MY FOOD FOREST PROJECT

Lunga road (RA) - Italy
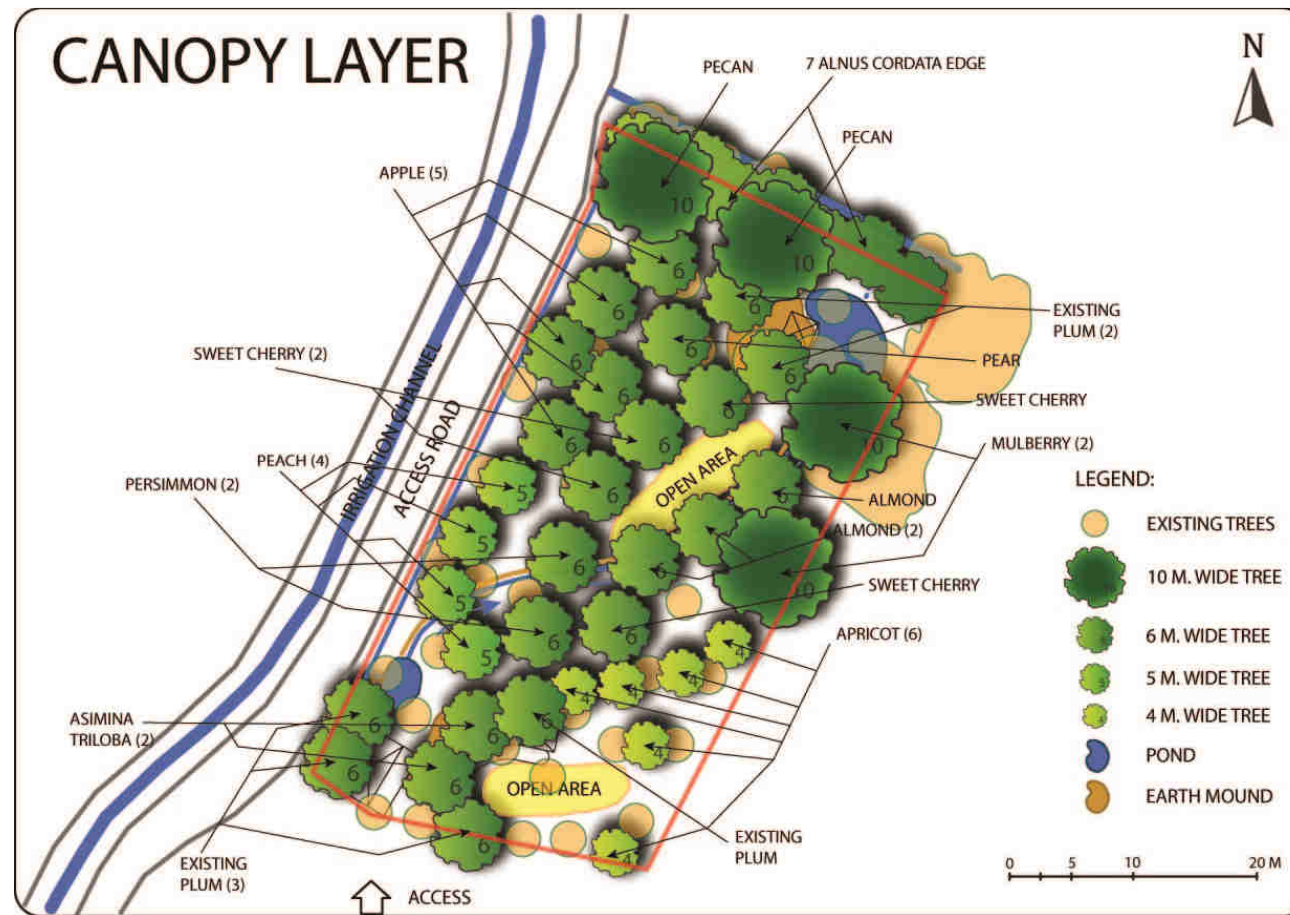
October 2014

Summary

I   INTRODUTION

I have recently visited Onorio Belussi's food forest in the Franciacorta (BS) vine region in the North of Italy. Onorio is a 75 years old men who has been a direct student of Fukuoka, Holmgren. 25 years ago Onorio bought a piece of agriculture land and transform it into a real paradise. His experience deeply inspired me and so I decided to try to transform the dead piece of land I have into my paradise.

The project field is located near the famous adventure park of Mirabilandia, to the Po Delta Park and not so far from the Adriatic sea. At the end of the summer 2014 there was still the seven lines of Trebbiano grapevines in the field.

The intention of the client is to transform the vine monoculture in a living and biodiverse Food Forest. The Food Forest will provide food, relax and nature to the client and to his family.

The Permaculture design method chosen for the Food Forest project is the **O.B.R.A.D.I.M.E.T.:**

Observation, **B**oundary, **R**esources, **A**nalysis, **D**esign, **I**mplementation, **M**aintenance, **E**valuation, **T**weaking.

I.1   ETHICS

Earth Care: driving along the Romagna region, within the plains between the Apennine hills and mountains and the Adriatic sea it is not very common to see woods, trees or edges. You see only kilometers of agriculture fields and conventional orchards. When my father in law bought 20 acres of these field 5 years ago I started to make some experiments, but only at the end of 2014 he decided to give the old vineyard to me. At that time I had no doubt, I would have created a Food Forest. And the first step should have been to take care at the soil that was really exhausted.

People care: the forest will be a place for my family relax and also a place where my sons can express themselves into the nature.

Fair Share: The surplus product of the food forest will be transformed into dry fruits or marmalade which will be shared with friends and relatives.

I.2   PERMACULTURE PRINCIPLES

The design framework for this project has been influenced by Holmgren's principles; that's how I have applied them in the project:

- *Observe and interact*: In the South-West corner of the area there is the container and during rain events there where a rain water accumulation due to low ground level; I decide to transform the natural rain accumulation into a small pond

- *Catch and store energy*: I have created three small ponds in order to catch the sun heat and store inside the water and inside the mass of the stones. I have also created a small swale to collect the rain travelling on the field

surface. The rain flows in the swale and in the small pond. The swale was also created to prevent a rain water accumulation near the container.

- *Obtain a yield*: I have planted several kind of trees, shrubs and plants, good guilds below the fruit trees and a good layer of mulch. I expect that in a few years I will be able to obtain a yield!

- *Apply self-regulation and accept feedback*: In order to obtain the best solution for the food forest I have tweaked a lot. I have changed the pattern of the trees and I have added a swale to respond to the need of removing rain water from the entrance area where the container is.

- *Produce no waste*: All the material produced and used in the food forest is natural and will be recycled in it.

- *Use and value diversity*: to apply this principle I started from the soil and in late spring I planted a mix of 19 different kind of herbs, than I created several ponds, planted more than 20 kind of fruit trees 30 different shrubs, and a lot more in order to value as much as I can the bio-diversity.

- *Use edges and value the marginal*: The pond is bean shaped creating several different margins and orientations. The soil excavated has been accumulated alongside the pond in order to help collecting rain water, the soil mount is itself a very interesting margin, full of plants and shrubs. Along the west side I created a set of huegelkultur to grow berries and trees and I leave the big ditch in the North border as a source of wilderness.

The design required a long time of observation and evaluation, after the first phase (the canopy and shrubs design) I ask Martin Crawford for an advice in order to have good suggestion on my design. Martin suggestion have been very useful in particular for the type and number of trees and N-fixers to plant.

I.3   DESIGN TOOLS USED

- Base maps
- Zones
- Sector analysis
- Client interview
- Microclimates
- Restriction map
- PASTE
- Function, System and elements
- PMI
- Nutrient budget
- 4 questions

II   OBSERVATION

II.1 OVERVIEW:

Figure 1:   2014 Satellite view of the vine field. In the image are visible the grapevine lines, the container in the lower right corner and the shade of big white poplar tree in the top left corner.

Figure 2   The vine field in the Romagna Region

II.2 ZONES

The zone 0 is the gazebo, it is not a house, it's a place to relax, stay with children and friends and enjoy the open air life. The zone 1 is where the children will play, where the container and the kitchen off grid will take place, where we will cook a pasta or we will have a barbecue with friends.
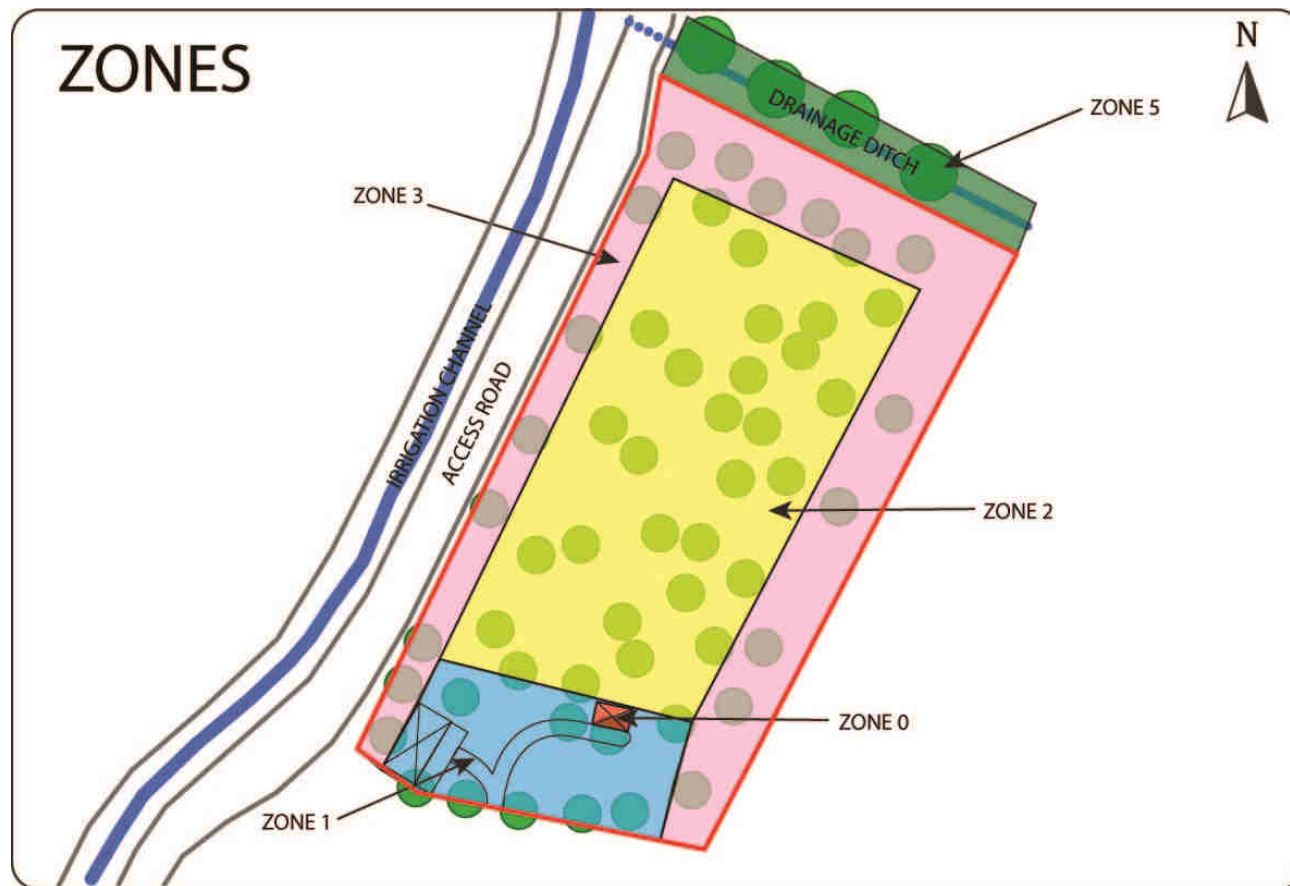
Zone 2 is the area with the fruit trees while the zone 3 is the windbreak zone. No zone 4 but a small area of zone 5 is the drainage ditch.

