POLITECNICO DI MILANO
Scuola di Architettura e Società

CHALMERS
UNIVERSITY OF TECHNOLOGY

Master Thesis in Architecture

Foster sustainability through revalorisation

A project in a dismissed nature reserve in Sicily

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Gothenburg, Sweden 2014

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Cover Picture: Schematic rendering view towards the Visitor Center and Fire-fighters Base, illustrating the project developed in this master thesis

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Abstract - English

Introduction
This is a project created through the collaboration of two universities, my home university – "Politecnico di Milano" in Milan, Italy, and Chalmers University of Technology in Gothenburg, Sweden, where I have obtained a one-semester Master Thesis Exchange program.
Originally I started developing my thesis project at Politecnico di Milano with my Italian supervisor - Professor Alessandro Rogora from the Department of Building Environment Science & Technology. Secondly, the whole Master Thesis Project Development has been transferred to Chalmers University of Technology , where I received the supervision of Dr. Ass. Prof Inger Lise Syversen and her assistant Roberto Cattaneo.
It is also important to consider that a big part of the initial research has been done personally on site in Sicily with the collaboration of local organizations and experts.

Abstract
After a personal visit in Sicily, and more in particular after exploring into detail the Oriented Nature Reserve "Bosco di Santo Pietro, I had the idea to dedicate my Master thesis on a project that could foster appreciation, conservation and sustainable fruition of "Bosco di Santo Pietro"s territory. The work presented in this volume is the outcome of this exact goal setting.
The first part of this work presents the outcome of a personal visit in Sicily, and more in particular of a detailed site survey of the Nature Reserve "Bosco di Santo Pietro" in order to identify both problematic areas of the territory, available resources and development potential. The Site Survey concerns the naturalistic and cultural value of the area and its state of decay. Secondly the analysis is referred to the main activities that promote natural enhancement in the territory of "Santo Pietro" with the purpose to identify how the project can fit into the local reality and collaborate for the promotion of sustainable tourism and to raise the naturalistic value of the area.
As a result of the conducted analyses the project concept is settled: to provide additional space for the activities of the local Nature Museum of Mediterranean Maquis. It has to be a Visitor Center with the purpose to involve practical tasks connected to the museum program and create public participation, particularly addressed to schools. The building space has to be flexible, since it has the aim to provide shelter for the local volunteers firefighters during their working period of six months a year.
By using local materials, sustainable design strategies and renewable energy resources, the building project has the opportunity to achieve its initial goal setting.
With the help of preliminary bioclimatic analysis and selected case studies, and by revalorisation of the pre-existing site structures, the design project is gradually developed. One part of the pre-existing structures are preserved and reused, while a newly built part is developed more into detail.
In the end there is a brief quality check in order to see how far it was possible to obtain results in accordance with the concept requirements and goals.

** As required from my home university - Politecnico di Milano, this report contains a detailed abstract and a short excerpt for all the chapters in italian.*

Abstract - Italiano

Nota Introduttiva

Il progetto di tesi è nato tramite la collaborazione di due relatori e il supporto di due università: il Politecnico di Milano e "Chalmers University od Tecnology" di Goteborg, Svezia, dove si è avuto accesso tramite uno scambio universitario durato un semestre.
Originariamente la tesi è stata iniziata a Milano con il mio relatore – prof. Alessandro Rogora del Dipartimento Di Architettura e Studi Urbani e sucessivamente è stata trasferita all'università Chalmers sotto la supervisione della prof. Inger Lise Syversen, responsabile del Dipartimento di Conservazione e Trasformazione, e del suo assistente Roberto Cattaneo.
Una parte consistente della ricerca iniziale della tesi è stata svolta personalmente in loco con la collaborazione di organizzazioni e professionisti locali, tra cui il direttore dell'associazione ecologica "Il ramarro" Renato Carella e l'agronomo del "Borgo di Santo Pietro" Salvatore Di Gregorio.

Abstract

Dopo una visita personale in Sicilia, e più in particolare dopo un sopralluogo approfondito della Riserva Naturale Orientata Bosco di Santo Pietro, ho avuto l'idea di dedicare la mia tesi di Laurea Specialistica a un progetto che promuove la valorizzazione, la conservazione e la fruizione sostenibile del territorio di "Bosco di Santo Pietro". Il lavoro presentato in questo volume racchiude il risultati ottenuti in seguito alla definizione di tale obiettivo.
Durante la mia visita ho scoperto che il patrimonio naturalistico di "Bosco di Santo Pietro" stava gradualmente scomparendo per via della non curanza delle autorità locali e per via degli interessi politici ed economici coinvolti, provocando un crescente sfruttamento di quella terra.
Insieme alle invevitabili conseguenze, ho scoperto che le strutture turistiche presenti erano in stato di degrado per mancanza di fondi e per la crescita diffusa e sempre maggiore del suolo agricolo a spese della superficie rimanente di macchia mediterranea.
Probabilmente la piaga peggiore del "Bosco di Santo Pietro è rappresentata dagli incendi dolosi, che occasionalmente si ripropongono sul territorio. Per via degli interessi economici di alcuni in un attimo ettari di vegetazione secolare di enorme importanza ambientale vengono distrutti, contribuendo al fenomeno crescente di desertificazone presente in Sicilia.
Ho incontrato sia individui, che organizzazioni locali che sono impegnati nella promozione e la salvaguardia del territorio di Santo Pietro e che lavorano attivamente per il miglioramento delle sue condizioni. Ho scoperto l'esistenza di alcuni progetti appena conclusi ed alcuni sul punto di partenza, impegnati in differenti aspetti dello sviluppo sostenibile del territorio, come ad esempio la rinaturalizzazione della vegetazione autentica locale, il restauro e il riutilizzo di alcuni edifici del centro storico del Borgo di Santo Pietro e delle strategie per attirare turismo di tipo sostenibile e aumentare l'interesse pubblico nei confronti dell'area.
In un momento consecutivo alla mia visita personale, sono stata informata che il Decreto Istitutivo che dichiarava "Bosco di Santo Pietro" una Riserva Naturale Orientata è decaduto per motivi ignoti. Nonostante la mancanza di una vera e propria motivazione per tale avvenimento, ancora ad oggi Santo Pietro non ha riacquistato il suo status di riserva, perdendo in ques'occasione il diritto di essere naturalisticamente tutelato e rischiando la sua completa estinzione. Alla luce

di questo fatto l'idea di progetto di questa tesi è diventata ancora più forte nell'intenzione di promuovere iniziative che aggiungano valore al territorio, attirando allo stesso tempo maggiore interesse verso la zona.
In seguito all'analisi dei principali attori, che operano sul territorio con lo scopo di proteggere e promuovere il patromonio ambientale della macchia mediterranea, ho individuato il museo naturalistico locale come una struttura con potenzialità di ulteriore sviluppo . Pur essendo strettamente legato alle attività scolastiche, il museo ha a disposizione una superficie ridotta e di conseguenza non è dotato di spazi per lo svolgimento di attività pratiche come corsi di educazione ambientale, di conoscenza del territorio e laboratori dedicati ai mestieri tradizionali e la vegetazione locale. Questo genere di attività non sono previste altrove all'interno della riserva. Inoltre il museo è completamente privo di spazi all'aperto e di conseguenza al suo interno è soltanto possibile visitare la mostra permanente.
La mia idea è stata quella di progettare una struttura di supporto dove collocare le attività non presenti per poter trasformare la visita al museo naturalistico in un'esperienza completa dove gli ospiti non sono più soltanto visitatori, ma diventano partecipanti e vengono coinvolti attivamente nella conoscenza e preservazione del territorio.
Sempre durante la fase di studio del territorio ho scoperto che all'interno del Borgo di Santo Pietro erano state istituite delle squadre volontarie di antincendio, attive all'interno della riserva da maggio a ottobre per tutelarla l'area nel periodo a maggior rischio di incendi naturali o dolosi. Visto che la presenza delle attività antincendio sul territorio di Santo Pietro è di carattere temporaneo e a causa delle restrizioni dettate dal Regolamento della Riserva sulle nuove costruzioni in zona A, non è stata prevista una base per le squadre antincendio. Per potersi riparare hanno avuto a disposizione una tenda da campeggio, dove non hanno la possibilità di custodire la loro attrezzatura professionale e di ricevere adeguata protezione in caso di condizioni climatiche sfavoreli, soprattutto dal sole cocente tipico della Sicilia nei mesi caldi dell'anno.
Durante la mia visita ho individuato un'area all'interno del Borgo che ha richiamato la mia attenzione in quanto un ex-campo di tiro al piattello dismesso in forte stato di degrado. La sua collocazione in una posizione strategica in prossimità immediata al museo naturalistico e al centro abitato e ben collegata alla strada principale, lo ha reso un luogo particolarmente adeguato per inserire il tipo di progetto che volevo sviluppare. Allo stesso tempo la sua precedente destinazione d'uso come campo di tiro al piattello, senza dubbio in forte conflitto con i requisiti all'interno di una riserva naturale, poteva essere vista come un'opportunità di riqualificare la zona in accordo con gli obiettivi progettuali posti.
In questo modo il concept progettuale ha preso la sua forma definitiva, ovvero quello di creare un Centro Visite a supporto e in collaborazione con il Museo Naturalistico locale, che però al suo interno deve dare ospitalità temporanea per sei mesi all'anno alle squadre antincendio volontarie, adeguando parte dei suoi spazi a questo tipo di flessibilità d'uso.
Una volta stabilite le strategie progettuali, sono stati selezionati ed analizzati alcuni casi-studio inerenti da cui prendere spunto. Inoltre sono state svolte delle analisi bioclimatiche di tipo preliminare. L'insieme degli elementi essenziali ottenuti tramite questa ricerca hanno portato alla stesura dell'aspetto architettonico del progetto di tesi.
Una volta definito il concept progettuale, è stata svolta un'analisi del'area di progetto, considerando le strutture preesitenti e le risorse disponibili. Si è deciso di progettare una struttura realizzata in pietra locale rifacendosi alle tradizioni antiche siciliane, la quale si apre verso un cortile interno, così come si faceva negli antichi Bagli siciliani[1].

In maniera analoga a quella del Baglio, il cortile diventa un'estensione dello spazio visitabile, che procura un'ampia zona ombreggiata durante i mesi estivi in modo da poter svolgere diverse attività pur rimanendo protetti dal sole diretto. Mentre i muri portanti in pietra di spessore consistente creano massa termica, isolando l'interno dell'edificio dalle condizioni climatiche estreme. Una copertura articolata e leggera, integrata nella composizione architettonica del progetto, modulata in base alle ottimali angolazioni rispetto all'inclinazione dei raggi solari durante l'anno, svolge la tripla funzione di raccolta delle acque meteoriche, ombreggiatura e integrazione dei sistemi di pannelli fotovoltaici e solari per la produzione di energia elettrica e acqua calda.
Un'ulteriore superficie per le attivita del Centro Visite viene aggiunta tramite l'installazione di una struttura cubica di tipo leggero, realizzata in pannelli di legno e vetro, collocata sempre al di sotto dello stesso sistema di copertura. Questa aula per le attività didattiche e i laboratori di educazione ambientale è dotata di un'ampia parete adibita ad armadio per poter immagazzinare le attrezzature delle squadre antincendio quando non vengono utilizzate, oppure gli arredamenti per le varie attività del Centro Visite. La permeabilità di questa , chiamiamola "scatola in legno", varia durante l'anno tramite le portefinestre a libro e il sistema di protezione solare a listelli regolabili.
La struttura in legno si apre verso la corte in posizione contrapposta rispetto all'ingresso principale dell'edificio in pietra, ottenendo così uno ambiente continuo tra aperto e coperto, interno ed esterno.
Le strutture preesitenti delle due pensiline per il tiro al piattello vengono riutilizzate, diventando dei punti di osservazione del paesaggio in valle con vista diretta verso la zona a macchia mediterranea. Le pensiline mantengono la loro struttura portante, ma i pannelli di copertura vengono sostituiti da un sistema a pannelli fotovoltaici integrati. La forma sommaria delle pensiline non è cambiata sostanzialmente, mentre è completamente trasformata la loro destinazione d'uso e il rapporto che si crea con l'ambiente circostante.
Una strategia simile viene impiegata per le due fosse una volta occupate dalle macchine per il tiro dei piattelli. La soluzione è quella di lasciare il segno delle fosse visibile sul terreno, anche se il cemento viene rimosso. La proposta è di riutilizzare le fosse come luoghi di riferimento, o i così detti "landmarks". Il terreno viene modellato a gradoni per creare dei giardini/orti, dove i visitatori possono prendersi cura della cresita di piante locali, possono sedersi, osservare ed essere in contatto con la natura. Dei pannelli informativi illustreranno il confronto tra le fosse prima e dopo l'intervento progettuale per ricordare ciò che è stato e imparare da questo esempio.
Una volta illustrato il progetto di tesi, nuovamente in sede a Milano è stato deciso insieme al relatore italiano di svolgere alcune valutazioni ambientali e ad apportare di conseguenza le modifiche necessarie per ottimizzare il funzionamento bioclimatico del progetto .

1. Baglio: fattorie feodali con ampie corti interne dove si svolgeva una buona parte dell'attività contadina.

Estratto tesi - Italiano

Capitolo 1 Una riserva naturale non protetta in Sicilia
Il primo capitolo racchiude tutte le analisi prodotte attraverso un primo approccio all'area del area di interesse – Bosco di Santo Pietro. Sono comprese le informazioni riguardo all'inquadramento territoriale della riserva, le sue caratteristiche e valore naturalistico. Viene evidenziata la perdita di status di Riserva Naturale Orientata da parte di Santo Pietro e i pericoli che ne derivano. Vengono analizzati i principali attori presenti che lavorano per la salvaguardia dell'ambiente in modo da poter individuare i potenziali punti di sviluppo, il quadro degli aspetti problematici e le risorse del luogo.

Capitolo 2 Definizione del progetto
Il secondo capitolo comprende l'analisi dell'area di progetto, le sue caratteristiche e i problemi di inquinamento di piombo legati alla precedente attività di tiro al piattello. Viene effettuata un'analisi ambienale preliminare attraverso i diagammi bioclimatici di Olgyay e Givoni per conoscere come intervenire sulla sensazione di comfort durante l'anno. Inoltre viene descritta la vegetazione presente sul sito e un sommario degli aspetti negativi e positivi dell'area di progetto. Nella seconda parte del capitolo si ha la descrizione degli utenti finali, delle loro attività e i relativi requisiti. Nel fare ciò vengono descritti i tre diversi scenari per l'utilizzo dell'edificio in progetto. Infine si ha un breve accenno alle strategie sostenibili da adottare nella selezione delle risorse e i materiali per il progetto.

Capitolo 3 Concept iniziale e punti di partenza per la stesura del progetto
All'interno del terzo capitolo è racchiusa tutta la fase di documentazione e approfondimento inerente alle strategie adottate nella fine del secondo capitolo. L'analisi comprende le risorse rinnovabili per l'energia e le strategie progettuali passive per arrivare alla selezione dei casi-studio mirati e inerenti alle strategie prescelte.

Capitolo 4 Concept di progetto
In questo capitolo sono raffigurati gli aspetti essenziali da considerare nella progettazione, iniziando con il posizionamento e l'orientamento del progetto con riferimento a tutti i principali elementi della struttura pre-esistente. Viene illustrato il concept compositivo per finire con un breve elenco delle principali tecnologie ed elementi costruttivi da impiegare nella progettazione.

