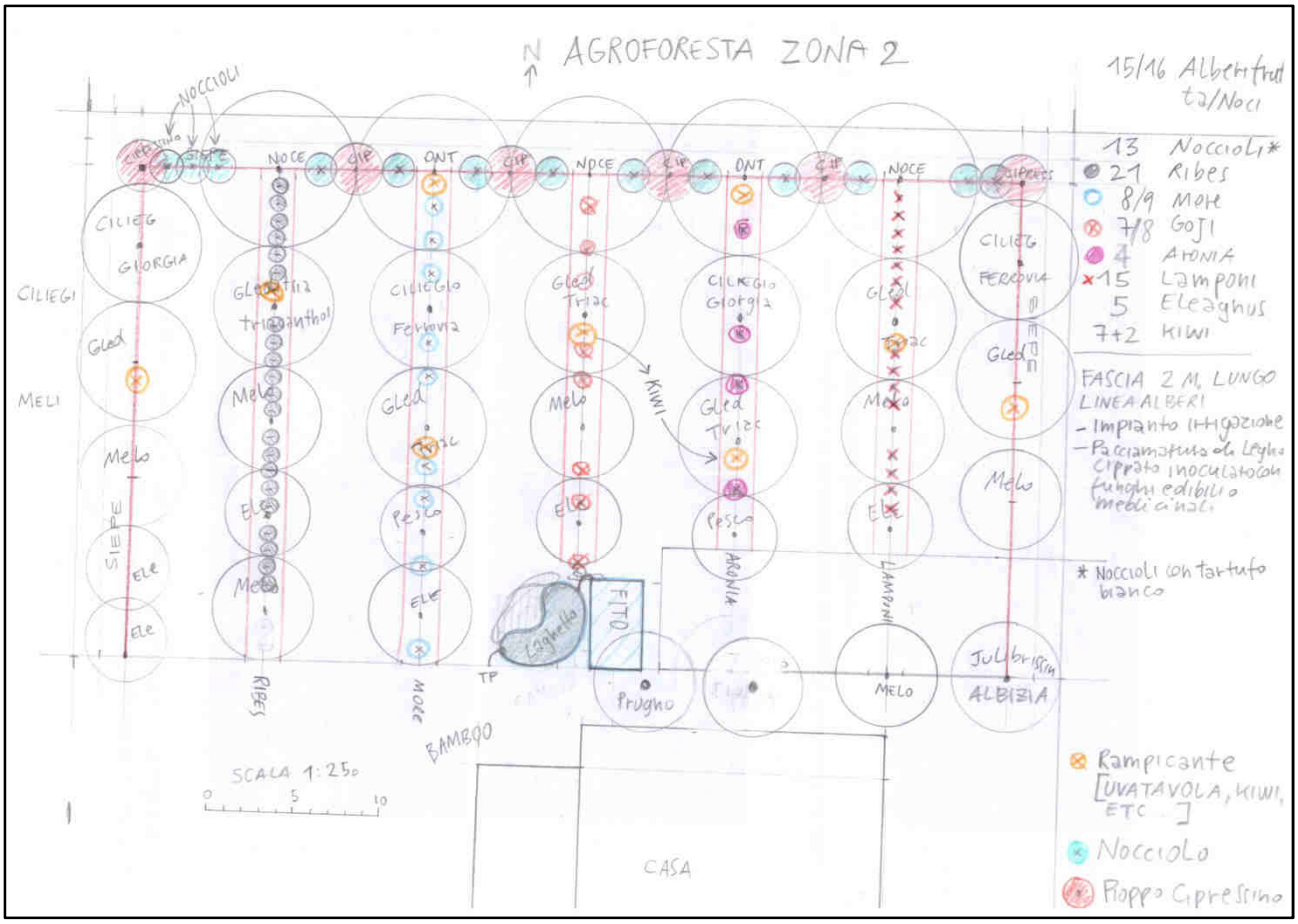
The area devoted to animals involves the construction of chicken coop which will offer a shelter to the hens (inside it) and geese (below it), it will be the place for the nests and for eggs, and will allows to collect rain water for the animals and for the small pond for ducks.

