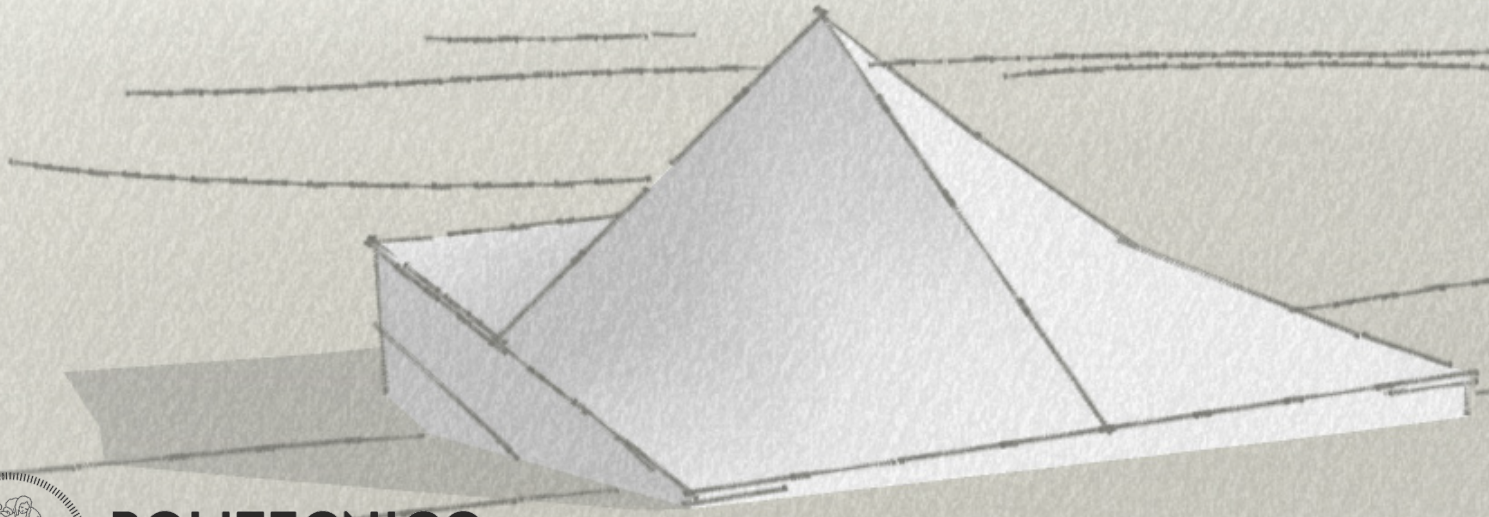
Carelli winery

Project for a new winery in Sala Monferrato



POLITECNICO
MILANO 1863

School of Architecture Urban Planning Engineering of Construction
Master of Science: Technological and Environmental Planning
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Grande è la fortuna di colui che possiede una buona bottiglia,
un buon libro, un buon amico.

Molière (1622 – 1673)

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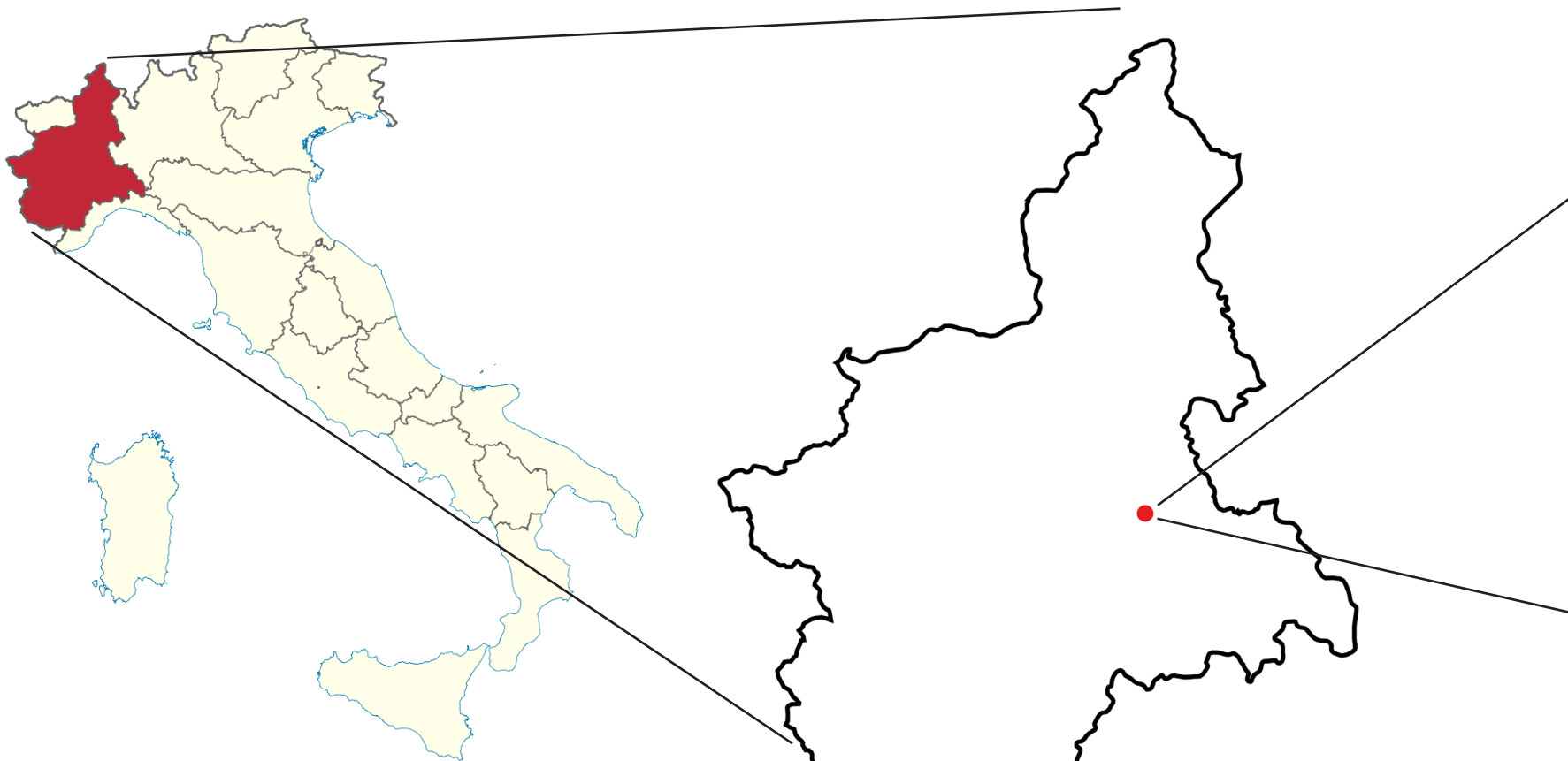
Analysis

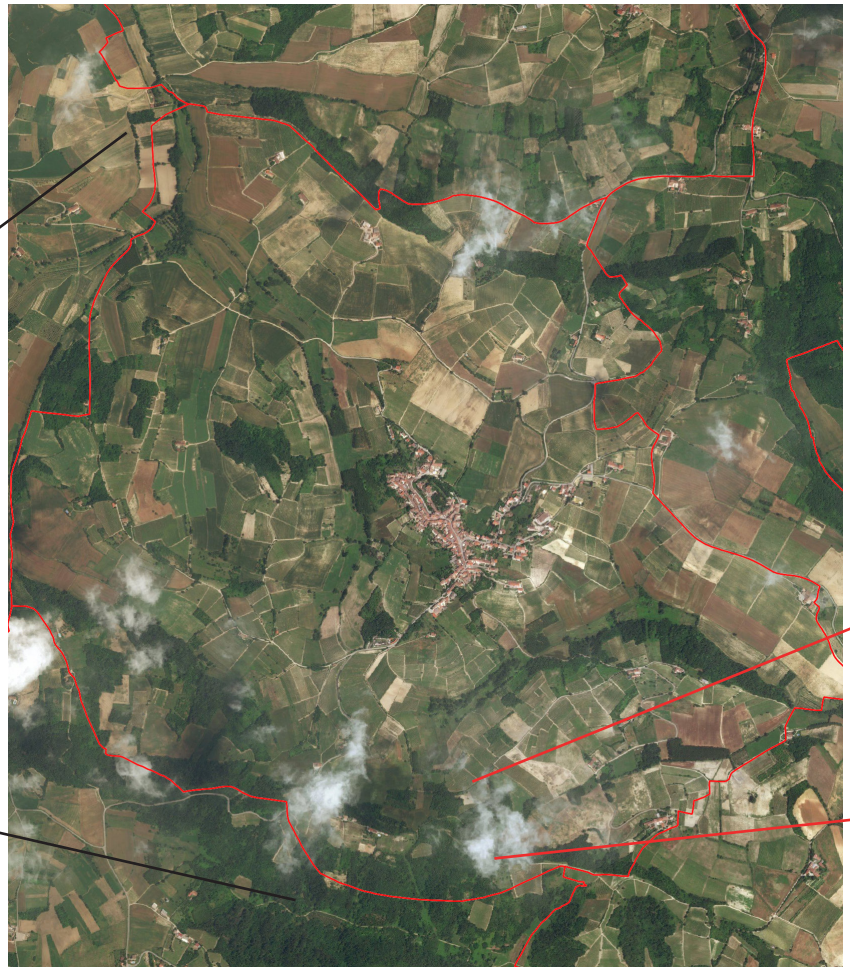
Se alla vendemmia, d'acqua empiesti il tino,
come puoi oggi sperar di trarne vino?
Cristoforo Poggiali (1721 – 1811)

General overview of the area



Piemonte in Italy

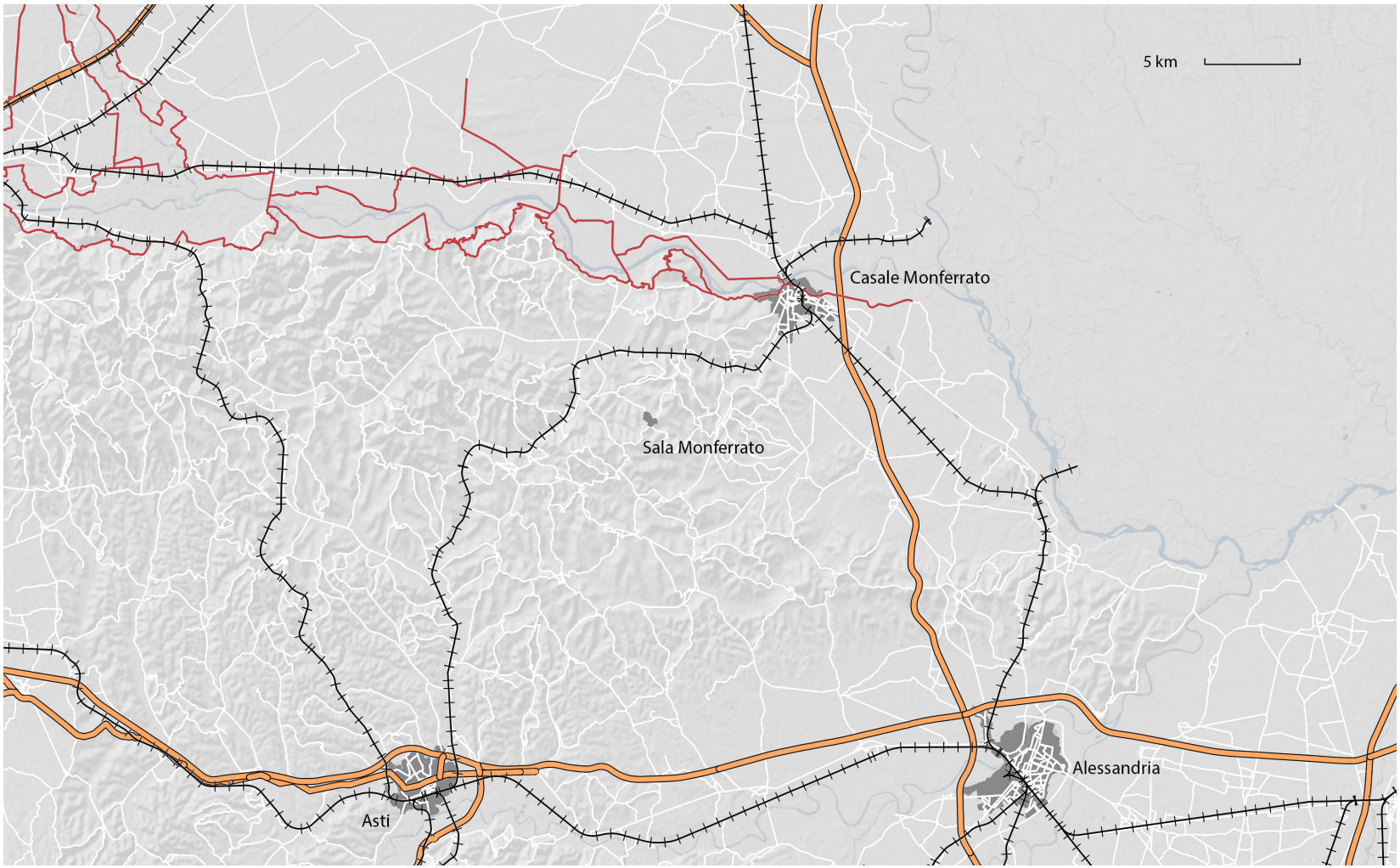
Sala Monferrato in Piemonte



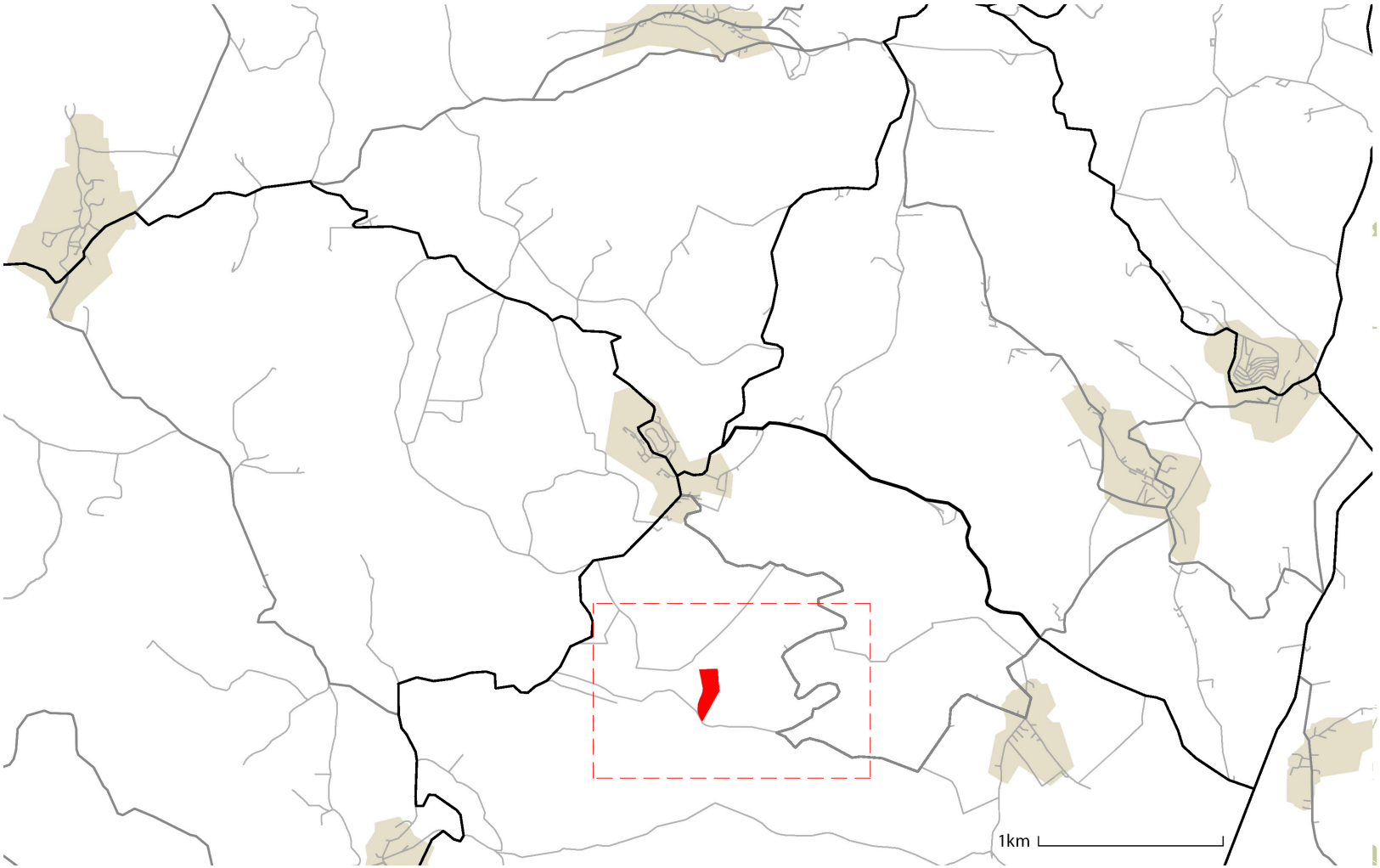
Municipality of Sala Monferrato

Project area

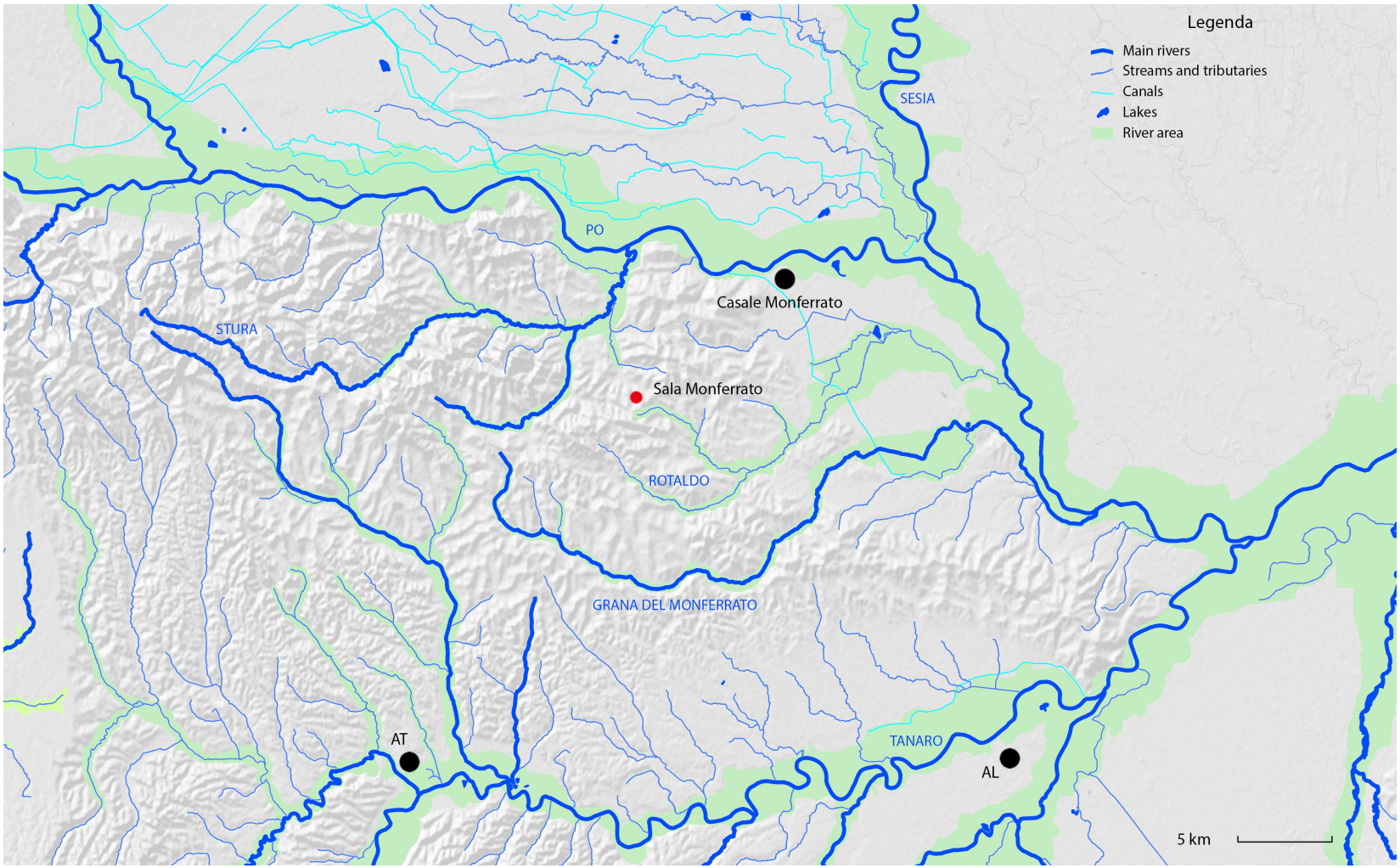
Infrastructural network



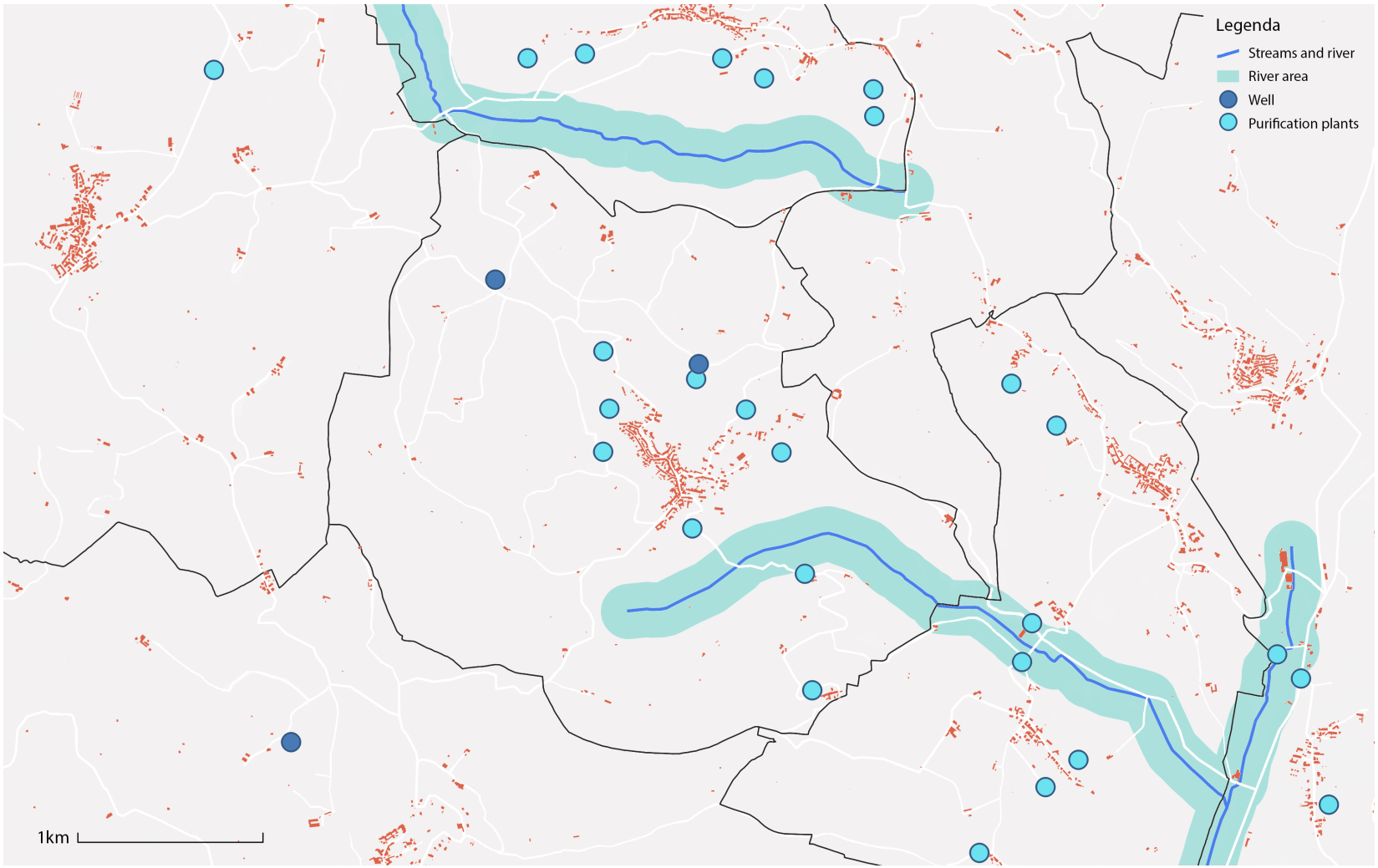
Infrastructural network (municipal scale)