II.3 SECTORS
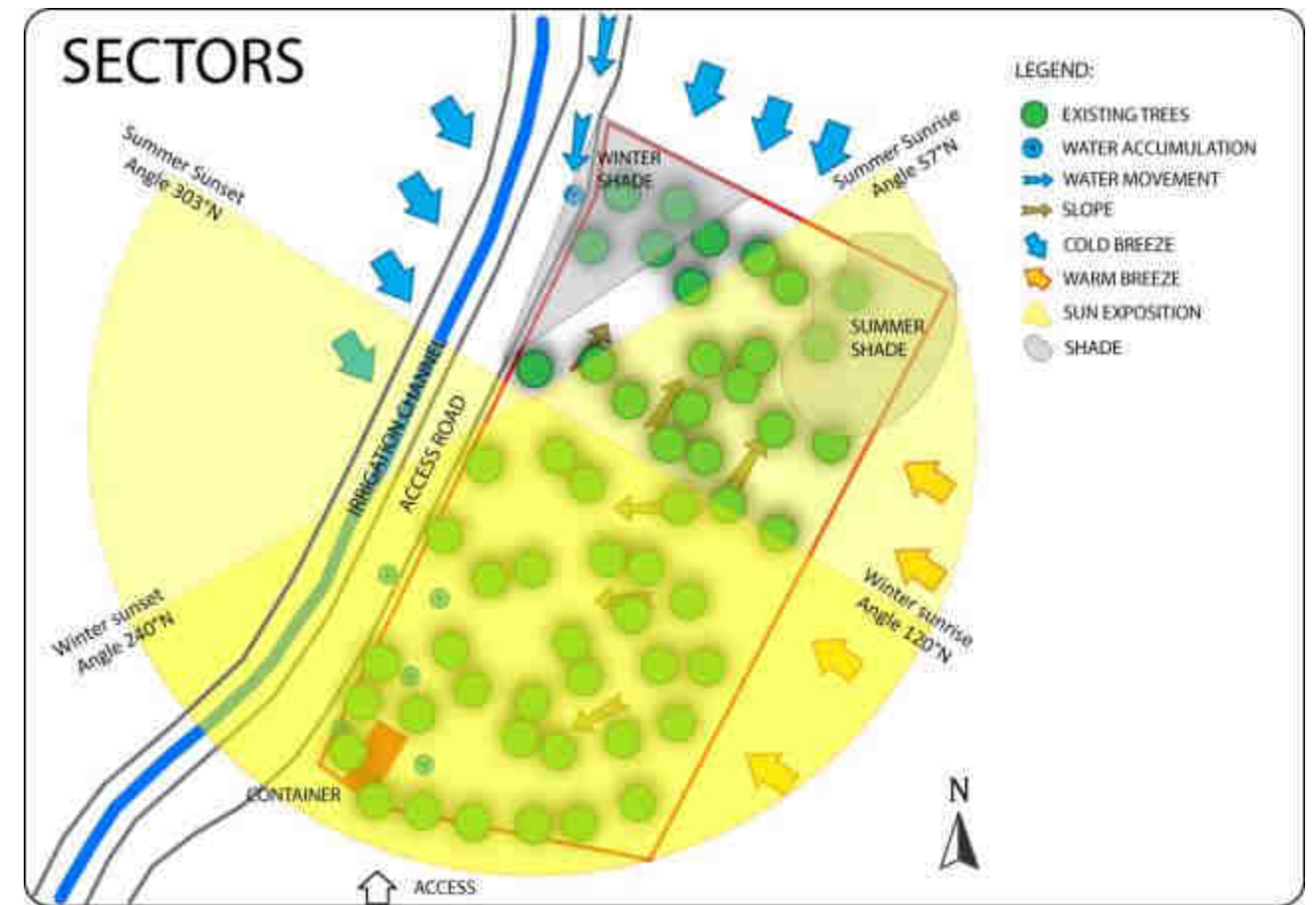
Figure 3: Map of sectors (winds, sun exposition, slope, existing trees)

The map shows the direction of the main wind (cold and warm) blowing the area, the existing trees (mainly maples and plums) the sun exposition in winter and in summer, and the slopes. It is also added the rain water accumulation due to field topography and surface water flows.

BRIEF DESCRIPTION AF THE FIELD

The field is located near the city of Ravenna (12 km), the city of Cervia (10 km), 2 km from the Mirabilandia amusement park and 8 km from the Adriatic Sea.

The field occupy an area of 1'500 square meters with seven lines of vines (Trebbiano) and at least 50 trees (*prunus* species and *acer campestre*).

On the East side there is a country house that will became a Bed&Breakfast, in the South side there are kilometers of conventionally managed country fields and at the very end of the sight some of the most beautiful Romagna hills. In the West side there is an old country house with a very nice little and wild wood.

The West boundary is delimited by a channel with water managed by the Emilia Romagna water service while the North and East boundary are delimited by a 1.5 meters net fence.

The vineyard have been there for very long time, between 20 and 30 years; at the beginning of Autumn the vines were in a very bad condition and they were no more productive.

II.4 CLIMATE

Altitude: less than 15 m wsl

Precipitations:

769.2 mm/year average 1960-1999;

546.4 mm/ year average 2000-2010
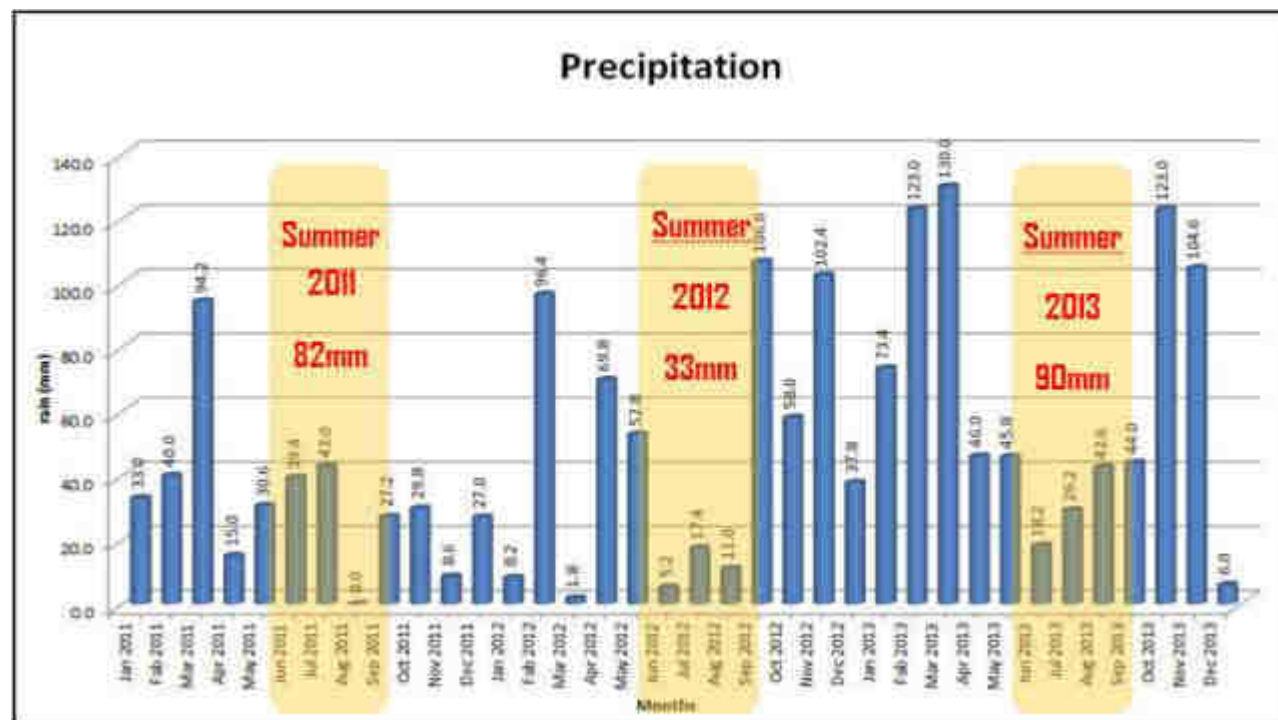
Figure 4:Precipitation (year 2011, 2012 and 2013) with highlighted the small amount of precipitation during the summer time.

Snow: normally between December and March, max 50cm. Late frost in April with an average of 2,8 days of frost in April.

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: very high from April to May and medium from May to July.

Temperature: Min -5° C, Max 35°C
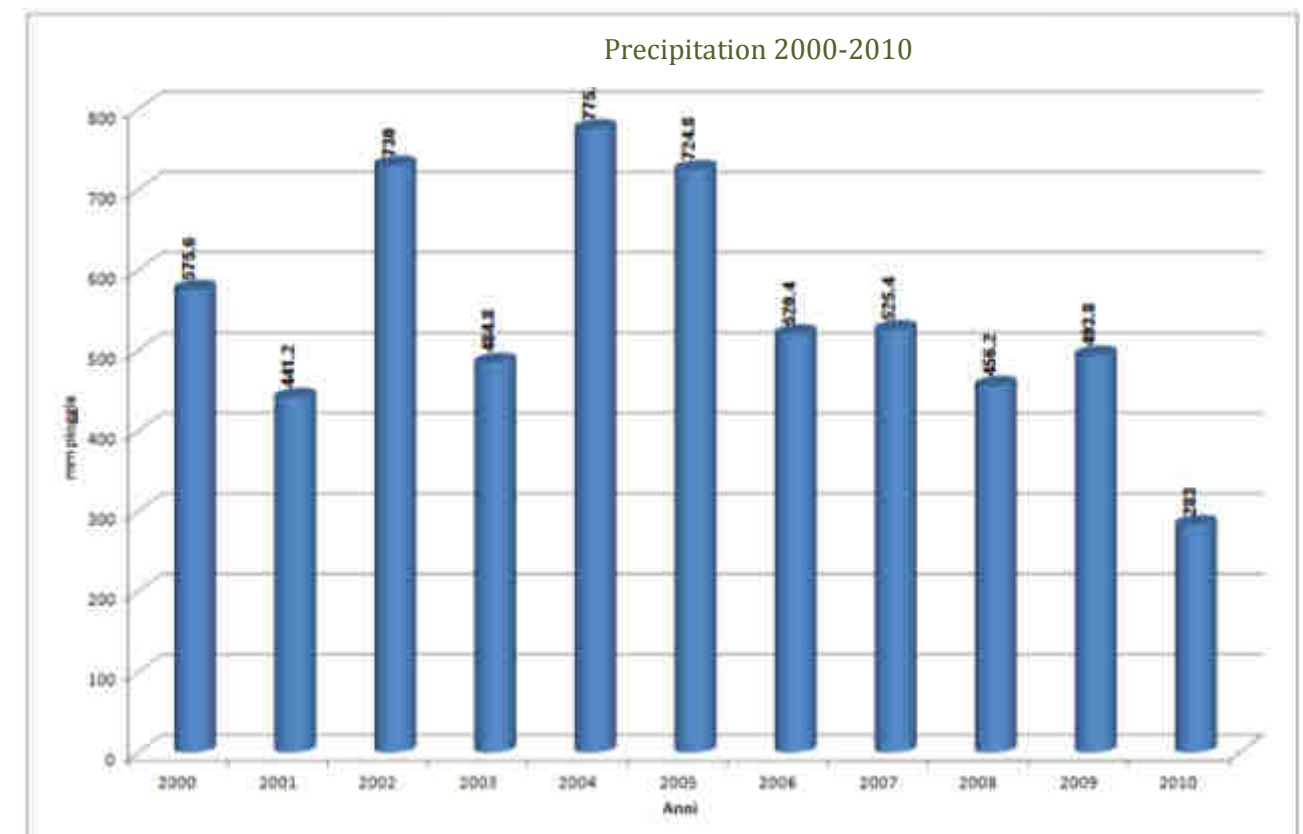
Figure 5:   Last 10 years of precipitation

Winds: Winter: from North-West, Spring and Summer: from East and South-East and Autumn: from West and North-West.
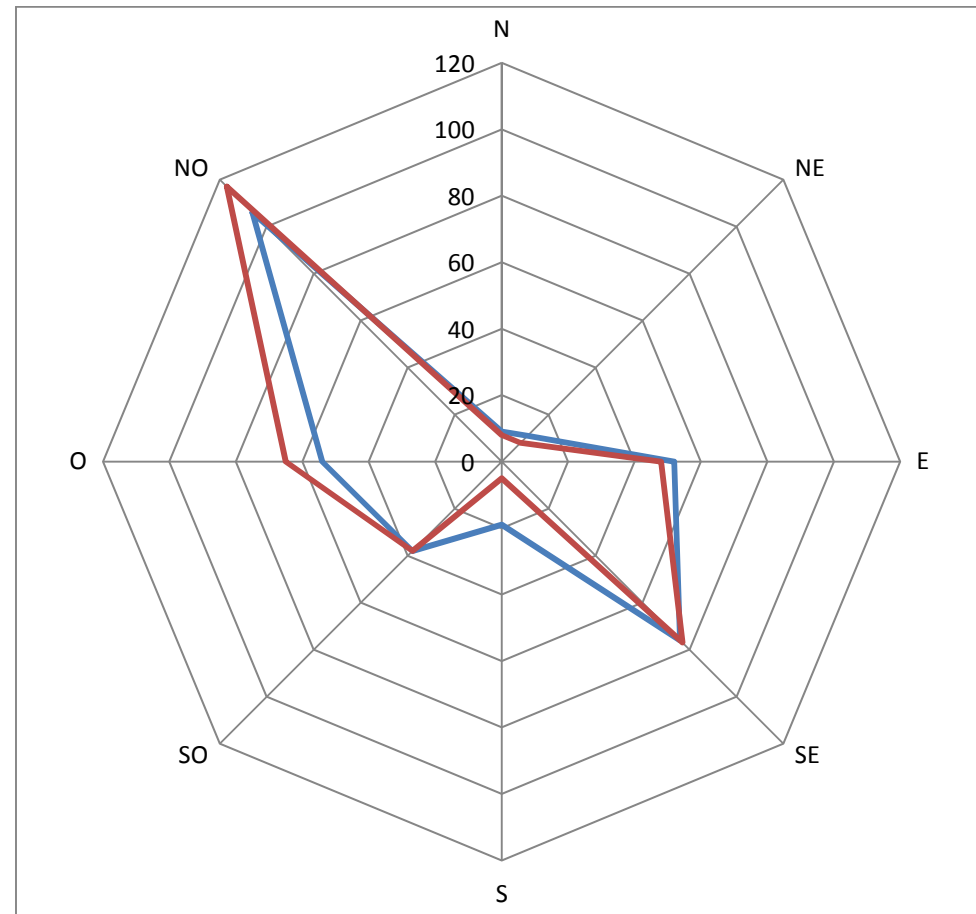
Figure 6   Wind direction. In red the wind direction for year 2013, in blue the 10 years average.