This area may provide a small shallow pond, planted with aquatic plants that will help to seal the small pond. The ducks in the pond will put in suspension the fine material that, mixed with their feces, will form a waterproofing layer. The pond serves as accumulation of biodiversity and source of water for the animals and could be used to store the overflow water coming from the animals coop/shed.

Relax zone

Under the wallnut will be realised the relax zone with table and chairs to eat and relax.

V.3 ZONE 2



The design for Zone 2 includes the creation of an agroforestry system consisting of rows of perennials (trees, shrubs, vines, plants, ground cover and roots) alternated with a band of 7 or 10 meters (depending on the chosen configuration) of field for large annuals culture hedged and protected by a large hedge of trees and shrubs.

Hedge

Cold winter and autumn wind come from the North, West and North-West side, in this side are positioned trees that slow the winds and create a barrier to the poisons used by neighbors. An hedge around 10 meters high protect 80 meters of land. As regards the hedge in North will be composed of a first row 1.5 meters from the border of shrubs and a second row 3 meters from the border with poplar planted on a row at a distance of 2-3 meters from each other, alternated with hazels, Eleagnus, broom, rose, buckthorn, prunus spinosus, etc ... using if possible an alternation of evergreen and deciduous plants. The outer hedge must be designed very dense.

In the west side hedge will protect about 50 meters of land, therefore the height of the trees or shrubs should be at least 7 meters. It is possible to plant poplar in the corner of North-West (4 plants), a dense hedge on the outer side, while a second row of lower plants in the inner side as suggested for the North hedge. The East hedge will protect field from the chemicals and the pollution coming from the neighboring fields and from the road.

The hedge should therefore be dense. Plants can be planted with 1 meter spacing.

Trees/shrubs till 3 meters high:

- alnus viridis
- Amelanchier alnifolia
- Aronia
- Berberis
- Caragana arborescens
- Eleagnus multiflora
- Garrya elliptica
- Gaulthiera shallon
- juniper
- Mahonia
- Poncirus trifoliata

Trees/shrubs from 3 to 8 meters:

- Alnus glutinosus
- Amelanchier
- Strawberry tree (evergreen)
- Berberis (good in shade)
- Cornus mas
- Hazel
- Eleagnus x ebbingei and umbellata
- Climbing roses
- Ash
- Elder
- viburnum

the South side should have the following elements:

- car park
- pytopurification basin
- pond

car park (30x7 meters 210m^2)

The car park will occupy the whole area behind the house for a total length of about 30 meters and a width of at least 6-7 meters. On the south side of the parking it is suggested to plant a row of lime trees on the edge of the parking lot. Lime trees tolerate the shade, have edible leaves and shoots, flowers for relaxing herbal teas, a strong fragrance in late spring/early summer and can create a dense shade for cars protection. It ' a great tree for the bees, can be pruned without suffering, leaves are transformed quickly into a wonderful soil. A good configuration could be a tree every 4 meters on the south side of the parking lot considering some plants (2) to be coppiced in order to have leaves and sprouts as a yield.

Pytopurification basin (18 m^2)

The size of the basin is a function of equivalent inhabitants (EI), for example for 5 EI the basin should be 3x6 meters (18 m^2). The basin will be connected with a pond to retrieve the outgoing water. For more details, see the paragraph WASTE WATER AND PYTOPURIFICATION.

Pond

The pond will collect the outgoing water from the pytopurification basin, will be located near the Southwest corner of the zone 2 next to the hedge. The pond will be planted with aquatic plants and an overflow will be provided to control the water level. The overflow will be directed into the bioroll system.

Figure 17: agroforestry system with trees and shrubs.

Agroforestry system:

The lines for the perennial system (trees, shrubs etc..) will have a width of 1.5-2 meters; a watering system will set up along the lines and everything will be covered with wood chips or other organic material suitable for controlling the weeds. The fruit trees will take place in the mulched stripes (in green in the figure) interspaced with nitrogen fixing trees or shrubs (in purple in the figure) that will provide food for the trees and fertility for the soil, on these trees/shrubs it's possible to grow vines (grape vines, actinidia, schisandra, akebia, etc...).