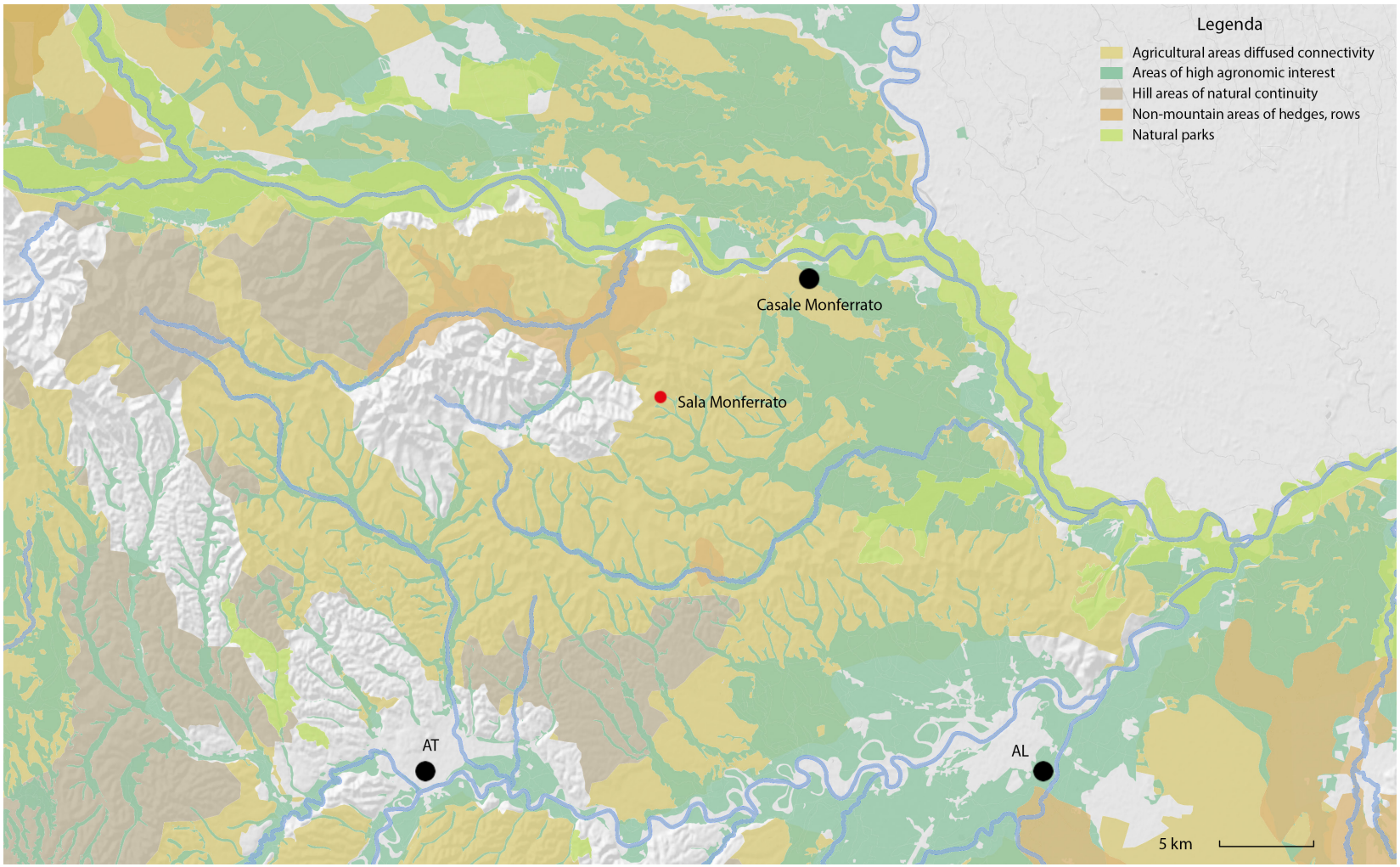
Idrography of the region



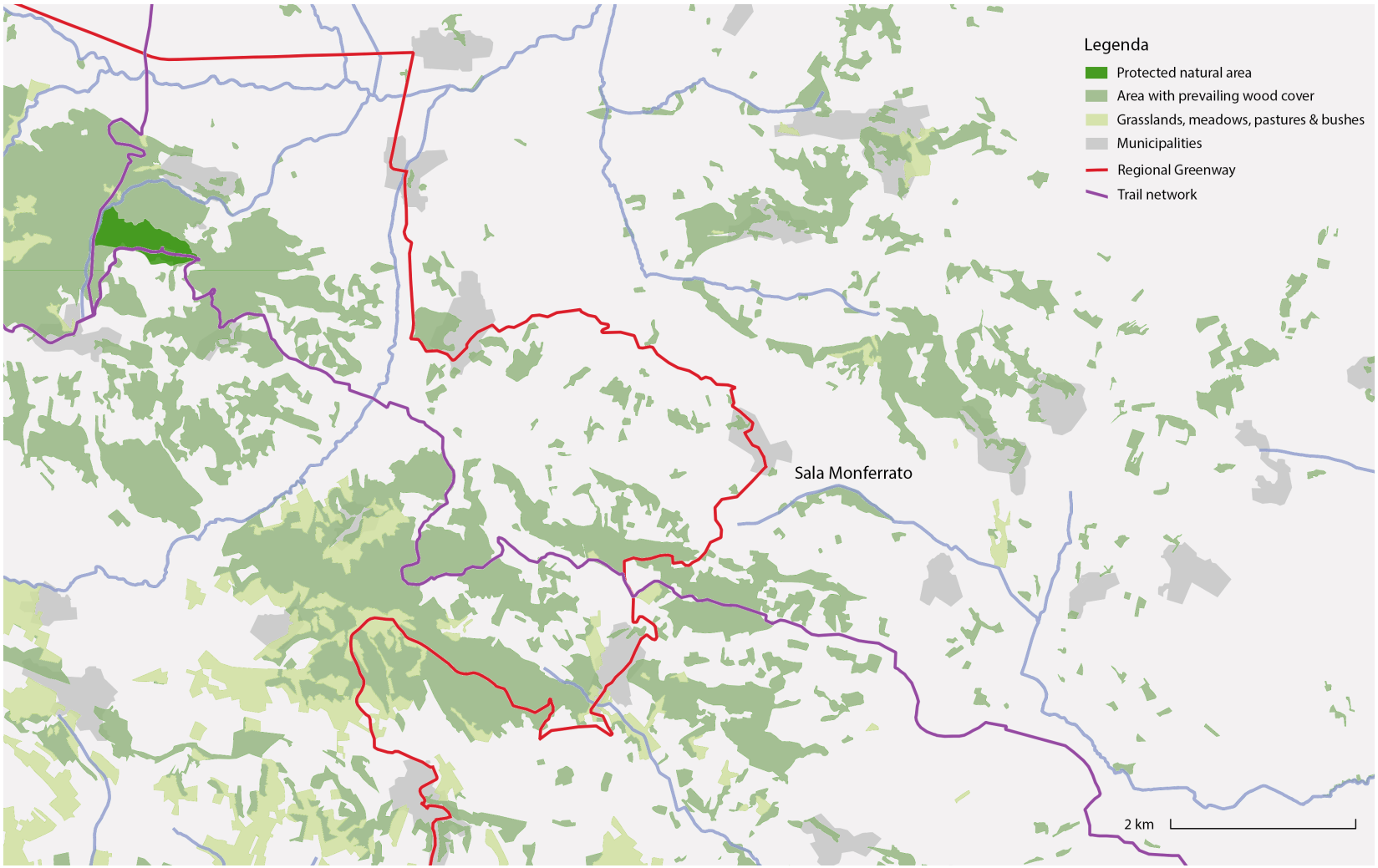
Idrography of the town



Green areas network



Green areas network (local scale)



Historical introduction

Etymology of name "Monferrato"
The origin of the name "Monferrato" is uncertain: someone associate it to Aldo di Ricaldone, according to whom its meaning was "Mount of spelt". For others it comes from the latin "Mons ferrax", fertile and abundant mountain. On the other hand, some historians ascribe the origin of the name to the saxon city of Aysemberg that gave birth to the Aleramici family (feudal lords in the 10th century) whose name, translated into english, means "Mountain of iron". Whichever the meaning and etymology of the name, the Monferrato has always been an area vocated to viticolture, producing some of the best wines of Europe for centuries.

Roman Era
After the passage of Hannibal's army (218 B.C.), the Romanization of the territory began. The indigenous tribes were absorbed in the Roman Republic, and the title of province to Gallia Cisalpina was granted. Along the roads the dislocation of "mansiones" or mail stations fostered the control of the countryside and the establishment of large rural farms, followed by reclamation and deforestation. The regular design of the centuriae marks forever large portions of the Piedmontese flat territory.
Recent findings confirm that the location of the Roman town of Vardacate could coincide with that of the city of Casale.

Middle Ages
Throughout the second half of X century, frequent raids by Saracens and Hungars caused devastation in the region, while the construction of castles in the territory began. During the XI and XII century the Cistercian monks occupied wild uncultivated fields and started to cultivate directly, through farms called "grange". This made possible the development of the first relevant productive settlements. Their contribution had been essential for agricolture. In 1434 A.D. the area is been administratively divided into High and Low Monferrato. During the Renaissance the wine produced in the region was served at the court of Gonzaga.

The 20th century
The Monferrato always had difficulties in procuring water for irrigation because of its scarcity. In the past, to overcome this problem some pools were built to collect the rainwa-

ter and wells took water from the aquifer. In 1932, during the fascist epoch, the aqueducts were completed so that the problem was finally solved, letting the farmers enhance the production. In the post war period the industry of cement, already active, gained importance; the mechanical industry and the freezing industry also developed. Wine and rice were the most important goods produced.

Today

During the '90s Flavescence dorée (a vine disease) affects the area causing huge losses for the wine market. Even now the economic recovery is being hard, also because of the lack of a vision and business mentality, that could actually help to face the problem more efficiently. The inexorable depopulation of the countryside, already undergoing from the second half of the XX century, is even more difficult to contrast because of the local issues. In order to enhance the touristic possibilities of the territory and the landscape, the application to the UNESCO tentative list was made. In 2014 the World Heritage Committee recognizes the "Vineyard Landscapes of Langhe-Roero and Monferrato" as World Heritage.

A landscape of Monferrato

Geology of the Monferrato

The process of formation of the Monferrato
Hundreds of millions of years ago the Po valley was part of a vast ocean. Due to the clash with the African plate, the Eurasian plate started to lift, gradually forming the Alps and the Apennines mountains. Thus the plain of the Po river originated partly for the effect of this telluric movement, partly for the transport of river debris. The Monferrato among the first areas that emerged from the waters of the "Piedmontese Ligurian Ocean" as it has been named by geologists.

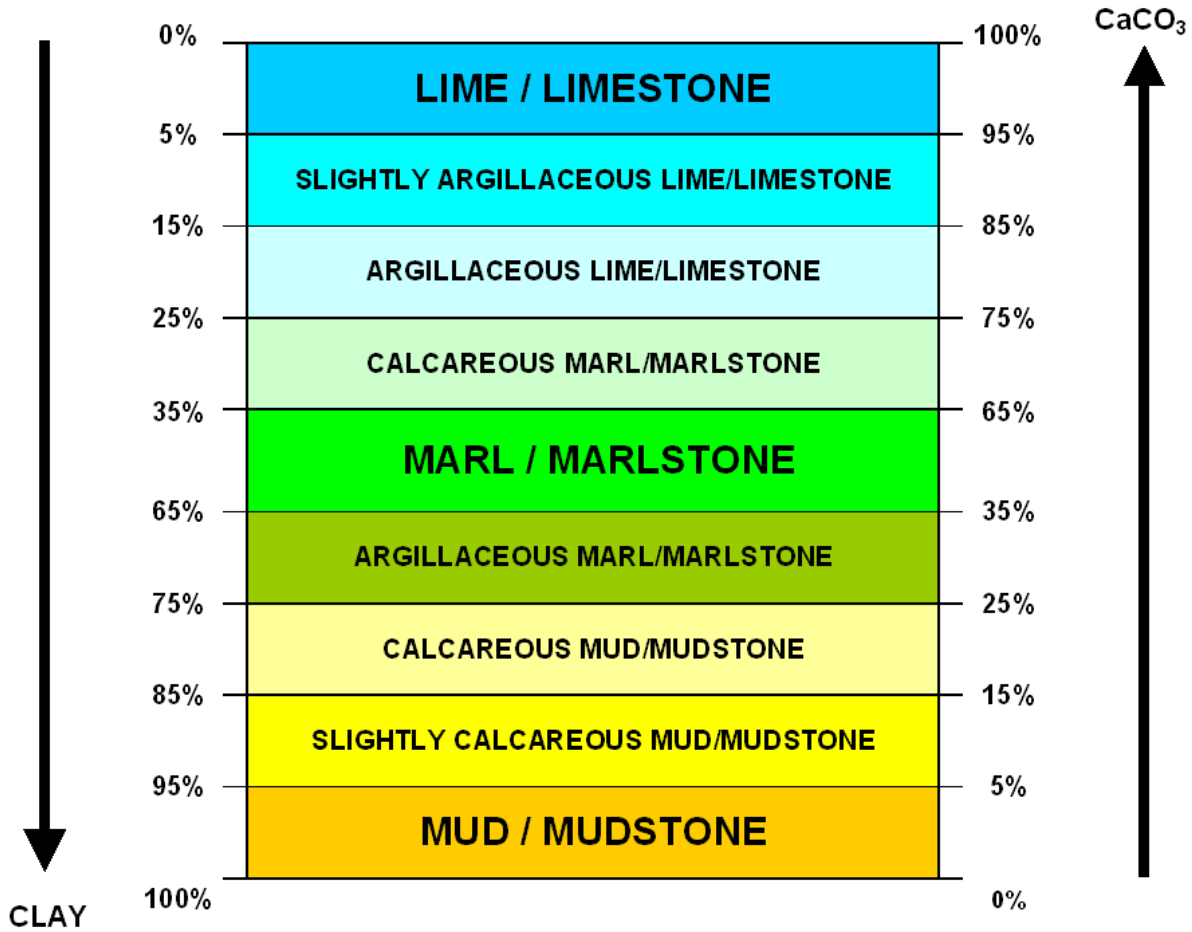
Influence on local economy
The configuration of the rocks determined by the geological history of the region, has been crucial for its economy. The Marl or marlstone is the main compound of rocks, divided into clay marl, marl, and calcareous marl. In particular, the calcareous marl made possible the excavation of the so-called infernot. From the point of view of the agriculture, we can say that in general, clayish, fertile soils give robust red wines and the marllstones are perfect for the cultivation of Nebbiolo vines. Moreover, depending on how much clay or limestone is contained in the rocks they were used to produce lime or cement. The presence of quarries for the extraction of rock material permitted also the development of the infamous "Eternit" technology, consisting in the combination of cement and asbestos fibers together to create slabs; this technology was mainly used for roofing. The most important factory was in Casale Monferrato.

Pietra da Cantone casalese
The "Pietra da Cantone Casalese", it's a calcareous marlstone, thin, soft and crumbly. Its origins date back to about 18-14 million years ago and its formation derives from the sediments deposited on the sea floor that occupied the Monferrato: it is not difficult to find marine fossils inside the blocks used in the construction of houses. Many quarries were opened since this stone was the most important building material for centuries.

The Infernot
The piedmontese word "infernot" can be associated to the ancient provencal "enfernet", defining a narrow prison, and afterward applied to a tight, underground space, supplementary to the main building of a winery.

The infernot is an accessory space of the winery really useful to keep and preserve the

Scheme of the stone types



wine after the bottling. It usually consists of a little chamber carved out under the ground, without direct light and ventilation, located next to or under the winery, and connected to it directly.

The territory of Monferrato Casalese is connoted (as previously mentioned) by its geological history. We can ascertain the presence of rocks dating back to the Miocene period; among them we find the "pietra da cantoni", a rock whose origin can be traced back to ancient sedimentary deposits typical of shallow marine environments. This type of sandstone is the most suitable for excavation and easy to work: since it ensures constant climate and humidity, it's also perfect to keep cool the bottled wine.

The buildings known as infernòt are intimately linked to the centuries-old history of winemaking in Piedmont and therefore appear under the hills of this region, intensively cultivated with vines. Although not exclusive, the Basso Monferrato Casalese is the area where most of these structures have been discovered. In fact it is not unusual for people living here to own a infernot, excavated under their own dwellings.
Recently, the "Monferrato of infernot" became part of the UNESCO World Heritage list.

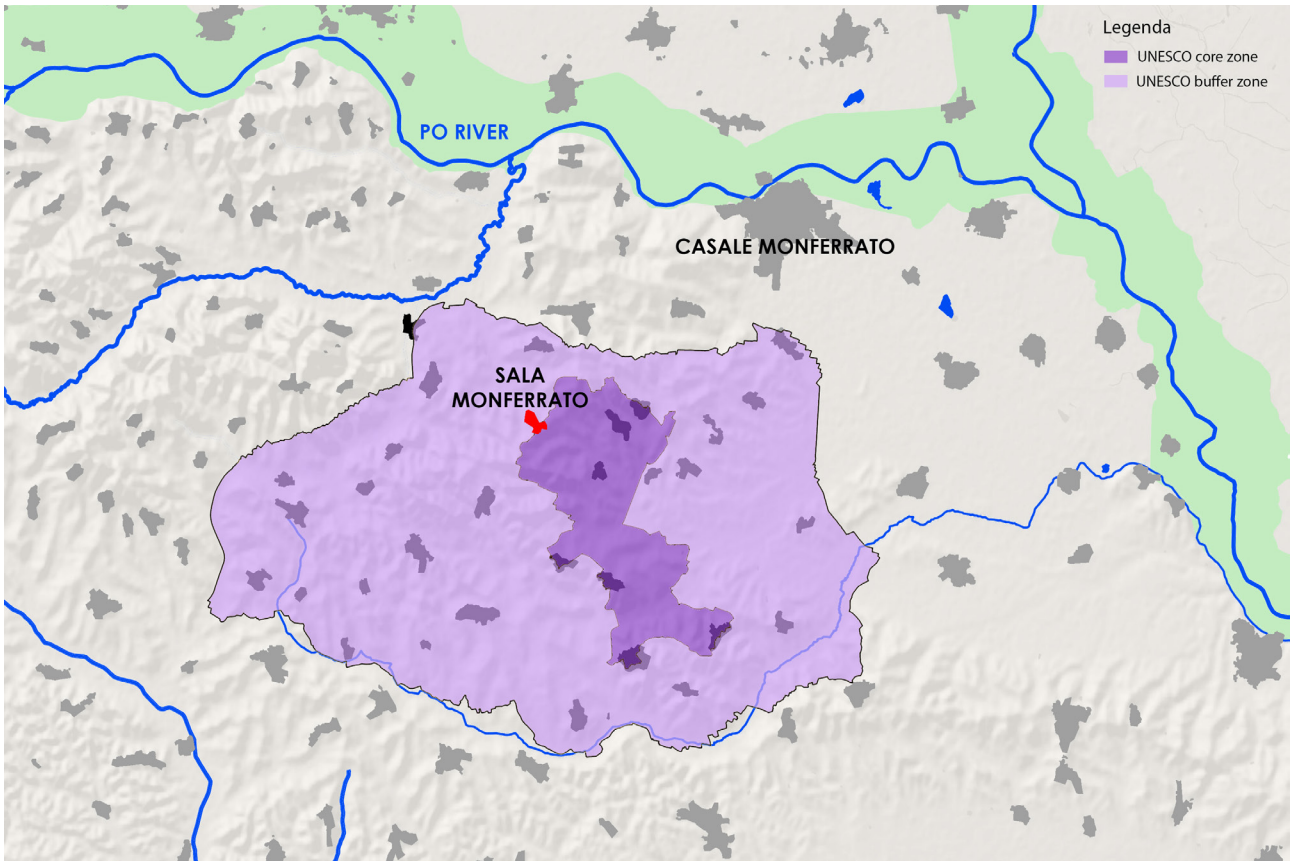
Asbestos in Piemonte

The production of Eternit components flourished throughout Italy in the first half of the 20th century. Piedmont had many factories working, the most important in Casale Monferrato, which was the biggest of Europe in the 60s. The closure of this factory, due to bankrupt occurred in 1986. Eternit was developed and then used for its good characteristics of resistence and durability. Its usages comprised roofing and realization of extruded components (tubular etc.). Since it was a compound of cement and asbestos, once deteriorated Eternit released fibers. As it later came out, those fibers are the cause of Asbestosis, a severe type of cancer.

For those reasons the national government issued some Legislative decrees:

- Ban on Eternit production (Decree of the Ministry nr. 257, year 1992)
- Mapping of the affected zones (Decree 18 March 2003, nr. 101).

Moreover the production plants were reclaimed.

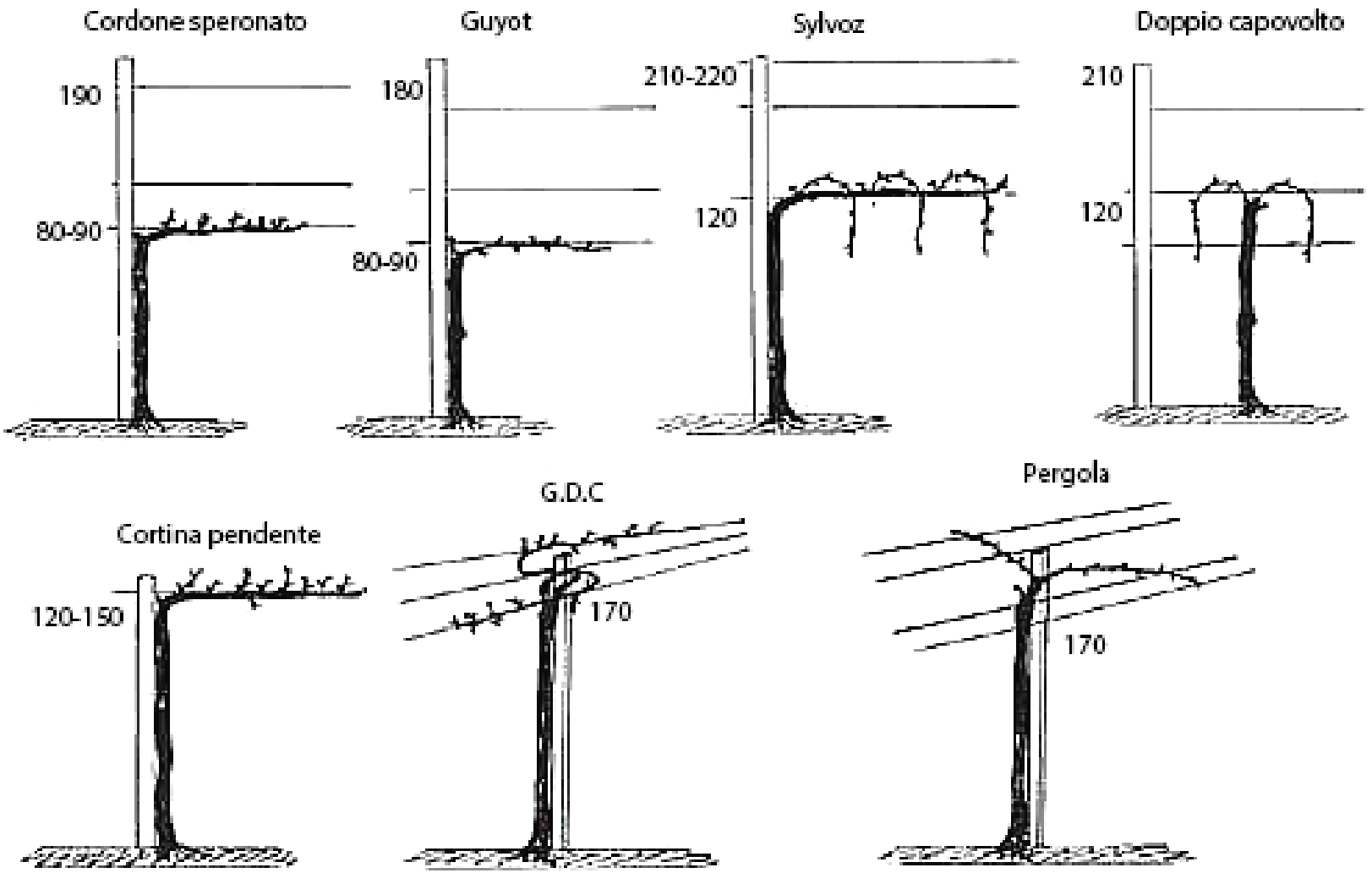


The UNESCO map “Monferrato of the infernot”: as you can see the town of Sala is part of the core zone

Viticulture

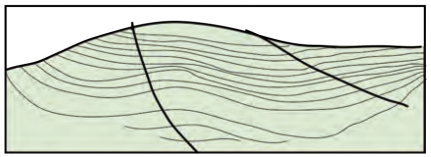
Forms of vine breeding

The history of vine cultivation is closely linked to the environment where it is present. The form of breeding is a technique that allows the adaptation of the plant to the aforementioned environment. It is fundamental to understand that the choice of a form of breeding do not rely only on the will of the farmer but more importantly on the climate, the soil, the type of final product and the local tradition. The form of breeding is an expression of the enological history of a territory, and the way how the winemakers have shaped the vine to make them produce better in that specific environment according to their needs. Italian viticulture is characterized by a remarkable variety of pedoclimatic environments, vines, grafts and local traditions that have contributed to the spread of numerous systems of breeding and pruning. The main systems are: Alberate, Alberello, Guyot, Capovolto o alla cappuccina, Cordone speronato, Sylvoz, Casarsa, Geneva Double Curtain (GDC), Cortina semplice, Pergola trentina, Tendone, Ray System or Bellussi. The method used by most farmers of the Monferrato area is the Guyot. On the next page there are some examples of those methods.