II.5 WIND

A few more word on the winds that blow in the area. The Figure 7 shows the sectors of the winds for every day of the year 2014. It is quite clear that the dominant winds are those coming from the North – North-West sector, especially for the Autumn and winter while for Spring and Summer the warm winds coming from the South- East sectors.

Figure 7: Sectors of the wind for every day of the year (2014) The colors refers to the sector, a map of the sector and relate color is showed below.
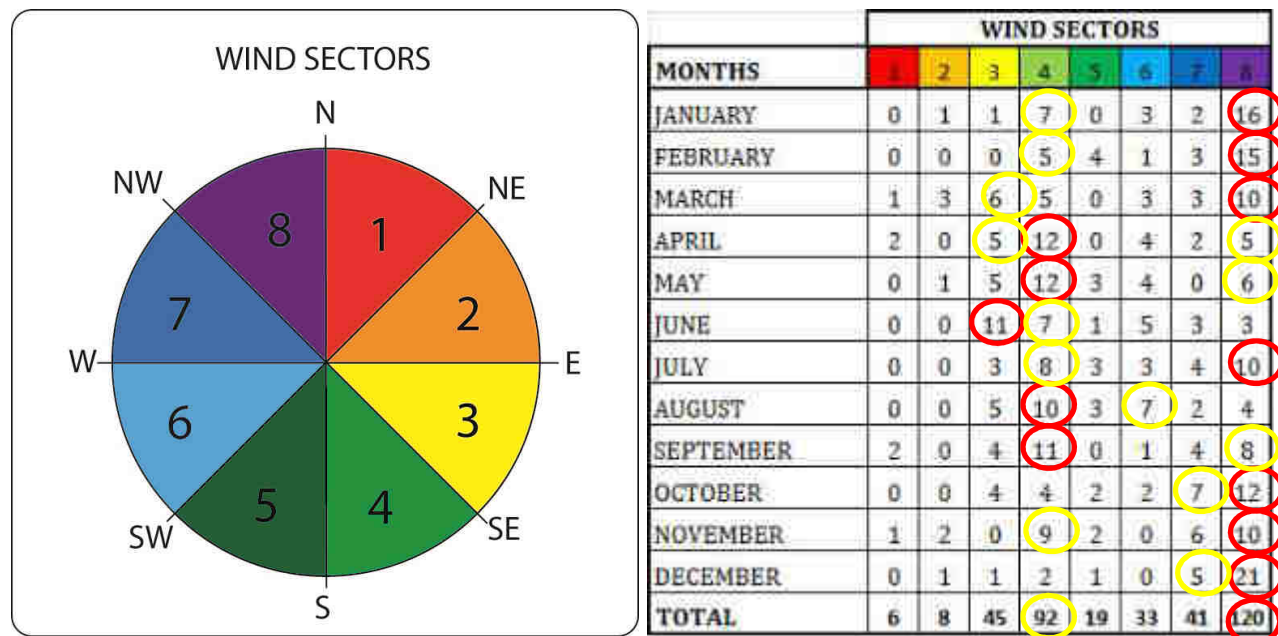
One more note about the wind velocity: the winds are normally very low intensity winds. As shown in Figure 9 except for a few events (10) the winds are normally classified as light air (in green).

Figure 9: Wind velocity/Intensity. Green: light air, Yellow: light breeze, Red: gentle breeze (Beaufort Wind Scale). The winds are expressed in Knots.

MONTHS	WIND SECTORS							
	1	2	3	4	5	6	7	8
JANUARY	0	1	1	7	0	3	2	16
FEBRUARY	0	0	0	5	4	1	3	15
MARCH	1	3	6	5	0	3	3	10
APRIL	2	0	5	12	0	4	2	5
MAY	0	1	5	12	3	4	0	6
JUNE	0	0	11	7	1	5	3	3
JULY	0	0	3	8	3	3	4	10
AUGUST	0	0	5	10	3	7	2	4
SEPTEMBER	2	0	4	11	0	1	4	8
OCTOBER	0	0	4	4	2	2	7	12
NOVEMBER	1	2	0	9	2	0	6	10
DECEMBER	0	1	1	2	1	0	5	21
TOTAL	6	8	45	92	19	33	41	120

II.6 CLIENT INTERVIEW

The client (Andrea Minchio) and his family (a wife and two children of 6 and 1 year in 2015).

Name: Andrea Minchio

Address: Ravenna (RA)

Dimension of the field: 1'500 sm

People visiting and living the field: 4 to10

Groups of visitors: friends and relatives.

Works and skills: good manual skills, a lot of passion.

VALUES: Sustainability. They eat mostly veggies but also some good meat and fish.

Age: from 1 to 42. (2014).

Economic situation: not a lot of money to invest in the project.

Resources in the field: water from the canal, a power generator (gasoline), water from the well (not connected to the vines field) a 3X5 container.

Type of property: the property is owned by the father of the wife of the client.

Restrictions: the father-in-law ask for 3 meters empty area along the ditches.

Potential weather adversities: Frost and floods from the canal and from the rain.

Maps: homemade and Google Earth.

WANTS: Food forest, place for kids, gazebo with tables and chairs, off-grid kitchen, off-grid bathroom, wind breaks, sunny open fields, mushroom, biodiversity, a small but very nice pond and few animals like free chickens, a wormery for the vermicompost.

Water: From the rain, the canal and the well, from the container roof.

Soil: Silty-clay soil, more than 20 years of mechanic movements. Water logged in winter and dry in summer, needs a lot of organic material and a lot of life.

Erosion: not very evident.

Look: at the beginning of Autumn 2014 the field is still a vineyard with seven rows of vines with 46 maples, 6 plums and 31 concrete supports.

NEEDS: good food, nature, relax, a place for weekend vacations, place for children, fertility.

Winds: from West.

Date of the Interview: 07.10.2014.

III   BOUNDARIES:

III.1 SURVEY

A survey of the vineyard has been carried out on the 9th of October 2014.

View of the Irrigation canal on the West side

Big ditch with Poplar and Maples trees, this is the North Boundary where the cold and strong winds arrive from.

Detail of the ditch with trees.
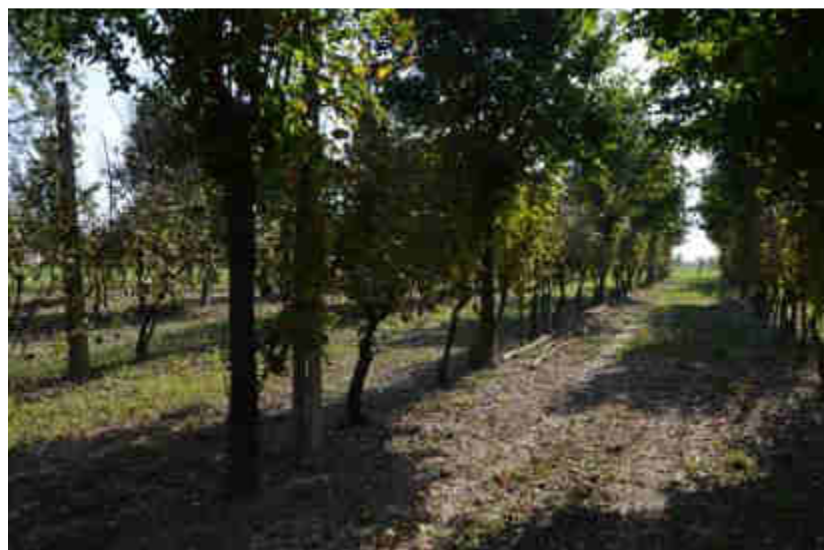
The existing rows of vines with concrete poles and acer trees

The container in the Southern boundary

A view of the surface of the ground beneath the vines.

III.2 LIMINITING FACTORS

Very poor soil

Low biodiversity (vineyard and maples)

Waterlogged soil in winter and dry in summer

Not a lot of money to invest in the project

The field is 15 km far from the client home

Unfriendly neighbors

III.3 MICROCLIMATES.

The canal in the West side, the ditch in the North side. The net fence in the East side. There are also two small areas of water accumulation: near the North side between the first and the second line of vines and near the container, between the second and the third.

III.4 RESTRICTIONS

There are a few restrictions to respect:

In the Northern boundary we have to respect three meters wide area without trees or shrubs from the edge of the drainage ditch.

In the West boundary we have to respect four meters wide area without trees and shrubs from the edge of the irrigation channel.

In the East boundary we have to respect a three meters wide area without trees and 1,5 meters wide area without shrubs.
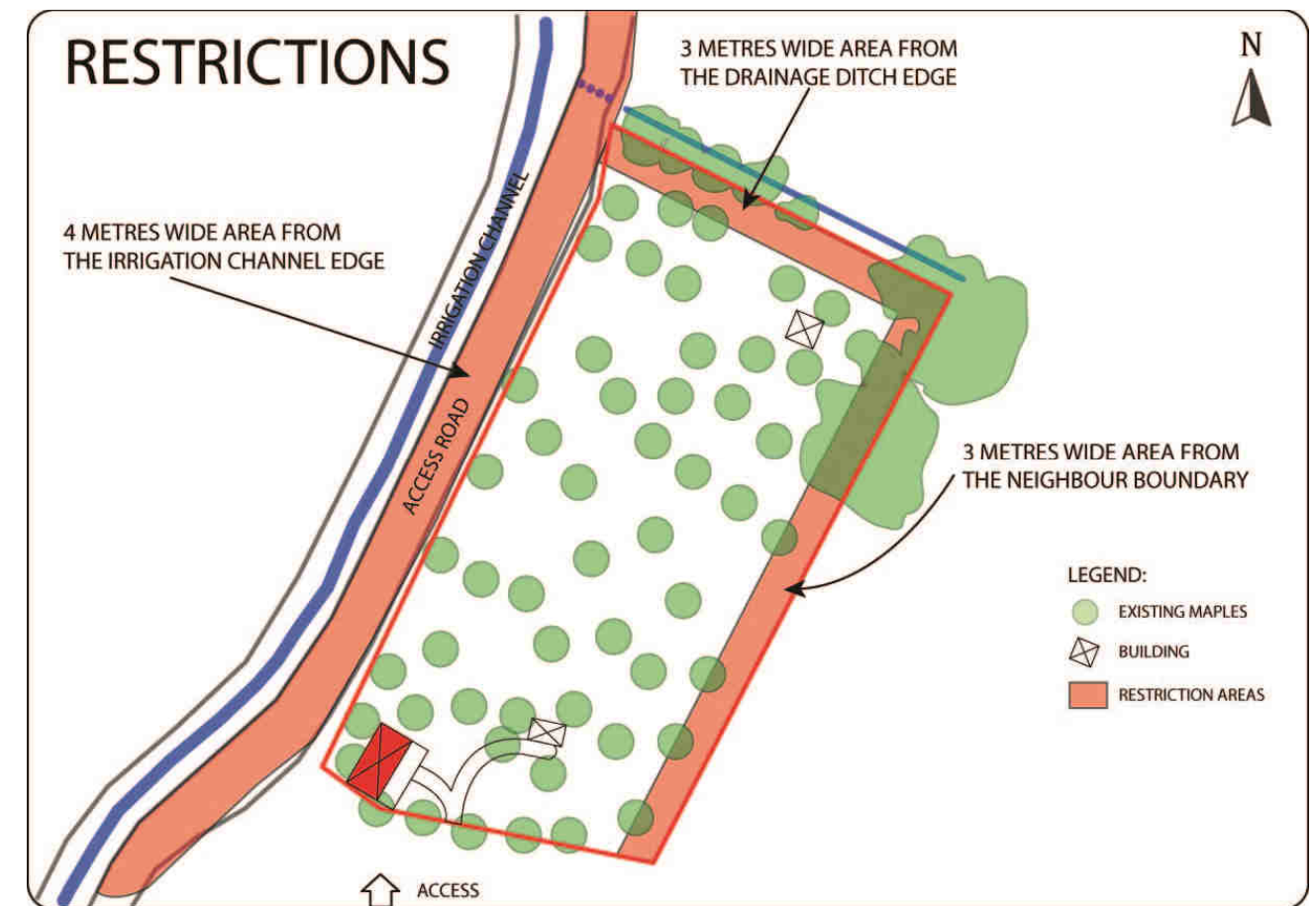
IV   RESOURCES