Figure 18: alley cropping examples in agroforestry systems.

Berries and aromatics, together with annuals will take place between trees.

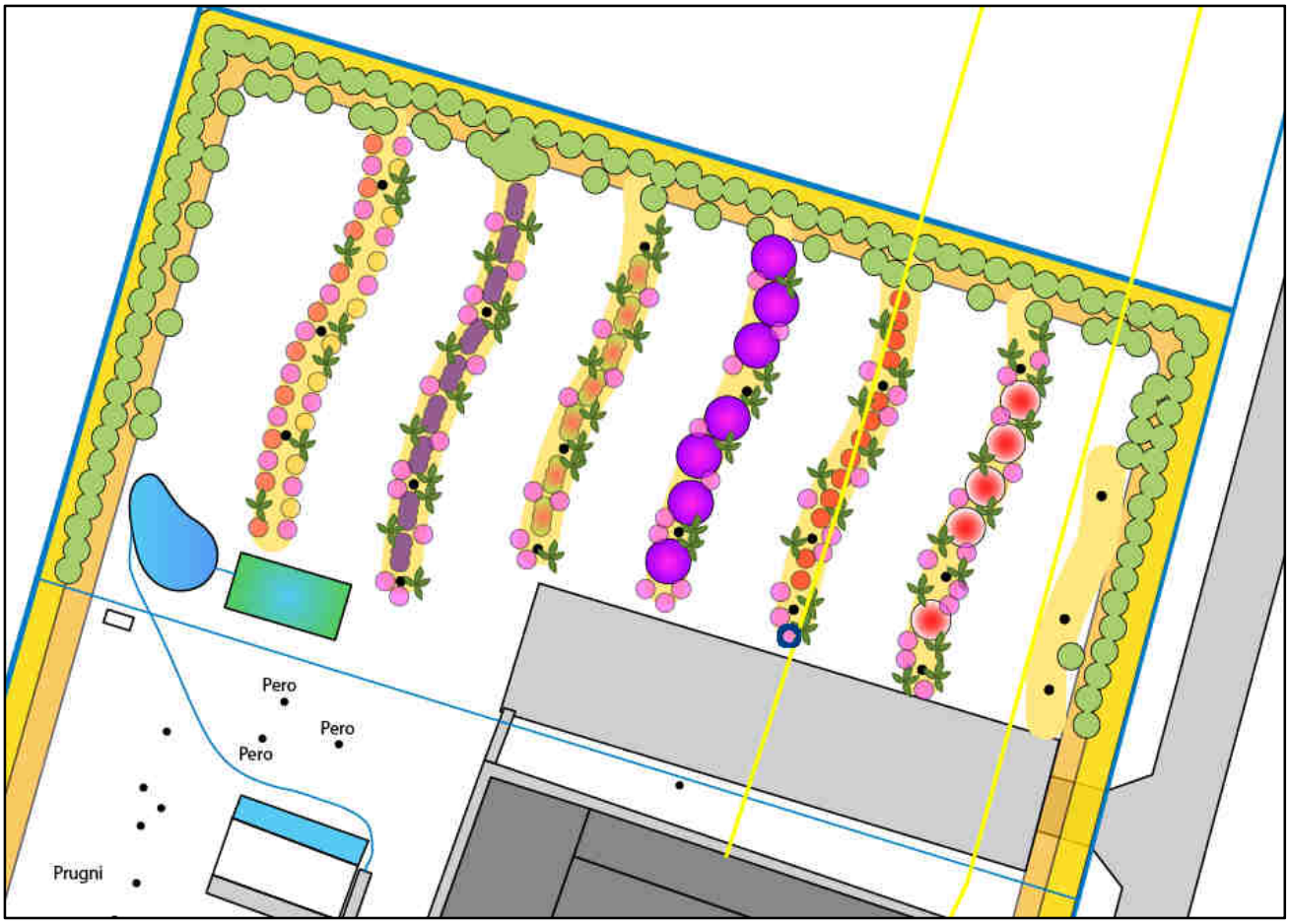


Figure 19: agroforestry system with shrubs and plants level.