Capitolo 5 Il progetto per il Centro Visite Naturalistico / Base temporanea per le squadre antincendio
L'ultimo capitolo consiste nell'illustrazione dettagliata del vero e proprio progetto architettonico. Comprende i disegni tecnici con viste planimetriche e prospettiche, lo studio dei volumi e il rapporto con l'area di contesto. In allegato sono disponibili le tavole tecniche dove i disegni di progetto sono illustrati in scala.
Infine viene effettuata una valutazione del punto di arrivo del progeto svolto per capire fino a che punto ha raggiunto gli obiettivi posti nella fase di concept iniziale. Viene svolto uno studio

sul comportamento bioclimatico dell'edificio per apportare i miglioramenti necessari per il suo funzionamento ottimale nel clima di riferimento.

Contents

Chapter 1 – An unprotected Nature Reserve in Sicily

1.1 Introduction – personal story

The Nature Reserve “Bosco di Santo Pietro” (Santo Pietro Forest) is located inside the island of Sicily in Italy, only 20 km away from the city of Caltagirone. It is one of the largest and most important green areas of Calatino (the District of Catania).

In 1999 the area has been declared “Oriented Nature Reserve” or ONR. This is a particular type of protected area in which are allowed cultivations, agricultural and pastoral activities as long as they don’t enter in conflict with the conservation of existing natural environments. Around the protected zone (zone A) is identified an area of pre-reserve (zone B) defined “a zone of controlled development” in order to integrate the surrounding area in the system of environmental protection. The area of pre-reserve has fewer restrictions but serves as a buffer zone between the nature reserve and the urban and industrial areas.

During my first visit in 2006, “Bosco di Santo Pietro” was officially an ONR. My personal impressions back then were of a land of rare exotic beauty but which was unfortunately left a bit to itself and neglected by the authorities. I was introduced to the area by the director of a local ecological or-

Figure 1.

Figure 1. View inside the area of Maquis Shrubland, “Bosco di Santo Pietro

Figure 2.

Figure 3.

Figure 2 - 5. Images from personal archive

Figure 3. Together with Salvatore Di Gregorio, agronomist of Santo Pietro

ganization called “Il ramarro” (a type of lizard). I studied the territory with their special collaboration and I was later assisted by the Caltagirone’s Agronomist and territorial expert, Salvatore di Gregorio, who guided me through the territorial analysis.

What I learned during my visit was that the natural beauty of “Santo Pietro” Forest was gradually disappearing because of the carelessness of the authorities and because of political and economic interests involved that cause an increasing exploitation of the land. Among the inevitable consequences I found degradation of tourist facilities due to lack of funds and a proliferation of agricultural land at the expense of areas of forest. Perhaps the worst plague of that territory are the arson fires, which occasionally occur on the territory. Because of the personal economic interests of some, in an instant hectares of secular vegetation with huge environmental importance are destroyed contributing to the growing desertification of the island of Sicily.

At the same time I felt that there was still a thread of hope for the territory of “Santo Pietro”. I met local organisations and individuals who were protecting and loving it and who were actually working to improve its

Figure 4.

Figure 5.

Figure 4. Cycling trip in Santo Pietro together with Renato Carella, director of the ecological organization “Il ramarro”

Figure 6. Maps of territorial analysis and urban setting of ex-nature reserve “Bosco di Santo Pietro”

conditions. There were some newly concluded projects and some were on the starting point, all dedicated to different aspects of the sustainable development of the territory, like the re-naturalisation of the original vegetation, restoration and reuse of some buildings in “Santo Pietro” District and some projects pointing to attract sustainable tourism and to increase the public interest in that area.

I felt personally involved during my visit and willing to do “something” and participate. I could see that there

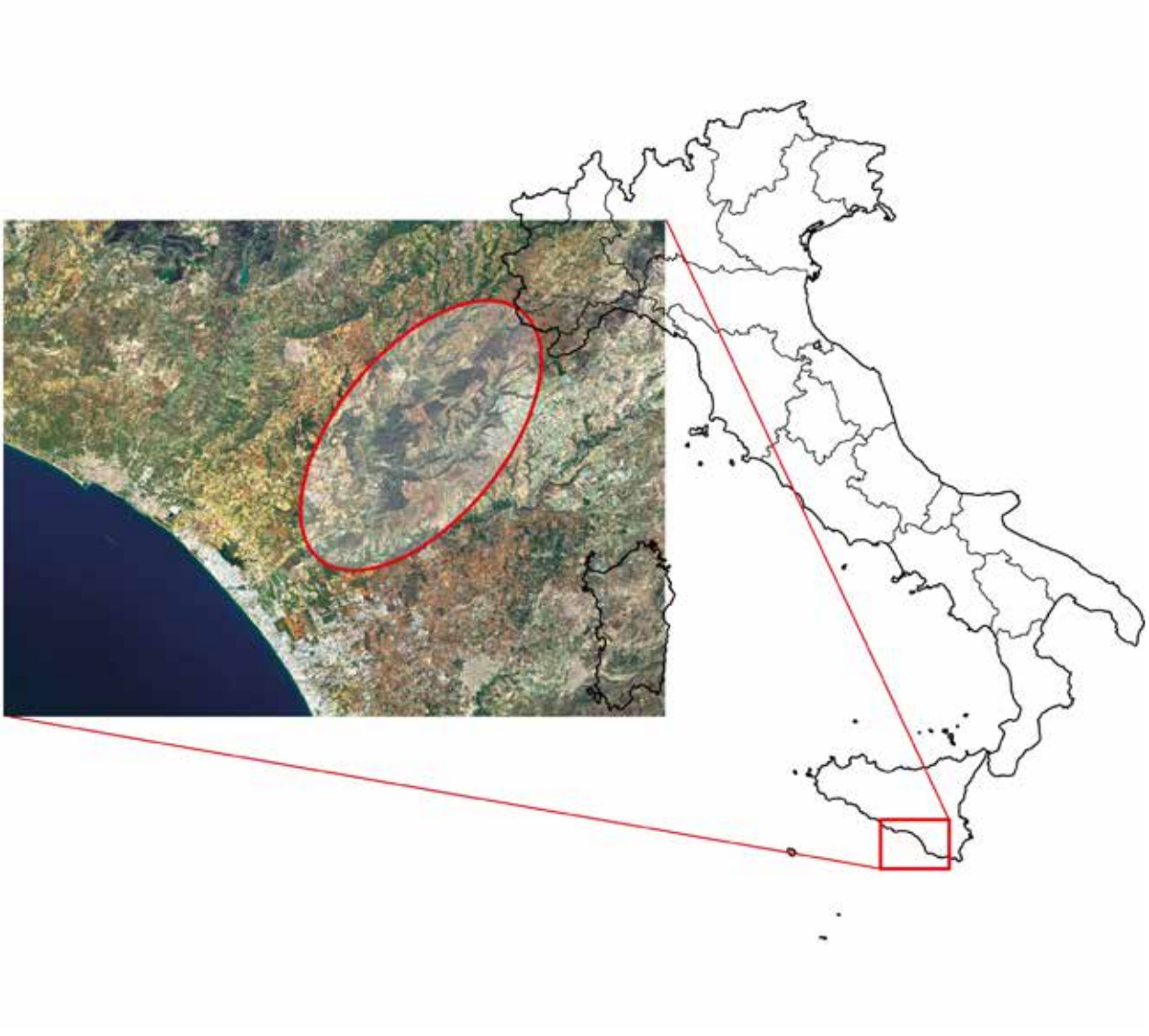


Figure 6.

was so much that could be done on a territorial, urban and architectural level. Therefore I had the idea to dedicate my Master thesis on a project that could foster appreciation, conservation and sustainable fruition of the territory of "Bosco di Santo Pietro". The work presented in this volume is the outcome of this exact goal setting.

1.2. "Bosco di Santo Pietro" Dismissed Nature Reserve – Site Survey

"A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values."

IUCN (International Union for Conservation of Nature) Definition 2008

Figure 8.

The most significant inhabitant nucleus of the former nature reserve is called "Santo Pietro" District and is provided with Elementary School, Hospital (an Important Center for Physical Rehabilitation), Post Office, Police Station. Currently there are some derelict buildings and buildings in poor state of conservation (ex Agricultural Wheat Research Station, the oldest part of the district) which could be restored for public or private use and improve tourism.

Figure 7.

Figure 7. New information panels on the flora and fauna of Santo Pietro Forest

Figure 9.

Figure 8. Touristic trail inside Santo Pietro Forest

Figure 9. Restoration of the local Graniculture Experimental Station (image taken from Google Maps Street View)

Figure 10. Ancient mill "Mulino Polo", Santo Pietro Forest

Figure 10.

Figura 11. Bosco di Santo Pietro Area

Figure 11.

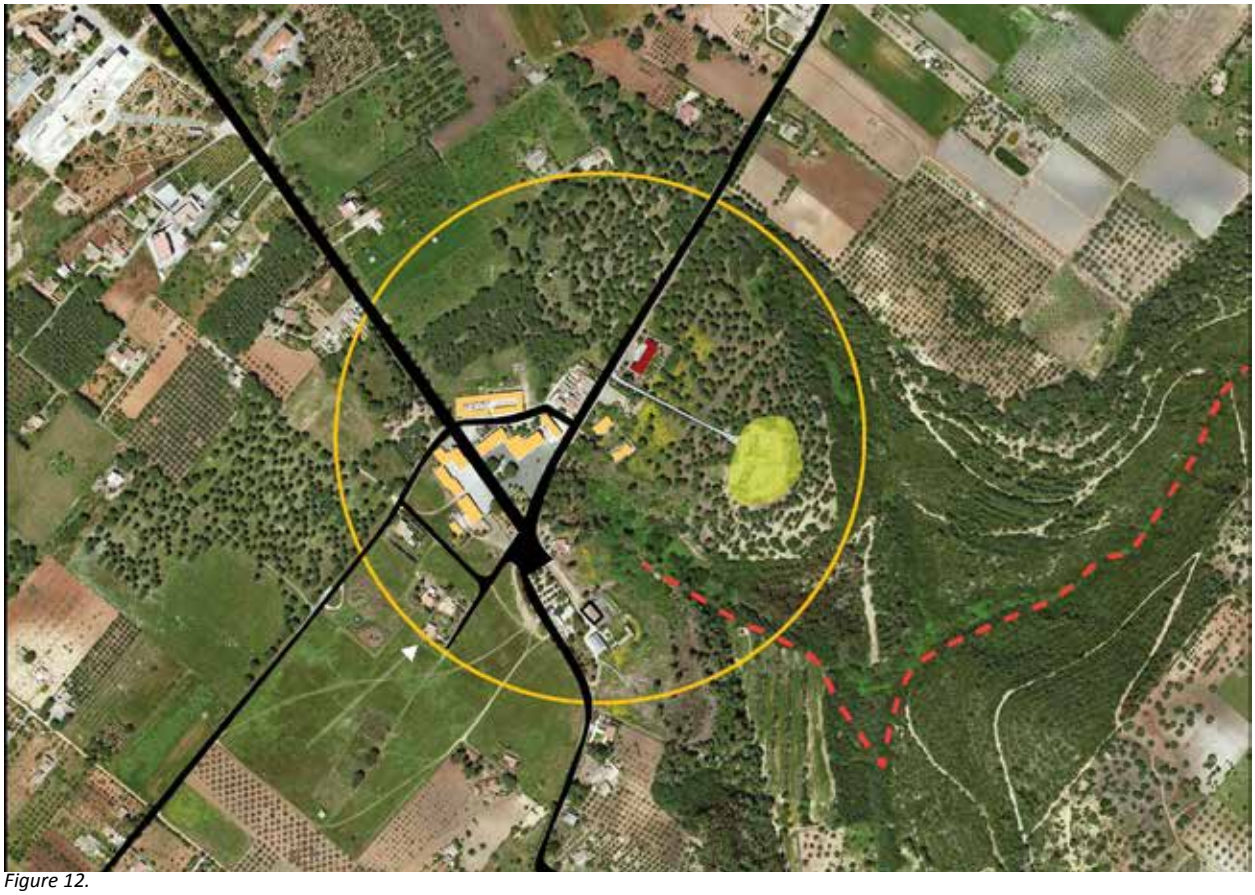


Figure 12.

Figure 12. Location and urban setting of Santo Pietro District

1.2.1 Short history note on "Santo Pietro" Forest's naturalistic value

What is an "Oriented" Nature Reserve in Italy?

The first historical evidence of the Forest dates back to 1160, when the Norman King Ruggero of Altavilla gave it to Caltagirone, together with the Barony of Fetanasimo as a reward for the help received against the Saracens. At that time the extension of the Forest was of 30,000 hectares. The massive presence of man over the centuries devastated the original appearance of the area. However, in some locations, such as Fontana del Cacciatore, Fontana Molara, Cava Cannizzolo and Dongiovanni, the vegetation is still so dense to make the visitor revive the original and unique charm of the forest as it once was. Repeated fires, lack of maintenance, illegal pastures and hunting are responsible for the deterioration and decay of the forest.

The Natural Reserve "Bosco di Santo Pietro" was established in 1999 with the purpose of containing the decline and reverse that tendency. Today there are several actors who operate on the territory of the Reserve and give their contribution to the requal-

ification and redevelopment of the area.
In 2006 the Administrative Order that proclaimed "Santo Pietro" Forest an Oriented Nature Reserve was dismissed. There are several speculations regarding the causes but the real reasons remain unknown.
This is a statement of the biggest Italian environmental association, called Legambiente declaring the fact on

Figure 13.

their internet site (translation available in Note 1):

"A seguito di ricorso al TAR, su aspetti formali e non di merito riguardanti la pubblicazione degli atti relativi all'istituzione, la riserva è decaduta.
Nonostante sia necessario soltanto un atto formale, l'Assessorato regionale al Territorio e Ambiente ingiustificatamente non ha ancora istituito nuovamente la riserva." [1]

(http://www.legambientecatania.it/conservazionenatura/bosco_santo_pietro.htm)

In other words, an appeal was made but only regarding the perimeter of the nature reserve and it was questioning which parts of land should be included and which shouldn't. Although this type of appeal is not legally sufficient in order to dismiss the whole reserve and even though the reestablishment should be just a formality, until now the Regional Department for Land and Environment hasn't provided to restore the status of nature reserve to the territory of "Santo Pietro".
Unfortunately, similar kind of illogical in a sense, events can happen frequently in Sicily. It may take many years before a change and administration and legislative body result too slow and inefficient in assuring the necessary assistance.

Figure 14.

Figure 13 - 15. Views of the area of Maquis Shrubland inside Santo Pietro Forest (the images are taken from the book "Bosco di Santo Pietro. Riserva Naturale Orientata", Fabio Orlando Editore, Palermo, 2002

Note 1:
Translation of the quote: After an appeal to the TAR (The Regional Administrative Court) on formal aspects and not on the merits regarding the publication of the acts related to the establishment, the reserve has decayed.
Although it would only require a formal act, unreasonably the Regional Department for Land and Environment hasn't yet reestablished the reserve again.

1.2.2 The Naturalistic value of "Santo Pietro" Forest today

Naturalistic aspects of the area – «Macchia mediterranea» - Maquis shrubland: "Santo Pietro" Forest is valued for the characteristic vegetation which is still preserved in some of its parts.