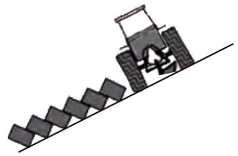

Cordone speronato
190
80-90
Guyot
180
80-90
Sylvoz
210-220
120
Doppio capovolto
210
120
Cortina pendente
120-150
G.D.C
170
Pergola
170

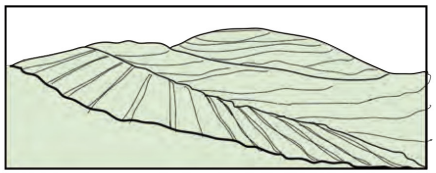
Schemes of vine cultivation

There are different ways to arrange the vine rows along the hill, for example: cavalcapoggio, giropoggio, rittochino, terracing and spina. These types have been developed over time to meet the needs dictated by the evolution of technologies and the characteristics of the terrain and the sunlight. In particular the scheme adopted in the Monferrato is the Cavalcapoggio, chosen by the farmers because it's considered the most suitable for the geological and morphological characteristics of the soil and the hill area around Sala. The layouts of the rows are explained by a diagram on the following page.

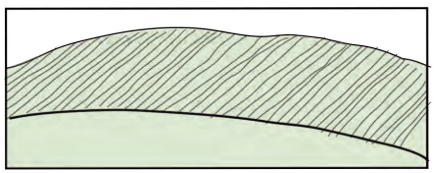


GIROPOGGIO
rows of vineyards planted
parallel to terrain contour lines

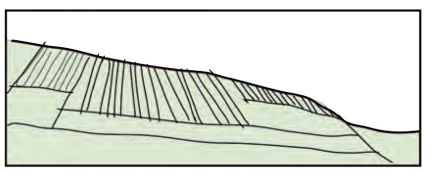




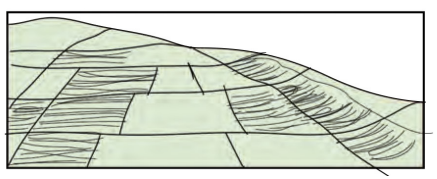
TERRACING
hilly terrain dug flat and bordered
by stone walls to make it cultivable



RITTOCHINO
rows of vines are perpendicular
to the contour lines to regulate
the flow of water and reduce
the risk of landslide



CAVALCAPOGGIO
rows of vines are flowing from
the hilltop to the two sides
with two different inclination
in the opposite direction.
This is possible on hills
that are not too steep



SPINA
the hill is divided in plots of land
with rows of vines parallel
to the contour lines of the terrain

Vine diseases

Historical introduction

Nowadays the Monferrato has suffered greatly from depopulation due to many factors like the splitting of agricultural funds, the abandonment of the countryside and some environmental criticalities existing in the territory. The biggest threat is now the flavescence dorée epidemic that came from France during the last decade of the XX century. However, flavescence dorée is just the last one in a long list of vine disease, developed over the last three centuries throughout the importation of plants and the action of wind and insects.

The first one was the Powdery mildew (Oidium Tuckeri) noticed for the first time in 1845 by an English gardener on a variety of grapevine imported from America. Shortly after, this mildew invaded the french vines and then the italian ones. Later on, sulfur was designated as the main method to contrast the disease.

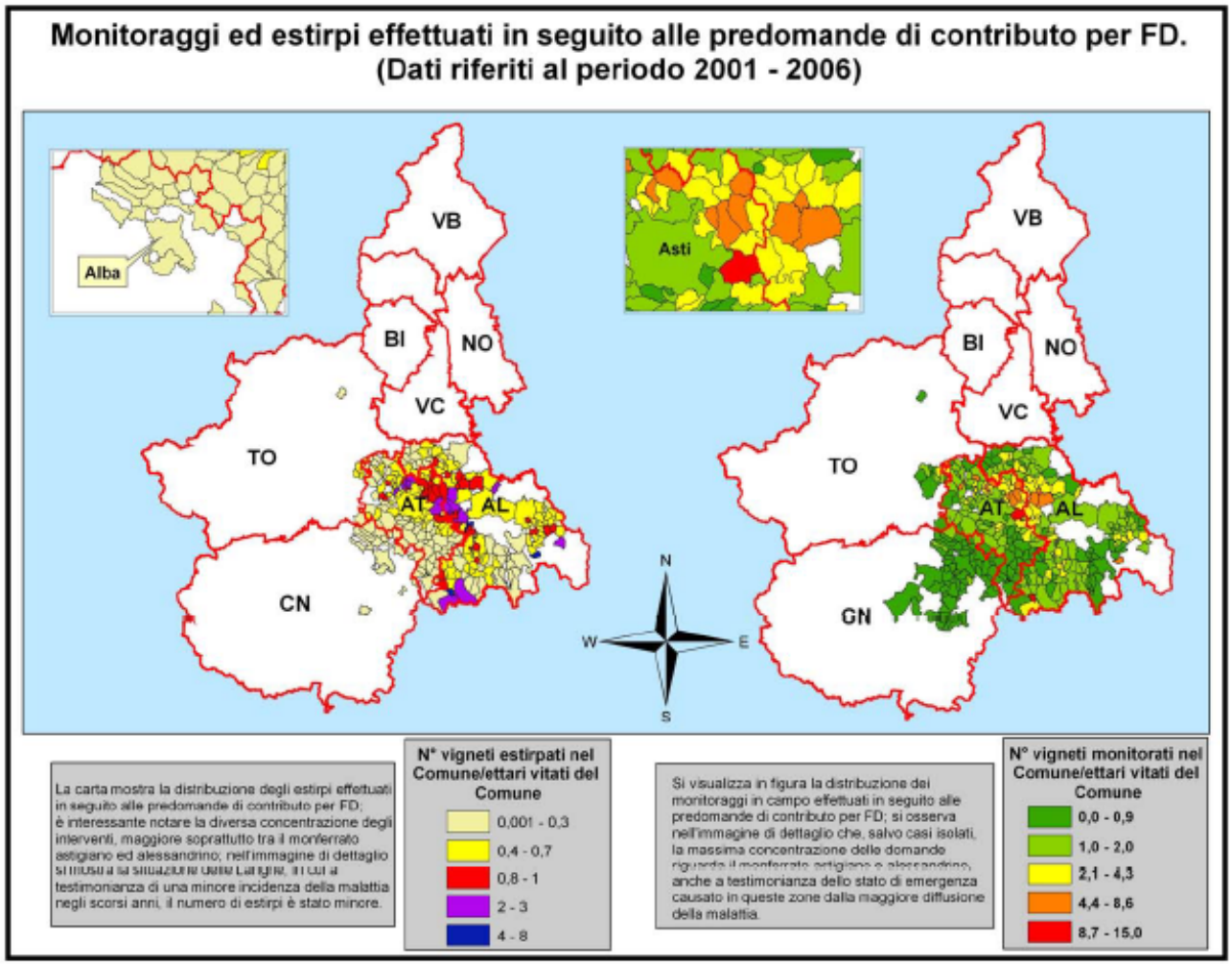
Almost in the same period the phylloxera was also striking. It was discovered in 1854 on the leaves of wild vines from North America. In Europe, the bugs were found for the first time in 1863 on leaves and roots of vines cultivated in the greenhouses of Hammersmith, London. Phylloxera was then observed in french vineyards between 1868 and 1869. Since 1879 outbreak of phylloxera strike for the first time in Italy. The grape-growers were conscious of the dimension of the threat they were facing, even the end of viticulture was possibly close. To constrast the insect, new and specific insecticides were developed.

Also, since the american varieties of grapevine are more resistant to phylloxera, farmers started to graft it with the local vines, so that they could better survive to the epidemic.

In 1880 downy mildew appeared in the vineyards of Piedmont. This type of mold, originally from North America, first appeared in France in 1879. The new disease, that was effective in Italy from 1884 - 1885, induced Experimental Stations, Agricultural Institutes, Phyto-Pathologists and Winemakers to study and experiment the possible remedies. Copper sulfate, lime and sulfur were the first cure available. Later on they developed actual formulas.

Flavescence dorée

Flavescence dorée (from French “Flavescence”: yellowing and “dorée”: golden) is a phytoplasma disease of the vine with the potential to threaten vineyards.

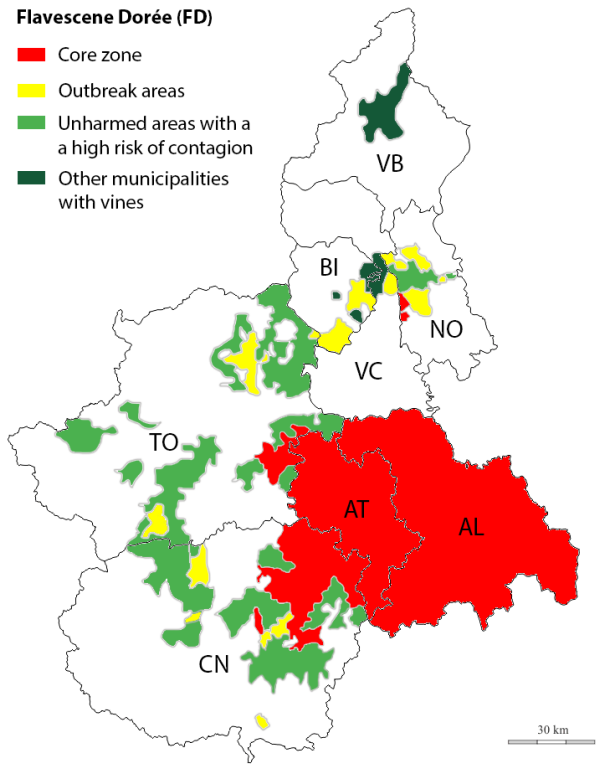


Monitoring and uprooting carried out after the pre-request of contribution for FD (data referred to the period 2001-2006)

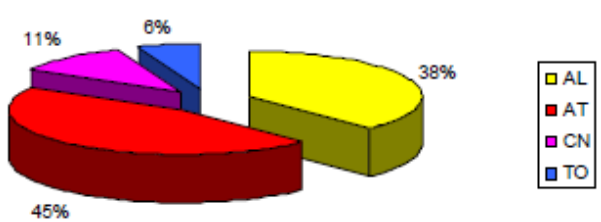
FD in Piemonte, spread of the disease.
Data by Regione Piemonte website: "Speciale flavescenza dorata della vite, 2008" (Special issue on FD, 2008)

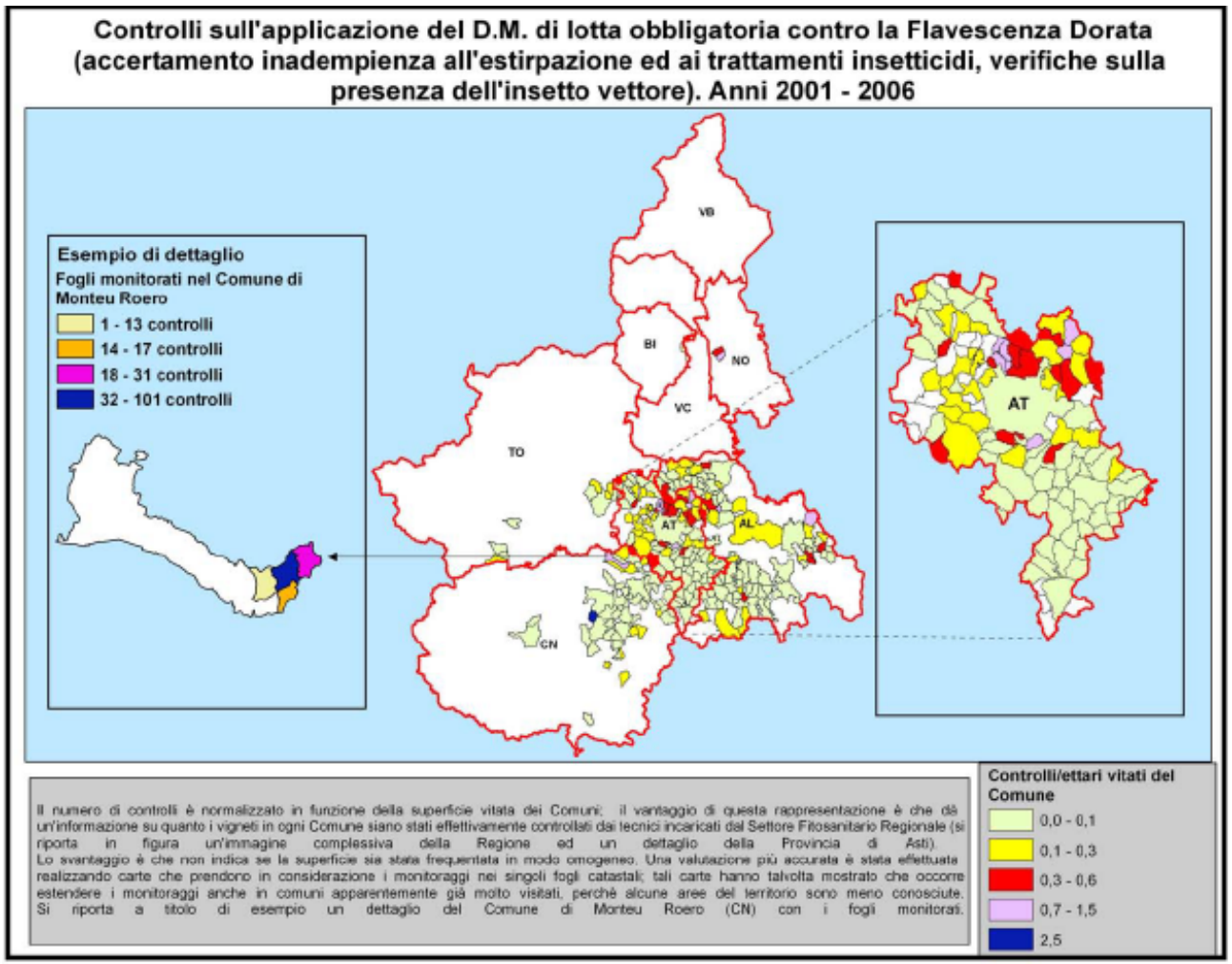
The name comes from the golden yellow color the leaves and the branches take once they are affected by the disease. Those symptoms are noticeable in summer from mid-August to mid-September. The disease itself didn't constitute a threat untill the second half of the XX century, when the leafhopper Scaphoideus titanus arrived in Europe from North America and became the main vector of the phytoplasma. The pathology had devastating effects on wine production, especially in the provinces of Alessandria, Asti and Cuneo, causing a reduction of the volume of wine produced. Since there is not a cure for it, the infected plants had to be eradicated to prevent the contagion. Recently, more and more effective drugs have been developed against the disease and even treatments suitable for organic farming are now available.
To counteract the spread of FD the national government issued a decree for the mandatory fight against the disease. (DM n° 32442 31 May 2000) where the guidelines to follow are fixed; in particular the fight against FD comprise:

- Quarantine
- Elimination of infected plants
- Elimination of the vector bug throughout specific insecticides
- Sterilization of nursery material



Weighted distribution of S.titanus captures (2005).
Data by Regione Piemonte website: "La flavescenza dorata in Piemonte, Indagini 2005 e 2006" (FD in Piemonte, 2005 & 2006 survey)





Controls on the application of the decree of obligatory fight against the Flavescence dorée (verification of non-compliance with uprooting and insecticide treatments, checks on the presence of the vector insect). Years 2001-2006

Other crops

Mulberry

Nowadays the 2 main varieties of this tree are cultivated in Europe:

- The black mulberry, originally from Eastern Europe; its cultivation spreads during the pre-roman epoch. It is cultivated for its dark edible fruits similar to blackberries.
- The white mulberry; originally from China where it was cultivated since 2.700 B.C. for its leaves, that are precious nourishment for the silkworms. It also produces edible fruits, but with a light color. It was introduced in Italy from the XV century, together with the silkworms, to produce silk.

Mulberry then became a significant crop in the whole area of Northern Italy and it was often cultivated together with vine. In fact the italian sentence "vite maritata al gelso" means that the mulberry was used to sustain the growth of the vine. This tree has great importance in the Monferrato because of its deep roots, that helps to stop landslides and hydrogeological instability. The territory is subject to this type of phenomena because of the geology of the terrain.

The mulberries of Monferrato are often pollarded (It.: capitozzati). Unfortunately this crop has been abandoned almost completely.

Hazel

The hazelnut tree is an autochthonous species known since the ancient times in Greece and Italy. The most ancient crops known are from Campania (an italian region), where this fruit was produced and traded in the whole Europe since the Middle Ages. In the 19th century, the confectionery industry started to develop in Italy and hazelnut became more and more popular in Piedmont. The main crops were located in the provinces of Asti, Cuneo and Alessandria. To cultivate hazelnut it is not necessary to have much sunlight; in fact this is a tree that usually grows wild in a natural habitat of wood. For this reason it was cultivated on the northern side of the hills, a soil that was otherwise unproductive, and used only for firewood. On the sunny side of the hill the main crop was of course the vine, which requires more sunlight. Because of the recent FD threat, unfortunately, many farmers decided to cultivate hazelnut also on the southern side.

The piedmontese hazelnut called "tonda gentile del Piemonte" is a fruit with an indication of protected origin (I.G.P).

Olive
Recent researches show that this is not something new in the region. To support this thesis there seems to be the toponyms of some places in Monferrato, such as the municipality of "Olivola". The olive grove was abandoned in the past after some incredibly cold winters that compromised the harvest. Recently, its cultivation has been recovered, also because of global warming.

Strawberries
Another fruit particularly popular nowadays is the strawberry. It is mostly cultivated in greenhouses and it became a nice occasion of tourism thanks to the "fruit picking" formula: people are paying a fixed price to harvest strawberries in a limited period of time. Then, the strawberries can be eaten. The phenomenon of "fruit picking" is taking hold in depressed agricultural areas also in Japan.

Peach
Other fruit trees are grown more and more often in Monferrato. Among these, the most important seems to be the peach tree.

The 2 varieties of Mulberry

Piemonte I.G.P. hazelnuts are widely used to produce Giandujotto, Nutella® and other confectionery original of Piemonte

Thanks to some daring farmers, olive cultivation has been re-introduced in the Monferrato area

Activities and functional areas

Reception and control
The incoming grapes are discharged and qualitative and quantitative control is carried out on it. The area for the reception is usually external, covered by a canopy with a height of about 4 m to allow the parking of vehicles, with a floor plan possibly raised in order to make the operations easier.

Crushing-de-stemming and pressing
The crushing and de-stemming operations are carried out with special machines, consisting of coaxial cylindrical rollers counter-rotating with a horizontal axis; they prevent the succession of the polyphenolic substances from the stalks from the must and also allow a soft pressing of the grapes. The choice of the working capacity of the machine depends on the quantity of grapes to be processed per day, depending on the quantity of grapes produced and purchased and the duration of the harvest. This operation can also take place in the reception area or in the boiler room. The separation between solid and liquid parts of grapes is carried out with the use of special presses. These can be continuous or discontinuous, mechanical, pneumatic or hydraulic.
Tumultuous fermentation
In the case of vinification in red, the primary fermentation in the presence of marc is followed by crushing, during which the sugars are transformed into alcohol, with abundant production of carbon dioxide. This process takes place in special tanks, winemakers and fermenters, usually made of stainless steel or fiberglass, whose capacity is commensurate with the quantity of grapes pressed daily (the yield of the grapes in must is 70-75%) and the duration of fermentation in the presence of marc. These plants, which are economically accessible, durable, light and have a high mechanical resistance, can be conditioned at the desired temperatures and allow to accurately control the conditions in which the fermentation process takes place respecting the organoleptic properties of the product. For operational needs and in order to allow the easy depletion of the marc, the fermenters are usually arranged in battery, so as to be able to alternate on them the operations of loading and unloading of the product. Tumultuous fermentation takes place in a special room called “tinaia”, where the temperature must be maintained at values between 18 and 20 ° C and the ventilation (natural or forced) must prevent the stagnation of the carbon

dioxide produced. The height of the room must be at least one meter higher than that of the tanks. Its surface will be calculated in relation to the number and size of the tanks, aligned at distances of about 50 cm from each other, of the other machines possibly housed and the spaces necessary for the movement of the workers.

Exhaustion of the marc

It is carried out mechanically with the use of continuous or discontinuous presses. The working capacity of the press must be such as to allow the complete exhaustion of the marc contained in the fermenter (30-40% of the content) during the working day. This operation is usually performed in the same vat.

Processing and storage

The subsequent wine maturation process takes place through further processing (slow fermentation, clarification, possible "cuts", filtration, decanting) and a stabilization phase, which can be followed by a period of aging. The storage rooms are sized according to the type and number of containers, the share of the product destined to aging and the duration of this. The most frequently used containers are fiberglass silos, or stainless steel and traditional wooden barrels. In the storage room it will also be necessary to provide auxiliary tanks for transfer and processing operations. The cellar must be kept at a constant temperature between 15 and 18 ° C, oriented with north exposure, well insulated and ventilated, and partially buried (if the morphological and permeability characteristics of the soil make it convenient). It can be sized to a first approximation by providing a volume of 0.4-0.6 m^3 / hl.

Bottling and storage

The bottling takes place with special filling machines (siphon, tap, vacuum), capping, sealing and labeling of the bottles. The most common bottling practices are:

- hot, past pasteurization
- cold, with sterile microfiltration or pasteurization (before filling and after packaging).

The working capacity should be calculated considering, on the total production, of the processing waste by 5-10% The storage of the bottled product takes place in a special room having characteristics similar to those required for the cellar. In the same local or special room, however, live and the waste quality of 10-20%. The storage of the bottled product takes place in a special room with characteristics similar to those required for the cellar. In the same room or in a special room, howe-

On the opposite page: red wine production scheme. The scheme is divided into two parts because it shows the procedure to be followed for the new wine on the right, and for the aged wine on the left.