IV.1 P.A.S.T.E. (Plants, Animals, Structures, Tools and Events)

PLANTS	ANIMALS	STRUCTURES	TOOLS	EVENTS
Trees: *Populus alba* *Acer campestre* (Maples) *Prunus domestica*	Different species of birds	One 3X7 container.	Power generator (gasoline)	Weekend vacation with family and friends
Shrubs: none	Mice and porcupines	Vineyard concrete supports (30)	Work tools	Workshops.
Climbers: vines	Snakes		Wheel barrel	
Plants: *Cynodon* sp.				
Runners: Clove, *Veronica Persica (*dominant*)*				

V   ANALISYS

V.1 NEEDS, WANTS AND VALUES

NEEDS	WANTS	VALUES
Permanent food Relax Space for kids Nature Soil regeneration Protection from visitors	Food forest Gazebo with tables and chairs Off-grid kitchen Off-grid bathroom Wind breaks Sunny open fields Mushrooms Biodiversity A small but very nice pond Few animals (Bees and chickens) Worm farm	Sustainability Family Permaculture

V.2 FUNCTIONS, SYSTEMS AND ELEMENTS

FUNCTIONS	SYSTEMS	ELEMENTS
Relax	Increase Biodiversity	Trees
		Shrubs
		Plants
		Runners
		Roots
		Climbers
	Pond	Water
		EPDM liner
		Water plants
		Stones
		Sand
		Gravel
	Gazebo	Access/Paths
		Wood
		Chairs
		Hammocks
Permanent Food	Food Forest	Trees
		Shrub
		Plants
		Runners
		Roots
		Climbers
	Legume rows	Beans
		Peas
		Fava
		Soy
	Mushrooms	Wood logs
		Straw bales
		Spores
	Chickens coop	Chickens
		Net
		Wood
		Nests
Place for kids	Open field	Grass cover
	Kid structures	Workshop for kids
		Structures construction
		Wood
		Sand or woodchips
Off-grid Bathroom	Compost toilet	Wood
		Net
		Salix viminalis
		Straw (or any carbon

	Shower	source)			Iron net
		200 l. iron tank			Small trunks
		Water			Bricks
		Canes			Cement
		Plastic sheet	Wind breaks	Edges	Trees
		Black plastic tube			Shrubs
Off-grid kitchen	Pyrolytic stoves	Workshop			Plants
		Metal cans	Protection	Net fence	Poles
		Scissors			Net
	Barbecue	Bricks			
		Cement			
		Net			
		Copper tubes			
	Oven	Workshop			
		Clay			
		Sand			

V.3 WIND BREAKS SYSTEM

Three sides of the property need to be protected from the winds:

The **North side**: from the North we have cold winds. The area is 30 meters wide.

The **West side**: from the North-West and from the West we have the majority of the winds in autumn and winter, cold winds not very strong. The area is 60 meters wide.

The **East side**: from the East and from South-East we have Spring and Summer winds, not strong winds but full of humidity. The area is 50 meters wide.

For this project we have to design three different wind break system let see the boundaries in detail.
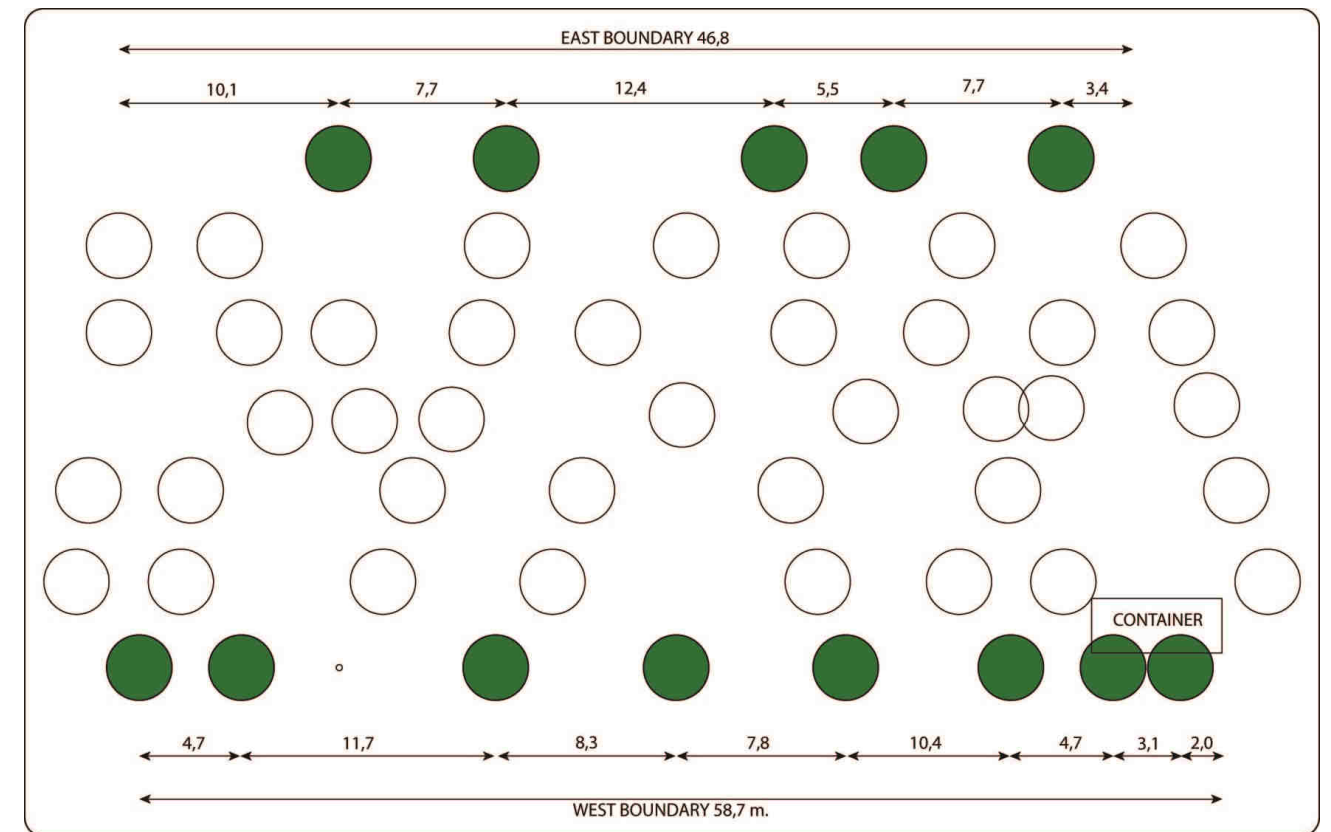

Figure 10: position of the existing trees (maples and plums) and distance between trees.

THE NORTH SIDE

Figure 11: The North side taken from the west side. On the left there is the ditch and on the right the vine lines.

On the North side there is a deep drainage ditch (1.5 meter deep), it is the drain system for the water collected from the roof of the country house and from the adjacent fields. Inside the ditch there are four tall trees (7 meters)and aside from it a three meter wide corridor that has to be considered a free area (no trees or shrubs in it). Off the corridor start the vines, maples and concrete support lines (the vines are no longer there).

THE WEST SIDE
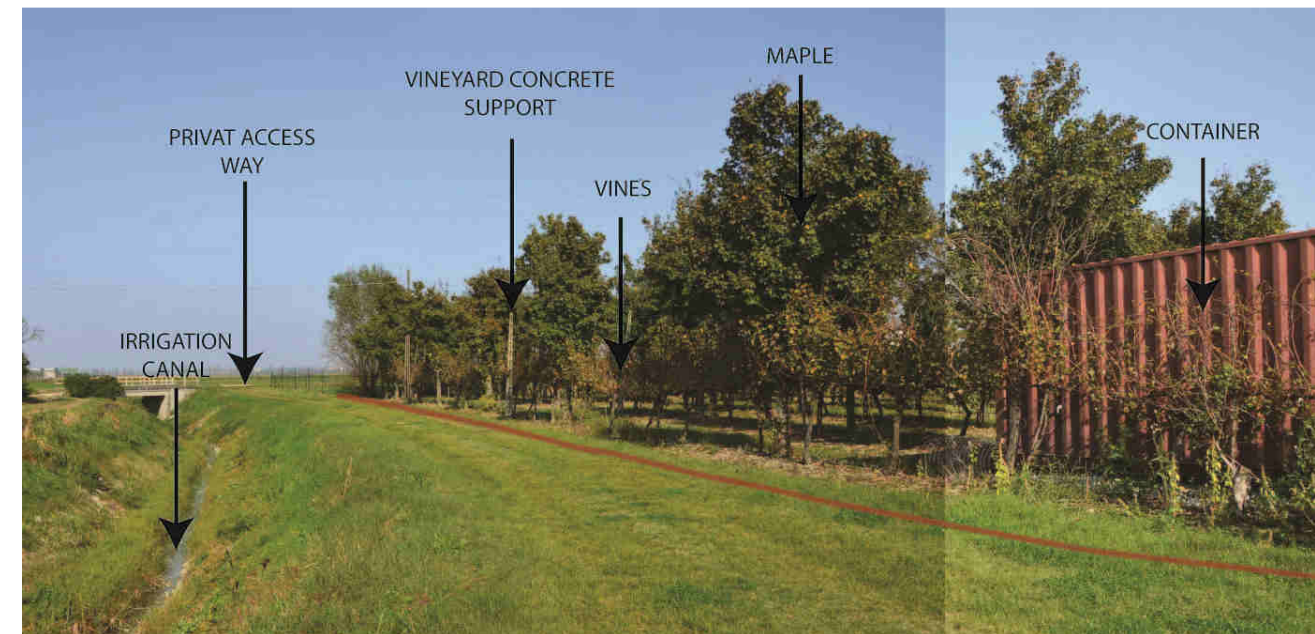
Figure 12: The West side. On the left there is the irrigation channel.

The West side is a 50 meter long boundary with a deep (2.5 meters) irrigation channel with water flowing only when needed, the water is controlled by the Emilia Romagna Water Service, aside the channel runs an unpaved road with private access and with planting restrictions (the road has to keep clean for 4 meters from the channel – till the red line). The road access and the road itself are a source of water, during rain events the water flows from the road to the right. The vines in this first row were supported with maple trees, that used to be coppiced, concrete supports and iron wires. At the moment (January 2015) the vines are no longer there nor the wires that connect the supports and the trees; only the maples and the concrete supports are still there (Figure 13). Between November and december a few HugelKultur beds have been created for the wind break trees and shrubs.

Figure 13: The west side in winter (January 2015) the vines are no longer there except for a few close to the maples.

Figure 14: The East boundary. On the back there is the future B&B in construction and two of the three old poplars.

The East side is a 50 meters boundary with a net fence and a few fruit trees (in the neighbor side). In the northern part of this boundary there are few old poplars that project a wide and dense shade on this part of the project area. In this side we have to respect a 3 meters wide corridor from the net fence in which it is not possible to plant trees.

SOIL TEST

A soil sample has been taken to analyse the soil composition and to have a record of the soil changes during the process of regeneration.

I took a sample from the surface soil and put in a jar, I add some rain water and mix very well. After two days the different components of the soil sedimented showing a dominance in clay with some pieces of dry leaves on top, no organic matter expect for the leaves has been found.

VI   DESIGN

VI.1 GENERAL PLAN

First year (2014): to regenerate the soil, to plant trees, shrubs and plants in the windbreak edge, to create the water system, to excavate the pond, to remove all the vines, to remove concrete supports and some maples, to protect the property with a net fence, to build the gazebo and access paths, to build the off-grid kitchen and to build some children structures.