"Maquis is a shrubland biome in the Mediterranean region, typically consisting of densely growing evergreen shrubs such as holm oak, Kermes Oak, tree heath, strawberry tree, sage, juniper, buckthorn, spurge olive and myrtle. It is found throughout the Mediterranean Basin, including most of coastal Italy, southern France, southern Spain, southern Portugal, Lebanon, Sardinia, Corsica, and elsewhere." (Wikipedia)

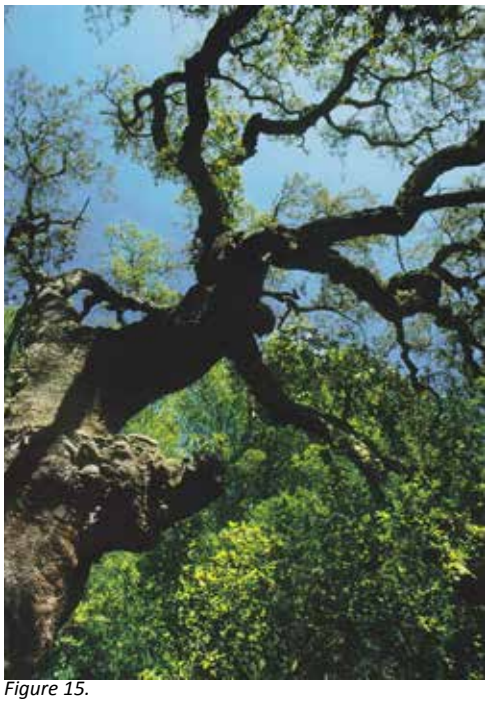


Figure 15.

Despite the slow decline of "Bosco di Santo Pietro" after three allotments (in 1093, 1939 and in 1952) the territory is still one of the largest examples of Maquis shrubland in Sicily. Over 300, in fact, are the species, all of which able to withstand prolonged drought conditions, like rare prickly oaks, cysts, many herbs, wild orchids, lichens and mushrooms. The fauna is particularly rich in birds - about hundred species have been observed.
Another important naturalistic aspect of "Santo Pietro" is the presence of cork trees of the highest quality. The territory of "Bosco di Santo Pietro" along with the adjacent nature reserve "Sughereta Niscemi" include the last strips of what once was a vast 30000 hectares forest of cork oaks. The deforestation has reduced the original forest to 2,500 hectares, which are very fragmented and in many cases seriously deteriorated by anthropic intervention.
After dismissing the area of "Santo Pietro" from the status of nature reserve there is no legal way to protect the authentic Maquis flora and fauna. The remains of what once has been a majestic forest is risking to be swallowed by the activities of agriculture, deforestation, urbanization and desertification.

1.2.3 Who is in charge of promoting natural enhancement in the territory of "Santo Pietro"?

In order to have a better understand-

Figure 16.

ing of how the territory of Santo Pietro can be helped to regain its position as a nature reserve, I made a research on the activities that operate with the aim to promote nature conservation and restoration in the area. I found out that there are two main activities: the “Museum of Mediterranean maquis” and the ecological association “Il ramarro”.
There is also “Agenzia Foreste Demaniali” – the Forestry Authority, which is mainly engaged in the management of the area, civil and fire protection.

Figure 17.

Figure 18.

Museum of Mediterranean maquis

The Museum is a collaboration between the Municipal Administration and the Sicilian Fund for Nature and collects significant finds from various parts of Sicily and in particular from the surroundings of Caltagirone and “Bosco di S. Pietro” Natural Reserve. The museum is equipped with a permanent exhibition, a laboratory and a classroom for didactic purposes and teaching. The Natural Museum, already allocated as a permanent exhibition of museum-based materials in the Convent of the Benedic-

Figure 19.

Figure 16 - 19. Nature Museum of Mediterranean maquis (images from personal archive)

Figure 20. "Renelle" Base Camp of the Ecological Association "Il ramarro" (personal archive)

Figure 20.

tines (Caltagirone) , was reorganised and reopened in 2005 in the former elementary school in "Santo Pietro" District. It is now considered a developing project since it is the first step for the realisation of a future naturalistic section of the Civic Museums of Caltagirone. The museum is currently a center for knowledge recognised by the Ministry of Environment and included in the National System of INFEA (Information, Education and Environmental Education). What I noticed by studying and visiting the museum is the fact the building is quite small and all the offered activities are indoors. There is not enough space to host activities where the young visitors can actively participate. All the room is already taken by the permanent exhibition and the laboratory. It would be difficult to host a temporary exhibition for example.

Personal considerations

In my opinion the museum has a lot of potential that could trigger local social attitudes towards environmentally sustainable development of the territory of the "Santo Pietro". By working with youth and educating children to cherish nature one is directly operating on the future of that territory. Here's why I believe that providing support structures for the museum can facilitate the sustainable development of the territory and preserve the authentic nature of "Santo Pietro", maybe even push the Administration to work for restoring the status of nature reserve of the land. My idea is to make a project that provides additional space for the museum activities and bases its pur-

pose on involving practical tasks connected to the museum programme.

Ecological association "Il ramarro"

The ecological association "Il ramarro" has more than 20 years of experience in promoting the culture of sustainable development in the area of Caltagirone. Their main base camp is located inside "Santo Pietro" Forest, approximately 8 km away from "Santo Pietro" District.
Once barracks, the base is now custody of the association. The house has been renovated and almost completely rebuilt with the authentic

Figure 21.

materials of the original building. "Il ramarro" found it in a state of severe deterioration, but during the rebuild-

Figure 22.

Figure 22. Prohibition sign inside Santo Pietro Forest (personal archive)

ing process the precise architecture of the preexisting house has been respected.
The base is used for environmental and educational activities, meetings, seminars, workshops, courses, stages lasting one or more days. Its extension equals to 7 ha. The rural building has 16 beds divided in two rooms, bathroom, kitchen and living room and a small museum of the forest. The energy is supplied by photovoltaic panels and hot water is produced by solar heating panels. In front of the house a large gazebo provides shelter from the sun for outdoor meetings. There are other areas equipped with tables and benches, an educational nursery and a stone amphitheater for performances and social activities. Inside the base is practiced waste sorting and composting of wet waste.

Figure 21. Arson fire inside Santo Pietro Forest (personal archive)

Personal considerations

What I noticed by visiting the base "Renelle" is that is provided with a huge and well-equipped outdoor

Figure 23. Actual position of the volunteer firefighter teams inside Santo Pietro Forest

Figure 23.

area and offers plenty of activities related to the promotion of the forest and the nature. The association "Il ramarro" is very open to collaborate with other local organizations. The only weak point is that the structure is not open constantly and outside of the activities and scheduled events, it can happen to remain closed for long periods. Its position is distant from "Santo Pietro" District and to walk from one to the other can be challenging and not suitable for groups of children, for example in case of outdoor school activities.

On the other hand what is positive about "Il ramarro" is that for a symbolic amount of money anyone can obtain membership and actively participate in the activities and present new ideas. The founders of the association are simple citizens of Caltagirone who started the association, promoted it and involved more and more people into it. In the same time all the public and social activities are open and everybody can join in. In my opinion this has educational function, pushes people to get involved and helps them to build their own environmental awareness and sustainable mentality.

The Forestry Authority "Foreste Demaniali" and fire protection activity

The Forestry Authority is mentioned for its assignment to manage the fire protection activity on the territory of "Santo Pietro".

During my visit I was informed that the area of "Santo Pietro" is at high risk of arson and natural fires, especially during the hot period. Arson

and wild fires are a serious problem in the territory, considering that till today they have caused huge naturalistic and economical damage, burning secular trees and authentic vegetation and contributing for climate change, a medium temperature increase and desertification. Therefore the territory is provided with observation tower and fire break paths which limit the spreading of eventual fires. In 2009 the Local District started engaging squads of volunteering firefighters in order to assure a constant supervision of the forest during the months at higher fire risk. The squads of firefighters operate on the territory of "Santo Pietro"from May till October. The teams are considered "volunteering" even though they receive a salary, due to the fact that they are employed after a merit ranking and only for a certain period of the year. Because of the discontinuity of the squads' work, their location in "Santo Pietro" District is just a simple tent where they perform their working shifts of 8 hours.

Personal considerations

Considering the arid climate typical of the area, in my opinion "Santo Pietro" Forest will probably always need the presence of fire-fighting teams. I think that it's important to supply a fixed location, where teams can perform their shifts with dignity. Provide shelter from adverse weather conditions, in particular from the burning sun during summer, as well as provide them with the necessary space for their activities are, in my opinion, basic and necessary conditions so that the fire-fighting teams can perform their tasks well.

1.3. Brief description of problems, resources and opportunities

In the end of the Site Survey I found the need to draw up a summary of all the important aspect of the area that I have found. On one hand there were many problematic points, but on the other I needed to consider positive perspectives, resources. I found essential to focus on the benefits, because I felt that the sum of cultural and naturalistic heritage, different elements that could be involved, different activities and behaviors could all work together in order to make the difference on the territory of Santo Pietro.

Here is a list of these aspects:

Problematic aspect
-Decay of the status of Nature Reserve and lack of protection for forest
-Increasing agricultural activity at the expense of maquis shrubland land
-Unauthorised building
-Administrative difficulties
-Decay of buildings, touristic facilities, green areas and service spaces
-Scarce participation of locals
-Natural and arson fires
-Desertification danger
-Not always efficient collaboration and cooperation between different organizations that work for the protection of the reserve
-Almost total absence of solar photovoltaic and heating systems on the territory of Santo Pietro, despite the huge potential for these systems on the territory

Benefits and opportunities
-Large naturalistic value of the area (One of the largest examples of Maquis Shrubland in Sicily)
-Active local ecological organizations
-Newly concluded and ongoing projects for the sustainable development of the territory
-Activities of re-naturalization with authentic vegetation with the intention to solve the problem of desertification
-Guided tours for schools
-Temporary Teams of volunteers firefighters to control wild and arson fires
-New connections between different ecological organizations
-Great availability of solar power for photovoltaic and solar heating systems
-Possibility of European social funds for the implementation of projects that promote sustainable tourism

So accordingly to this summary the project concept strategy aims to attract sustainable tourism and therefore funds for the protection of the flora and fauna of Bosco di Santo Pietro while is improving the fruition of the forest.

Chapter 2 – Project Definition – Visitor Center and Base for the volunteers firefighters

2.1 Site Survey of the project area

The project area, previously used as illegal Clay Pigeon Shooting Range, is situated in the Nature Reserve of Santo Pietro in the territory of Caltagirone (CT). Its location is adjacent to the "Borgo of Santo Pietro" District. Up to 2006 "Bosco di Santo Pietro" was a Nature Reserve, but as a result of an appeal the decree is decayed and today still is expected for the Sicilian Region to reintroduce a decree establishing the necessary corrections.

The area of the former Clay Pigeon Shooting Range consists in two large squares bounded by two artificial embankments. Each square is equipped with a projecting roof with steel structure and steel corrugated cover, where the shooters were aligned, and a concrete pit containing the traps (machines launching the clay pigeons), also features a small metal building for the observatory.

Inside the area there is a one-storey half-open building provided with electricity, running water and a bathroom with a septic tank.

The area has become Clay Pigeon Shooting Range about 30 years ago.

Figure 24.

Figure 24. Urban setting of the project area - a former illegal Clay Pigeon Shooting Range (map taken from the internet site of the Geoportal for the Sicilian Region - http://www.sitr.regione.sicilia.it/geoportale)

Figure 25. Urban setting of the project area, 3D-Model

Figure 25.

It is assumed that for the purpose it has been partially fenced and in the same time the half-open structure and one of the pits were built. In the 80's the second pit and the two platform roofs were added.

The area is currently in state of significant decay. The existing structure, built sparingly with pre-stressed concrete blocks and tuff, timber roof beams and roof Eternit shingle has been abandoned for a decade.

The electricity is provided by a power line on concrete piles lining the driveway. Currently the building has a 10 kW (380 V) three-phase counter. In addition, the building is connected to the public water (provided by the territory of the city of Grammichele, about 20 km away) and the sewage system is equipped with septic tank.

Until 2007 there were objects in the pollutant due to shooting: cartridges, pieces of plates, lead shots, the last ones known for their high level of toxicity.

2.1.1 Pollution problems

The pollution of soil and land reclamation

The project area has been subjected

Figure 26. Urban setting of the project area, 3D-Model

Figure 26.

to soil pollution since it's been used as Clay Pigeon Shooting Range. In 2007 a land remediation has been done. This transaction was funded by the "Foreste Demaniali" (State Land Forests Department), however no building interventions were included. The intervention consisted in the collection of pollutants in different piles. Not only plates, cartridges and lead shots were collected, but also all the spreaded in the area pieces of construction materials. When impossible to collect the too small pieces, whole portions of land were taken. The collected material was disposed of in the authorised landfill company "Battiato Venerando" in Santa Venerina (Catania) on 18/12/2007.

Anyhow is difficult to say if the operation of land remediation has been completely successful and from a different point of view it couldn't have been. If one considers only the terrain pertaining to the ex-shooting range, it might even result almost completely recovered. But peaces of plates and mostly lead shots have been spread in the surroundings for years. The remediation of the soil hasn't considered the full range of possible shootings and in that case the area to recover would be many times larger than the recovered one.
It is important to understand how dangerous a lead pollution can be. Lead is a poisonous metal that can cause serious damage to health, mainly to the nervous system (especially in children), fertility in women, it may also cause diseases to the brain and the blood. The lead shot causing the death of many waterfowls in the

wetlands, which usually ingest them confusing them for pebbles. For this reason, in most European countries and in many Italian regions use of lead ammunition has been banned. Lead maintains its polluting characteristics and once released into the environment gets accumulated in water basins, soil and subsoil, starting to make part of the poisons in the food chain.

2.1.2 Vegetation

The vegetation in the project area is represented mainly by Stone pines Pinus Pinea, but one can find several plants pertaining to the Mediterranean ecosystem, Maquis. The pines were planted about 35 years ago by the city of Caltagirone. There are also a citrus tree, a mulberry tree near the existing building and two viburnum bushes adjacent to the canopies. During a recent intervention of rearrangement of the area and soil decontamination there were planted fifty-five saplings and around thirty bushes. At this moment there are fifty holm oaks in the area that are higher than 2 meters and a have trunk circumference between 8 and 12 cm and five more higher than 1 meter and a trunk circumference greater than 2 cm. The new-planted bushes belong to different species typical for the maquis, namely: cistus, mastic, Mediterranean dwarf palm, Phyllirea, Euphorbia Hawthorn and Rosemary. The restoration work of vegetation is essential to fight desertification in Sicily and to conserve and rebuild its original flora. Most likely the area of the ex-Clay Pigeon Shooting Range has been deprived of its original vegetation in order to be adapted to the practice of clay pigeon shooting.
The most present tree on the territory is the Stone pine Pinus Pinea that can reach up to 30 meters of height, but usually is 12 to 20 meters tall. The pines surrounding the project area have already gone beyond their youth stage and are completely shaped as middle-aged trees with umbrella canopy and thick trunk. One of the characteristics of the pine trees, which may be considered negative, is the fact that their roots, fruits and falling leaves tend to acidify the underlying soil and prevent grass or other plants from growing. For the same reason several nature restoration projects, including some in the “Santo Pietro” Reserve, aim to thin pine forests and fill up the clearings with original Mediterranean vegetation, particularly with holm oaks. During the last years this operation has been done in the areas surrounding the ex- Clay Pigeon Shooting Range. The recent intervention of rearrangement mentioned above makes part of a bigger naturalistic project for the re-integration of the original flora of the Island of Sicily as an answer to growing desertification. For the environmental aspects development of the thesis project is

significant the presence of a young mulberry tree in close proximity to the existing building. This tree can reach up to 10-12 meters of height and thanks to its wide crown produces excellent shadow. It is important to notice that mulberry trees are deciduous and consequently shade in spring and summer but their foliage becomes permeable in winter time, allowing the sun light to reach eventual near buildings.