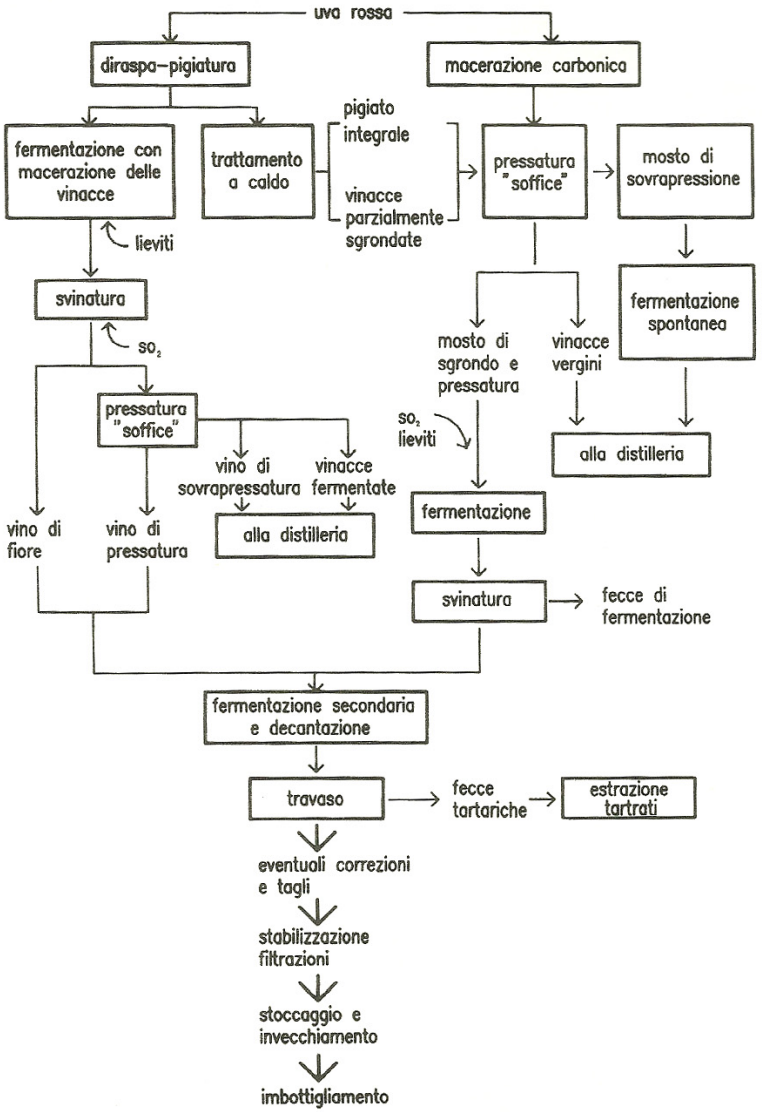
ver in direct communication with the bottling area, empty spaces can be stored. storage rooms must allow easy access from inside to outside and adequate dehumidification, as well as the processing rooms; the latter must have tiled walls up to two meters in height or treated with washable paints to prevent the development of molds. They must also be made with industrial flooring with a slope of at least 1%.

Accessory spaces

Other ancillary rooms, such as offices, changing rooms and toilets for staff, laboratories for oenological and chemical analysis, mechanical workshop for repairs, warehouses for oenological products and sanitizing, must be provided in relation to the size of the company and the number of employees.[1]

1 Translated from "Manuale di progettazione edilizia" Book 1, Vol.1, page 516-517, Franco Zaffagnini, Ulrico Hoepli editore, Milano (Italy), 1992

Production of aged wine



Production of new wine

Designed spaces

Weighting place
It must be positioned before the grape supply area, to allow the tractors to load the weighbridge at full load with a route as short as possible.

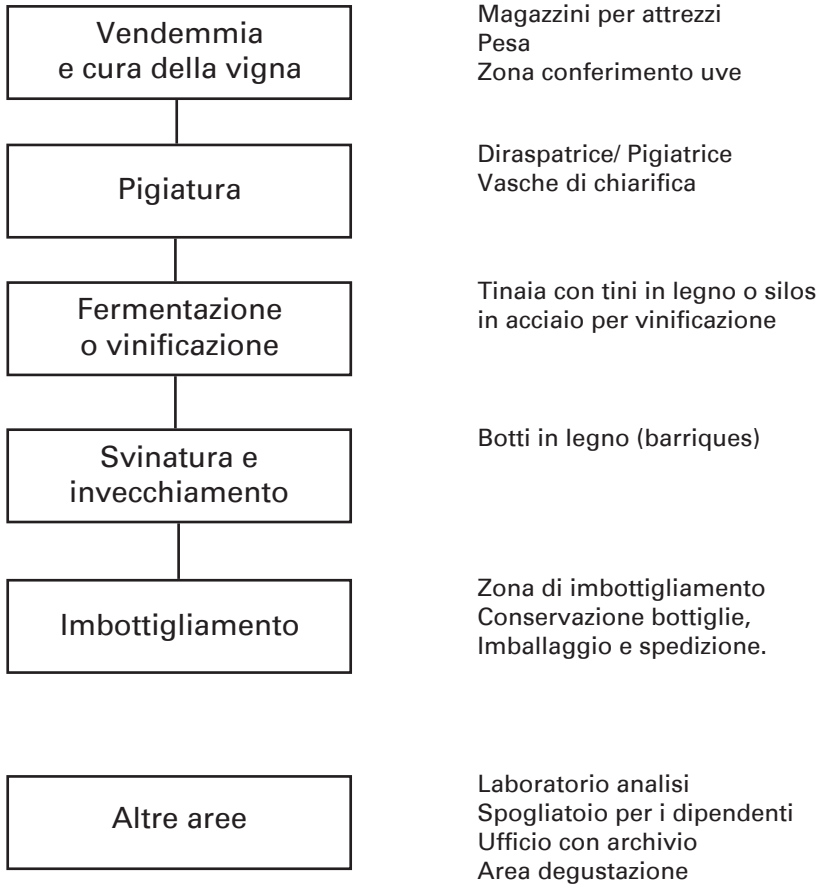
Grape conferment area
The grapes are delivered to the winery using tractors. In addition, the area must be placed between the weighbridge and the tinaia, to ensure smoother operations.

Destemming-crushing & clarification tanks
These machines must be placed in the area of conferment, to facilitate the first transformation of the grapes. The destemming-crushing machines make possible to crush the grapes separating it from the stem, which if crushed would release substances that could compromise the quality of the wine. The quality of this machine is evaluated according to the quantity of stem fragments present in the must, integrity of expelled stems, elimination of shoots, leaves and other elements.
This first part of the process is composed of the following components:

- roller destemming
- horizontal press (crushing)
- dynamic draining
- clarification tanks

Tinaia
This area contains wooden vats or steel silos suitable for vinification. The first fermentation of the wine takes place in these containers. It must be located immediately after the must collection tanks, to facilitate the transfer of the must into the silos. The silos can be placed on the same level of the must and be poured by means of pumps, or located at a lower level and allowing the transfer by gravity. The floor must be easily cleanable and washable from any liquid or solid residues produced. In the case in question it is at a lower level, reachable through internal stairs to the building. This allows the transfer by gravity and therefore a saving of electricity with a consequent positive turn-around from the ecological point of view.

Barricaia
The wooden barrels (barriques) are located in a room adjacent to the tinaia. Immediately after the vinification, in fact, the fermented must is poured into the barrels to be transformed into wine. During this operation there is



The scheme shows the different moments of the production and the resulting spaces

a further purification of the liquid, from which any residues are removed. The barrels are racked to a lower level than the silos, which is why the silos are raised above the barrels. The barrel room is a closed room, where it is necessary to avoid:

- Direct lighting
- Sources of noise or vibration

Furthermore it must have:

- constant temperature
- constant humidity

This place can be reached from the inside, where it is easily reachable, or from the outside thanks to the slopes of the hilly ground. The barrels are housed in overlapping rows on wooden supports.

Bottling area

The bottling area is adjacent to the barrel room and has 3 main processing steps:

- transfer of wine into the bottles (isobaric filler)
- capping of the bottle with cork (capping machine).
- labeling (labeling machine)

The bottling machines can be manual or automatic, equipped with a conveyor belt.

Bottle storage area

As the barrel cellar must be characterized by absence of light and noise and constant temperature and humidity. The bottles must be placed horizontally in order to guarantee the right thermo-hygrometric characteristics. It can be reached from the barrel cellar or through an external path, taking advantage of the natural slopes of the hilly terrain.

Warehouses for tools

They must be positioned in such a way as to be easily reachable by the laborers directly from the outside.

Garages for agricultural vehicles

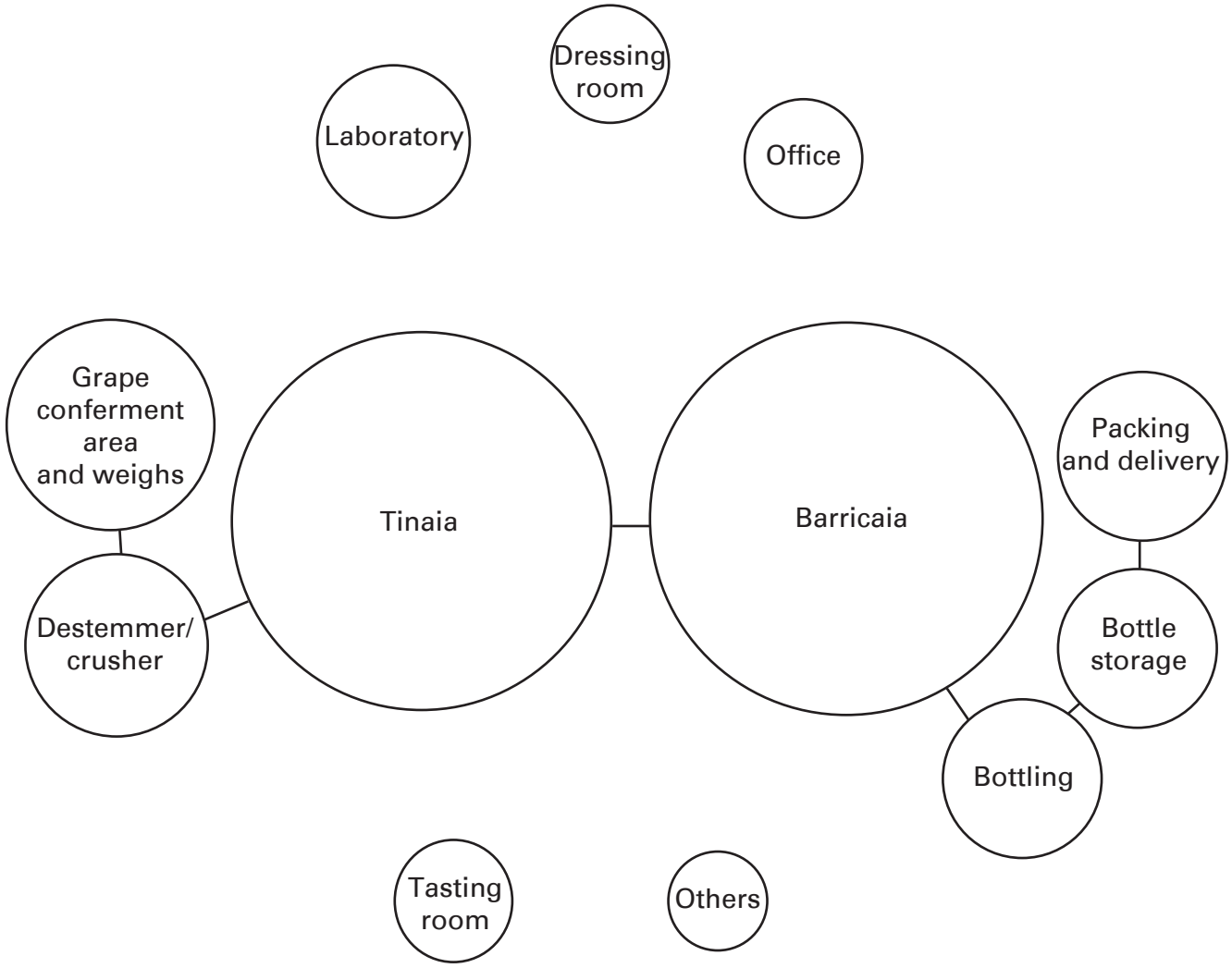
A garage is provided to repair the tractors from the weather. It must be separated from the wine production functions.

Laboratory

The laboratory is a space necessary for the quality control and the organoleptic qualities of the wine. In it is also integrated a space for the study of vine diseases the collection of data related to them.

Dressing room for employees

The production must be completed in compliance with the health and hygiene stan-


Dressing room
Laboratory
Office
Grape conferment area and weighs
Tinaia
Barricaia
Packing and delivery
Destemmer/ crusher
Bottle storage
Bottling
Tasting room
Others

dards. For this reason a changing room was provided for the employees involved in the processing of the product.

Office
It is considered necessary to include an office where the owner can receive his clients to entertain business relationships. The office will also include a small archive concerning sales volumes and earnings year by year.

Wine tasting area
According to a well-established scheme, the owner of the agricultural fund often has a wine tasting area inside his own cellar. This reinforces the company's image and gives a certain boost to wine tourism. This is important to publicize its activity and it could also give a new impetus to the area, already recognized as a UNESCO heritage for its "viticultural landscapes".

Technical rooms for plant system
Finally, there are technical rooms for plants:
- electric plant
- water suply
- lighting plant
- conditioning
- wastewater disposal
- vertical connection (stairs, elevators)

Accessibility
The entire building must be easily accessible to disabled people, in compliance with the relevant national regulations. A toilet complying with this legislation is also planned.

Fire proof
The building will not be equipped with a centralized system, but safety devices such as fire extinguishers are provided.

The cellar

Building site

After a long quest we finally found a suitable place for the project of the winery complex. It is a plot of land located in the municipality of Sala Monferrato, property of Mr. Carelli Silvio. The land plot is situated on a slope overgrown by years of abandonment after the extirpation of the pre-existing vineyard, which was necessary as a measure to contrast flavescence dorée. Nearby we find the old Cascina Carelli (now named Cascina San Gregorio) and a little votive chapel dedicated to San Gregorio. The lot is on the north-east side of the hill, overlooking the valley.

The use of this site for the winery building will bring benefits to the viticolture of Sala, as cutting and mowing of wild woods and uncultivated areas will help to reduce the number of S.titanus. In fact they find their ideal habitat in the woods, especially in the presence of ailanthus plants, where they can escape from the insecticide treatments and lay their eggs undisturbed. By eliminating the ailanthus (which is an allochthonous plant) and the thicket in general, their number will also decrease considerably (as it has been proven in Franciacorta were the same strategy has already been applied).

The choice of the site was also influenced by the will to produce wine in a sustainable way. Nowadays, many wineries follow a production process that take advantage of the gravity force. Since most of the wines are produced in hill areas, the conformation of the terrain made it possible to make use of it. This method rely on the conferment of the grapes in the cellar in the highest level, hence they will undergo the necessary transformations passing through tanks and barrels placed at different altimetric levels and without using pumps or machinery, which would consume energy unnecessarily. Finally the wine will be bottled, packed and then stored in the warehouse.

Building dimensioning

Since our target was to create a winery that could be competitive on the market, we came to the conclusion that it is necessary to have an initial extension of land of at least 10 ha which is actually possible for our customer. The extension of 10 ha is also comparable the dimension of the kingston winery's vineyards (taken as an architectural reference).

The chosen lot, located in the municipality of Sala Monferrato

A previous research[1] carried out at the Faculty of Agriculture of the University of Milan, shows that for an area of 25 hectares cultivated with vines, there was a yield (for that type of wine) that led to the production of about 200,000 bottles a year. For comparison we could calculate the yield of the fields in Sala Monferrato. The winery will produce Monferrato Nebbiolo D.O.C. and Monferrato Nebbiolo Superiore D.O.C.. It has has been demonstrated[2] that the Nebbiolo vine has the highest resistance to flavescence dorée. Nebbiolo is a high quality wine produced only in the region. Those crops have an average productivity of about 90 q per hectare[3] therefore:

$$90q \times 10ha = 900q$$

Since the 70% of the weight of harvested grapes will actually be transformed into wine we can say that:

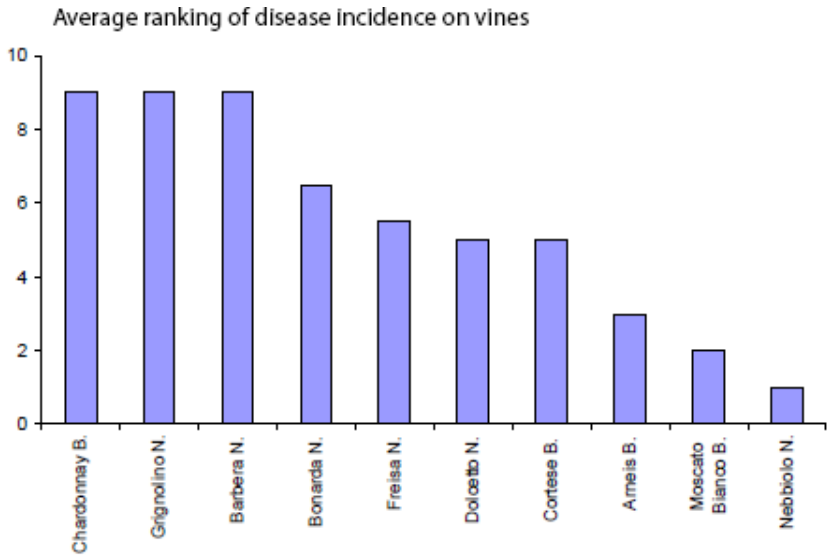
$$(900q / 100) \times 70 = 630q$$

The usual bottles of wine have a standard volume of 0,75cl, thus, if we consider that the specific weight of wine is not so different from that of water we can assert that:

$$630q = 63.000kg \approx 63.000L$$
$$63.000L / 0,75L = 84.000 \text{ bottles}$$

So this is the approximate number of bottles produced in the winery. According to the cited research, we can calculate the dimension of the winery building. We can state that the production building will have a surface extension of about 800 m^2.

1 Progetto di una cantina sita in Franciacorta, Azienda agricola "I due calici" di Carelli Alice e Colli Camilla
2 Regione Piemonte, Assessorato Agricoltura, Direzione Regionale Sviluppo dell'Agricoltura Settore Fitosanitario, "La flavescenza dorata in Piemonte indagini 2005 e 2006"
3 "Disciplinare Nebbiolo D.O.C." http://www.vinacciolo.it/viewPage.asp?rif=97



Average ranking of disease incidence on vines.
Data by Regione Piemonte website: "La Flavescenza dorata in Piemonte, Indagini 2005 e 2006" (FD in Piemonte, 2005 & 2006 survey)

Average incidence of disease and affected surface per vine

Vine	Average incidence of the disease	Affected surf./vine surf.	Incidence Ranking	Diffusion Ranking	Average Ranking
Chardonnay B.	0,17	0,1065	9	9	9
Grignolino N.	0,16	0,1955	8	10	9
Barbera N.	0,20	0,1006	10	8	9
Bonarda N.	0,15	0,0712	7	6	6,5
Freisa N.	0,14	0,0857	4	7	5,5
Dolcetto N.	0,15	0,0370	6	4	5
Cortese B.	0,14	0,0589	5	5	5
Arneis B.	0,13	0,0255	3	3	3
Moscato Bianco B.	0,12	0,0225	2	2	2
Nebbiolo N.	0,09	0,0032	1	1	1

Average incidence of disease and affected surface per vine.
Data by Regione Piemonte website: "La Flavescenza dorata in Piemonte, Indagini 2005 e 2006" (FD in Piemonte, 2005 & 2006 survey)

Project references

La sapienza è figliola dell'esperienza.
(Leonardo Da Vinci)

Kingston winery, Sabbagh & Cardemill

On the next page: photo of the interior of the kingston winery

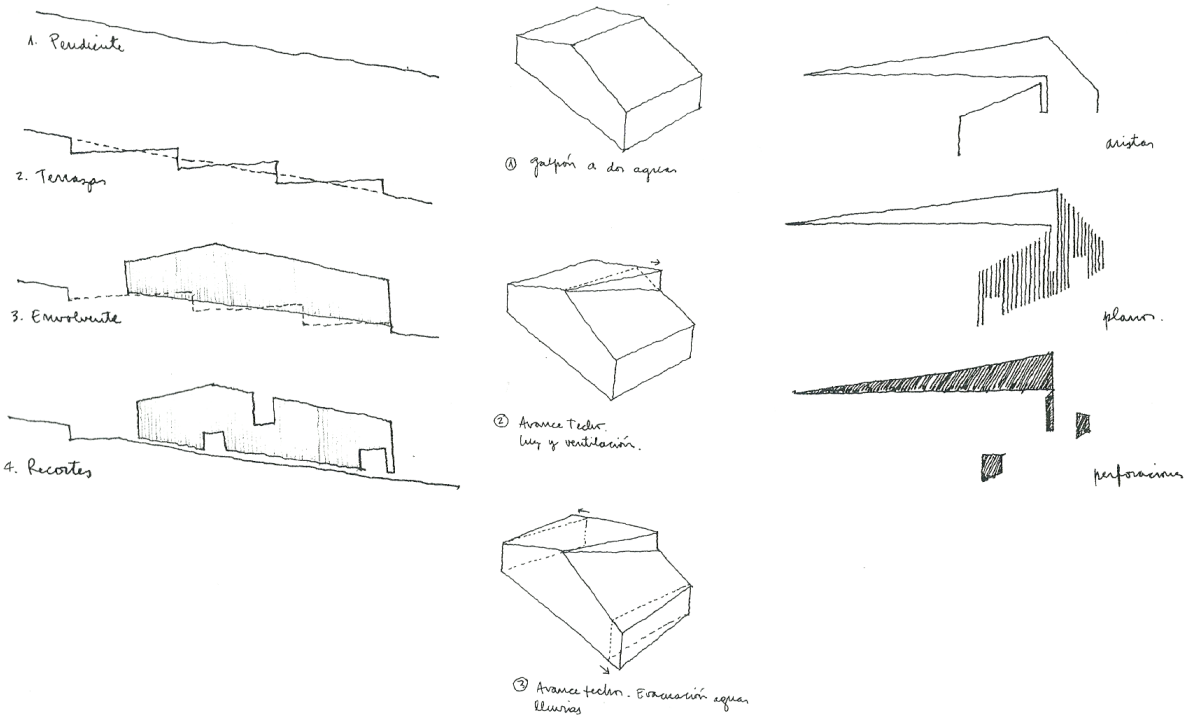
In 2005 the Chilean architects Gonzalo Cardemil and Juan Carlos Sabbagh were asked to design a winery for the wine company Kingston. The winery is located in Fundo Santa Rita, north of Casablanca Valley and is renowned for the production of the best chilean wines.

The architects took into consideration the possibility of an expansion of the company business of about 3 times the actual size. For this purpose they hypothesize the expansion as a complex of new buildings, connected to each other like a citadel. This approach allows the construction of finished buildings and, at the same time makes it easier to plan an expansion without any restriction of space, technique or tecnhology.