Second year (2015)(in autumn): plant the fruit and nut trees, N-fixers trees and shrubs, start to create guilds with the fruit trees.
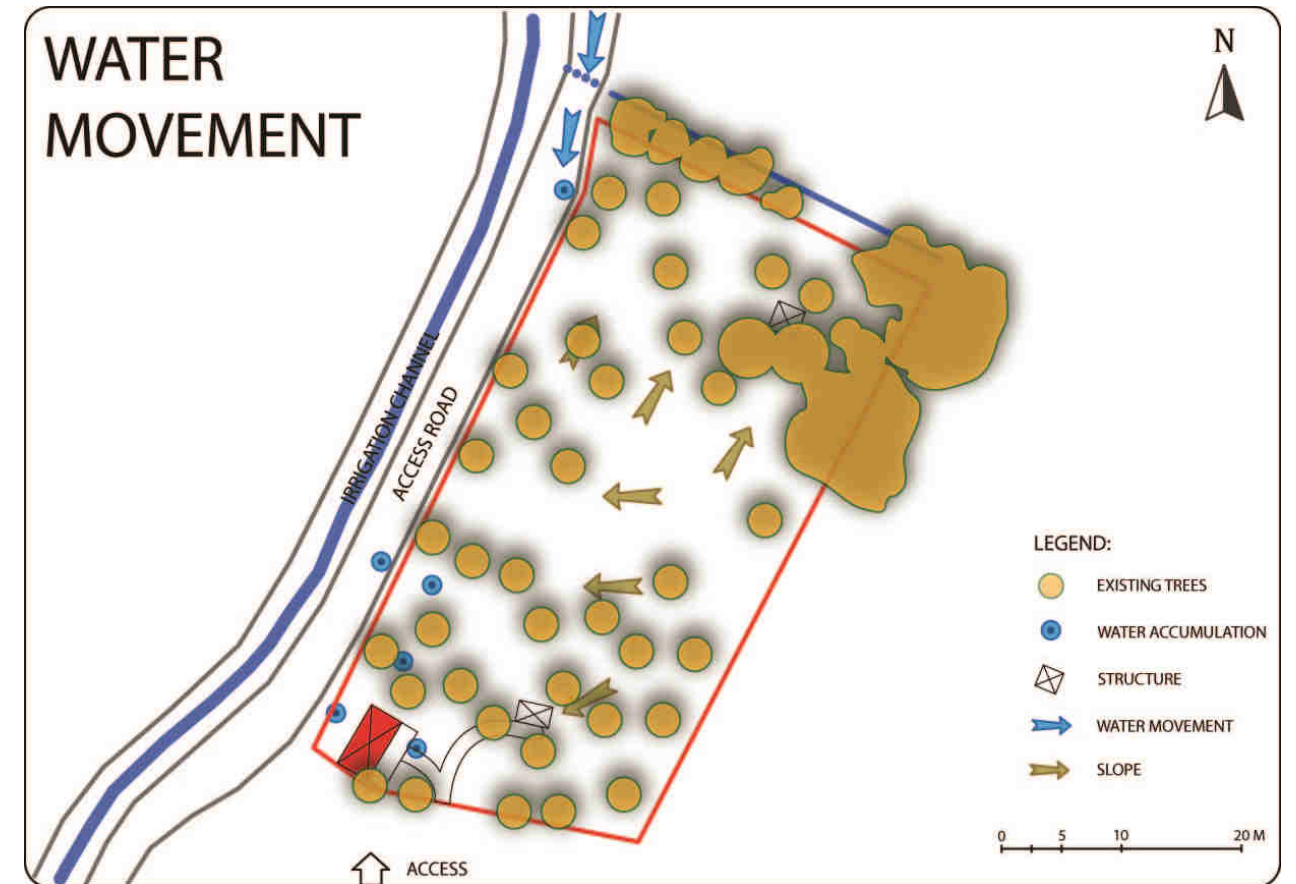
The ground is slightly sloped towards the North and the West, therefore the rain water tend to accumulate in the South-West corner, around the container that lay on an elevated area. The access road on the West side is another source of rain water; in particular in the North-West corner were the road is gently sloped.

Figure 15: Water accumulation between the first and the second row (left), water accumulation near the container (right).

An addictional existing source of rain water accumulation is the roof of the container; with its 9 square meters it is possible to catch and store almost 5 cubic meters of water/year.

Because of the horizontal shape of the road (Figure 16) there is also a water accumulation on its east side, while in the west side the water flows into the irrigation channel and doesn't accumulate.

WEST

EAST

Figure 16: Horizontal shape of the road.

VI.3 SOIL REGENERATION

The field has been a conventional vineyard for more than 20 years, I am not sure what kind of polluter the previous owner was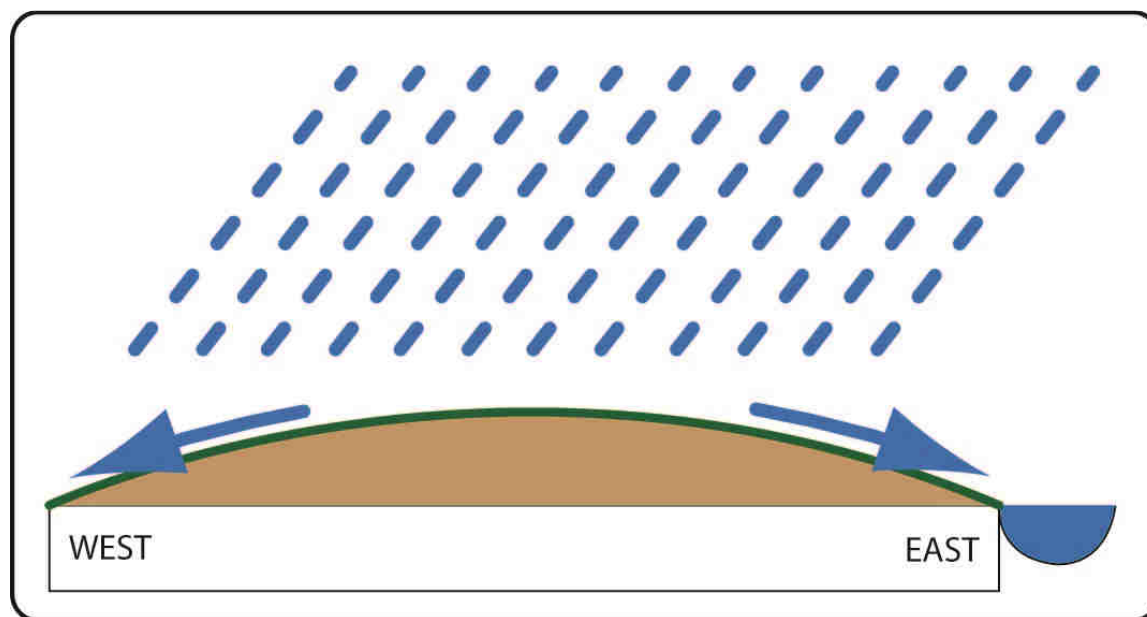 use to spray on the vines but I know that in the last 5 years the farmer who took care of the vines have been using the copper sulfate on the plants and maybe some herbicide along the rows below the vines. The soil is compacted between the rows while it is quite soft along the vines rows. The soil is a silty clay soil with very low level of organic matter; at the moment I still don't have a soil analysis but I plan to ask for it.

In January 2015 I plan to remove the concrete supports and some maples, to excavate a pond and a central swale in order to move water from the South-West corner and store it in the pond, in the North-East corner across all the fruit tree. Before spring 2015 I have planned to chisel plow the ground and to prepare it for the sowing. I will spray dynamized humic acid water on the ground and, after this treatment, I will sow a multi floral mix (Persian clover, Egyptian clover, Sweet clover, Sainfoin, Crimson clover, Alfalfa, Radish, Facelia, Common vetch, Buckwheat, Coriander, Serradella, Calendula, Caraway, Agrostemma, wild Fennel, Mallow, Endive and Dill.) in order to regenerate the soil and enrich it with organic matter. The green manure will stay in place for more than 2-3 years and, after this period, I will start to plant the desired understory plants by using the sheet mulching technique.

VI.4 WINDBREAK SYSTEM

NORTH BOUNDARY

On this side I will take away the 5 of the 7 maples and plant *Alnus cordata*. Between the *alnus cordata* I will plant *Eleagnus x Ebbingei* spaced 2 or 3 meters

WEST BOUNDARY

This windbreak edge will protect a 25 meters wide area. On this side there are two Plums and 6 maples, in November I have created some Hugelkultur beds (6,80 – 5,10 and 4,30 meters long) using the old vines trunks and brunches and several others organic materials. On the top of the beds I will plant the bigger shrubs*: Sambucus Nigra, Hippophae rhamnoides, Eriobotrya japonica, Eleagnus umbellata* interplanted with *Rosa canina*. On the west side (outside) of the beds I will plant *Rubus fructicosus* or *Lycium barbatum* and aromatic plants (rosemary, sage, thyme, lavender, etc…) and flowers (Calendula, Tagetes, Nasturtium, Alfa alfa beans, etc…).

OUTSIDE HUGELKULTUR BED

BIGGER SHRUBS

SHRUB

SHRUB

AROMATIC PLANT

AROMATIC PLANT

AROMATIC PLANT

BERRY SHRUB
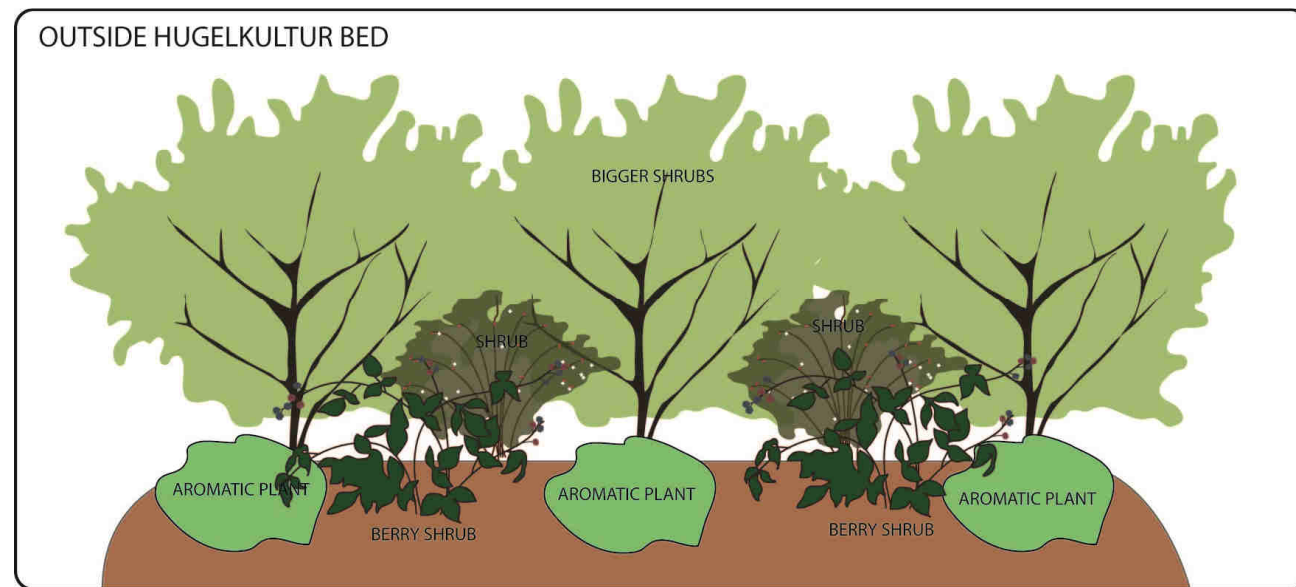
BERRY SHRUB

concrete supports and near some maples. Between the shrubs/trees I will plant some berry shrubs like *ribes rubrum, ribes uva-crispa*

In december I have dug small swales to collect and store water from the road and with the excavated soil I have created some mounds. I will also use these mounds for planting different guilds of shrubs and plants, following the aforementioned scheme. On the existing concrete supports and near some maples I will plant some climbers (*Actinidia deliciosa, actinidia arguta* and vines).

In the east side of the mounds (inside) I will plant *ribes rubrum* interplanted with *ribes uva-crispa*.

EAST BOUNDARY

This boundary has a section (the northern) that is under the shade of old big poplars, in this northern section I will plant *Berberis species.* Out of the shade I will plant*: Sambucus nigra,* Pomigranade*, Amelanchier* and *Eriobotrya japonica.* Also in this side I will plant some *Actinidia deliciosa* and *arguta* near the

VI.5 FOOD FOREST SYSTEM

The scope for the food forest is the production of food mainly in the form of fruits and nuts but also leaves and flowers to cover the needs of at least a family of four components, for the whole year. In a second time, the food forest would produce food also for some animals (in particular a flock of chickens/ducks that will freely range in the property and some honey bees families).