2.1.3 Summary of negative and positive aspects of the area

"Negative" aspects of the area requiring attention:
- Precariousness of the current architectural structures

- Prior use as an illegal Clay Pigeon Shooting Range and resulting lead pollution

- Main structure's roof containing asbestos

- Presence of unused concrete structures

"Positive" aspects of the area to protect and cherish:
- Naturalistic value

- Strategic position as for the connection with the main road and the village

- Strategic position as for the scenic landscape towards the Maquis Shrubland valley where one of the main touristic routes take place

- Amount of received solar radiation

- Position that favours summer breezes

- Proximity to water

- Recent planting of authentic vegetation

2.2 Description of the final users, their activities, work and requirements

As already mentioned in Chapters 1.1 and 1.2.3 during the months at higher fire risk of natural and arson fires teams of volunteering firefighters have been placed inside the District with the aim to provide fire protection on the territory of "Santo Pietro". At the same time the squads haven't been provided with a proper base where to stay. I recognised an interesting pattern in the time of the year during which firefighters and Nature Museum are operative. While the teams are engaged on the territory from Mid-May till Mid-October, most of the activities of the Nature Museum are related to School visits, which means from September till June. It has already been established that both sides require more space in order to develop their practical activities. Therefore the project concept

idea has been modified in order to include the opportunity to create a space that satisfies both requisites. The main Intended Use remains the Visitor Center, which however has to perform as a firefighters base too for six months a year. This is seen as chance to optimise a space, which otherwise is likely to remain unused for part of the year.
For a simpler approach to a project with flexible Intended Use, it has been chosen to create three different scenarios for its use.

2.2.1 First Scenario : Visitor Center in conjunction with the Museum of Maquis

Multifunctional flexible space, highly dependent on the period of didactic activity of schools.
Most activities are expected through the academic year - normally from mid-September to mid-June.

The Visitor Center should provide space for :
- Laboratories for children
- Courses – Educational courses in environmental awareness and forest fires prevention; experiment local crafts
- Guided tours for schools
- Temporary exhibitions
- Recreational activities
- Starting point of the nature trails

Santo Pietro already has a Nature Museum with permanent expositions. The new Center has to manage practical activities that involve visitors and invite them to get to know the territory. For this reason it's structure has to be more informal – people should be able to stay in many different ways, to make part of debates, to see projections or movies, to propose new initiatives, organise events, prepare meals and feel invited to turn back soon. Children and students should be assisted by specialised staff dedicated exclusively to their activities. I believe that this can be a unique opportunity to generate value to the area of Santo Pietro District and attract public and authority's attention.

2.2.2 Second scenario: Base camp for the volunteer Firefighters

Period of use expected from mid-May till mid-October. Very often merit rankings for Firefighter Operators are delayed and therefore activities start a month later.

The volunteer firefighters and their activities require certain conditions, space and facilities, equipment and tools to be delivered in order for them to perform as best as they can.

Description of the Teams of Volunteer Firefighters
-The teams are made up of six people.
- Every team has 8-hour shifts in order to guarantee a 24-hour-presence for 6 months a year: from the begin-

ning of May till the end of October.
-Used devices - personal protective equipment, chain saws, shovels, hoes, axes, binoculars, fire etc. raks.
-Used vehicles:
• Fiat Ducato vans (for the transport of the workers)
• 4x4 Vans Bremach 500 liters
• Tankers of medium-heavy type
• Off-road Jeep, cargo type

Main Requirements Recap
The teams need a dwelling where mainly:
- To have a shelter from the heat or other adverse weather conditions
- Rest, prepare meals
- Store, prepare and supervise firefighters equipment
- Change one's clothes, have access to personal hygiene facilities

2.2.3 Miscellaneous scenario

With miscellaneous scenario is intended the short periods when the activities of the Visitor Center overlap the stay of the volunteer firefighters. The situation is possible from mid-September till mid-October and from mid-May till mid-June. During those periods the weather is usually from warm to mild and allows to conduct most of the activities outdoors. Both employees, visitors and firefighters would have less indoor space for their activities but in the same time it's possible to imagine some interesting and stimulating collaborations between these three types of users. For example during the firefighters' working shifts there are long periods during which they must remain on guard but since there aren't any fires, they don't have to do any particular tasks.
Unofficially firefighter teams could take part in both maintenance of the building and the other structures and in educational activities by contributing with their knowledge in the field of extinguishing forest fires.

2.3. Preliminary Climate Analysis of the project area

The Bioclimatic charts are used in the early design stage to define potential building design strategies that utilise natural energy resources and minimise energy use in order to achieve indoor thermal comfort. Olgyay's and Milne-Givoni's Bioclimatic Charts are maybe the two most popular methods in preliminary bioclimatic analysis. What the two methods have in common is that they both show the boundaries of range of acceptable hydrothermal conditions.

In the Table in Figure 26 relative to Santo Pietro's Site are clustered together Minimum, Average and Maximum temperature data for each month of the year together with Relative Humidity measured in two different moments of the day, and Average Relative Humidity.

With the data illustrated in Figure 26 both Olgyay's and Givoni's Bioclimatic Charts have been elaborated.

So by analysing the obtained results, here follow:

MONTH	Tmed	Tmed max	T med min	Ur med	Ur 12h	Ur 6h	T max	T min
January	7,3	11,9	2.8	83,8	76,3	91,3	17,5	-2,1
February	10,8	15	6,5	86,0	78,3	93,7	19,8	1,8
March	12,7	18,2	7,3	73,2	63,3	83,0	27,0	-0,7
April	14,0	19,7	8,3	78,7	65,7	91,7	26,7	4,4
May	18,1	24,6	11,6	67,3	53,3	81,3	28,8	8,0
June	23,4	29,9	16,9	46,7	36,3	57,0	35	9,9
July	25,2	32	18,5	52,2	40,3	64,0	40,4	15,3
August	24,5	30,7	18,3	57,0	43,7	70,3	38,2	14,0
September	20,8	26,1	15,5	69,5	55,3	83,7	29,4	10,6
October	17,4	22,2	12,5	75,5	64,3	86,7	26	10,3
November	14,5	18,5	10,4	81,8	74,7	89,0	23,6	4,9
Dicember	10,0	13,5	6,5	88,2	82,3	94,0	15,9	4,1

Figure 27. Table of climatic data for the territory of Santo Pietro, extrapolated from documents published on the website of 'Italian National Institute of Statistics - http://www.istat.it/en/about-istat

Figure 27.

Climatic Analysis Conclusions and possoble strategies to ensure the hydrothermal comfort in the dwelling

The presence of the volunteers firefighters crew is scheduled from mid-April until mid-October.

By filling out the Givoni chart results that for a large part of the summer months the feeling of hydrothermal comfort is guaranteed without specific intervention.

APRIL To ensure the comfort, it is necessary to increase the interior environmental temperature (t °) in 5-10°C. The solutions are: 1) Heating the environment, 2) to use passive systems for winter heating, and 3) make use of the thermal mass of the building. In cooler days one a strategy could be to affect relative humidity (RH) of the air (dehumidify)to relieve the feeling of cold.

MAY Observations made for the month of April can be applied, but lower degree of intervention is required. About half of the obtained line falls within winter and summer comfort zones.

Figure 28. *Givoni Bioclimatic Chart*

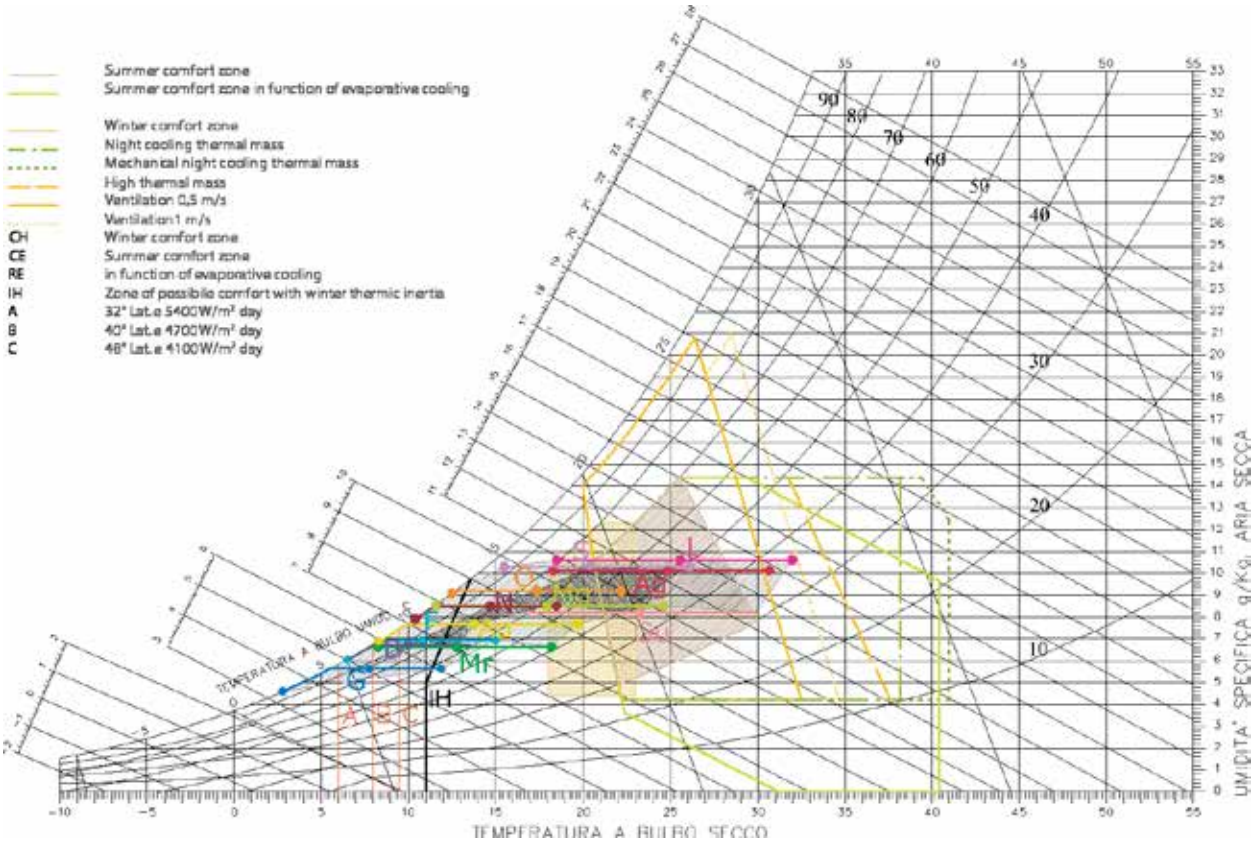


Figure 28.

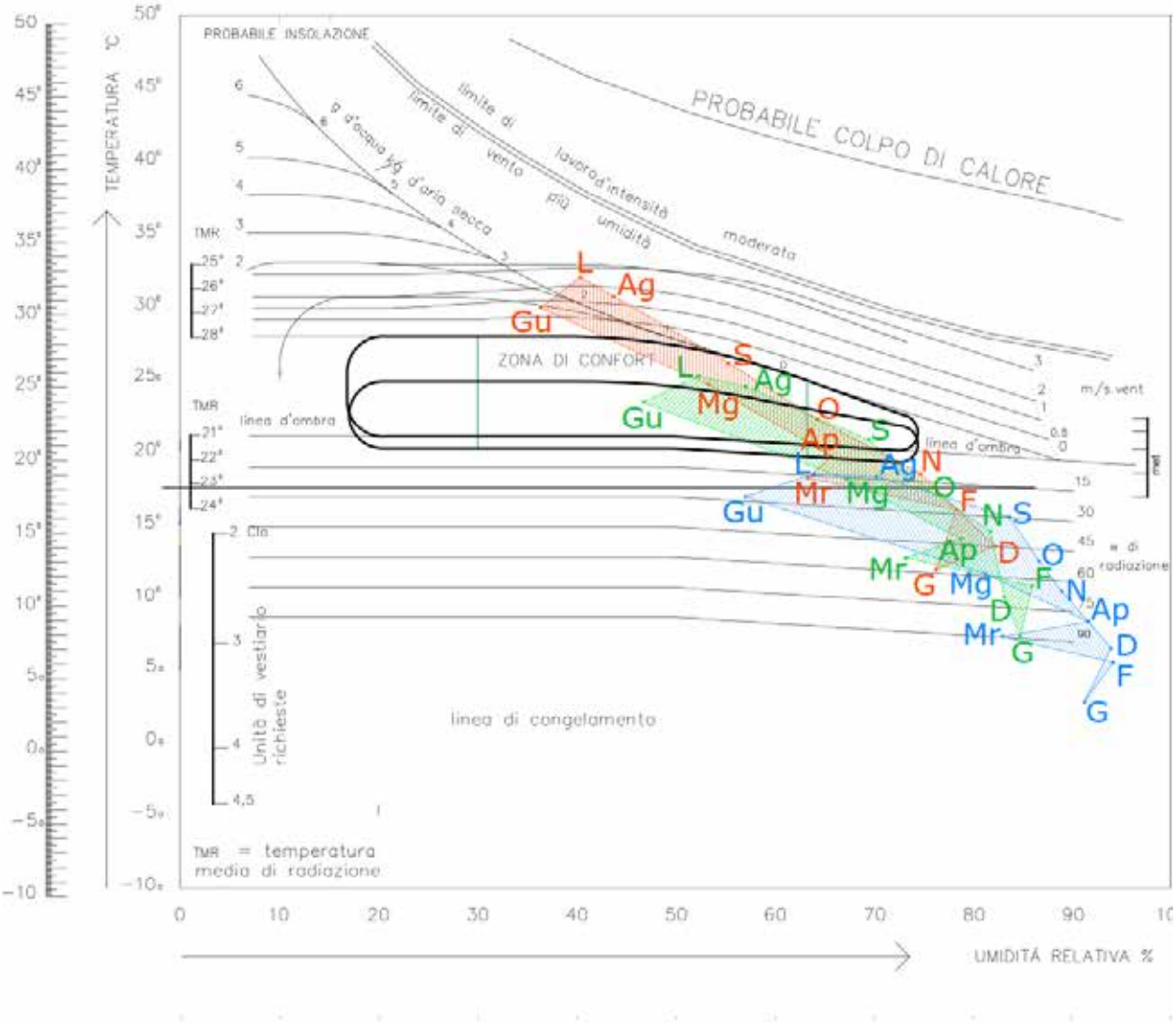


Figure 29.

Figure 29. *Olgyay Bioclimatic Chart*

JUNE In June there is nearly no need of intervention in order to improve the hydrothermal comfort is required.

JULY and AUGUST To ensure comfort the interior environmental temperature (t °) should be decreased. Possible solutions are: 1) to use techniques of natural ventilation from 0.5 m/s to 1 m/s 2) to use strategies for passive cooling thanks to the thermal mass of the building in order to dampen the daily changes, and 3) use of strategies for evaporative cooling.