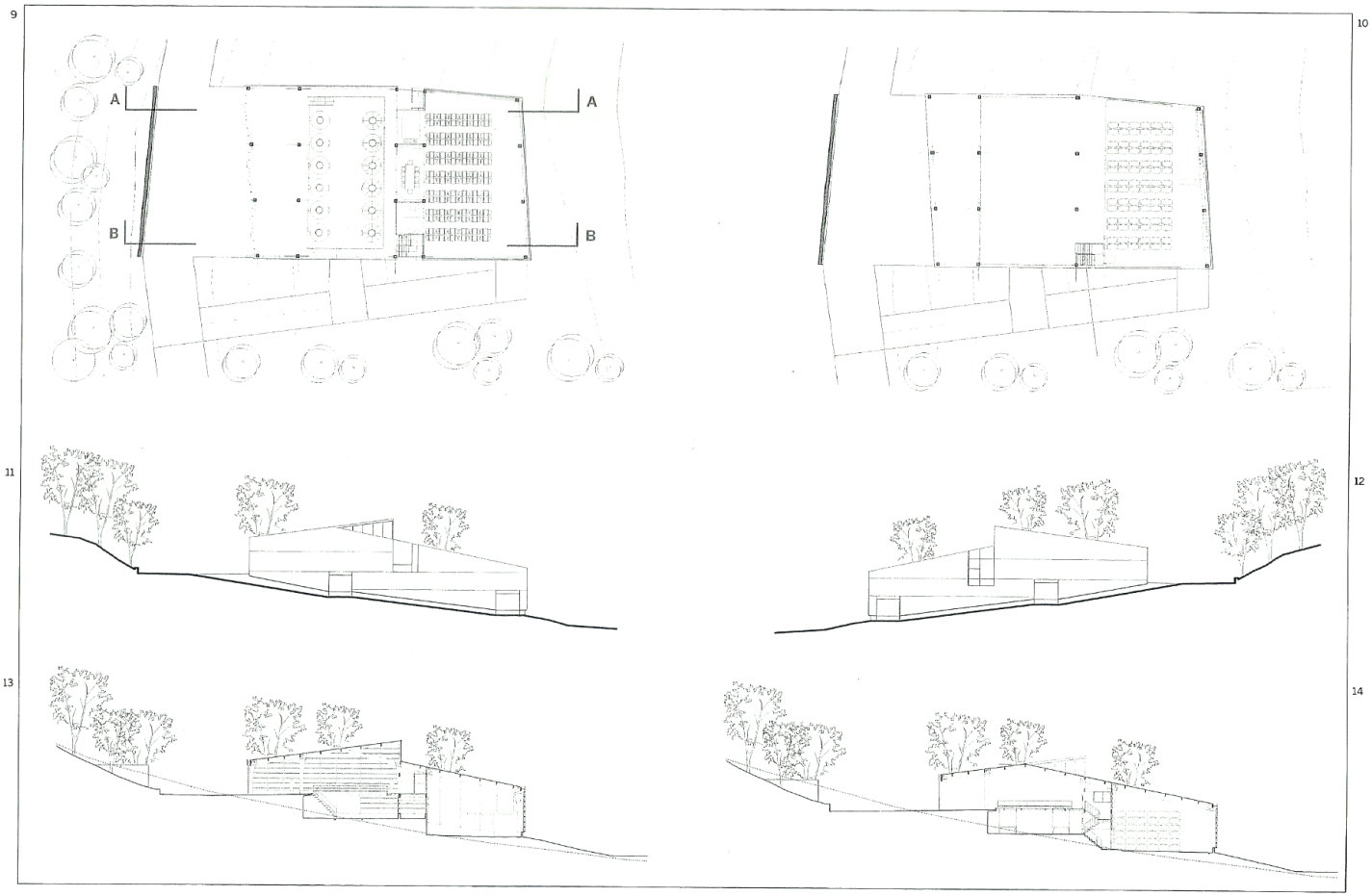
The orography of the site is an aid to the production itself, in fact the building is using the different altitudes for different purposes in the production process. We can say that the various phases follow the gravity force. Moreover the winery is visually dominating the vines from the hill and it is easily recognisable from the distance.

Like many rural buildings in the area, the winery is designed as a timber structure that lays on a reinforced concrete basement. The basement is adapting to the orography of the terrain and it identifies three different levels, each characterized by a different phase of the productive process. The original shape is designed from the starting point of a simple geometry, then modified to illuminate the interiors with natural light, but without letting in the summer heat.

Sketches of the shape
from Casabella, vol. 771
(pp.58-61) November 2008,
Arnoldo Mondadori Editore,
Italy



Onn the next page:
Floor plans, facades, and
sections
from Casabella, vol. 771 -
pp.58-61 November 2008,
Arnoldo Mondadori Editore,
Italy


9
10
A
A
B
B
11
12
13
14
0 5 10m

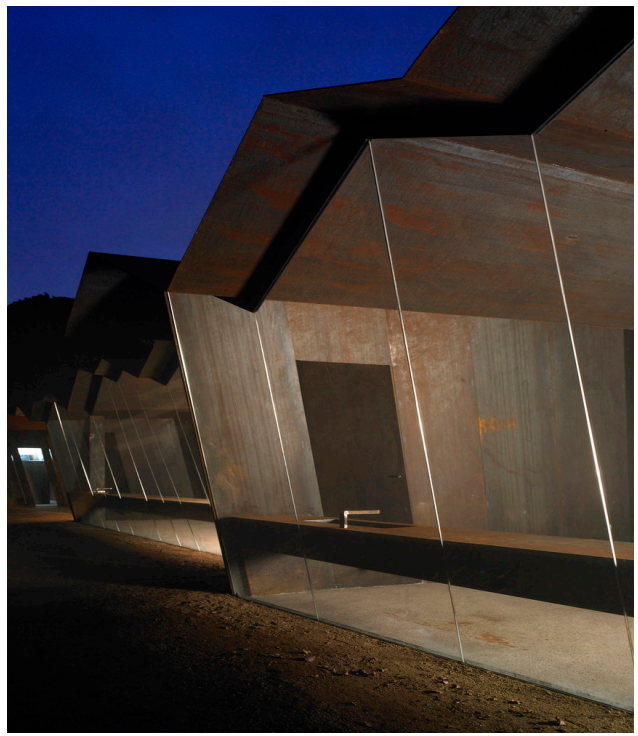
Bell-Loc winery, RCR Architects

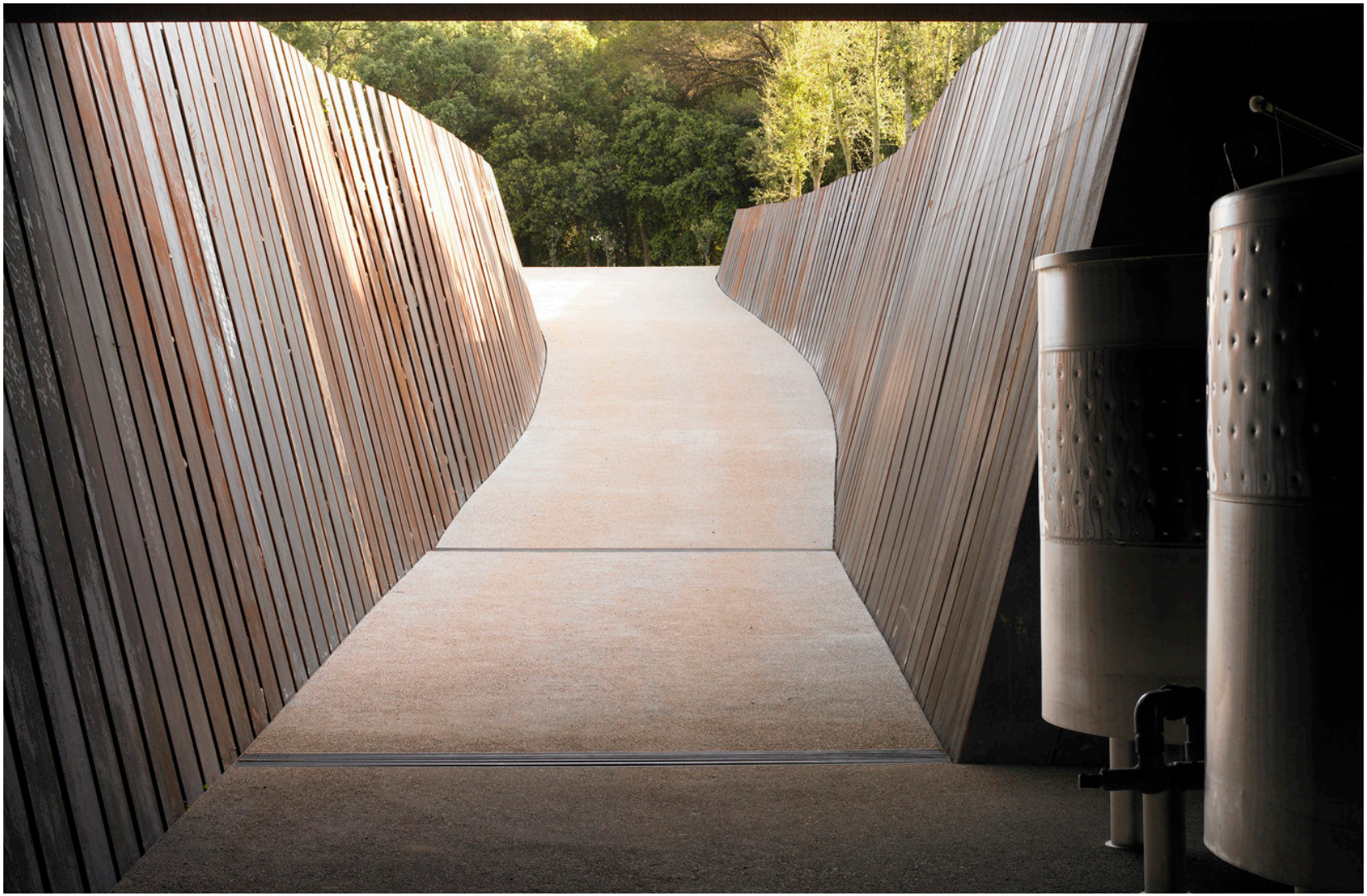
Between the Pyrenees and the mediterranean sea, at the foot of a hill there rise the winery for the company Brugarol, in an area which is close to the exploited and turistic coast of the Costa Brava.

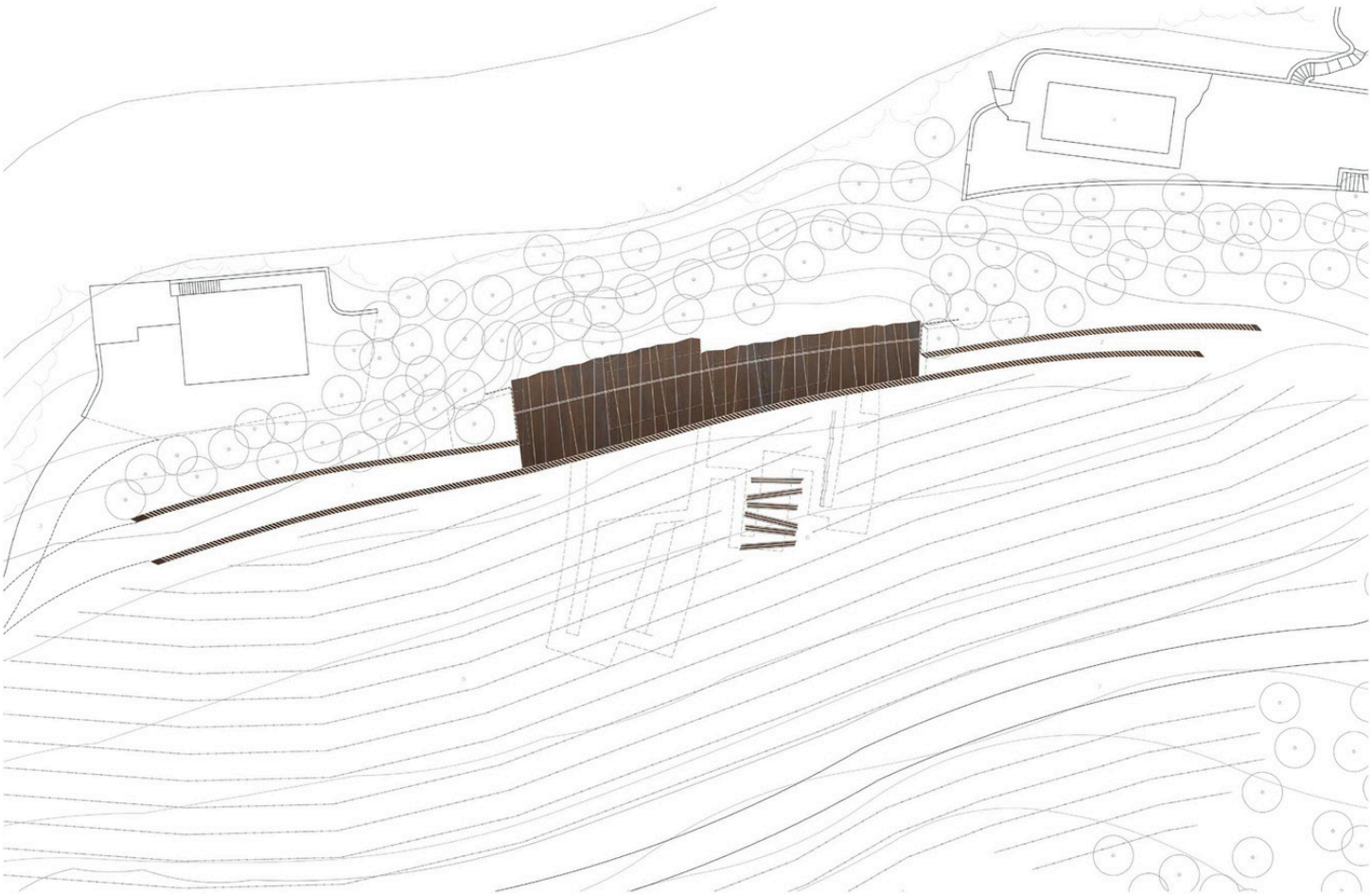
The architects were searching for a deeper connection between the winery and the surronding lanscape. In fact, even if the production is underground and run by the principle of gravity, the production area connects naturally with the wine tasting area and with the landscape.

Thus, everything is happening at the same level below the vine. Corten plates of 35 cm large cut the ground at the entrance and continue in the whole structure, which is conceived as a "promenade" with a central corridor and many rooms on each side. A few spaces have natural illumination: the bottling area and the nearby laboratory are facing an internal court, while the wine tasting hall has skylights on the ceiling, visible in the vine's terrain.

Reporting the words of the Architects:"The inertia of this excavated environment is used to avoid energy consumption in its environmental qualities, whose singular perception is the result of its spatial geometry and materials, steel and stones, that surround you in an underground world, cool, isolated, where you can feel and taste a different tempo."

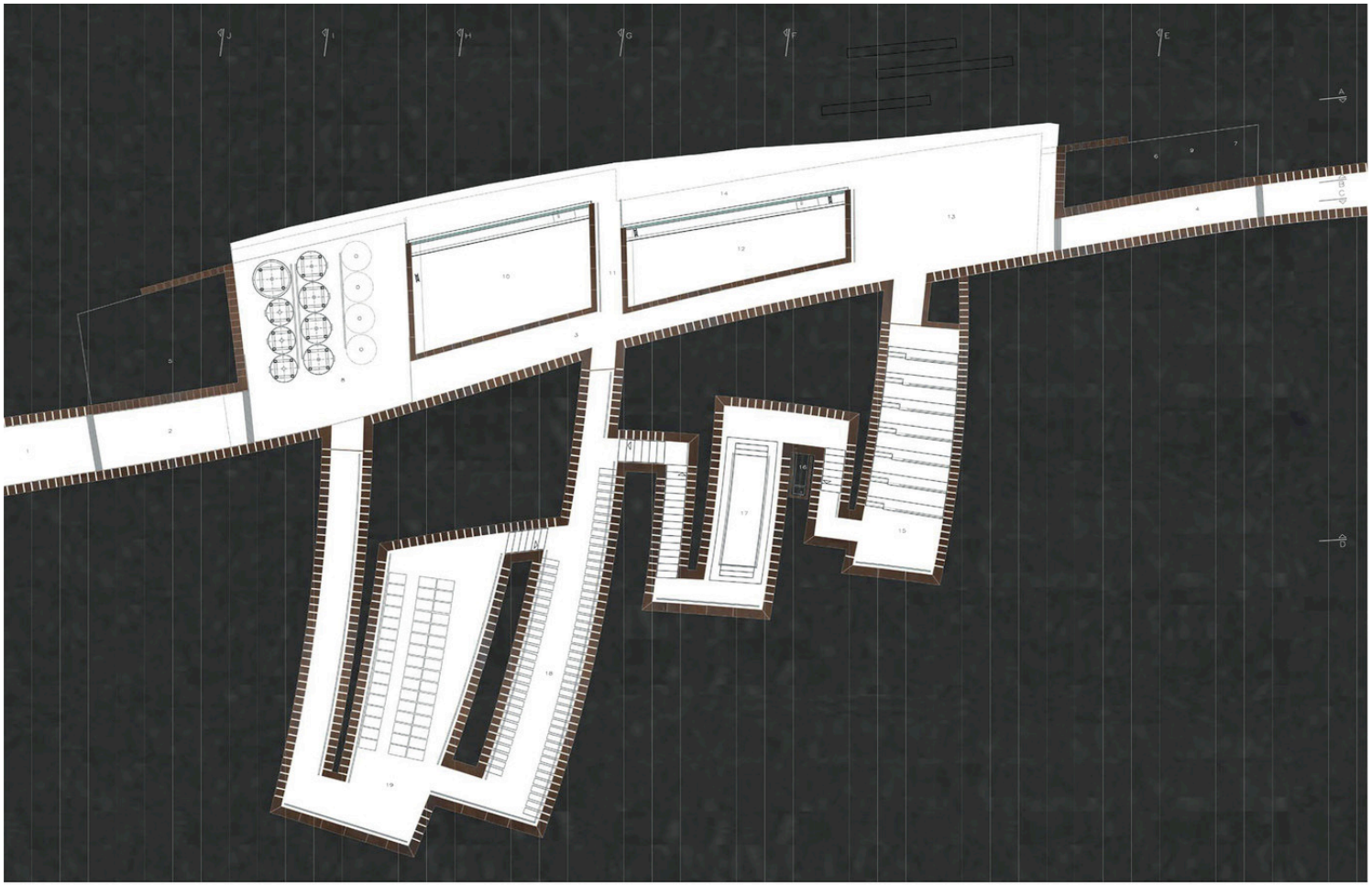






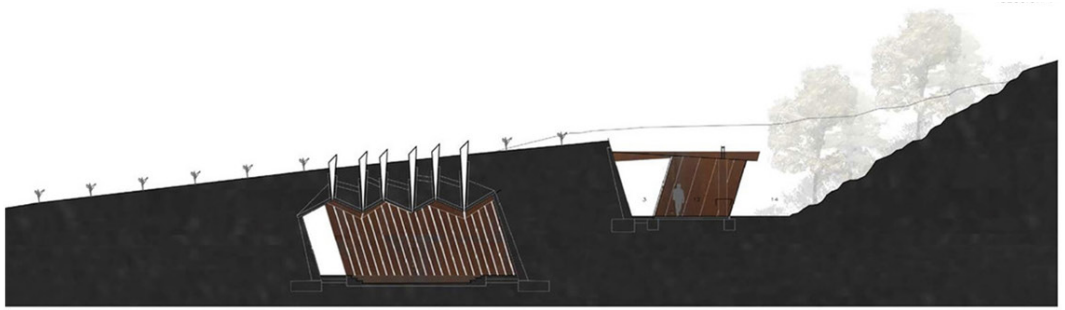
1.RAMPA ACCESO TRACTOR 2.RAMPA ACCESO PEATONAL 3.ÁREA DE MANIOBRA 4.EDIFICACIÓN EXISTENTE 5. ZONA CULTIVO 6.LUCERNARIO 7.CAMINO INTERNO 8.BOSQUE 9.CUBIERTA DE LAS CAVAS

PLANTA CUBIERTA 0 10m

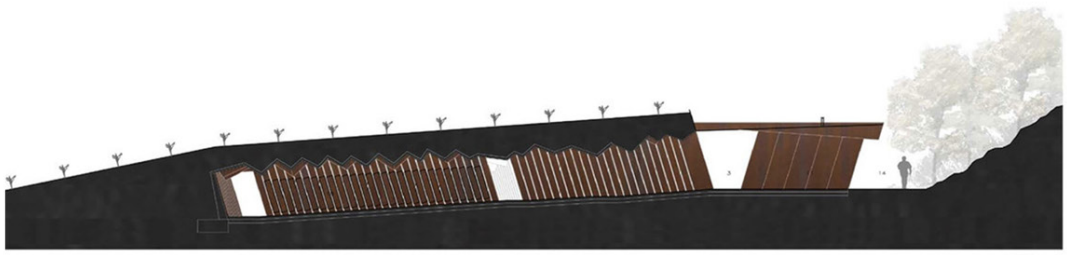


1.RAMPA ACCESO TRACTOR 2.AREA DE DESCARGA Y TRABAJO INICIALES 3.PASO COMUNICACIÓN INTERIOR 4.RAMPA ACCESO PEATONAL 5.ALMACÉN MÁQUINAS, EMBALAJES E INSTALACIONES 6.WC 7.SALA INSTALACIONES 8.SALA DE FERMENTACIÓN 9.VESTIDORES 10.LABORATORIO Y LINEA DE FRACCIONAMIENTO, EMBOTELLADO Y ETIQUETAJE
11.ESPACIO DE LUZ-VENTILACIÓN 12.TALLER DE TRABAJO 13.PORCHE, ACTIVIDADES VARIAS 14.ESPACIO EXTERIOR 15.AUDITORIO-SALA POLIVALENTE 16.ALMACEN 17.SALA DE CATAS 18.CAVA DE BOTELLAS 19.CAVA DE BOTAS

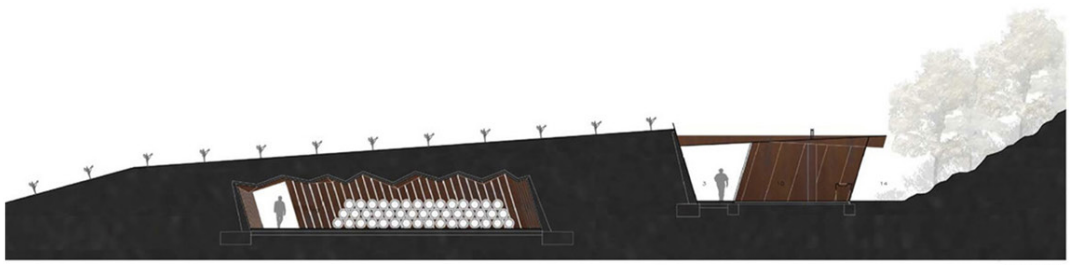
PLANTA 0 5m



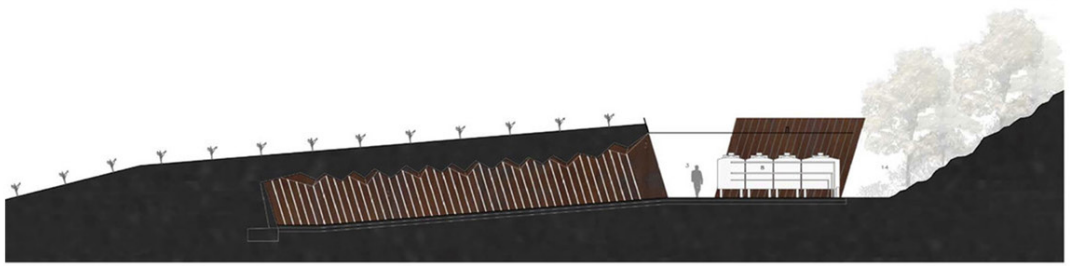
SECCIÓN G



SECCIÓN H



SECCIÓN I



SECCIÓN J

SECCIONES 0 5m

Materials

Sui monti ricchi di legno si costruirà col legno, sulle glabre montagne di pietra si costruirà in pietra; in alcuni luoghi sarà più economico il mattone, in altri il cemento. [...] Oggi c'è un errore assai diffuso tra coloro che credono feticisticamente che solo il cemento e il ferro siano dei materiali moderni.

(Adolf Loos)

Pietra da Cantone

On the next page:
an Infernot, excavated
inside the pietra da cantoni

A traditional material

The Pietra da Cantoni of Casale Monferrato (AL) had covered a great importance in the past from the constructive point of view due to the compactness of the marly-calcareous or siliceous-calcareous sandstones that make it up. Its origin is due to sedimentary marine deposits dating back to the Miocene, around 15 to 20 million years ago.

This material is known in the area also for the importance it has had in the Monferrato wine culture. Suitable for excavation as it is easy to work, ensures constant climate and humidity, perfect conditions for storing bottled wine. For these reasons it is the perfect material for the construction of spaces such as Infernot (see page 12).

La Pietra da Cantoni has been and remains the "ornamental" stone and building material that characterized the architecture of the buildings in the towns of the Casale Monferrato. After having been used before the year 1000 in the Cathedral of Casale and in other medieval buildings, Pietra da Cantoni was the protagonist, in a period between the 17th century and the first half of the last century, of an intense mining activity that guaranteed the production of building material (especially slabs and blocks). Even today it is an object of particular interest as an architectural material, especially for renovations of houses and farmhouses. Many buildings in Monferrato were built entirely in Cantons, and also in Turin you can find valuable monuments, such as the National Gallery, the Church of San Gaetano, etc., covered or built with the Pietra da Cantoni (PICCINI, 1999; TIMPANELLI , 2003).