I have begun the design from the pattern of a leaf and on the this pattern I will start to place the fruit trees. On the main vein of the leaf will stand the swale and trees while on secondary veins will stand the fruit trees. The distance between the trees will be calculated in relation to the mature size of the trees trying to avoiding the creation of very dark areas below the trees; moreover I will use half-standard or semi-dwarf trees. The fruit trees will be chosen in order to have crops during the most extended period of the tree production and will surely be the most resistant species for this geographic area.
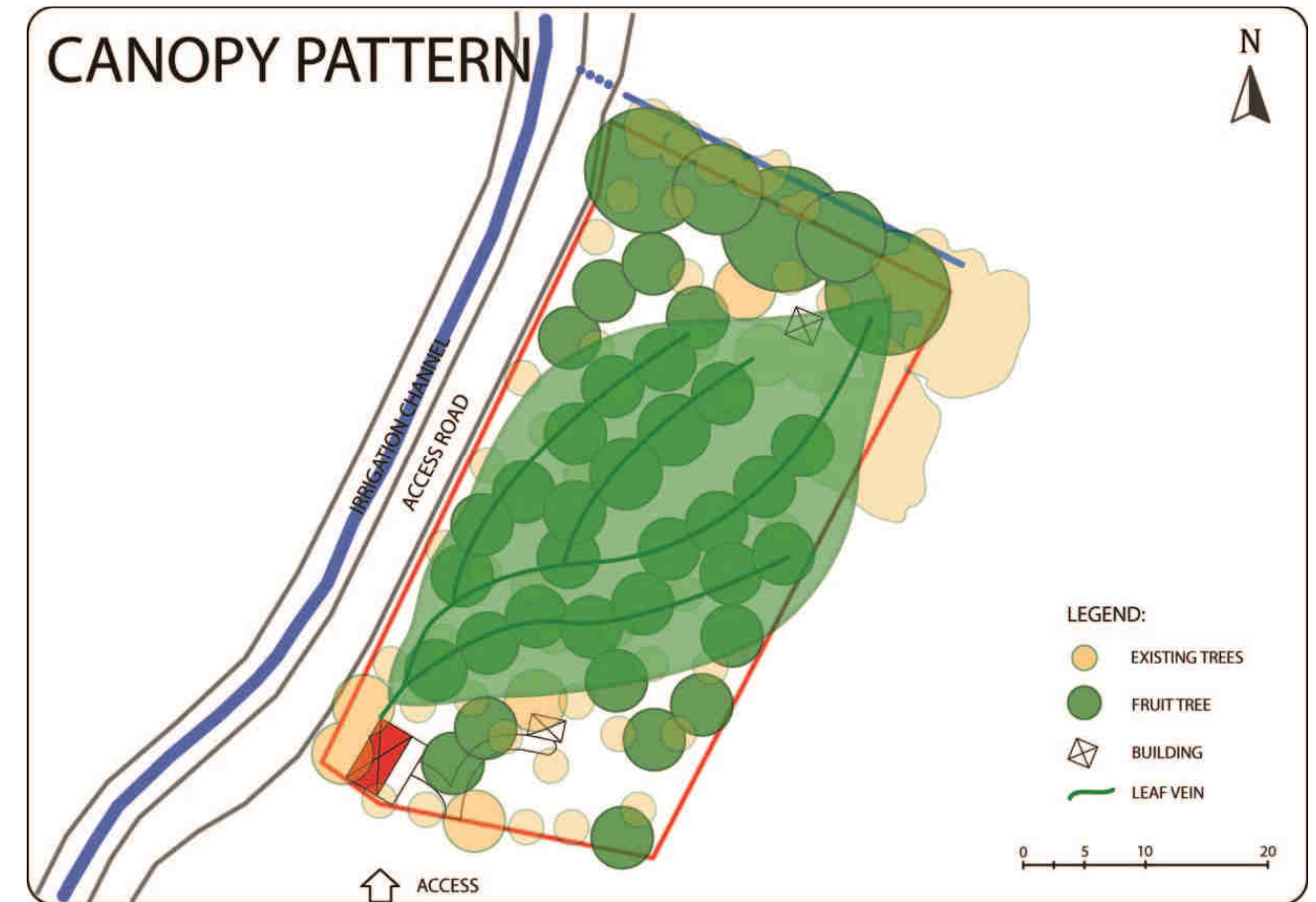
DESIRED FRUIT TREES

- *Apples (5)*
- *Pears (2)*
- *Apricots (6)*
- *Sweet cherries (3)*
- *Peaches (4)*
- *Persimmons (2)*
- *Pecan (2)*
- *Almond trees (3)*
- *Mulberries (2)*
- *Asimina Triloba(2)*

CANOPY LAYER

PECAN
7 ALNUS CORDATA EDGE
PECAN
APPLE (5)
SWEET CHERRY (2)
PEACH (4)
PERSIMMON (2)
OPEN AREA
ASIMINA TRILOBA (2)
OPEN AREA
EXISTING PLUM (3)
ACCESS

EXISTING PLUM (2)
PEAR
SWEET CHERRY
MULBERRY (2)
ALMOND
ALMOND (2)
SWEET CHERRY
APRICOT (6)
EXISTING PLUM

LEGEND:
○ EXISTING TREES
● 10 M. WIDE TREE
● 6 M. WIDE TREE
● 5 M. WIDE TREE
● 4 M. WIDE TREE
● POND
● EARTH MOUND

0   5   10   20 M

N-FIXERS LAYER

LEGEND:
○ EXISTING TREES
● CANOPY LAYER
⊠ STRUCTURE
● N-FIXER

ACCESS

0   5   10   20

NITROGEN FIXERS

The following shrubs (see list below) will be planted between fruit trees and coppiced or pruned as necessary for the necessities of the fruit trees.

- Caragana arborescens
- Genista odorosa
- Eleagnus Umbellata
- Myrica cerifera

While the Alders (*Alnus cordata*) will be placed between the nut trees in the northern part of the area.

SHRUB LAYER

I am not able at the moment to design the shrub layer, but I know a few plant I will sure want to plant in the Food Forest, they are:

- Berries: Red and white currants, Gooseberry, Raspberry and Goji berry
- Aronia
- Mahonia
- *Lonicera caerulea*
- *Chaenomeles Japonica*
- *Poncirus trifoliate*
- *Calycanthus*
- *Zanthoxylum schinifolium or simulans*
- Hazel

FRUIT TREE GUILDS

Under every fruit tree I will plant several type of plants belonging to layer 3, 4, 5 and 6. These association will be composed of several kind of different plants:

- Mineral accumulator (Consolida)
- Aromatic plants (Lavander, Rosemary, Thyme, etc…)
- N-fixers plants (beans, clover, vetch, alfalfa, etc…)
- Bee plant (Oregano, peppermint, flowers, etc…)
- Ground cover plants

The plants will be planted respecting the exposition needs, the water needs, the space needs of each of the different plants.

UNDERSTORY PLANTS

Even if I recognize that one of the most important layer for a food forest is the perennial plants, runners and roots that thrive beneath the trees and shrubs, for the first 2 or 3 years I will keep the multi floral mix planted in spring 2015. For the future I will observe what will going on and which kind of perennials will grow in my food forest.

VI.6 NUTRIENT BUDGET

To calculate the nutrient budget for my food forest I will calculate the budget for the whole system by calculating the total area occupied by the tree (maximum diameter) and multiplying it for the nutrient requirement. The whole system will be composed of the following fruit and nut trees:

Tree	N.	Ø (m)	Area (m²)	N (g)	K (g)
Apples	5	6	141	1130	1413
Pears	2	6	57	452	565
Apricots	6	4	75	603	754
Sweet cherries	3	6	85	678	848
Peaches	4	4	50	402	502
Plums	6	5	118	942	1178
Persimmons	2	6	57	452	565
Pecan	2	15	353	2826	3533
Almond trees	3	6	85	678	848
Mulberries	2	6	57	452	565
Asimina Triloba	2	6	57	452	565
Total	**37**		**1'134**	**9'068**	**11'335**

NITROGEN

To supply nitrogen in the forest garden I will use N-fixers ground cover plants (at the beginning) and also trees and shrubs. The following tables try to calculate the number of necessary trees and shrub to supply nitrogen to the fruit trees.

Name	N.	Ø	Area (m²)	N (g)
Eleagnus umbellata	20	5	393	3925
Caragana	20	4	251	2512
Alnus cordata	7	6	198	1978
Genista odorosa	20	3	141	1413
Hippophae rhamnoides	6	5	118	1178
Myrica cerifera	4	3	28	283
Total	**77**		**1'129**	**11'288**

POTASSIUM

To supply potassium I will use the comfrey planted under the fruit trees, some potassium will be supplied from wood ash and occasionally pees.

At this stage I sent the design to Martin Crawford to ask for a consultancy.
The following is the mail exchanged with Martin.

MC 22.01.2015

Hi Andrea

Fine, just email me the pdf file. If appropriate please also let me know if there are particular things you feel you want me to examine or other specific requirements. I would hope to spend time on it in the next few days and get back to you within a week.

Regards

Martin

AM 23.01.2015

Thanks Martin

Particular things:

- the shrub layer: any suggestion related to what kind of shrub I can plant even if not very common.

- The Canopy layer is composed with fruit trees we (me and my family) prefer, I will use old varieties of fruit trees but if you have suggestion also on this layer it is well appreciated

- the space between the shrubs in the windbreak edges

- the nitrogen fixers plants

- the source of potassium

- some hints on the layer below trees and shrubs.

Attached is the file and sorry for my english....

MC 26.01.2015

Dear Andrea

I have had a look through the plans and these are my initial thoughts:

Windbreaks

Northern boundary windbreak: Alnus cordata is good. I would be concerned about using Crataegus and Pyracantha as both are hosts of fireblight disease of pears etc. Also Prunus spinosa will sucker both into and out of the garden and will cause some management. Since northerly winds in autumn/winter can sometimes be an issue I would have thought that interplanting the alders with an evergreen would be good

– for example Elaeagnus x ebbingei. This will grow bushy and fill in the gaps between alders well. Also Nitrogen fixing of course, and has edible fruits. The E x Ebbingei could be planted at 2 or 3m spacing. Deciduous shrubs/trees like the Crataegus/Pyracantha/Prunus would need to go in more densely, at about every 60-100cm.

East boundary: in shade, hazel will grow very slowly and not very bushy. Something else may be preferable – perhaps a larger Berberis species for example.

Canopy layer
I think the density is too high. When the trees are grown it will be quite dark beneath and any nitrogen-fixing shrubs will struggle. You need to reduce the density by either removing 20-25% of the fruit trees (6-8 trees) or by reducing the size of trees (so for example instead of standard sized apples at 6m diameter you use half-standard or semi-dwarf trees at 4.5-5m diameter).

The mulberries are likely to get quite a lot taller than most of the other fruit trees in time. These 2 trees would be better placed towards the East of the site where they won't cause so much shade from midday onwards.

Nitrogen-fixing shrubs
Although should be happy to begin with in full sun, as the fruit trees grow and the N-fixers are pruned/coppiced the increasing shade will have a significant effect. At current canopy density (see above) most of the N-fixers are likely to perform badly once smaller than the fruit trees. Even with reducing the canopy layer, most of the

N-fixing shrubs will still be shaded – meaning I don't think you can rely on them for very much Nitrogen input at this stage, so you either need to reduce canopy density even further or work out a different strategy for balancing N requirements.

Similarly, nitrogen-fixing ground covers are likely to disappear with the canopy density increasing.

All the N-fixing shrubs you list should perform fine there in full sun initially.

Shrub layer
Most of the shrubs you list need significant light to crop well (see canopy density above) including Goji, Aronia, Lonicera, Poncirus, Calycanthus, Zanthoxylum, hazels for nuts. These need to be placed inbetween tree canopies where there is greatest light. Currants, Gooseberry, raspberry, mahonia, Chaenomeles are more tolerant of shade. Other shrub possibilities include Fuchsias (for fruit), Myrtus species (for fruit), Rosa rugosa.

Potassium
The current canopy tree list will require about 11kg potassium for optimal productivity.

25 comfrey plants cut regularly supply around 1kg potassium.
1 pee per day over a year supplies around 2.5kg potassium. A compost toilet will supply more via recycling of solid wastes.
10kg wood ash supplies around 1kg potassium.

Is there any possibility of collecting seaweed in winter from the beaches nearby? This is high in potassium and has many other useful nutrients.

As a forest-like system evolves, potassium will start to be cycled from the soil via leaf litter much more effectively.

Ground layers beneath trees and shrubs
I would advise waiting a year or two before trying to implement much underplanting. If the budget is tight, then concentrate of herbs and perennials that you can grow from seed easily or which you can easily propagate yourself (eg. by layering).

Let me know if you have supplementary questions or want more details of something. I have spent 1.5 hours on this so far.

Best regards
Martin

AM 27.01.2015
Thanks Martin
very useful thoughts!

N-fixers

If I decide to use half-standard or semi-dwarf trees it is still a problem for the N-fixer shrubs to thrive? Can you suggest me others N-fixers shrubs that can thrive in my food forest planted with half-standard or semi-dwarf trees? I did not find any garden shop that sell the Caragana arborescens and I would like to grow it from seeds. Is it a good idea?
Canopy
I did not understand where to plant the mulberries. I planned to plant them in the east boundary is it right?
N and P
What do you think if I add free range chickens and ducks in the forest as a source of Nitrogen and Potassium?

Thanks in advance

MC 29.01.2015
Hi Andrea
N-fixers
Some N-fixers will thrive with the extra light if you use semi-dwarf trees. Their best position though will be in-between the rows of fruit trees, which I guess you also need as access paths to the trees.
Evergreen N-fixers will have the best chances of thriving as they can use the winter sunlight. So … Elaeagnus x ebbingei, Myrica cerifera/californica, Acacia dealbata etc.
Caragana is quite easy to grow from seed.