The area between the perennial rows can be planted with cereals, vegetables, legumes, potatoes, etc... One way to handle the sowing may be to create bands of 1 meter wide spaced by a variable width depending on the path type (from 60 cm to 1 meter). The main problem will be to manage weeds: the paths can be covered with a thick layer of mulch,

the cultivated areas can be prepared with a cultivator, seeded and mulched with straw. or. The sowing of cereals can be done using clover as cover crops and sowing corn between the clover.

An area for the vegetable garden could be planned in this zone too.

VI IMPLEMENTATION

VI.1 WORK SCHEDULE

ZONE 1

I. Finish to restructure the house
II. Free the field from all the rest of bricks, stones and ruins in general
III. Move the bamboo towards the lake
IV. Excavate the pond
V. Trace and realise the path
VI. Set the watering system
VII. Connect the overflow system with the watering system and with pond and lake using a connection tubes of 25 mm.
VIII. Build the compost toilet
IX. Set up the semi-permanent garden beds (from april to november)
X. Set up the compost heap
XI. Build the chicken coop
XII. Build the cage for the ducks

COSTS

I. -
II. No cost, the client has a bulldozer which will move all the ruins in the car park area
III. No cost, the bamboo will be moved with the bulldozer
IV. No cost
V. Can be done with the excavator or manually
VI. The length of the watering system will depend on the garden area. The watering tube cost 1 euro/meter while the tube to connect the watering system costs 0,50 euro/meter. Every line need a tap (1 euro each) plus two or three connectors (0,20 euro each). If we imagine a system composed of 10 lines (on garden beds 5 meters

long) with a connection tube of 30 meters: 100 m. of watering tubes (100 euros), 25 connectors (5 euros) 10 taps (10 euros) and 15 euros of connection tube: 100+5+10+15=**130 euros**

VII. The costs depend from the distance from overflow and the rest of the systems say less than 50 euros.

VIII. No cost, can be realized using recycled material

IX. No cost, manual work.

X. No cost, can be realized using recycled material

XI. Almost no cost, can be realized using recycled material and only buy the chicken net 2 euros/square meter

XII. See point XI

ZONE 2

I. Build the pytopurification basin; excavate the basin (6X3 meters and 60 cm depth), isolate the basin with plastic and with geotextile layers, fill with gravel and sand, test the flow rate and if everything work, add plants.

II. Set up the car park area

III. Escavate the small pond

IV. Connect overflow from pytopurification basin to pond;

V. Connect overflow from pond to bioroll system;

VI. In autumn prepare the field in the zone 2 area in order to sow the green mulch (in autumn);

VII. Compost distribution

VIII. Perennial line identification (before planting in november);

IX. Set up of watering system (135 meters of watering tubes, 60 meters of connection tube, some connection accessories)

X. Perennial line mulching (15 linear meters of 2 m. wide lines, 15 cubic meters of wood chips)

XI. Field mulching with straw

XII. Tree and shrub planting (November-February)

XIII. Hedge tree and shrub planting

XIV. Green mulch or cover crop sowing (in spring before heavy rains)

XV. Guild plants planting under the trees (in late spring)

COSTS

I. The EPDM layer cost 10 euros/square meters (30 square meters needed means **300 euros**)

II. No cost

III. No cost

IV. Connection tubes less than 5 meters and accessories: say **5 euros**.

V. No cost

VI. ½ day of work for a farmer: say **50 euros**

VII. To be done together with the point VI

VIII. No cost

IX. 135€ + 30€ + 15€ = **180€**

X. 40€ of straw (every two year) or 25€ of wood chip (every 4 years) or mulching textile (270 square meters, 22 rolls 8€ each meaning **176€**)

XI. One big bale of straw **20 €**

XII. 22 trees (10€ each), 11 N-fixers trees or shrubs (1€ each), 13 berries (5 € each) and 50 berries (2€ each) in total **396€**

XIII. 20 trees (1€ each) and 20 shrubs (2€ each) in total **60€**

XIV. Cover crops (mix of clovers) **75 €**

XV. 120 mixed plants of aromatics, comfreys, globe artichokes, etc.. **100€**

VII MAINTENANCE

VII.1 ZONE 1

TREES : the first year should be pruned;

Compost can be spread at the base of the trees and compost tea can be sprayed on the canopy.