The extracted sandstones have sometimes shown excellent refractory qualities, such as to be processed in large slabs used to cover the ovens, hence the name of "Pietra da Forno" which was attributed to them. For some decades the production of the Cantons of Monferrato has been interrupted because the construction typology has been replaced by new "modern" materials such as cement. Today the material is still used in limited quantities as raw material for the Casalese cement industry. The importance of the use of the Pietra da Cantoni as a building material is immediately evident along the inhabited areas of the Ghenza valley villages (Camagna, Cella Monte, Frassinello, Olivola, Ottiglio, Rosignano, Sala, Vignale), where in recent years there are numerous examples of building renovation and renovation of buildings, in which the

On the next page:
The Ecomuseo della Pietra da Cantone, in Cella Monte. After a restoration, the XVII century facade is back at its ancient splendour and the Pietra da Cantone is now visible again

Pietra da Cantoni, often plastered with lime, is combined with the use of bricks. For the protection and enhancement of the territory of origin of the Stone, economic activities, landscape resources, historical and architectural and related traditions, was established by resolution of the Regional Council of Regione Piemonte n. 284/10922 of April 1, 2003, the Ecomuseo della Pietra da Cantoni based in Cella Monte (AL).[1]

Valorization of pietra da cantoni

The Pietra da Cantoni, a building material object of flourishing mining activity until the first half of the twentieth century, widely used in traditional local construction, was extracted in many now abandoned quarries. In the last few years, it has been hypothesized a re-opening of the quarries to re-launch this material in the construction sector. However, this project requires careful prior assessment. In this regard the Ecomuseo della Pietra da Cantoni has therefore begun a study divided into 4 phases, some of which have already been completed:

- geological study of the territory.
- geomineral analysis of abandoned sites
- census of the realities still able to supply the raw material
- design of a quarry site for the limited production of stone blocks for local construction.

1 translated from the wesite of Pro loco Rosignano Monferrato: www.prolocorosignano.com

Wood

On the next page:
Sunny Hills at Minami Aoyama by Kengo Kuma, 2013

The italian tradition

In order to talk about the materials of architecture we must once again take up the topic of the geology and morphology of the places. In fact, if we look at the history of Architecture we realize that the most used materials in Italy (and in Europe in general) are bricks and concrete. This is because in the West, as in some areas of Asia (China, Thailand, etc.) these materials are the easiest to find. In mountainous areas of Italy (i.e.: Trentino) and in Northern European countries, where masonry works are more difficult to complete and the forests are more abundant, there is instead a greater presence of wooden architecture building. Up to now, in Italy there has always been the perception that masonry works are more resistant and durable. Unfortunately, recent experience has taught us that, on the contrary, there is no "eternal" material. The earthquakes of L'Aquila in 2009 and Amatrice in 2016 are only the latest in a long series. These catastrophic events made architects think about this issue giving them a different perception of what the architecture of the future should be. In addition, wood is used more and more often for its ability to be a sustainable material.

The japanese tradition

On the other hand we find Japan, where the earthquake standards are among the best in the world. In the country of the Rising Sun, a land of volcanic origin and mostly covered by mountains and forests, the masonry works were difficult to build and for this reason the wooden architecture was never a regional character or a type of niche construction. Even today, wood is one of the most used material in Japanese construction.
To explain the importance of timber structures I will cite the catalogue of the exhibition: "Japan in Architecture" held in 2018 at Mori Art Museum, Tokyo:
The Japanese archipelago has a hot and humid climate as well as abundant forests, that means wood can be procured from almost anywhere. Indeed long ago the Japanese took full advantage of these resources. Wood was cultivated on mountains in a sustainable way and then circulated to construction sites, where it was used to build things. Traditional Japanese architecture, the kigumi (木組み) *carpentry craft of interlocking joints, and the secret manuscripts of carpentry handed down between generations of artisans are surely a testament to this wood culture. [...]*

On the next page:
Coal house by Terunobu Fujimori, 2008

Unlike a culture centered on stone, which requires the concentration of various abilities for procuring and processing in small numbers of places, a wood-based culture means artisans equipped with the skills for designing and constructing are spread across the country. Timber can be acquired from different regions. It is also possible for a structure to be added to, repaired, and replaced. It might even be suggested that these techniques for wood construction, [...] have an affinity with the technology and other aspects of today's information society, where everything can be precisely controlled.

Japanese Carpentry

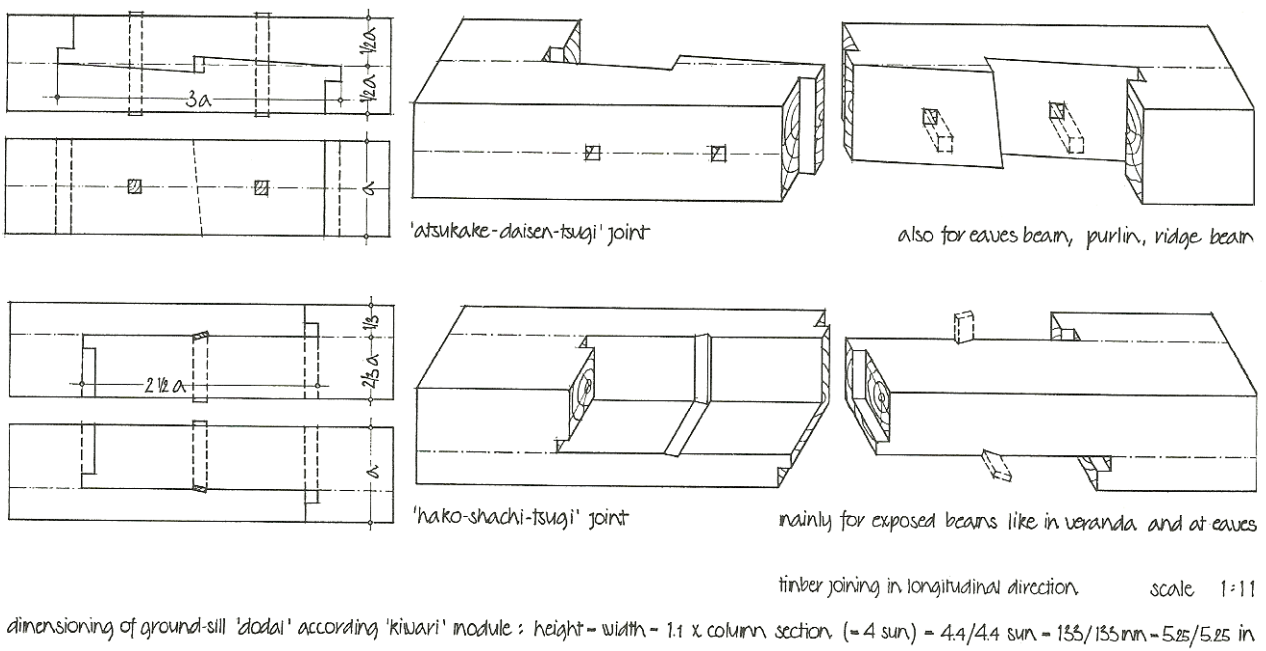
Since wood is so important to Japanese people, unique techniques have been developed for its use in architecture. For example, the joints between beams and pillars were made without the need for metal nails. This is possible through particular joints, which make the construction like a puzzle. For this reason the carpenters had to be very meticulous in their work and use specific tools to work the material. Nowadays these techniques are replicated more easily trough machinery using CAM and CAD technologies. With these types of joints, extraordinary results could be achieved and even very large buildings could be assembled, such as castles (eg: Himeji castle) or temples (eg: Todai-ji in Nara). Contemporary architects such as Kengo Kuma have revisited some of these techniques for the construction of new buildings. An example is the Sunny Hills store in Minami Aoyama (Tokyo) where the wooden beams, crossed diagonally to form the feeling of a "forest", are able to support the entire building.

Another technique that has recently given renewed popularity to the material is the yaki sugi (焼杉) literally "baked cedar" which indicates the technique of scorching the outer layer of wood used as an external partition. In this way greater resistance to fire and atmospheric agents can be achieved. At the same time, the yakisugi is useful to avoid the formation of mold and to keep insects away. Long-forgotten technique for the advent of plastic (cheaper and easier to produce) has recently been rediscovered by contemporary architects such as Terunobu Fujimori, as it is more sustainable and less impacting for the environment. The yakisugi also adds a mysterious charm to the building, which is why it is arousing a growing interest in today's architecture. If tradition is an excellent source of inspiration, there are also those who have been able to patent totally new and innovative construction techniques as in the case

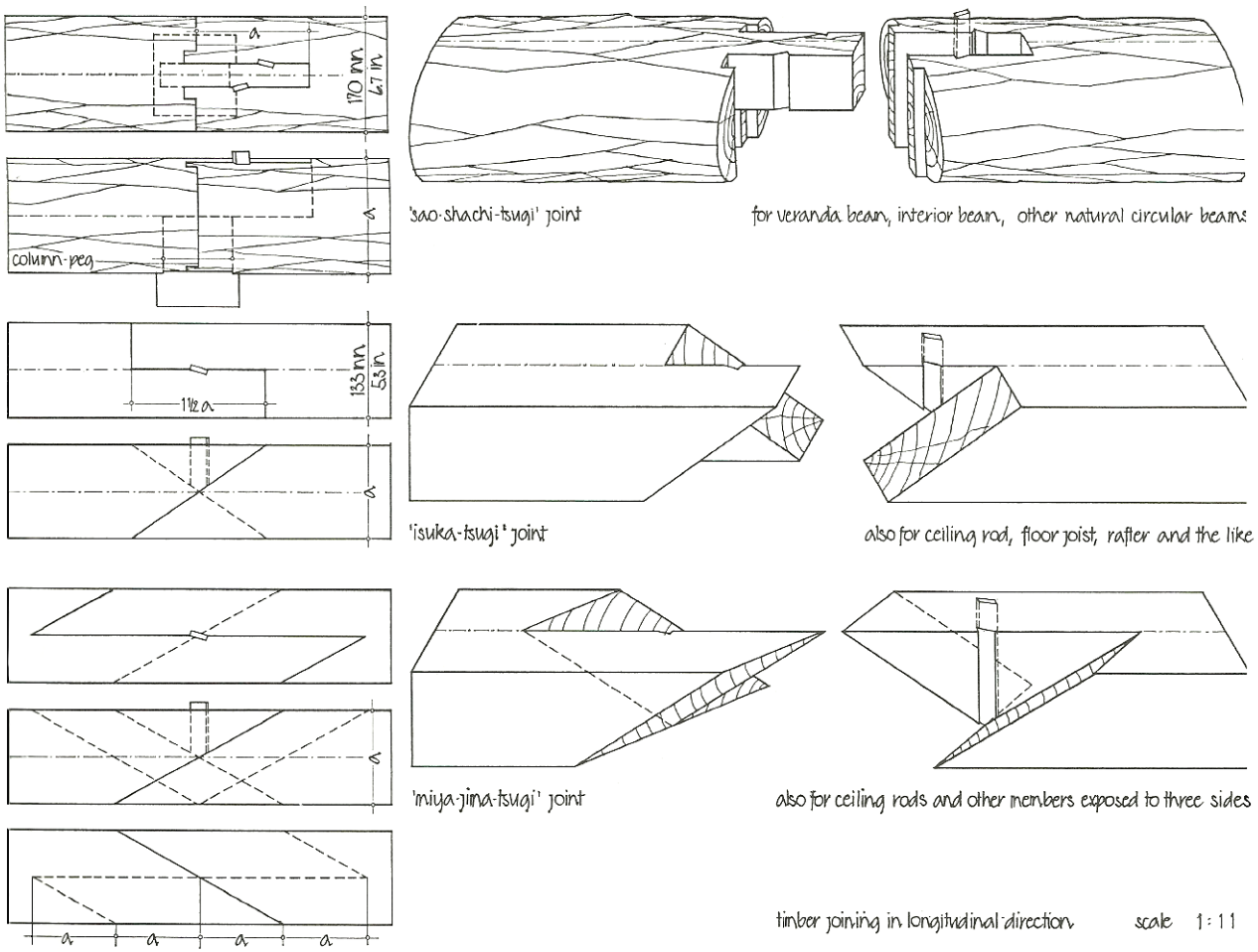
of Satoshi Okada, inventor of the Container Structure System (CSS) and Log Hinge System (LHS) developed by Japanese architect in collaboration with engineer Hirokazu Toki.

Reasons for using wood

So why use wood for a modern building? Wooden constructions don't need water to be built, they are light and can be prefabricated and this makes it the best material for any type of terrain. Wood can be produced in a sustainable way from certified forests. It comes from trees (that captures $CO_{2)}$ which makes it a good contribution against air pollution. It gives the architect a great possibility of expression and can be computer modeled with the modern tecnhologies. It is a natural insulating material, which gives the building a better insulation without the need to use further artificial material. Moreover (against what most people think) it is a fire resistant material.



Longitudinal wood joints from the book "Measure and construction of the Japanese house", Heino Engels, Tuttle publishing, Singapore 1985.



Longitudinal wood joints from the book "Measure and construction of the Japanese house", Heino Engels, Tuttle publishing, Singapore 1985.

Project

L'architettura è un fatto d'arte, un fenomeno che suscita emozione, al di fuori dei problemi di costruzione, al di là di essi. La Costruzione è per tener su: l'Architettura è per commuovere.
(Le Corbusier)

Climate analysis

Wind analysis

From the website windfinder we can learn about the climate in Sala Monferrato. The prevailing winds are blowing from the North. On the south we have the Appennino, a chain of mountains which is working like a barrier against the wind blowing from that direction.

Temperatures

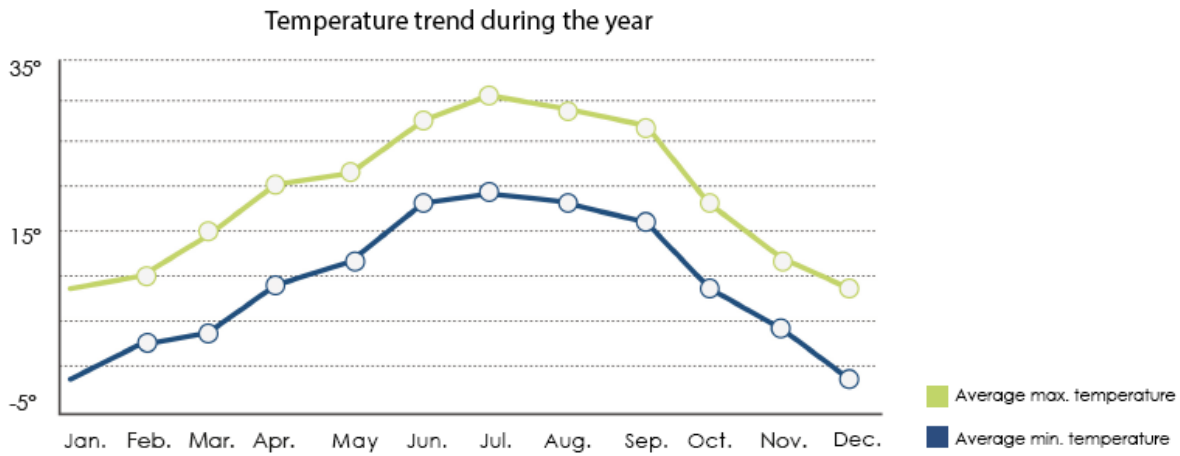
The temperatures are following the climate of northern Italy. The hottest period is during Summer (with a peak in July) and the coldest period is during Winter (with a peak in January).

Rain

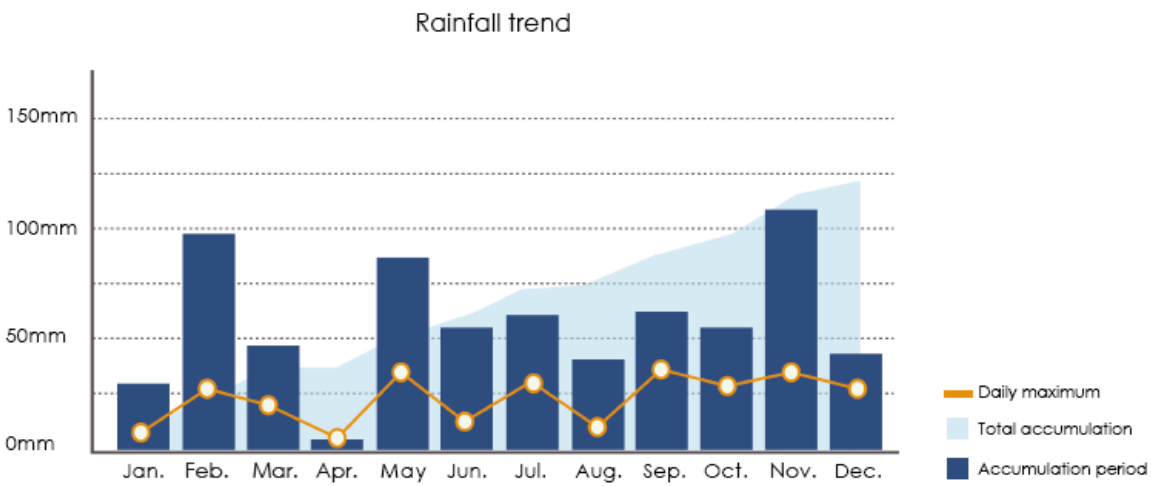
After analysing the rainfall we can state that the most rainy season is the autumn, with a peak in November.

Solar light

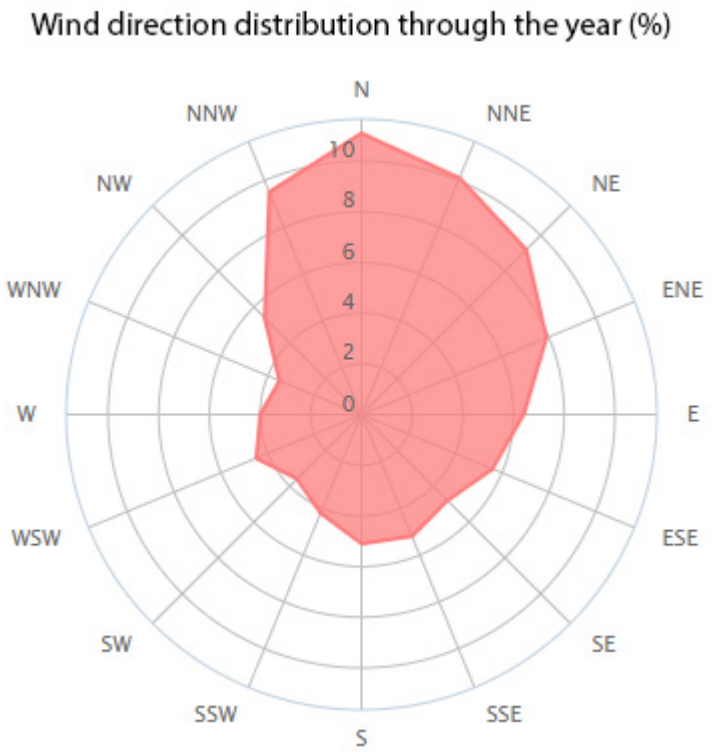
Moreover if we analyse the solar light we learn that the highest point reached by the apparent movement of the sun is +68° of altidude, while the lowest point is +21° of altidude. Since we are in the northern hemisphere the value of azimut of those points is +180° so the sun is always on the South.

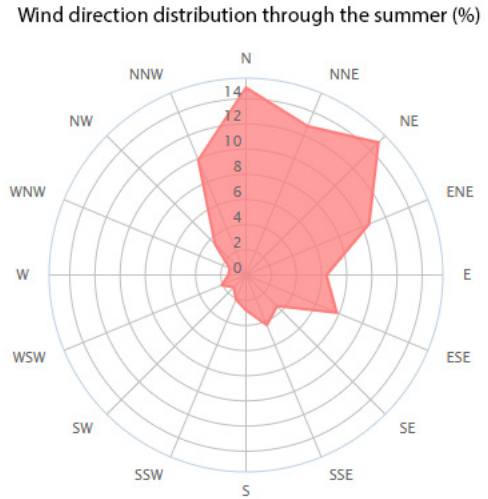


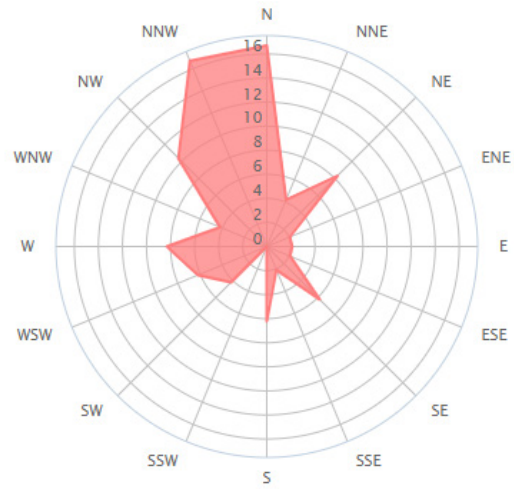
Temperature trend during the year.
Data: ISTAT 2016 "Temperature and rainfall in the main italian cities"

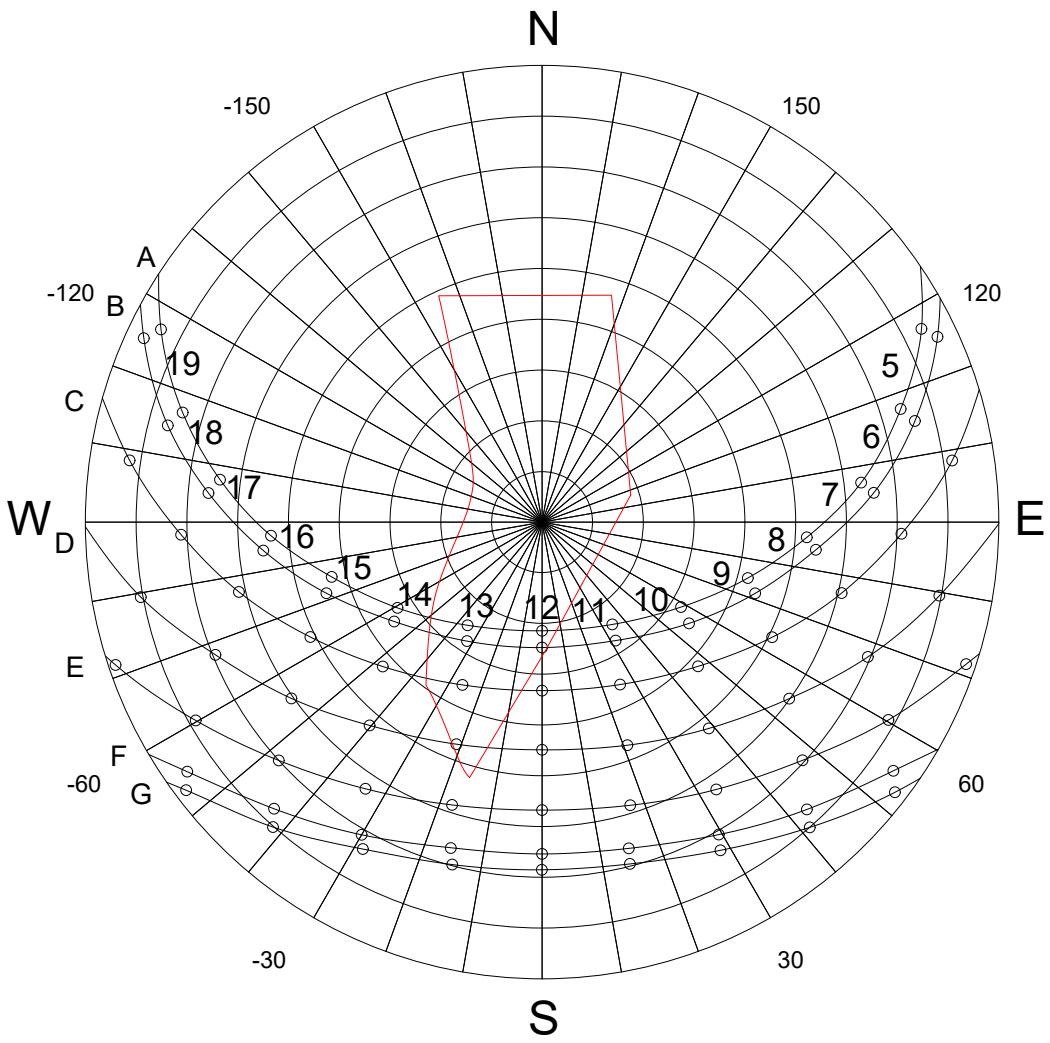


Rainfall trend during the year.
Data: ISTAT 2016 "Temperature and rainfall in the main italian cities"


Wind direction distribution through the year (%)
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
0
2
4
6
8
10


Wind direction distribution through the summer (%)
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
0
2
4
6
8
10
12
14


Wind direction distribution through the winter (%)
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
0
2
4
6
8
10
12
14
16



Sun Diagram
Latitude: 45° N

A 21 June
B 21 July- May
C 21 August- April
D 21 September- March
E 21 October- February
F 21 November- January
G 21 December

Sustainability

On the next pages:
diagrams showing the dimensioning and study of thermal insulation

Photovoltaic panels
On the southern part of the roof I decided to put flexible photovoltaic panels. It is quite difficult to follow the shape of the roof, so for this reason they will not cover the entire surface. Those panels will provide green energy to the winery and the eventual surplus of energy will be sold to the electricity supplier company.