Canopy

Your position for the mulberries is fine. I got in a mix-up!

 N and P

Chickens and ducks will help with cycling N and P but of course they cannot create
it out of nothing. If you feed them extra grain, for example, then this has significant
N and P some of which will get into the forest garden.

Regards

Martin

VI.7 STRUCTURES AND PATHS

Inside the property the intention is to build the following:

- Paths
- Pond
- Gazebo
- Pond shed
- Kitchen off-grid
- Kids plays
- Shower
- Compost toilet

PATHS

At the beginning only the main path will be created, the main path will connect the access in the South to the gazebo and to the kitchen off-grid. This path will be made with a first layer of geotextile fabric and covered with gravel. It is not very long and so the cost will be contained. It is important to create these two paths because they will connect the zone 0 with the main structure of zone 1.

The secondary paths will be created in the future by cutting the grass and plants, one of these would be probably along the swale, and will permit the easy access to the pond and the pond shed.

POND

The pond will be a great source of biodiversity for the whole project and also a source of water in case of necessity.

The pond will have different water depths in other to diversify the life in it. I will plant several water plants in it and also some plants that love water like the *tifa* around it.

To choose whether to use the EPDM layer or not I used the PMI technique:

PMI

	PLUS	MINUS	INTERESTING
EPDM	1. Start to immediately collect and store water	1. It cost a lot 900€ 2. what is going on after 20 or 30 years? 3. Can be damaged	
NO EPDM	1. No added costs 2. No added work	1. The water can infiltrate 2. You have to recharge the pond with water from the well using electric pump 3. It may need some years to seal	4. No use of plastic 5. No need to remove anything and manage the waste in the future 6. Accidental damages will not cause infiltration

The PMI method clarify my doubts, the solution without the EPDM is far more economic and offers some interesting point of view. In particular because I don't have to place it and to spend some added work to fix it if anything go wrong.

GAZEBO

The gazebo will be a simple structure made with a recycled wooden floor, and a light roof made of branches collected along the sea side and, in the future, covered with climbers.

POND SHED

I will build this shed for my two sons and their cousins, the trees are not enough tall and big to house a shed, so I decide to use 4 of the removed concrete supports to form a tower, on which I will create the shed.
Below are some images.

VI.8 COSTS

Net fence:

100 meters net fence 1,5 m high with a small gate (80 cm) and big gate for machinery (4 meters):   3'600 €

Vine concrete supports and trees removal:

Half day of work with small bulldozer   250€

Pond excavation :

Half day of work with small bulldozer   250€

Organic Green manure seeds: 100€

Trees, shrubs and plants acquisition: 300€

MASTER PLAN

WALNUT
7 ALNUS CORDATA EDGE
WALNUT
APPLE (5)
SWEET CHERRY (2)
PEACH (4)
PERSIMMON (2)
IRRIGATION CHANNEL
ACCESS ROAD
OPEN AREA
EXISTING PLUM (2)
PEAR
SWEET CHERRY
MULBERRY (2)
ALMOND
ALMOND (2)
SWEET CHERRY
APRICOT (6)
ASIMINA TRILOBA (2)
OPEN AREA
EXISTING PLUM
EXISTING PLUM (3)
ACCESS

LEGEND:
EXISTING TREES
10 M. WIDE TREE
6 M. WIDE TREE
5 M. WIDE TREE
4 M. WIDE TREE
POND
EARTH MOUND

0   5   10   20 M

VII   IMPLEMENTATION

Between October and December 2014 I have taken away all the old vines; I have left only a few of them to let them climb on the trees or on the concrete supports.

Figure 17: Top: the field at the end of September 2014 with the rows of vines and acer campestre trees.

Figure 18: the vines have been removed and there are only the acer campestre trees with just a few vines and concrete supports

Between October and December 2014 I have also prepared some HugelKultur beds in the west border. I have used some of the trunks of the removed vines and other organic material. I decided to build the mounds because I had a lot of vine trunks and branches deriving from the removal of the grapevines. The second reason is because I will not place an irrigation system in this part of the project and so I hope the hugelkultur will work fine to collect the autumn, winter and spring rains and distribute the absorbed water during the summer time.

Figure 19: Photo sequence of the creation of the hugelkultur bed from left to right, top to bottom.

After some rains events in the rainy season (autumn and winter), I noticed some water accumulations in different areas of the property. To solve some of these situation along the field and to store the water for the better season, aside from the mounds I have excavated some shallow ditches (some 30-40 cm) in order to accumulate the rain water drained from the surrounding fields. The water will be soaked by the trunks buried in the hugelkultur and will also hydrate all the surrounding soil. Also a small pond have been excavated with the same purpose.

Figure 20: the PROBLEM: rain water accumulation in the container area

Figure 21: The SOLUTION: I have excavated a small pond to retain rain water and infiltrate it into the soil. The small pond will also be use to collect the water from the shower cabin.

JANUARY 2015

At the end of January 2015 I call a guy with the bulldozer to help me for removing the concrete supports and to excavate the pond.

In spring 2015 after a week of rain the field was covered with water and the ditches and the canal were full of flowing water.

Figure 22: the water canal full of water.

When the soil had the right condition I carried out a soil preparation for the sow, this was at the end of April 2015.

Figure 23:the 10 kg bag full of green mulch seeds.

After the soil preparation I sowed a mix of green mulch seeds including:

Persian clover, Egyptian clover, Sweet clover, Sainfoin, Crimson clover, Alfalfa, Radish, Facelia, Common vetch, Buckwheat, Coriander, Serradella, Calendula, Caraway, Agrostemma, wild Fennel, Mallow, Endive and Dill.

I have planted a few trees and shrubs in the wind break edges. Some of these include:

5 Alnus cordata, 5 Berberis (in the North edge).

Sambucus Nigra, Hippophae rhamnoides, Eriobotrya japonica, Eleagnus umbellata interplanted with *Rosa canina*. (in the West and East edges).

On the hugelkultur mounds I have planted *Rubus fructicosus, Lycium barbatum* and red currants and some aromatic plants (rosemary and lavender) and flowers (Calendula).

At the beginning of May 2015; 10 days after the sowing the first sprouts appear.

Figure 24: Some photos of the green mulch coming out between the straw.

The summer 2015 has been a very hot summer with no rain from June to August. In these strong condition and with no added water to the field only a few plants of the green mulch survive and also the shrubs in the hedge suffered a lot. The plants that survive in summer were: alfalfa, Calendula, wild fennel mallow and dill.

In autumn 2015 I ordered some trees and shrubs. In November I planted them in the field on the arcs of the circular pattern. I planted the following trees:

3 apple trees

2 peaches

2 sweet cherries

2 apricots

2 almonds

1 walnut

1 persimmon

1 mulberry

2 pomigranade

3 hazels

10 ribes

3 blackberries

Figure 25: The pond in May 2015, on the right there is the overflow channel

During winter 2015-2016 I created the paths by cutting the grass and by putting some sticks.

The trees and shrubs has been planted and the area around the trunk has been protected with two layers of cardboards and a thick layer of straw. A protection (metal or plastic) has been added around the trunk.

In March 2016 after the spring rains the field show some problems of water accumulation:
In front of the access; this is a low area and the water accumulate

The swale was full of water and the water slowly flow from the South to the North of the field. It seems it work but the water is still accumulating in the

lowest area of the field in front of the access point and near the container area. I will plan to enlarge the pond in the south to be able to drain the water from the low areas.

During summer the green mulch grow a lot showing a dominance of *Melilotus Officinalis. The meliloto* grew very well ad became higher than me. It was like to enter into a forest. The field was unrecognizable.

The last rain event was in mid-June but the trees and the plants were still in good condition even after a month of very hot weather. On the 20th of July I decided to water the trees. They were still ok except the sweet cherries and the hazels that were showing clear signs of water need.

VII.1 IMPLEMENTATION SCHEDULE:

FALL – WINTER 2015-2016:

- Creation of the access paths
- Fruit trees planting
- N-fixers shrubs and trees planting
- Berries shrubs planting

SPRING 2016

- Create the irrigation system and test it before summer
- Fruit trees guilds creation
- Sowing of green manure and flowers
- Sowing of corn and pumpkins along the edge of the swale
- Sowing of sunflowers
- Add plants to the ponds.

SUMMER 2016

- Control the trees for water need
- Enjoy

FALL – WINTER 2016-2017

- Create shed near the pond in order to catch rain water and store it in the pond
- Connect the swale pond with the big pond with a swale
- Create a roof for the container and add a plastic container to store rain water collected from the roof
- Cover some areas of the circular pattern with a strip mulch in order to suppress plants and weeds.

SPRING 2017

- Create the irrigation system and test it before summer

- Fruit trees guilds creation

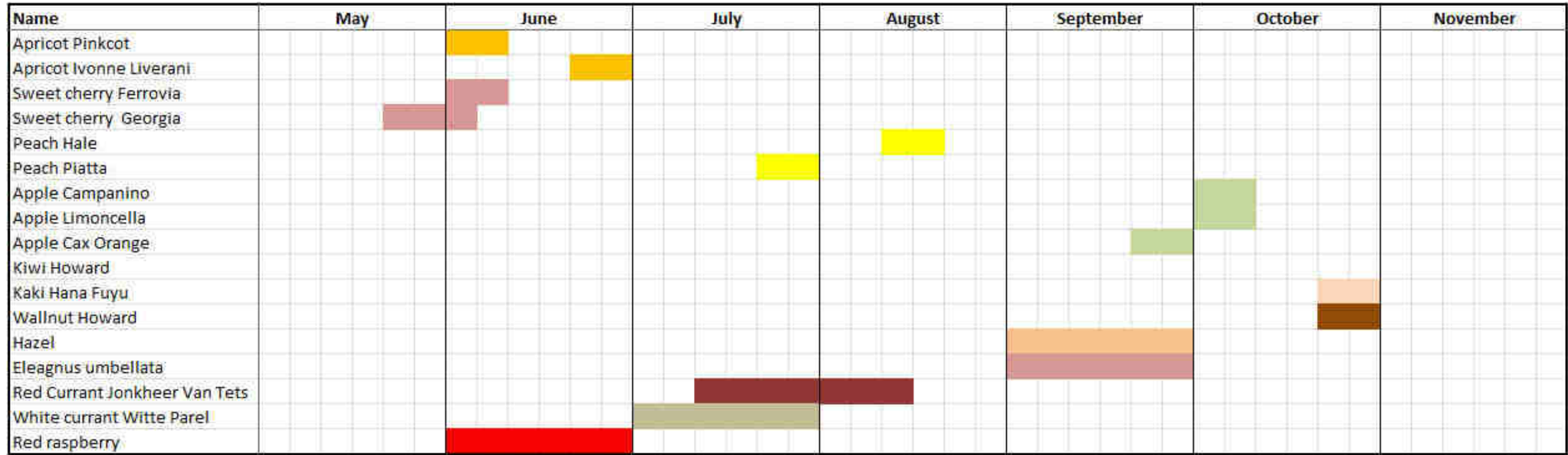- Remove strip mulch and sow trees associated herbs and flowers

VIII MAINTENANCE

Name	May	June	July	August	September	October	November
Apricot Pinkcot		■					
Apricot Ivonne Liverani		■					
Sweet cherry Ferrovia		■					
Sweet cherry Georgia	■	■					
Peach Hale				■			
Peach Piatta			■				
Apple Campanino						■	
Apple Limoncella							
Apple Cax Orange					■		
Kiwi Howard							
Kaki Hana Fuyu						■	■
Wallnut Howard						■	■
Hazel					■		
Eleagnus umbellata					■		
Red Currant Jonkheer Van Tets			■	■			
White currant Witte Parel			■				
Red raspberry		■					

Figure 27: fruit harvest calendar.

These are the planned works to be done:

- In April of even before the end of May if in a rainy year, cut the green manure plants and leave the cut on the ground.

- Cut the grass in the zone 1 to let the children play (every week in the summer time)

- Between May and September keep the paths clean by cutting the grass/plants. It's important to keep also the path covered with mulch in order to avoid the soil to dry.

- 2 weeks before bud break, apply foliar compost tea to establish the beneficial organisms on all the leaf surfaces. For as long as no foliar disease is found, only apply tea in a foliar fashion once a month.

- Apply compost tea after all leaf fall has occurred, in order to cover all leaf litter surface. This prevents diseases from being able to grow on the leaf material and overwinter.

- Clean the surface of the pond from the leaves (at the end of Autumn)

- Check the fruit trees for any disease (from Spring to end of Summer)

- Spray some compost tea (before flowering, before fruiting)

IX   EVALUATION

The OBRADIMET framework proved to be a good guide trough the design process because with this framework all the design phases could be well analysed. I liked to put my attention in particular on the first three letters: the Observation phase (I have been coming in this field for 6 years and I had time to observe the field in different situations), the Boundary phase (there are neighbors in two side of the field and I have to deal with them and with my father in law worries) and also with the Resources phase that helped me in understanding what was already there and could be used for the project.