For the following years the maintenance is related to control pruning, fruit harvesting and compost or tea compost treatment.

PATH : adding covering materials if necessary.

VEGGIE GARDEN: intense in spring-summer.

GREENHOUSE : cleaning the roof, cleaning the walls, control of weeds check for any problems in the tube system.

ANIMALS : weekly cleaning of the bedding by sostituting of all of it with a new layer, annual deep cleaning of the chicken coop (it is necessary to keep the animals out of the coop for a week in order to remove parasites or disease), structure controls.

HEDGE : mulch in the early years and annual pruning.

VII.2 ZONE 2

HEDGE: mulch in the early years and annual pruning.

CAR PARK: erosion and weed control. Addition of cover material if necessary.

PYTODEPURATION BASIN: water plants pruning (in July), water flow control, cleaning of the ingoing and outgoing tubes.

POND: bottom cleaning to eliminate excessive leaves and organic material, water plants pruning (in July).

AGROFORESTRY SYSTEM: the same for trees and perennial strips.

VIII EVALUATION

This is a design for a client. It is the second for me and it is done for different system in a quite big field. I decided to use the SADIM framework because it is easy and clear to follow for me and I think for the client too. Within the framework I have tried to keep the information simple and schematic for the client to understand more.

The CLIENT INTERVIEW has been done twice, the first time in the field with the client and his father in law the second time in the client's home and with the wife. I have found decisive the presence of the wife for adding more wants and needs to the husband one. I also find the interview not adequate to let emerge the background of the project, of the clients and the real visions of the client. Need to be substituted with a more detailed one (which I have already implemented).

The information collected during the climate analysis have been very useful to determine the sector maps, the type of cultivation, the protection and to inform the client. Should be nice to add a paragraph on the chilling requirements and a list of chilling requirements hours for the suggested trees and shrubs, but finding local data about this is not easy.

Good to insert a list of how to manage the food after producing it. It helped me to increase my confidence and knowledge about food preservation. Good to offer to a client a simple list with all the possibility and good to add the euro symbol to remember when energy is needed in the preservation process.

Good to use graphs to show the clients the use of water within the house. Good for dimensioning systems like the phytopurification basin and the pond. The list of plant with images will help the client in deciding what to plant in the basin and consequently how deep has to be the basin. I added an schematic map to illustrate water movements within the project.

INPUT/OUTPUT analysis shows elements and procedure in a very simple and clear form, necessary for the client for understanding the flow of input and output materials.

The detailed description of the type of plants needed under the trees will help the clients to be able to use it as a guide for adding plants guild in the project.

The input/output for several system helps in having a list of useful information for understanding what is needed and what is produced by any system. It is also easier to see connections between system.

The map help in understanding concepts and information described in the design.

Good to use the list to show the implementation and maintenance operation, this way of data presentation is easy to follow and can be used as a check list too.

IX REFLECTIONS

PMI

POSITIVES:

- I have created several map to facilitate the comprehension of the concepts described in the design. This helped me in increasing my mapping skills and also in creating a format for producing maps for clients reports.
- I have used some maps element created for another client design. This could became a format and a standard for work optimization.
- I have learned more about food preservation
- I have learnt how to apply simple and slow solution to big project
- I have improved my skills in dealing with clients in particular in the very first stage when is needed to collect as much as possible data to be used in the design.
- From the tutor feedback I have learnt that it is better to keen separated information related to the analysis phase and the design phase to facilitate the client understanding.
- During the survey phase I use a procedure that can be adopted for all the future designs

MINUSES:

- Evaluation and reflection phase not adequately developed
- I took too much to present the design to the client
- I still did not decide what is the right way to present the final Master Plan map

INTERESTING:

- Several information and procedure developed for this design will be used in other designs with similar characteristics with a relevant time saving.
- Increased the evaluation skills for determining the time needed for these kind of designs.