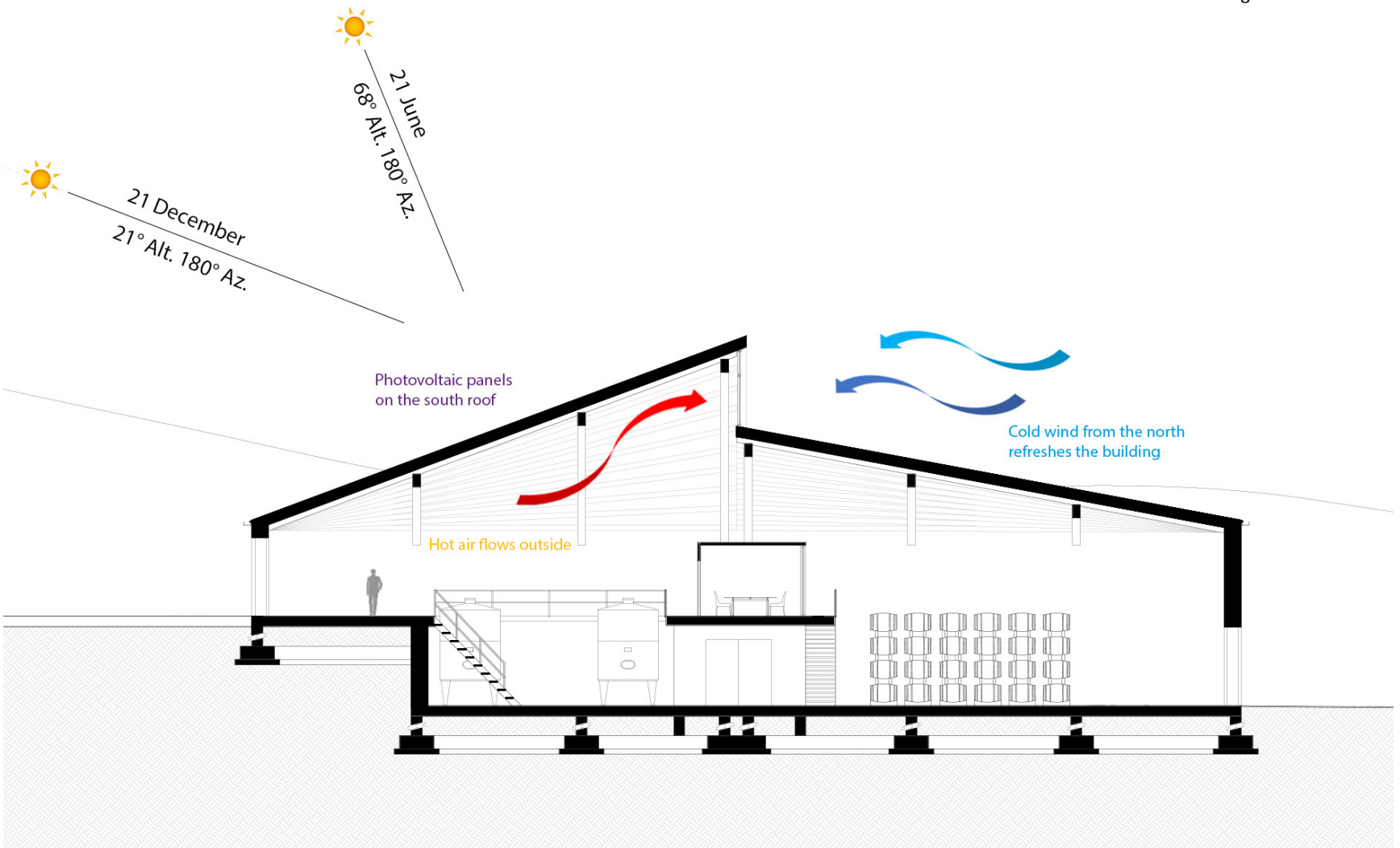
Natural ventilation
Taking inspiration from the arab wind towers and the typical japanese roof, I shaped the roof to provide natural ventilation to the building. The higher part of the roof will let the hot air outside the building and collect the cold breeze from the North.

Orientation of the building
The building has an orientation North-South and the top of the hill is situated south to it. This orientation is the best to keep the site as cool as possible, in order to use less artificial cooling (or no artificial cooling). Moreover, the building is partly underground. This is one of the best solution to keep the inside fresh all over the year.

Insulation
Pietra da Cantone can keep the same temperature and humidity inside the cellar, which makes it the most suitable material for the building. Moreover it is a local material, which increases its sustainability and decreases the CO_2 emissions during the construction of the building.

Biomass power plant
In order to further increase the sustainability of the winery activity, the organic waste will be re-used in a "micro" biomass power plant, a plant of new generation that will be able to produce green energy out of it.

Bioclimatic diagram section



Totale: 642 mm

Ordine	DESCRIZIONE DELLO STRATO (dall'interno all'esterno)	s (mm)	C (W/m²K)	M.V. (Kg/m³)	Px10¹² (Kg/msPa)	R (m²K/W)
	Adduttanza interna		7.7			0.13
1	Tufo	100	0.6300	1500	0.02	0.159
2	Pannelli rigidi di lana di roccia	120	0.0390	80	150.00	3.077
3	Cls a struttura densa con aggregati naturali (per pareti esterne non protette)	420	1.2630	2000	2.60	0.333
4	Bitume	2	0.1700	1200	0.00	0.012
	Adduttanza esterna		25.0			0.04

s = Spessore dello strato; C = Conduttività termica del materiale; M.S. = Massa superficiale; P = Permeabilità al vapore; R = Resistenza termica

Trasmittanza (W/m²K): **0.267 < 0.3** (Valore di legge)

Massa superficiale (Kg/m²): **1002**

Resistenza termica (m²K/W): **3.75**

Spessore totale (mm): **642**

OK Il valore della trasmittanza (0.267) è all'interno dei termini di legge (0.3)

Comune di **Sala Monferrato**

Zona Climatica: **E**, Gradi Giorno **2704**

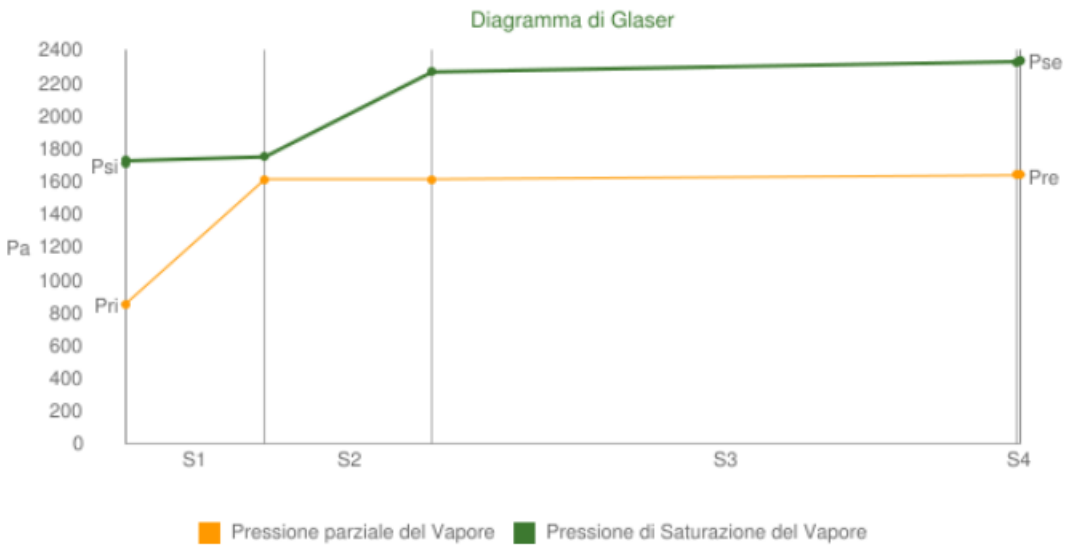
T interna (°C): **15.0**

T esterna (°C): **20.0**

U interna (%): **50.0**

U esterna (%): **70.0**

Thermal insulation: calculation of the thermal transmittance of the underground level and its Glazer diagram



All'interno della parete in esame non si generano fenomeni di condensa

Totale: 642 mm

Ordine	DESCRIZIONE DELLO STRATO (dall'interno all'esterno)	s (mm)	C (W/m²K)	M.V. (Kg/m³)	Px10¹² (Kg/msPa)	R (m²K/W)
	Adduttanza interna		7.7			0.13
1	Tufo	100	0.6300	1500	0.02	0.159
2	Pannelli di fibra di legno extraporosi	120	0.0400	160	40.00	3
3	Cls a struttura densa con aggregati naturali (per pareti esterne ed interne protette)	300	1.9090	2400	1.30	0.157
4	Bitume	2	0.1700	1200	0.00	0.012
5	Tufo	120	1.7000	2300	0.02	0.071
	Adduttanza esterna		25.0			0.04

s = Spessore dello strato; C = Conduttività termica del materiale; M.S. = Massa superficiale; P = Permeabilità al vapore; R = Resistenza termica

Trasmittanza (W/m²K): **0.28 < 0.3** (Valore di legge)

Massa superficiale (Kg/m²): **1168**

Resistenza termica (m²K/W): **3.568**

Spessore totale (mm): **642**

OK Il valore della trasmittanza (0.28) è all'interno dei termini di legge (0.3)

Comune di **Sala Monferrato**

Zona Climatica: **E**, Gradi Giorno **2704**

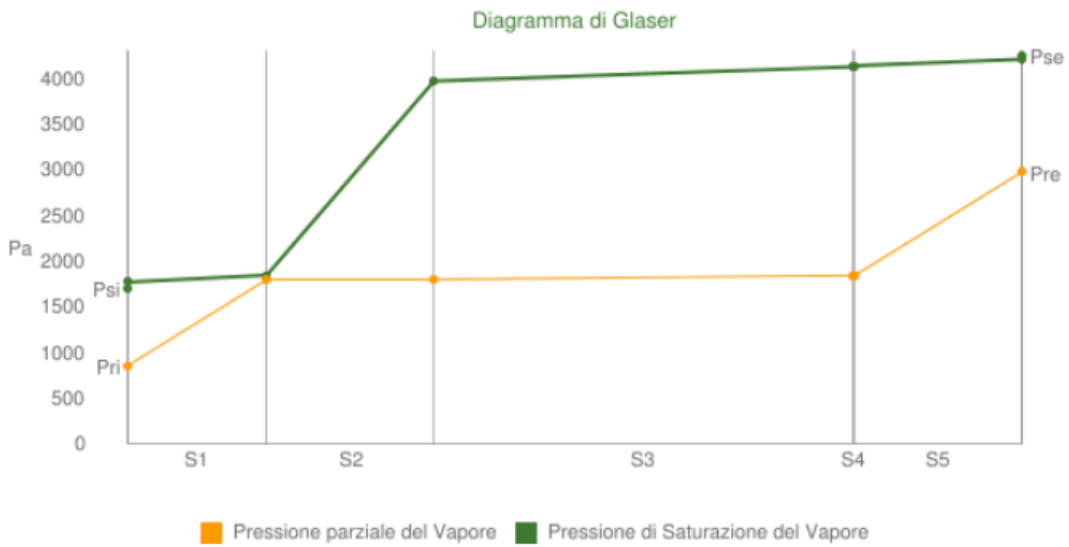
T interna (°C): **15.0**

T esterna (°C): **30.0**

U interna (%): **50.0**

U esterna (%): **70.0**

Thermal insulation:
calculation of the thermal transmittance of the first floor and its Glazer diagram

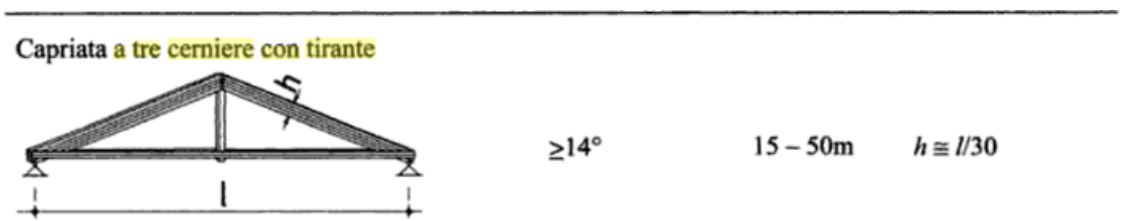


All'interno della parete in esame non si generano fenomeni di condensa

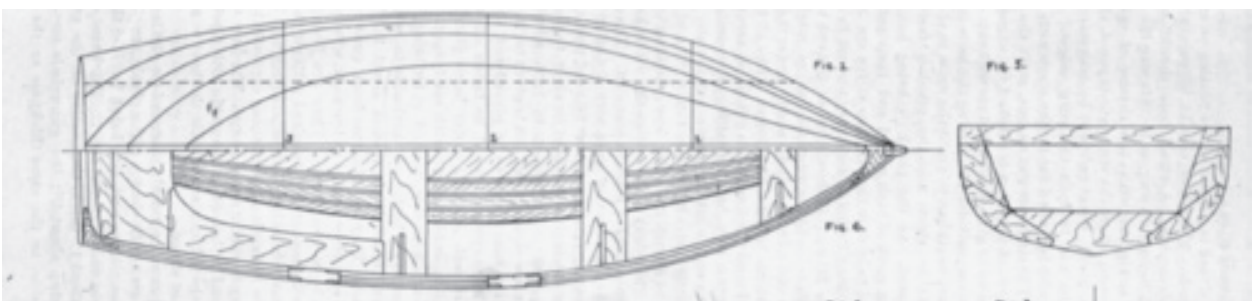
Structure

For the roof structure I choose to use laminated wood (legno lamellare) so that it is possible to have free space inside the building without the need to use many pillars. I studied the structure dimension taking information from the website of Holz. On the next page I put a chart with the beam type I chose to use. It the most suitable for the two parts of the structure of my building for its geometry and resistance to the mechanichal forces acting on the structure of the winery building. At first I chose a boomerang beam for the less sloping part while the highlighted one was supposedly only on the more sloping part.
It is a two beams system with a steel cable in between. I finally chose to use a timber frame structure with main beam (wooden but with steel cable) and secondary wooden beams; the wall is structural, made with concrete, with an exterior and interior part composed by Pietra da Cantone. For the secondary beams I took inspiration from the nautical engineering, because the roof is taking 2 different sloping directions.

Structural scheme of the roof

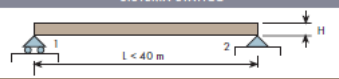
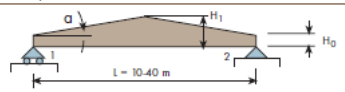
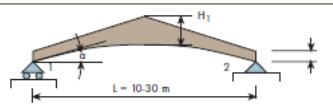
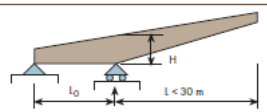
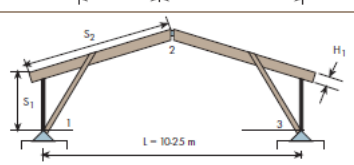
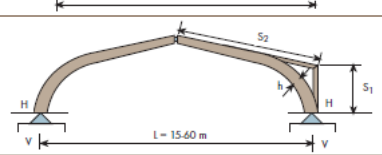
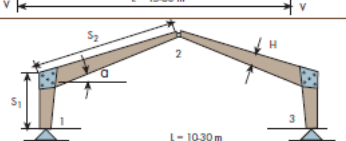
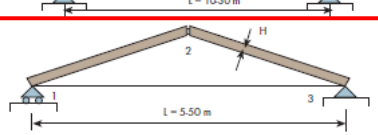


A boat: this tecnical drawing shows how its beams are bending according to the shape of the keel

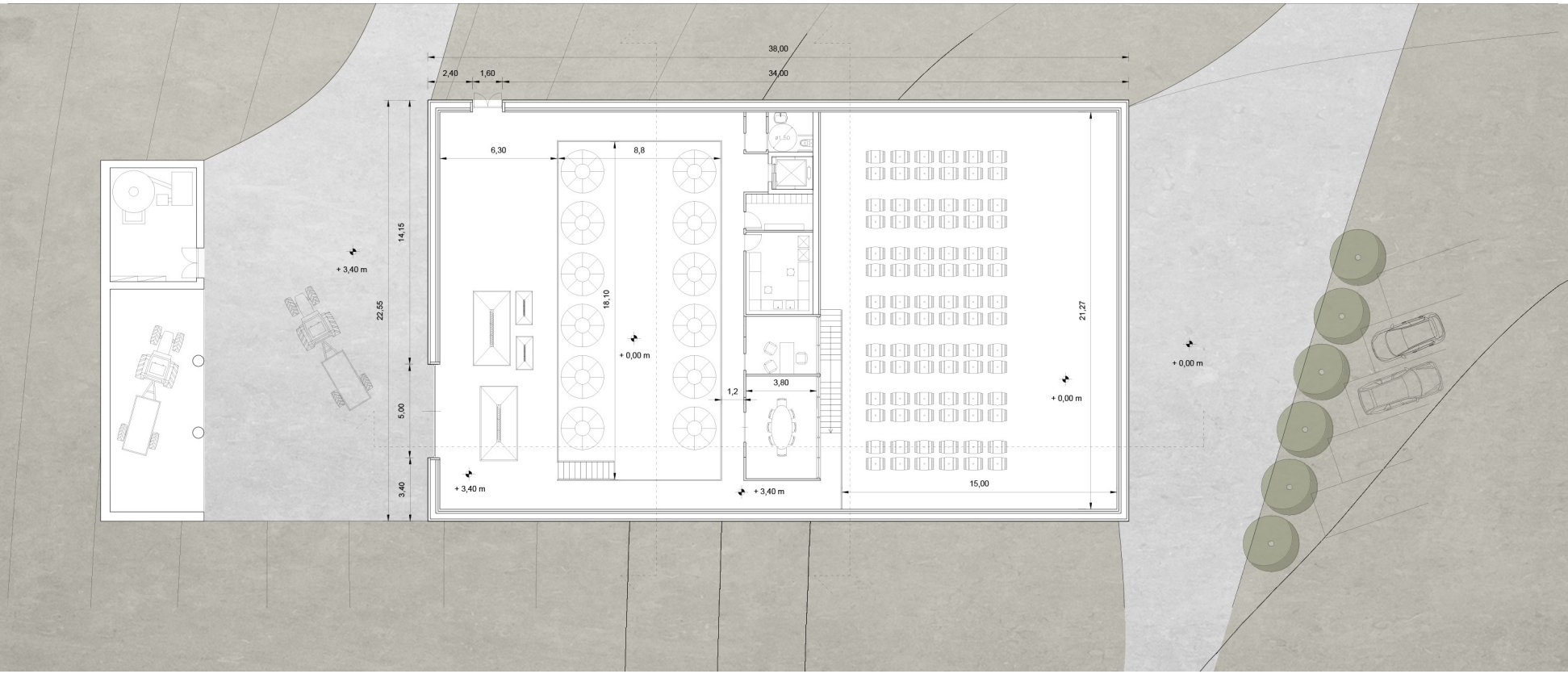


Schemes of wooden roof structures

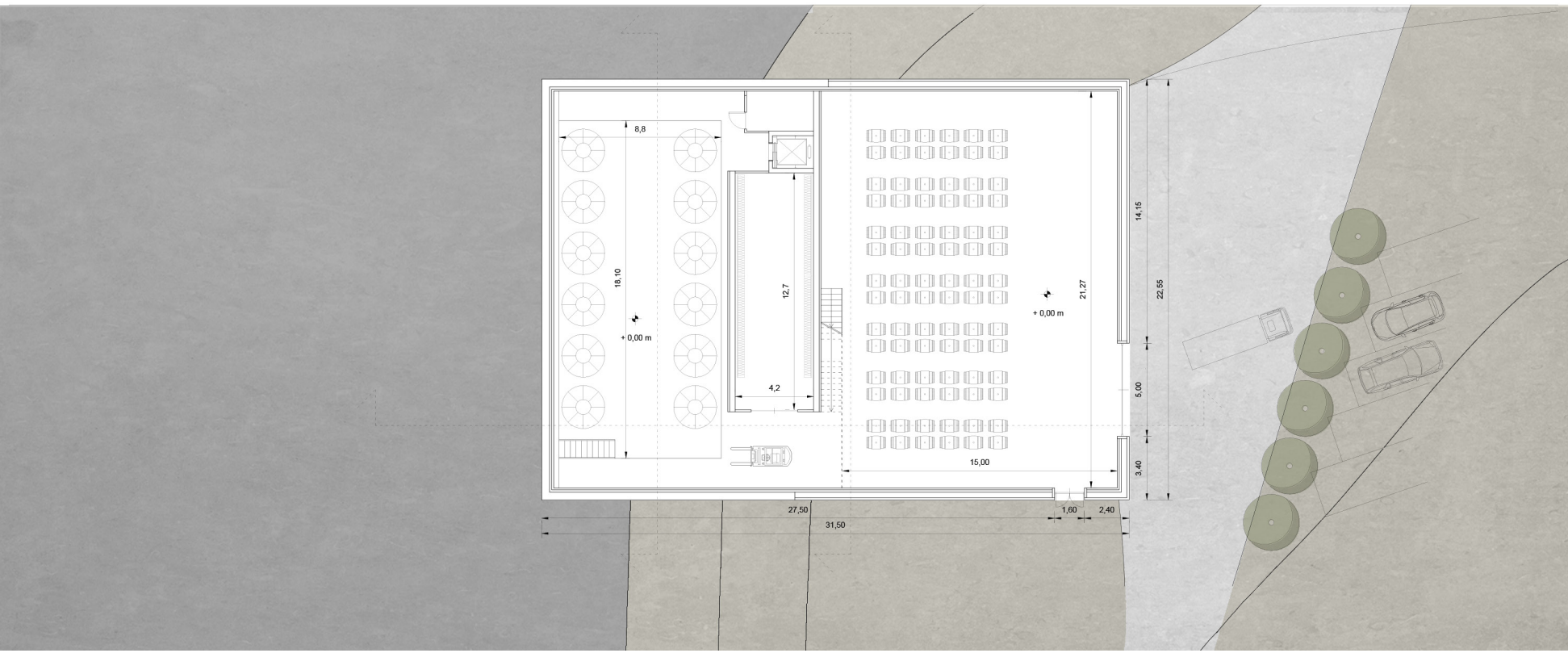
Tipologie costruttive

SISTEMA STATICO	DESCRIZIONE	INCLINAZIONE	LUCE(m) L (m)	ALTEZZE H
	Trave parallela o poco inclinata a doppia pendenza	< 5°	< 40	$H \cong L/17$
	Trave su due appoggi a doppia pendenza	3-10°	10-40	$H_0 \cong L/30$ $H_1 \cong L/16$
	Trave inflessa con curvatura a due falde a doppia pendenza	3-15°	10-30	$H_0 \cong L/30$ $H_1 \cong L/16$
	Trave a sbalzo con rastremazione	< 10°	< 20	$H \cong L/10$
	Portale a tre cerniere con montante scomposto in tirante e puntone	≥ 15°	10-30	$H_1 \cong (S_1+S_2)/15$
	Portale a tre cerniere a sezione variabile	≥ 15°	15-40	$H_1 \cong (S_1+S_2)/15$
	Portale a tre cerniere con giunto d'angolo a rosa	≥ 15°	10-30	$H_1 \cong (S_1+S_2)/13$
	Capriate a tre cerniere con tirante	≥15°	10-100	$H \cong L/40$