SEPTEMBER This month on one hand presents the characteristics of summer months, on the other brings the first signs of autumn with temperatures slightly below the comfort zone and specific humidity (Ur) gets

closer to the Dew point.

OCTOBER To ensure the comfort, it is necessary to increase the interior environmental temperature (t °). Possible strategies are: 1) heat up the interior environment, 2) to use passive systems for winter heating, and 3) to use the thermal mass of the building.

NOVEMBER – MARCH During these months the combination between temperature and humidity brings the sensation always outside the comfort zone. In this case heating is required throughout the whole period in order to raise the interior environmental temperature (t °) while intervening on relative humidity of the air becomes essential. From Givoni's Chart becomes relevant how in November, December, January, February and April that humidity reaches levels higher than the Dew point, which contributes largely to the sensation of cold.

Chapter 3 - Initial concept and starting points for the Project Design

3.1. Availability of energy resources

3.1.1 Solar energy

"Solar radiation is the primary source of renewable energy. Besides offering a direct source of energy, it drives the Earth's climate creating opportunities to draw energy from wind, waved, tidal (together with the moon) and a host of biological sources… Since the sun drives every aspectof the climate it is logical to describe the techniques adopted in buildings to take advantage of this fact as 'solar design'."
Peter F. Smith, Architecture in a Climate of Change

"A true architecture of the sun and wind is more than the sum of passive strategies, technological systems, and ecological engineering. Buildings that are shaped by the sun and wind, promote social and ecological values by revealing how our lives can be powered by renewable resources; and just as importantly, they also promote aesthetic values by creating relationships with place and site that are based on the form-giving and poetic attributes of these forces. The new solar architecture has a thin profile that optimises light and air, it employs an ecological envelope that is responsive to the site and environmental forces; it reduces or eliminates dependence on fossil fuels, is renewable, and strives for little or no carbon-based energy consumption."
Mary Guzowski, Towards Zero-energy Architecture New Solar Design

"We're now experiencing a moment of significance far beyond what any of us can imagine. What can be said is that the foundations of a new historical period, the Ecozoic Era, have been established in every realm of human affairs. The mythic vision has been set into place. The distorted dream of an industrial technological paradise is being replaced by the more viable dream of a mutually enhancing human presence within an ever-renewing organic-based Earth community… In the larger cultural context the dream becomes the myth that both guides and drives the action."
Thomas Berry (theologian and historian), The Great Work: Our Way into the Future

"Solar power: All energy is solar energy, stored in different forms. Every two minutes the sun gives the earth more energy that is used annually world-wide. It is the only renewable resource with the capacity to provide

all the energy we need on a global level."
Bruce Mau, Massive Change
One of the most important aspects of the area of "Santo Pietro" Nature Reserve is the huge amount of solar energy available during almost all the year. It can be considered its main resource.

3.1.2 Winds

In climates with hot arid summers the presence of breezes can be an important factor to integrate into the project of buildings. Even the slightest movement of the area, if channeled properly, can contribute to the passive cooling of a house. Therefore a wind analysis of the area of "Santo Pietro" is a part of its renewable energy concept design.

The description of the winds in this subchapter is referring to their specific characteristics in the region of Sicily. Nature and properties of Mediterranean winds can vary from one location to another. With regard to the subject of study of this thesis, the analysis of the winds is limited to the area of Sicily.
In the region of Sicily the main winds are listed below in association with the direction from which they originate:
- North: Tramontane – usually a cold winter wind

- South: Ostro – a wam humid wind, a

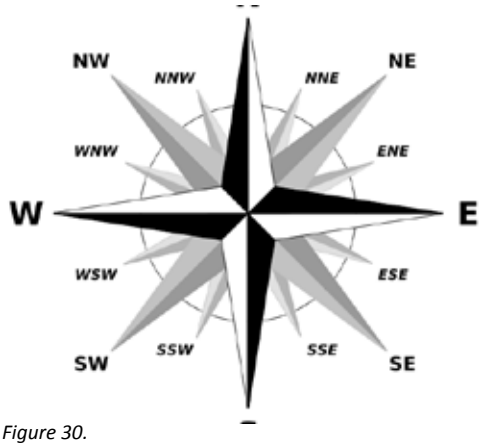


Figure 30.

Figure 30. Compass rose (source: Wikipedia)

times humid or even causing rains, at times dry; In both cases it can bring heat waves in summer

- East: Levant – usually a humid fresh wind, it can cause fogs, rains and rough sea; It can appear through the year, but mostly from July till October

- West: Ponente – it is known for being a humid sea breeze during the summer season that has a rather moderating effect on the heat

- North-East: Gregale – During winter usually it assumes the characteristics of cold dry wind that blows with moderate to strong intensity. During summer it can be a land or sea breeze, that can bring both atmospheric disturbance and raising temperatures

- South-East: Sirocco – it's a hot southerly wind deriving from Sahara and moving eastwards in advance of a low pressure system. It generally moves in the Mediterranean areas and often extends to the Adriatic

where it may reach gale force. This wind can be of two types – dry or humid; dry in areas adjacent to the desert or after having crossed mountain ranges; and humid in the regions reached after crossing sea areas. In Sicily the Sirocco can be very dry and often carries desert dust; causes abrupt increases of the temperature and can be harmful to vegetation and technological devices. It can easily vary its intensity up to storms and it can blow for short periods of two-three days in every season, but it's more frequent during spring.

- South-West: Libeccio - In a similar to the Sirocco's way, this wind is also known in Mediterranean areas because of the heat and the sand that usually brings with it, especially in the inlands.

- Nord-West: Mistral – this wind is caused when flows of arctic air burst in the Mediterranean. It can bring warmth during the first days of its action followed by a gradual lowering of the temperatures afterwards. During winter Mistral brings cold air and sometimes snow.

By consulting wind data for the territory of "Bosco di Santo Pietro"for the years 2000 and 2001 **(See Appendix number - Winds),** it is found that:

-During Winter most frequent and most intense winds were coming from North, North-West and West

-During Spring most frequent and most intense winds were coming from South-West and especially from **North-East and West**

-During Summer most frequent and most intense winds were coming from South-West and especially from **West**

-During Autumn most frequent and most intense winds were coming from West

Therefore during the period from the beginning of April till the end of September for the project area it becomes important to protect from hot South-West Libeccio, while trying to open up for breezes coming from West. And from late autumn and through winter it can be necessary to protect the building from the cold Tramontane and Gregale winds.

3.2. Documenting a starting concept – references to other projects, case studies and local building tradition

This subchapter creates a basis for the initial concept of the project. There are three case studies to be analyzed and each one is essential for a different aspect of the thesis project. The first is called Government Canyon Visitor Center and is an excellent example of green energy-efficient architecture. The second case study is a project for the restoration and reuse of an old Sicilian manor

house and represents an interesting starting point for the thesis project for its intention to reintroduce Sicilian architectural tradition on a formal level and partially in the selection of building materials. The third case study is actually a collection of selected projects from the Solar Decathlon Competition. The research was carried out with the idea to identify the essential elements of the major innovations in the field of sustainable homes. The Solar Decathlon prototypes are made in a way to be transported easily, usually have replaceable structural elements and a reduced total volume. These are family houses and as such provide the essential services that every home needs. At the same time because of the limited available space they have, often provide a clever and flexible space division, which is important for the building project in this thesis.

3.2.1 Case Study 1 - Government Canyon Visitor Center

"The design at Government Canyon considers the fundamental relation of people to the natural environment. The sun drives the ecosystem, from the wind to the plants to landform to climate. The approach is to fit into the natural environment. To fit together humans, nature, and climate in simple and elegant ways. This is the basis of the design thinking."
Bob Harris, Lake|Flato Architects

I learned about this project for the first time through the book of Mary Guzowski "Towards Zero Energy Architecture. New Solar Design". The

Figure 31.

Figure 32.

project is located in a context in some ways similar to “Bosco di Santo Pietro” – inside a natural park and is also used as a visitor centers that promotes site’s uniqueness in order to help occupants to appreciate natural beauty. The scale of the project is slightly bigger, but anyhow presents several elements in common with my personal idea of thesis project. As a

Figure 33.

Figure 31 - 40. Views and technical drawings of the Government Canyon Visitor Center, San Antonio, Texas, USA (source: internet site of the U.S. Department of Energy, www.energy.gov)

Figure 34.

Figure 35.

Figure 36.

Figure 31 - 40. Views and technical drawings of the Government Canyon Visitor Center, San Antonio, Texas, USA (source: internet site of the U.S. Department of Energy, www.energy.gov)

Figure 37.

consequence it was chosen as a very important case study that deserves a special mentioning in this thesis.

General information:

The Visitor Center floats in a field of native grasses and restored oaks at the mouth of the canyon, forming a gateway to the 8,600-acre Government Canyon State Natural Area. The canyon's rich ranching history is expressed in the exposed pipe structure. It's located in the Edwards Aquifer recharge zone, the sole source of drinking water for the city of San Antonio (Texas, USA). The building demonstrates sustainable water use practices by conserving water, collecting rainwater, minimizing run-off and contaminants, and reducing the use of ground water. The program included an exhibit hall, Texas State Park store, classrooms, offices, outdoor exhibit pavilion, amphitheatre, and trails. The goal of the project was to protect and restore the natural landscape while creating high-use, low-maintenance, and economical structures that reinforce the mission of the Natural Area. The facilities and improvements on the land provide the amenities necessary to attract ecotourism enthusiasts and to provide a local economic stimulus for land conservation.

Building details:

The priorities of the project are durability, maintenance and regional reliance in a way to create lasting value to the spaces. Therefore a special attention has been given to the choice of materials. The primary construction consists of rusted steel

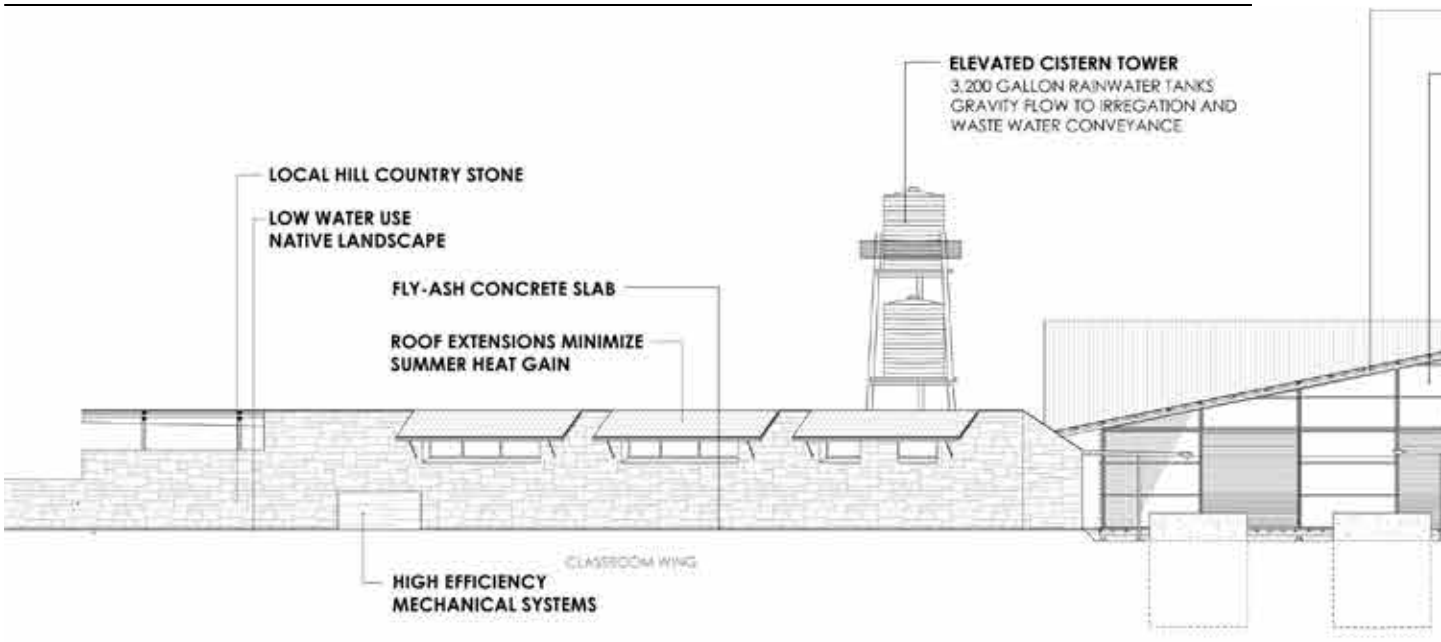


Figure 38.

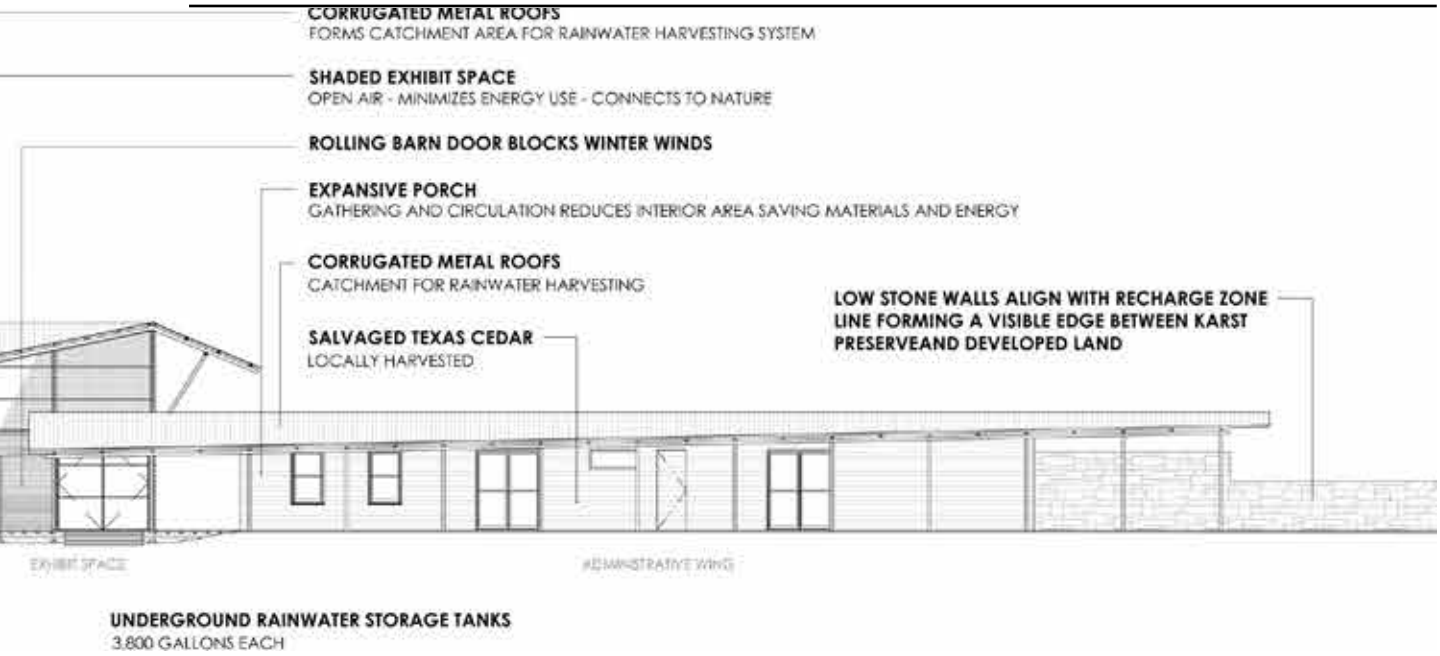
pipe with a minimum of 75% recycled content. The naturally oxidised surface protects the integrity of the inner steel and eliminates the need for paint, decreasing maintenance and the first-cost of materials. Exposed native stone and flyash concrete finishes likewise provide long life and low maintenance. The corrugated galvanised metal roofing is locally manufactured and provides a reflective surface while reducing the need for roof decking and substructure. The stone walls were constructed of stone quarried within 50 miles of the project site. The eastern red cedar siding, a byproduct of central Texas suburban development, was harvested locally and is used for the structures under the cover of the porches.