The climate analysis has proved to be not enough precise to understand the main limitation of the summer times. More information on the rain events and the precipitation period could help in understanding more the situation and in finding and designing more suitable solution for the trees, shrubs and plants.
A paragraph on the chilling requirements and a list of chilling requirements hours for the suggested trees and shrubs could help for understanding the trees and shrubs to put in the project and keep a record during the years could also help in visualizing the changes in climate.

Since I am a cartographer maps are the tool that I know better. Normally I start a design by drawing sketch maps on a paper, than I use Google Earth or go on the field to take measures in order to create a container for the sketches. I find SECTOR map mandatory for a design, because it make you aware of a lot of

situation that will affect the system, in particular for this project the wind sector, the slope sector and the sun exposition are rich information for the design phase.

I have used the PMI for the pond and I found it useful to analyse the situation and to decide whether to use the lining or not. It let me reflect on the different possibilities and see them more clearly.

And for designing a food forest the nutrient budget analysis was also interesting. In particular for the potassium which can be found in different form and solution. For example in July 2015 we built a mass stove in the bathroom of our house and during the autumn, winter and spring we have produced more than 3 kilos of ash. With these amount of ash I can feed a lot of plants and trees.

This is my third design and I start to me more confident with the design framework and with the tools. The design proved to be useful for analyzing all the ongoing situation in the field: in particular to see the limiting factors and try to design solution for them. The design process helped me in understanding the real meaning of natural pattern and to use them in a better way. The design of the tree canopy for example help me in creating a system nice to see but also easy to manage in case of drought. The circular pattern allow me to add a water system, connect the trees and manage it easily.
The analysis of the soil helped me in finding solution for increasing the fertility. The use of straw and the sow of a green mulch, together with a low impact of soil disturbance (no use of machineries and the identification of paths) are
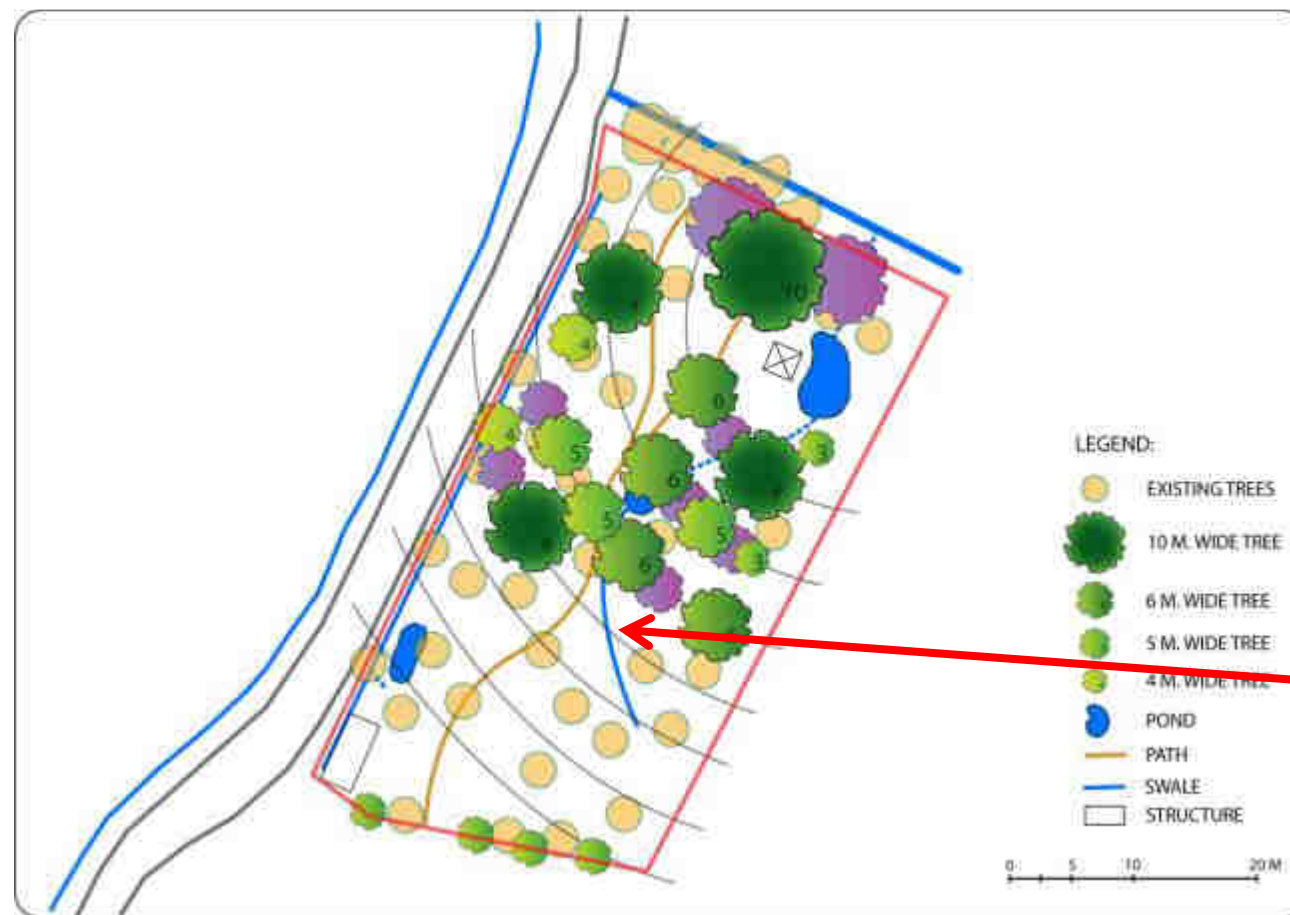
transforming the dead claily soil, the soil is softer, more oxygenated, and organic material is increasing.

The design help me also in analyzing the problem of water accumulation and in the definition of a possible solution. I have excavated a small swale and I have verified that the rain water flow from the surface to the swale accumulating water and organic material. At the end of the swale there is a small pond where I can observe the organic material accumulation during the seasons.

A sample of soil has been taken so there is a reference for further analysis. I think after 5 years I can foresee a new soil sample to see if soil regeneration process is going on.

X   TWEAKING

The trees at the beginning would have planted using a leaf pattern. I decided to change the pattern from the leaf pattern to the circular pattern to better manage water and watering system.

I also decide to add a swale to intercept the surface water running towards the container. The swale slowly move the water towards the center of the field. The next step will be to connect the swale to the pond, in order integrate the two water systems and to facilitate the migration of plants and animals from one side to the other.

A second tweak has been the paths set up. I decided not to connect the pond with the small pond close to the container but to realize a main path from the entrance in the South side to the Northside of the field passing through the field.

Figure 28: Swale, photo of January 2016.

XI   REFLECTION

XI.1 LEARNING OUTCOMES:

During the design and since the beginning of the field works the main learning outcomes are the followings:

- While designing a food forest reflect very well on every tree space. The majority of the trees need light to thrive, at the beginning the land seems to be an empty field with some small little trees, but in the future all the system will grew and the trees will then occupy a lot of space. So it's important to observe the nature and observe in particular the "real" size of a tree, not those in the commercial orchard.

- While designing a food forest you have to think that after planting everything you may have to leave the place for many years. What happened during those year of no-care? Is the system still working as designed? Well, in my design I try to figure out if the system will thrive also without me.

- Before investing too many resources in buying trees and shrubs the main energy has to be put in the soil regeneration. Without an healthy soil everything will go slowly.

- The importance of the nutrients. During the design is very important to calculate the nutrient budget, at least for the Nitrogen and the Potassium. And that is quite easy to have sources of nitrogen but it isn't the same for the potassium.

- In this particular clay soil is important to make major soil movements at the end of autumn. During the winter the cold temperature, together with rains and snows will create a perfect soil structure ready for spring sowings.

- In every phase of the design and of the project it's important to observe and record what is going on. PASTE is a very useful tool. To be used before starting the design and also to suggest elements to the client. I have learnt to be more precise in compiling the PASTE and also in using it for the design or implementation phases.

4 QUESTIONS

WHAT IS GOING WELL?

The general aspect of the field is getting better and better, and the trees are yet young and small.

The life is coming back, now if full of bees, insects, snakes, rodents, birds and also hawks.

After sowing the green manure I add some straw (see), unfortunately I wasn't able to cover all the field because I finished the straw. The area with the straw resulted in a more soft and aerated soil while in the area without the straw plants numbers per area was lower.

After a dry summer and autumn (2015) the rains of winter and spring gave great vitality to plants and trees. The green manure plants are now great (beginning of summer 2016) and they become higher than me. The trees and paths are now almost covered by them and I need to make some cuts. I

observed that the cut plants left on the ground helped in regenerating the soil and in keeping it soft.

The protection of the tree (see) went pretty well. After planting the tree I add 2 layers of cardboards around the tree and cover all with a thick layer of straw. After 8 months the protection layers (cardboards and straw) are still there and the tree are not suffering from weeds or water scarcity. I only suggest to do it wider as possible (a diameter of 1 meter is the minimum) at least in these condition.

WHAT HAS BEEN CHALLENGING?

Normally there isn't enough time to observe the field but the observation phase is very important. With this design I should have waited a bit more to decide where to dig the pond maybe. I also learn a lot by making mistakes. The west boundary with the hugelkultur is an example. I have learnt to observe and observe again, sometimes it's necessary to take some notes on the observed situation, but it's also important to record information in the mind. maybe I could have used the McHarg's exclusion tool to find a better place for it.

The pond during the summer time has serious problems with the water. It seems that the water flow away through the water table than for evaporation. On the other side the water plants are not suffering and it seems to me that a process of lake bottom sealing is going on. I have measured a small layer (say ½ centimeter) of very fine clay mixed with organic material which could help in keeping pond and water table separated. On the other hand during winter time the water table level increase and the pond is full of water.

Figure 29: pond in winter. The water table is high and the pond is full of water, also the small depression in the field are full of water.

Figure 30: the pond at the end of winter in a very low rain season.

There is still water accumulation in low areas after big rain events. The main problems may be found in spring or late spring. By transforming the soil and by adding organic matter to the soil it will be more able to manage and retain water in it and don't on its surface.

The creation of the hugelkultur was done at the right time, end of October. In spring the surface soil was soft and airy. Unfortunately I did not do the same with the rest of the land. The farmer came in April to harrow the surface but it was already too sunny and the soil become hard and clumpy (see image below).

Fortunately there was still time to sow and I did it just before a two days of rain. The rain tend to break the clumps and to cover the seeds with the right layer of soil. Next time I will try to better organize the works and to sow them in the right period.

The pond is too far from the water source and it needs to be filled (with water) in order to keep water in it. The pond is well protected from the wind but there are still a portion of sun coming in and therefore the water evaporate very fast in summer.

Figure 31: Straw added after sowing.

It could also be a problem of groundwater table, maybe it is very low in this place and the water flow away. I could analyse this aspect in detail before creating the pond. There isn't still a system to harvest rain water and redirect to the pond, but I will create a shed near the pond in order to have it. I will also plant some fast growing trees in the southern side of the pond in order to limit the sun power.

I got a few problems in the definition of the trees layer; at the beginning I used a natural pattern cause I like it and try to fit it into the design. After a while (all the summer of 2015) I started to really think at the meaning of the natural pattern and I figured out that patterns are expression of a need in nature and so I started to analyse the needs of the plants in the project. One of the problem I will figure out (especially in summer) will be the water. Therefore I decided to make a tweak and I changed the trees layer set up from the leaf pattern to the circular pattern. I imagine the water moving from the central body of the pond to all the trees and shrubs. With circular pattern is easier to design and implement a basic watering system.

A second reflection was about the huegelkultur mounds in the western side. I excavated for a spade in depth and fill the hole with the vine trunks and other organic material such as straw, leaves, small brunches. I like the final result but I am not very sure on the efficiency of the mounds. Next time I will have to find some rotten wood for the Huegelkulture because the fresh one are not very good in adsorbing water, they also create an hard layer for the roots and they also need a lot of nitrogen to be decomposed.

WHAT ARE THE LONG TERM VISIONS AND GOALS?
- Try to have a more rich plant level below the trees and shrubs
- To create a system which can thrive without my intervention
- To create a very fertile soil
- The A3 format for the report is difficult to manage, I would like to invest some time to increase my skills in learning to use a software more powerful than Word for report creation. In particular for the designs for the clients. I would like to implement a format using Adobe InDesign.

- I would like to implement a maintenance plan based on the on-going culture (trees, shrubs and plants). It should be easy to read and access, it should be easy to update. I also would like to use it in my projects and design consultancy work.

WHAT IS NEXT ACHIEVABLE STEPS?

Connect the swale to the pond for better water management

Plant more trees and shrubs in autumn/winter 2016-2017