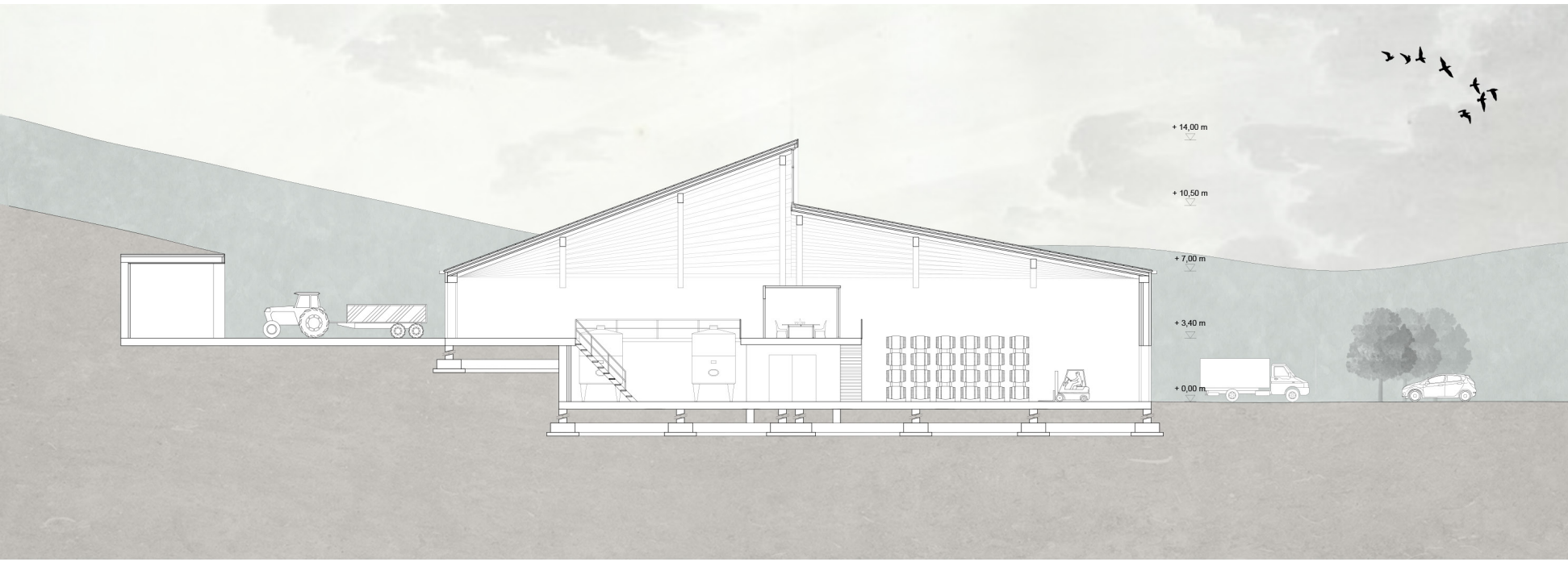
first floor plan


38,00
34,00
2,40
1,60
6,30
8,8
14,15
22,55
5,00
3,40
18,10
21,27
1,2
3,80
15,00
+ 3,40 m
+ 0,00 m
+ 3,40 m
+ 3,40 m
+ 0,00 m
+ 0,00 m

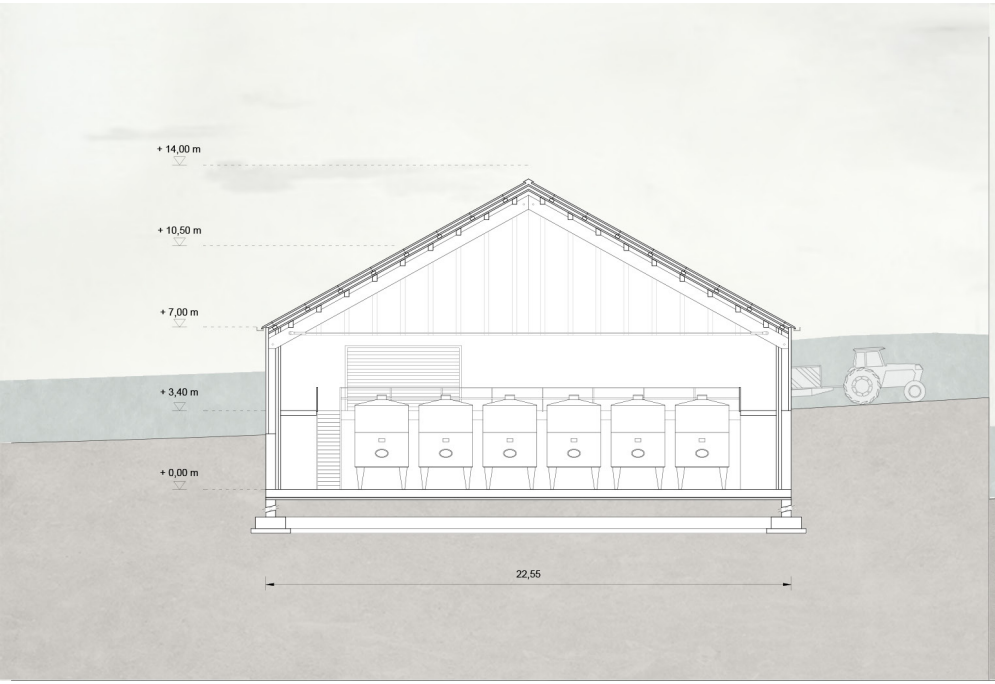
ground floor plan

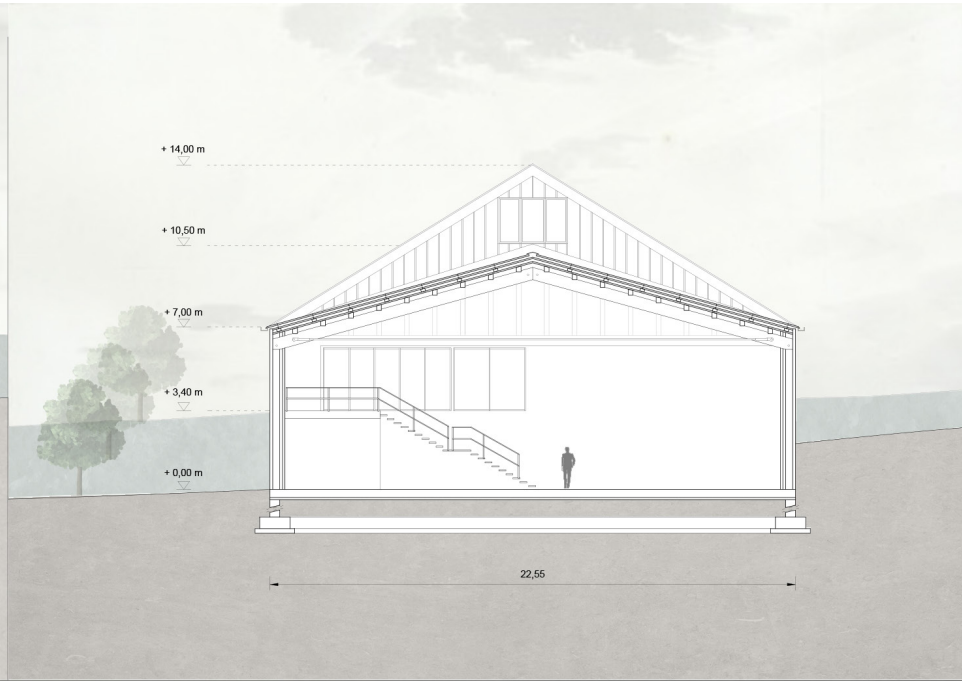

8,8
18,10
+ 0,00 m
12,7
4,2
+ 0,00 m
21,27
15,00
14,15
22,55
5,00
3,40
27,50
31,50
1,60
2,40

longitudinal section

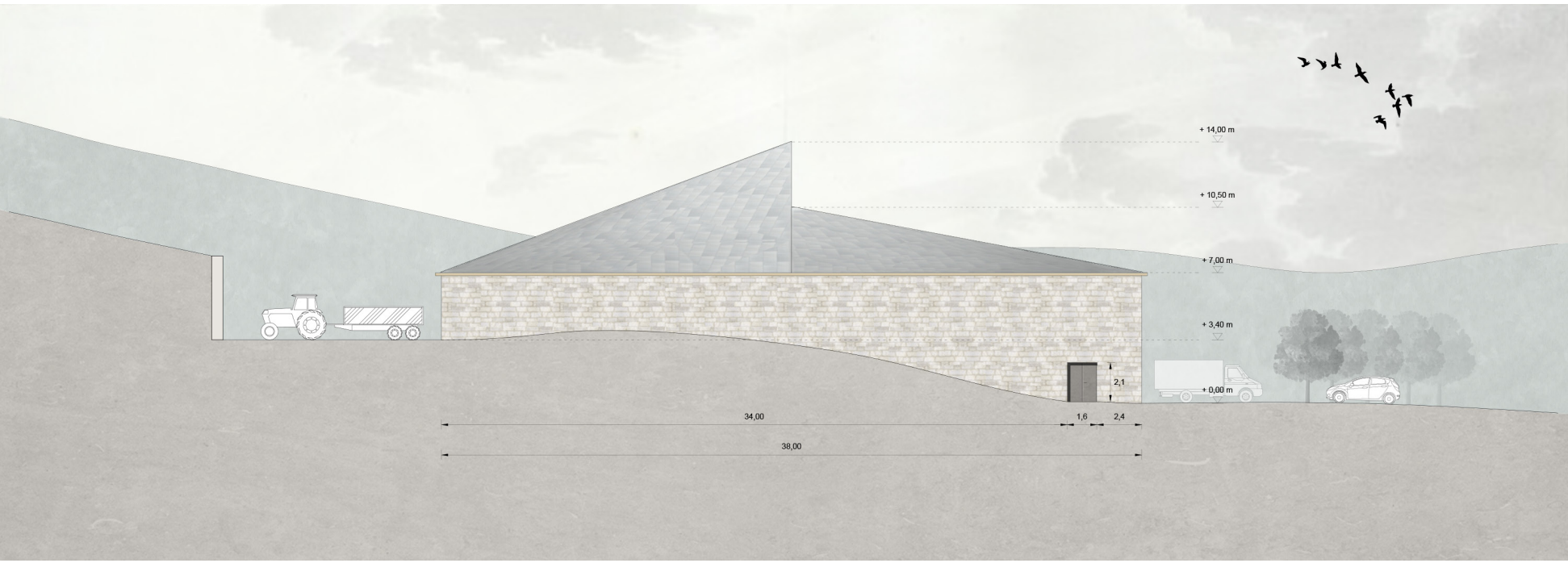

+ 14,00 m
+ 10,50 m
+ 7,00 m
+ 3,40 m
+ 0,00 m

cross sections

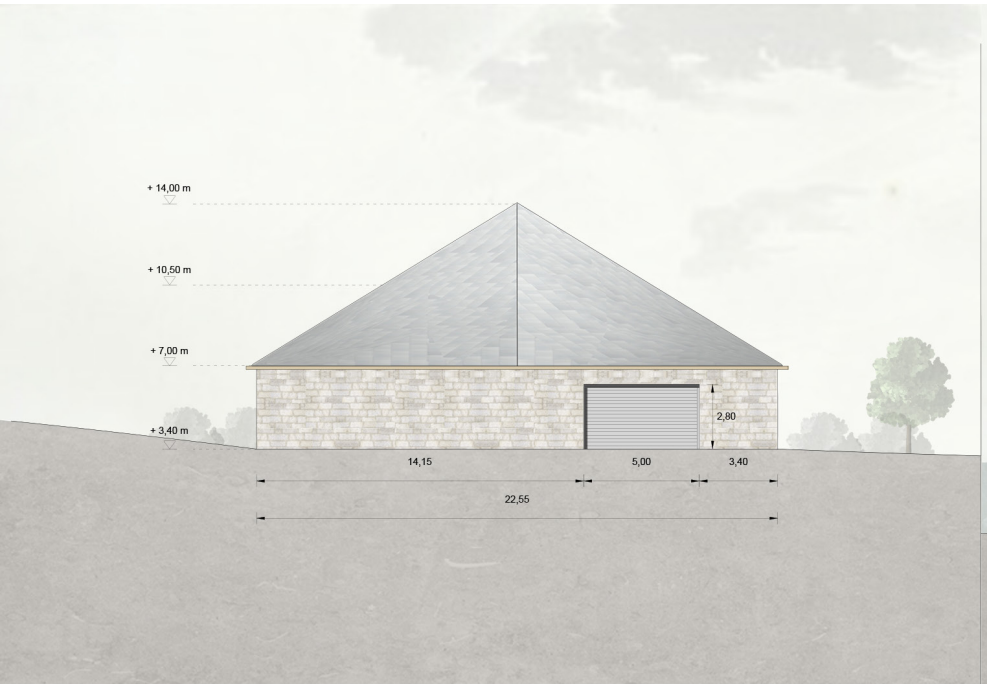

+ 14,00 m
+ 10,50 m
+ 7,00 m
+ 3,40 m
+ 0,00 m
22,55

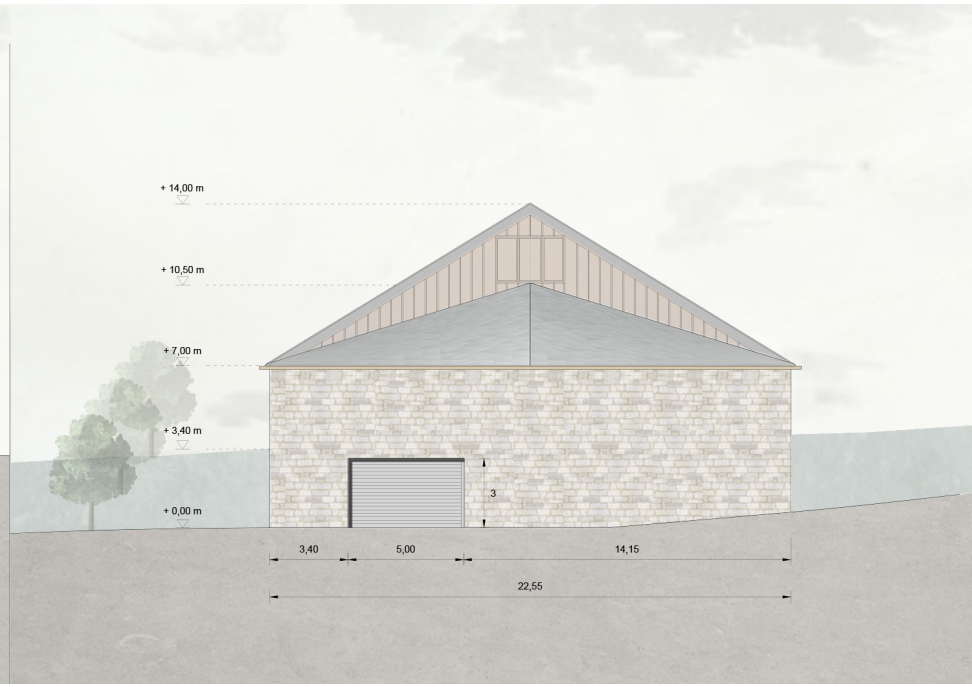

+ 14,00 m
+ 10,50 m
+ 7,00 m
+ 3,40 m
+ 0,00 m
22,55

east facade

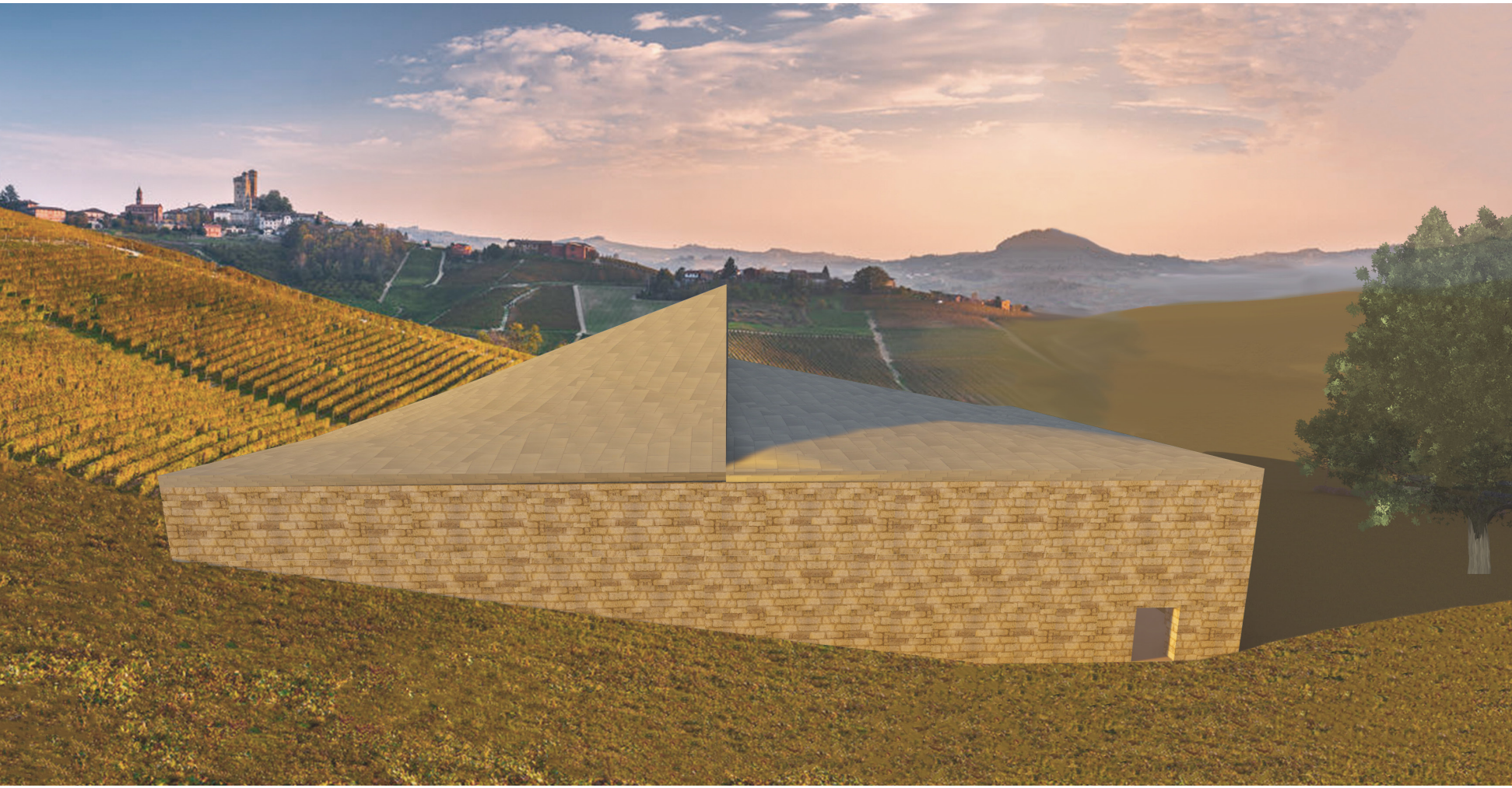

+ 14,00 m
+ 10,50 m
+ 7,00 m
+ 3,40 m
+ 0,00 m
2,1
34,00
1,6
2,4
38,00

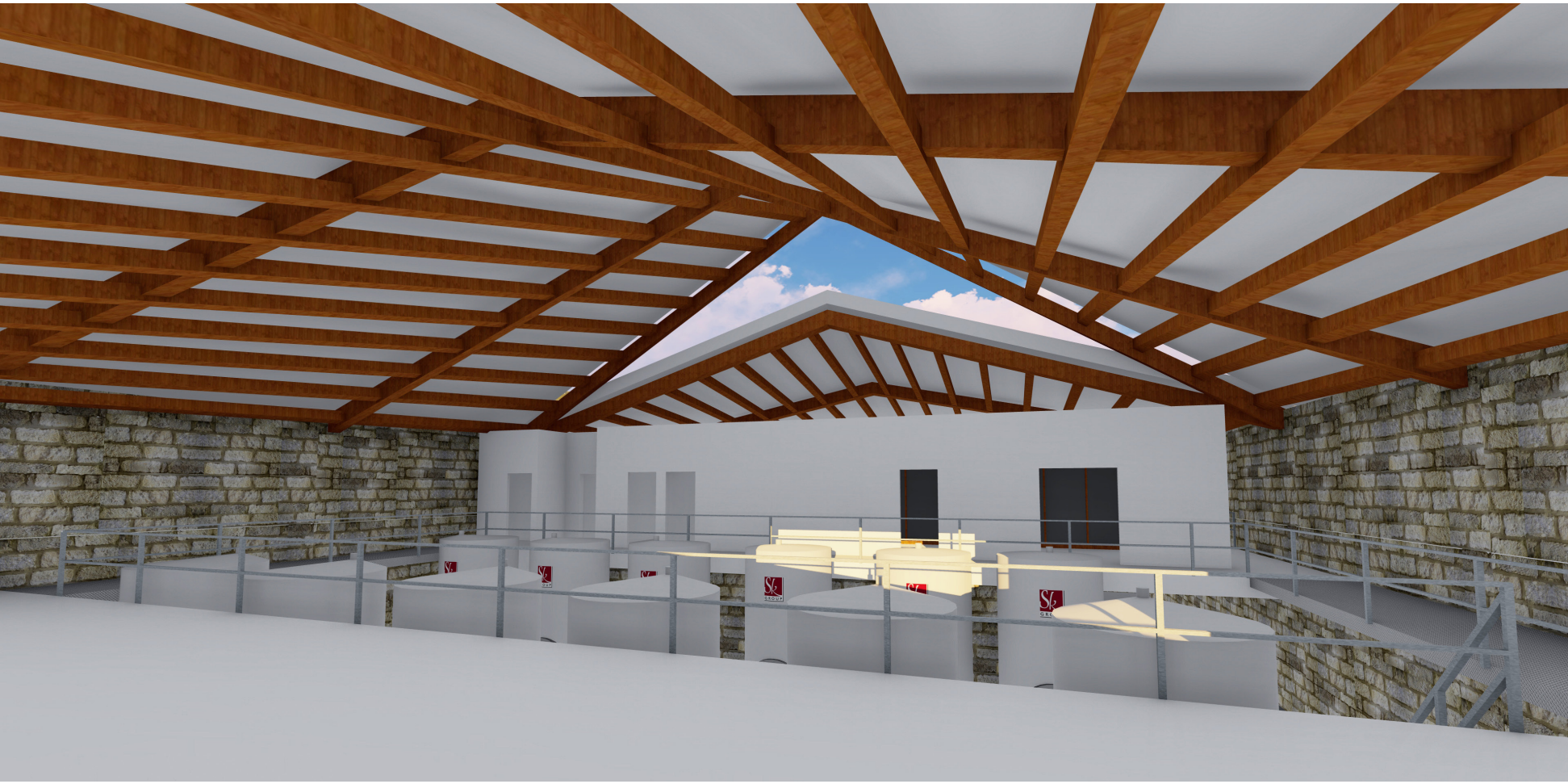
south and north facades


+ 14,00 m
+ 10,50 m
+ 7,00 m
+ 3,40 m
2,80
14,15
5,00
3,40
22,55


+ 14,00 m
+ 10,50 m
+ 7,00 m
+ 3,40 m
+ 0,00 m
3
3,40
5,00
14,15
22,55

renderings



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- Japan in Architecture: genealogies of its transformation - Catalogue of the exhibition at Mori art Museum, Tokyo Roppongi
- Casabella 771 - Novembre 2008

Sabbagh & Cardemil, Azienda vinicola, Fundo Santa Rita, Cile;
Rcr arquitectes, Azienda vinicola, Bell-Lloc, Spagna;

- Progetto di una cantina sita in Franciacorta, Azienda agricola “I due calici” di Carelli Alice e Colli Camilla (ricerca presso la facoltà di agraria dell’Università degli Studi di Milano)

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