Indoor Environment Issues

The building's narrow footprint allows for maximum use of indirect daylight from both the south and the north in all occupied spaces. Approximately 90% of occupied spaces enjoy effective daylight and views, and 100% of spaces have ventilation control. Dimming controls in the exhibit space balance electric light levels against available daylight. All windows are

Figure 39.

Figure 31 - 40. Views and technical drawings of the Government Canyon Visitor Center, San Antonio, Texas, USA (source: internet site of the U.S. Department of Energy, www.energy.gov)


CORRUGATED METAL ROOFS
FORMS CATCHMENT AREA FOR RAINWATER HARVESTING SYSTEM
SHADED EXHIBIT SPACE
OPEN AIR - MINIMIZES ENERGY USE - CONNECTS TO NATURE
ROLLING BARN DOOR BLOCKS WINTER WINDS
EXPANSIVE PORCH
GATHERING AND CIRCULATION REDUCES INTERIOR AREA SAVING MATERIALS AND ENERGY
CORRUGATED METAL ROOFS
CATCHMENT FOR RAINWATER HARVESTING
SALVAGED TEXAS CEDAR
LOCALLY HARVESTED
LOW STONE WALLS ALIGN WITH RECHARGE ZONE LINE FORMING A VISIBLE EDGE BETWEEN KARST PRESERVEAND DEVELOPED LAND
EXHIBIT SPACE
ADMINISTRATIVE WING
UNDERGROUND RAINWATER STORAGE TANKS
3,800 GALLONS EACH

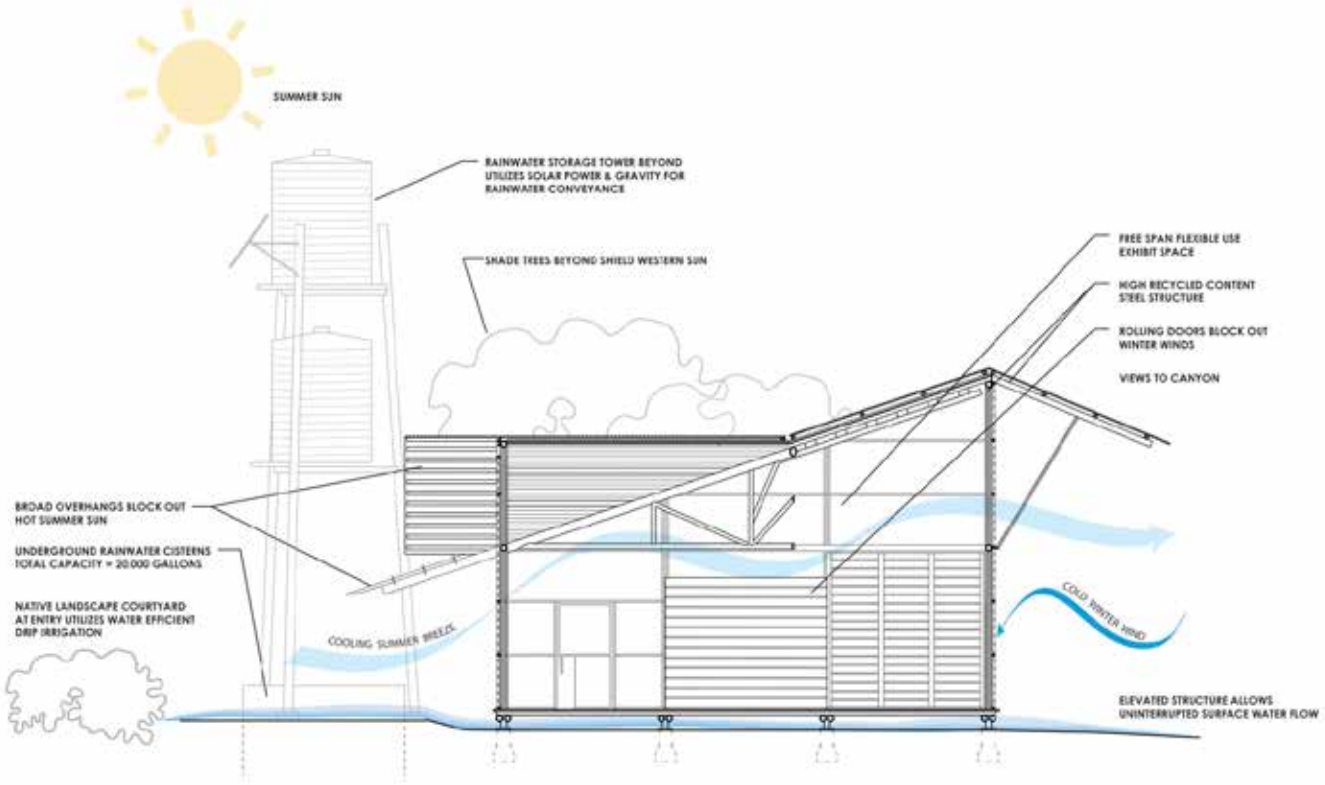

SUMMER SUN
RAINWATER STORAGE TOWER BEYOND UTILIZES SOLAR POWER & GRAVITY FOR RAINWATER CONVEYANCE
SHADE TREES BEYOND SHIELD WESTERN SUN
FREE SPAN FLEXIBLE USE EXHIBIT SPACE
HIGH RECYCLED CONTENT STEEL STRUCTURE
ROLLING DOORS BLOCK OUT WINTER WINDS
VIEWS TO CANYON
BROAD OVERHANGS BLOCK OUT HOT SUMMER SUN
UNDERGROUND RAINWATER CISTERNS TOTAL CAPACITY = 20,000 GALLONS
NATIVE LANDSCAPE COURTYARD AT ENTRY UTILIZES WATER EFFICIENT DRIP IRRIGATION
COOLING SUMMER BREEZE
COLD WINTER WIND
ELEVATED STRUCTURE ALLOWS UNINTERRUPTED SURFACE WATER FLOW

Figure 40.

oriented to catch both direct light and cooling breezes. Extensive use of conventional double-hung windows maximises the open area and minimises interference with work surfaces and flow paths, ensuring usability. Bronze screens allow breezes to naturally cool the main exhibit space, while large rolling doors can be closed to control light and keep out winter winds. Porches are oriented to provide various shelter options.

Design

In order to reduce the enclosed and conditioned area, generous sheltering porches provide for outdoor circulation and gathering. The porch space nearly doubles the usable area while reducing material and energy cost. To minimise time spent indoors, the project team created a variety of views, seating options, and intimate outdoor spaces. A tree-shaded outdoor classroom further extends this outdoor space.

Interior spaces were sized to minimal requirements. The exhibit space, the primary public room, is a 140 m2 screened room that reduced the programmed conditioned space by 35%. This structure provides shelter from the harsh Texas sun and adapts to the climatic conditions with large panels that shield against blowing rain and winter winds. The exhibits roll away and the space doubles as a multiuse free-span space for formal and informal gatherings.

The design uses durable materials such as rusted pipe and corrugated metal, reducing surplus finishes. Since the steel was not coated and was welded together, repairs, expansions, adaptation, and even future reuse would be relatively simple.

Energy Use

The design goal went beyond “right-sizing” by eliminating air conditioning from the exhibit area, which is the Center’s primary public space. This reduced the heating and cooling needs by 35%, plus the additional reductions associated with externalised circulation and space-efficient planning.

The building’s narrow floor plate, combined with deep porches, large overhang roofs, high-performance glazing, and reflective roofing, minimises cooling loads while allowing daylight to penetrate deep into the interior. Radiant barriers, foam-in-place insulation, and daytime operating hours further minimise energy use. The gravity-flow water systems, coupled with solar-powered water pumps, efficiently convey water while demonstrating renewable-energy technology. Natural ventilation, efficient equipment, fabric ducts, and accessible user controls increase comfort while providing further energy savings.

So here is a summary of some of the strategies applied to the Government Canyon Visitor Center which are considered important for the object of research of this thesis:

INDOOR ENVIRONMENT STRATEGIES

• - Visual Comfort and Building Envelope

- Orient the floor plan on an east-west axis for best control of daylighting

• Visual Comfort and Interior Design

- Design open floor plans to allow exterior daylight to penetrate to the interior

• Ventilation and Air Distribution - Ventilation and Filtration Systems

Design for optimum cross-ventilation through window placement

SITE STRATEGIES

• Site Planning

- Protect and celebrate a site's uniqueness

- Site buildings so as to help occupants celebrate the natural beauty

• Landscaping -Ecosystem Restoration

Replant damaged sites with native vegetation

WATER STRATEGIES

• Demand for Irrigation

- Select plants for drought tolerance

- Water Collection and Conservation

• Rainwater Collection

- Collect and store rainwater for landscape irrigation

- Collect and store rainwater for uses in building.

3.2.2 Case Study 2 – Antique manor house(masseria) restoration in Sicily

Figure 41.

Stone is a traditional Sicilian building material, which is widely used even now. Today stone is used both in new-built dwellings, both in the construction of dry stone walls -typical boundaries that divide agricultural fields. Maybe stone is still widespread since its use is rooted in the Sicilian building traditions. But certainly it can be said that local availability of this material is quite consistent.

This case study was chosen because of its representative contemporary interpretation of traditional Sicil-

Figure 42.

Figure 43.

Figure 41 - 44. Views ant technical drawings of Villa Sallinella restoration (source images: http://www.createurs-emotions.com/)

Figure 44.

ian architecture made out of stone. Stone was widely used in vernacular buildings in Sicily. An integral part of the design concept of this thesis is to refer to vernacular Sicilian architecture and use of local materials.
The ancient farm lays on the side of a hill designed by dry stone walls, exposed to the light of the sunset, and has a panoramic views towards Ibla. Being situated in the countryside between Ragusa, Noto and Modica, the location has a very strategic position. Before the restoration project, the manor house was found in state of significant decay, which was about to compromise its structural stability.

The project, which led to the recovery and expansion of the original structure was designed by architect Viviana Haddad, who has managed to bring together contemporaneity and Mediterranean tradition in perfect harmony.
The villa consists of a main building and an annexe with a pool: 250 square meters of indoor space and outdoor courtyards and includes 2.5 hectares of land with olive trees, vineyard and native organic garden. A photovoltaic system guarantees the electricity needs.

This project has a very interesting integration between new and traditional where stone walls become the compositional language of the project in accordance with the architectural traditions of Sicily. In the same time what is particularly interesting is how the outdoor wall sections are built with dry stone wall technique according to consolidated Sicilian tra-

dition. Since the external enclosure of the house is not subjected to high loads, dry stone walls are used to divide the courtyard space, becoming decorative elements and sometimes hanging pots.

3.2.3 Case Study 3 - Solar Decathlon

Solar Decathlon is a competition organised by the U.S. Department of Energy that first gathered teams from mainly American universities. Teams were asked and build self-sufficient, solar-powered houses equipped with technologies enabling maximum energy efficiency. Their houses were built and exhibited at the “Solar Village” in Washington, where they were evaluated and competed within ten different categories.

Universidad Politécnica di Madrid patecipated actively of the active participation of the as result The Spanish and the American Government had an agreement, by the virtue of which Spain organised two editions of the competition in Madrid, where participants come mainly from European universities.

Since the project presented during the Solar Decathlon exhibitions contain the latest innovations in the field of renewable energy systems applied to homes, I decided to analyze some examples in terms of:

-Vertical and Horizontal Shading Systems

- Integration of Heating and Cooling systems with a special regard toward Solar Heating and Photovoltaic integrated System

- Interior and exterior space solutions

- Roof system features

- Glazing solutions

Follows (Figure 45) a Summary Board of selected solution, that have been considered in terms of interest for the development of this Thesis project.

In this chapter has been chosen to illustrate more into detail two European examples of Solar Decathlon’s 2012 Edition because these projects have been developed in countries with similar to Italian and Sicilian climatic conditions and have in common the focus on Mediterranean culture and traditions.

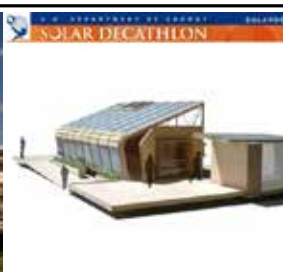
Building and structural tipologies - similar projects such as Solar Decathlon Houses

Independent roof shading/photovoltaic system

Minnesota 2009

Massachussets 2011

Canada 2011



Arizona 2009

Vertical/slanted shading systems

Texas Austin 2005

Ohio 2009

Florida Int'l 2011

Texas 2007

Ariz

Green / natural s

Innovative and high technologies

Arizona 2009

Spain 2009

Virginia 2009

North Carolina 2013

Figure 45.

Appalachian State 2011

New Zeland 2011

ona State 2013

systems

Virginia 2009

Rice Row 2009

Solar Decathlon Europe 2012 – Canopea, Nano Towers in the City – Winner Project

Figure 46.

Figure 46. Overall view, rendering image

For the object of study of this thesis, the element of interest of Canopea's project is their top floor solution for a common space where inhabitants can socialise around a playground for kids, a summer kitchen, a tv room or a common laundry. The living space has been left free in order to permit this kind of flexible use for the inhabitants. The room has an entrance, a functional kitchen core and a special roofing system with photovoltaic bi-glass panels which filter the sunlight, transform solar energy into electricity and collects rain water.

Figure 47 - 48. Common space plans

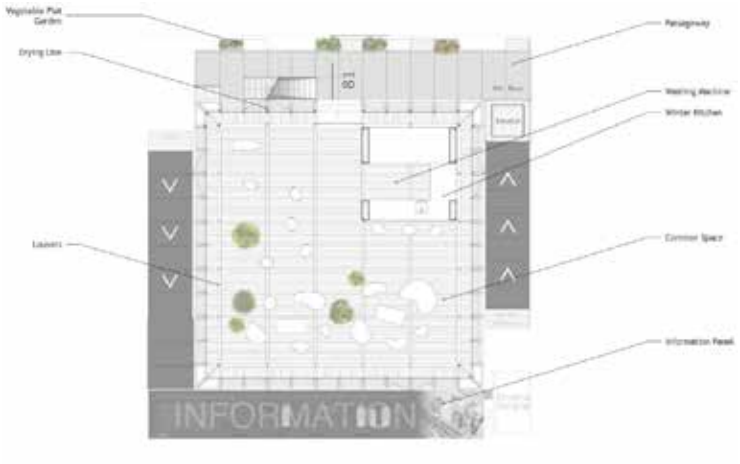


Figure 47.

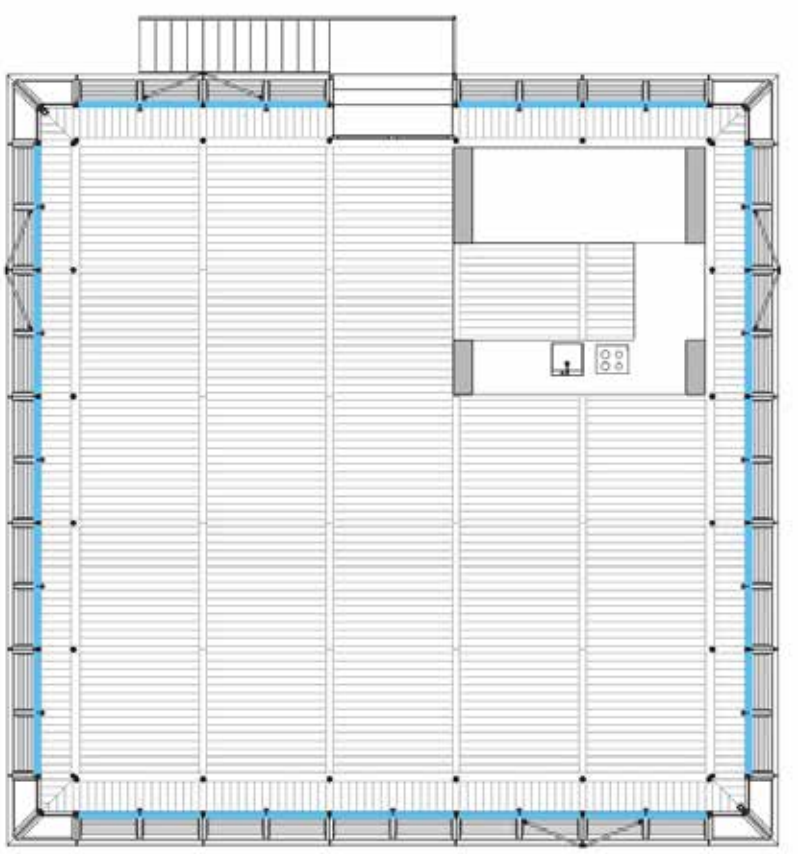


Figure 48.

Figure 49. Interior View of the common space, rendering

Figure 49.

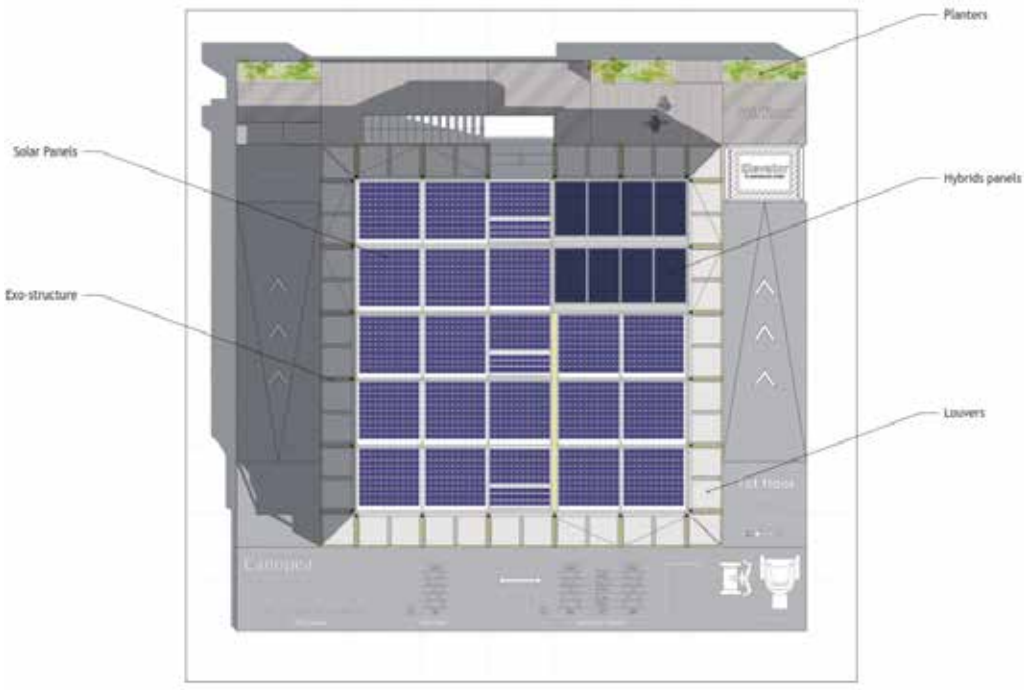


Figure 50. Roof top plan

Figure 50.

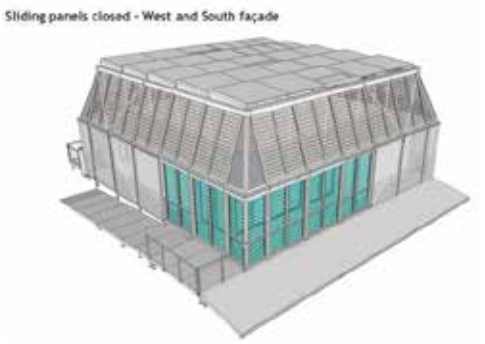


Figure 51.

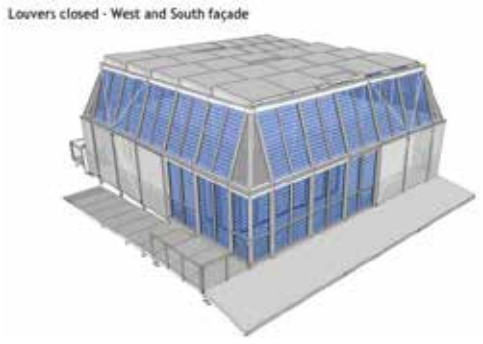


Figure 52.

Figure 51. Sliding panels tecnology

Figure 52. Louvers system tecnology

All the pictures are taken from the official internet site of Solar Decathlon Europe, http://www.sdeurope.org/

Solar Decathlon Europe 2012 – Patio 2.12 (Second prize winner)

The second prize winner at the 2012 Edition of Solar Decathlon Europe is the project of the Andalucia team. Their house solution is composed of four housing modules units, positioned so as to create an internal patio, which becomes the center of the household. The team has chosen to reintroduce the patio as a typical residential space in Mediterranean building traditions.
The four housing modules are:
- Living-room module, to rest and work

- Kitchen-dining module, to prepare food and eat

- Bedroom module with a toilet, to sleep and for personal hygiene

- Technical Box, to locate the equipment and leisure.

Referring to the object of the thesis, it is found relevant how Andalucia's team interprets the kitchen module as "a way to understand the Mediterranean culture". There are many similarities between Spanish and Sicilian culture, since they're both Mediterranean.

In Patio 2.12:
The kitchen becomes a distinguishing element of the Mediterranean lifestyle. Domestic life has traditionally been organised around the "home", becoming a meeting and communication place. The ability of reinterpreting this tradition, plus the

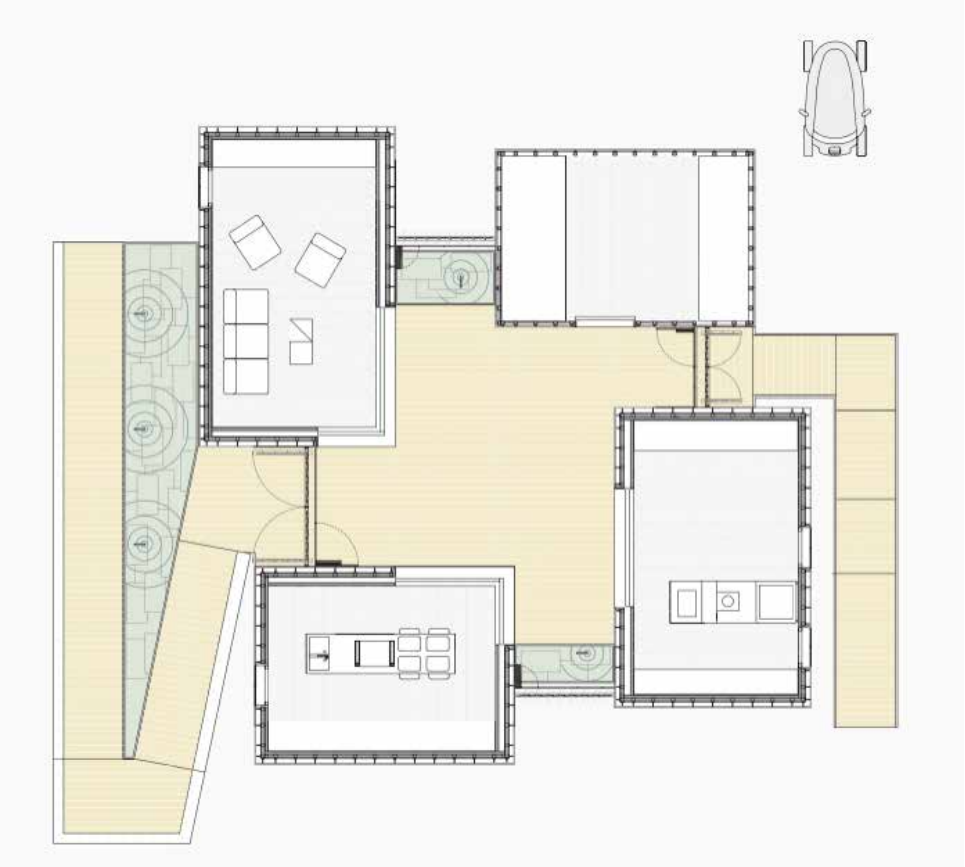


Figure 53.

Figure 53. Patio 2.12 Project Plan

cooking boom as a social act where specialization, creativity and cultural globalization are incorporated opens a very expressive area of researching, which is also related to the place and the new uses of time, and is enclosed in the Mediterranean cultural context.

The kitchen is the center of group activities: preparing, cooking, eating, chatting, and cleaning and it can be understood as the concept of workshop and laboratory.

The other important aspect of the project, when referring to this thesis research is the flexibility of living space.

…The main features are to set a flexible housing type and its technological patio that plays multiple functions in the house. The house is generated by the addition of living modules to a variable space, the patio.
The patio is an intermediate space, covered by a pergola, which is used for living, thermal regulation and energy generation. It is a technological patio, that uses the new technologies (movement engines, domotic control system, etc.) and which is based on the traditional knowledge about passive cooling and spatial comfort of

Figure 54.

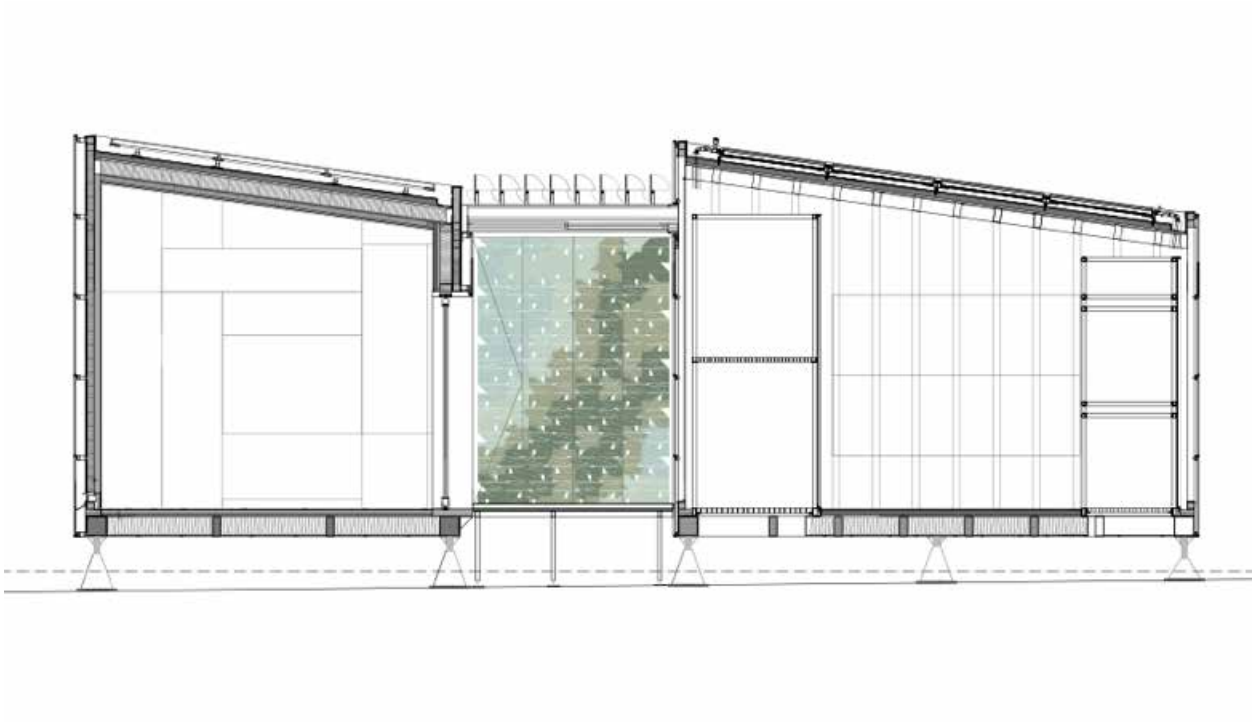


Figure 55.

Figure 54. Patio 2.12 Rendering View

Figure 55. Patio 2.12 Section

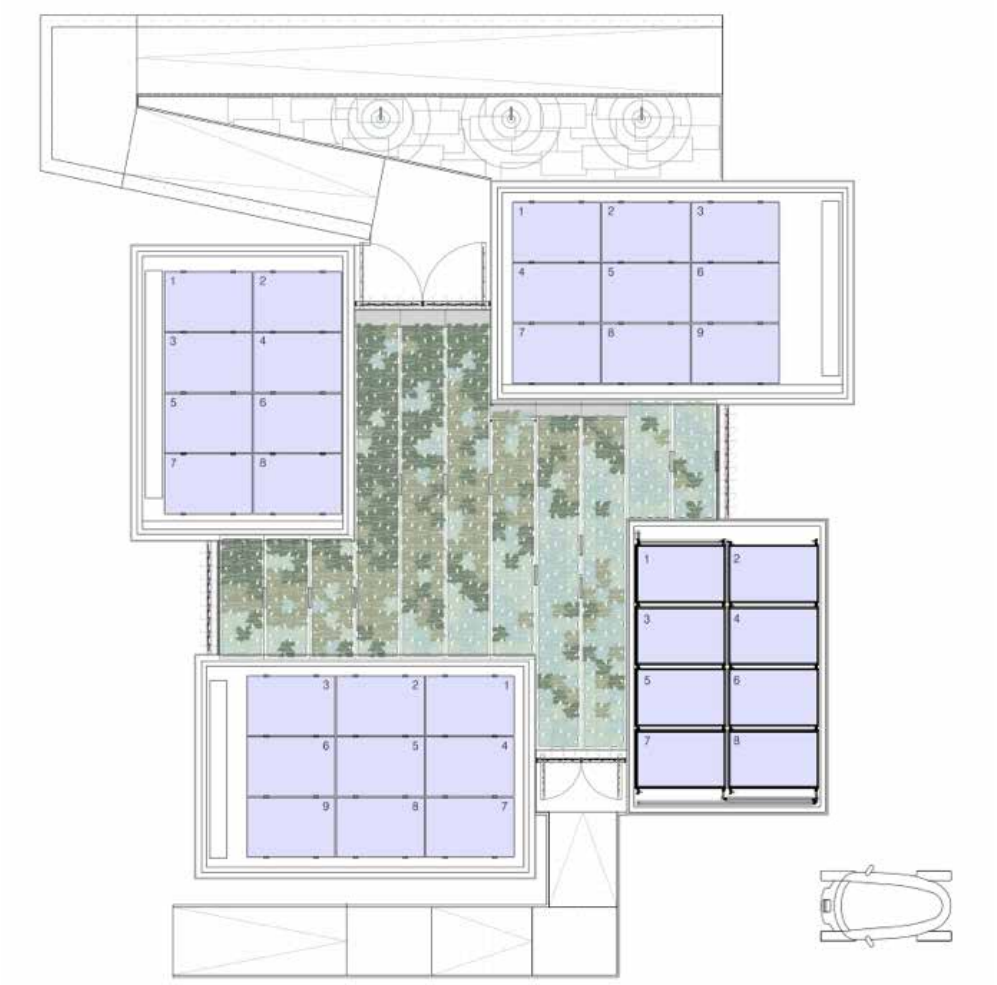


Figure 56. Patio 2.12 Roof plan with photovoltaic panels

Figure 56.

the Mediterranean house.
Patio 2.12 is integrated into the culture, rescuing the Mediterranean lifestyle virtues. It is the "patio" (in this case a technological patio) which combines the spatiality, the programmatic functions and the comfort of the housing set.

So we can conclude that in this project the patio is, as in the Andalusian traditional houses, a flexible element that is considered the center of the house. The functions of the surrounding rooms expand towards it, becoming living, dining room, work place, etc. in different moments throughout the year.It establishes a relationship between outside and inside, which allows for the adjustment of the conditions of climatic and acoustic comfort and privacy.

Figure 57.

Figure 57. Patio 2.12 Overall view, rendering

3.2.4 Historical research of industrialised dwellings

Given the need to address the issue of lightweight and modular architecture, the interchangeability of elements and their modularity, I chose to conduct a historical research on how prefabricated dwellings have been developed through the centuries. I examined 30 significant projects and I found part of them in tune with the kind of light structure that I want to develop my project. Therefore I analysed those projects from an environmental point of view in order to study practical solutions for a major sustainability in the building process. The examples illustrated in this subchapter have served as inspiration and knowledge and have directly or indirectly influenced the project development of this thesis.
I have summarised their potential environmental benefits into summary sheets as illustrated below:

Building, System, Year (number)
Author(s), Company

Closed-loop lifecycle of materials

Minor usage of materials
Limited number of materials
Recycled and recyclable materials
Interchangeable elements
Deconstructable/Reconstructable systems

Environmental impact reduction

Less polluting systems
Reduction of debris and waste products
Water consumption saving
Reduction of energy consumption
Transport efficiency

Building Figure

Kiwari (1600)

One of the most ancient systems is the japanese Kiwari, whose first carpentry manual dates back to 1608. A great influence on modern architecture for its rigorous geometric composition Kiwari bases its modulation on Ken, the standard size between the columns is equivalent to 6-6,6 Sakhu or feet (one corresponds to 183-198 cm) and afterwards is divided into smaller modules.

This system expanded rapidly throughout the country, implying a certain degree of prefabrication of housing, which in the mid-eighteenth century had included a large part of the wooden structure and carpentry. Even though it is true that the regularity of the measures and the repetitiveness of the components allowed to optimize the use of materials, the method of Kiwari could not yet be considered a prefabricated system, since most of the parts of the dwelling were made on site and in addition any basic design of the manual for carpentry had to be adapted to customer preferences and therefore the repeatability and standardization were not very frequent.

From climatic and energy efficiency's point of view, Kiwari was equipped with an interesting facility. Exterior walls and interior corridors allowed cross ventilation on top, which can be very useful in summer and not as much in winter.

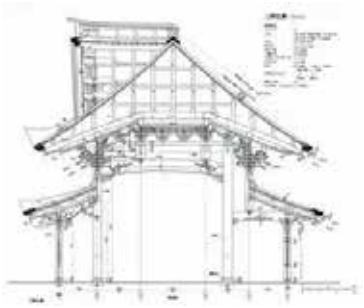
Kiwari, 1600 (1)
Traditional Popolar System, Japan

Closed-loop lifecycle of materials

Minor usage of materials
Limited number of materials
Recycled and recycable materials
Interchangable elements
Deconstructable/Reconstructable system

Environmental impact reduction

Less polluting systems
Reduction of debris and waste products
Water consumption saving
Reduction of energy consumption
Transport efficiency



Baloon Frame (1833)

The first construction made with Balloon frame system was made in Chicago in 1833. The prefabrication based on frames for walls and ceilings (Platform frame), placed on site to give the shape of the shell of the dwelling based on struts with 50 x 100 mm section at a center-to-center distance of 40 cm and joined together by traditional carpentry joints , allowed to rapidly build low cost one-, two- and three-storey dwellings.
The almost universal spread of Balloon frame, which later influenced many other frame systems in wood or metal, is based on two key aspects. In fact the presence of timber from local forests, as well as the industrial development of steam factories and automated manufacturing of nails gave the boost for an extraordinary widespread and social use.
Some buildings have reached a very long useful life, including disassembly periods in order to be reassembled in another site. This feature, together with the rational use of resources and the modular organization that this system assumes, brings out two aspects that certainly influence the environment: the optimized usage of materials, which makes possible to build with fewer resources, and retrievement of materials that can be reused. It is also important to acknowledge that the Balloon frame system is based on the use of one natural local material, wood, which can be managed in a sustainable mode.

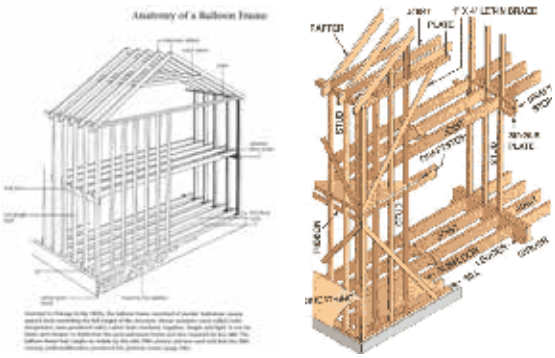
Baloon Frame, 1833
Traditional Popolar System, Chicago, USA (2)

Closed-loop lifecycle of materials

Minor usage of materials
Limited number of materials
Recycled and recycable materials
Interchangable elements
Deconstructable/Reconstructable system

Diminuzione dell'impatto ambientale

Less polluting systems
Reduction of debris and waste products
Water consumption saving
Reduction of energy consumption
Transport efficiency



Portable Cottages (1830)

In 1830 in England began the production of prefabricated homes that were later known as Portable Colonial Cottages. These houses made entirely of mass-produced elements, which were numbered and packed in large cases and then transported by ship to the British colonies especially in Australia and South Africa in order to be assembled on site without the assistance of carpenters and builders. The structure made of basement, walls and roof, was made from wood boards and beams and columns with already made assembly joints. The modulation responded to the need to use standard sections for the wood industry, as well as common measures of doors and panels for facades and internal divisions in the UK market at the time.
All the components of the building system could be handled by a single person and thanks to the fact that they didn't require special equipment in order to be assembled, in some cases the dwellings could be disassembled and moved to a new location. In the first version of the system produced in 1850 the external walls and the roof were made by corrugated steel sheets cladding system. Later on the structure was also released in steel. Given the need to reduce the weight and the transported volume, the following characteristics are revealed as important: the amount of used materials, the ease of assembly and disassembly, the reuse of parts and elements.

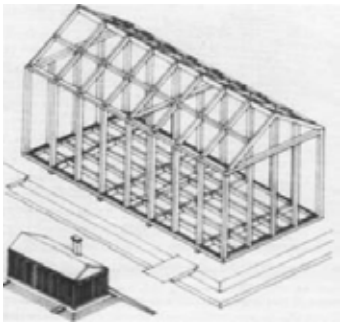
Portable Cottages, 1830
Traditional Popolar System, England (3)

Closed-loop lifecycle of materials

Minor usage of materials
Limited number of materials
Recycled and recycable materials
Interchangable elements
Deconstructable/Reconstructable systems

Environmental impact reduction

Less polluting systems
Reduction of debris and waste products
Water consumption saving
Reduction of energy consumption
Transport efficiency



Packaged House (1942)

In 1942, the United States has come to know the Packaged House project, which collected part of the experience of the Bauhaus school of the relationship between industry and architecture. This dwelling was based on a system of industrial modular panels that allowed two to four combinations between them thanks to an ingenious design of a multi-coupler, which was later replaced by a more simple one. All compositional elements , doors , windows, opaque walls , interior partitions , false frame coverage and had to adapt to the modulation of the base panel , usually made of wood .
The system will allow the development of housing of different sizes and a variable configuration on one or two levels , so it was necessary to standardize the stairs and double height. Eventually they start producing a prototype which was successfully presented in different industries and public administration, a factory for the production of the panels was also also established, although for various reasons both technical and political, it stopped before completing the production of the whole system and the activity was transformed into the production of doors , made of sandwich panels . The interchangeability of parts of Packaged house could facilitate the depletion of the useful life of the object and the selective division of the elements, simplifying the management of environmental resources .

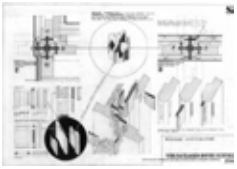
Packaged House, 1942
Walter Gropius and Konrad Waschmann (8)

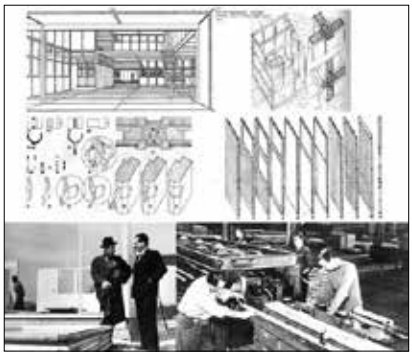
Closed-loop lifecycle of materials

Minor usage of materials
Limited number of materials
Recycled and recycable materials
Interchangable elements
Deconstructable/Reconstructable systems

Environmental impact reduction

Less polluting systems
Reduction of debris and waste products
Water consumption saving
Reduction of energy consumption
Transport efficiency





Maison Meudon (1949)

Another interesting innovation is the technology of rolled steel folded for use in structural and cladding sheets of aluminum that Jean Prouvé developed for different projects in France. These include Maison Meudon, which were mandated by the Ministry of Reconstruction in 1949 , some of which are still in good condition.
This project, carried out with the system constructive Metropol housing shell, supported by a central portico, summarizes the architecture and prefabricated lightweight Prouvé proposed as an alternative to the systems of reinforced concrete, which subsequently took over. Included innovative features such as structures of folded sheet metal, welded joints in the workshop, carpentry and covering aluminum sandwich panels with insulation, new insulating materials such as plastic foam reinforced with fiber glass, curtain walling independent of the structure and the total pre-assembly, and some of its houses were provided at the destination fully lined and equipped with everything you need to start living immediately. In addition Prouvé brought innovations in production processes, adapting the machinery and materials from other industries or creating them, when it was necessary. His constant search for the minimal use of materials and processes, as well as energy efficiency, appears to be of great environmental interest.

Maison Meudon, 1949
Jean Prouvé, Paris, Francia

(12)

Closed-loop lifecycle of materials

Minor usage of materials
Limited number of materials
Recycled and recycable materials
Interchangable elements
Deconstructable/Reconstructable system

Environmental impact reduction

Less polluting systems
Reduction of debris and waste products
Water consumption saving
Reduction of energy consumption
Transport efficiency

Stelco House (1969)

During the spread of plastics era, in 1969 the journal Canadian Homes summoned a contest on prefab housing, to which Barton Mayers Associates and the largest steel-producing company here in time, Stelco, presented a modular system based on a grid of 3.6 x 3.6 m. The structure was composed of four pillars of steel sections, above which is mounted a grid of metal beams arranged in two senses, used for both the base and the cover. The outer shell and internal partitions were resolved through sandwich panels with size of 0.9 x 3.6 m blind, with doors, windows, plumbing, etc. . The panels had two sides with layers in steel covered in plastic material and a core of thermal insulation urethane. They were installed on the frame by industrial velcro anchorages and finally were sealed with an elastic joint in neoprene.
From the point of view of management it is interesting to comment on the system Stelco House, despite the fact that he failed to be commercialized, it included a catalog of products and a guide for the installation, which allowed unskilled personnel to determine the type of building to build having the list of the pieces needed to mount it in a simple way. The system made it possible to stack modules to achieve up to three levels, and exchange different parts, disassemble the building, recovering materials through the use of reversible joints.

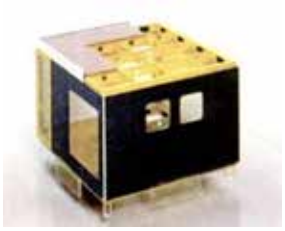
Stelco House, 1969
Barton Myers Associates, Canada (20)

Closed-loop lifecycle of materials

Minor usage of materials
Limited number of materials
Recycled and recycable materials
Interchangable elements
Deconstructable/Reconstructable systems

Environmental impact reduction

Less polluting systems
Reduction of debris and waste products
Water consumption saving
Reduction of energy consumption
Transport efficiency



Moduli 225 (1971)

In 1971 K.Gullichsen and J. Pallasmaa, having some experience behind the Nordic building tradition of structural skeletons and wood frames, developed in Finland the construction system modules 225 . It was named after the measure of the basic module of the system, 2.25 m in all 3 dimensions , which could be decomposed into submodules of 0.75 m wide by 2.25 m high panels used for the exterior and interior , the carpenters, and so on. The lack of windows in one or more sides of the module allow the creation of spaces of higher dimension , although with intermediate pillars. The furniture, also part of the system, followed the same module logic.
The place where it was more effort for innovation , as in many special systems, was the knot which binds together the pillars, the floor and ceiling joints, the pillar and the underlying foot of the foundation. This point, in which flowed six pieces , was made entirely of steel and included several mechanisms for adjusting the height

Moduli 225, 1971
K. Gullichsen and J. Pallasmaa, Finland (22)

Closed-loop lifecycle of materials

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Limited number of materials
Recycled and recycable materials
Interchangable elements
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Environmental impact reduction

Less polluting systems
Reduction of debris and waste products
Water consumption saving
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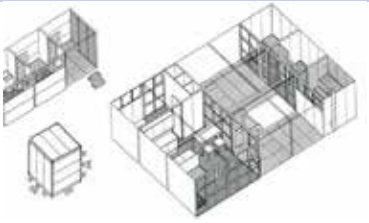


such as anchor points for the interlocking between the various parts. This knot also allowed to mount and level quickly the whole construction. The realization of the panels, joints and pillars, however, was not so much different from similar construction systems, based on industrialization of the wood. Modules 225 was mainly used for single-family, rational housing.

Thanks to the researched examples in history of prefabrication in architecture and by consulting the respective summary sheets for each work, there can easily be identified some that can be defined as “Deconstructable/ Reconstructable systems”. These, in fact, represent additional interest for the subject of this thesis, since they refer to its project design.
The examples show some important concepts that get repeated or are get developed over time. The deconstructabilty of the structures in their essential elements with modular

dimensions and reduced weight become important in order to facilitate production, storage and transportability of the work. The reversibility of the structural joints appears to be another key-aspect in the design choices, as well as the availability of local materials and the lower consumption of raw materials. With time and evolution of technologies, recyclability becomes one of the fundamental concepts of the elements together with the least possible environmental impact not only in terms of constructive choices, but also with regard to the plan design and resource and energy consumption.

Chapter 4 – Project Concept

4.1. Sketches of possible strategies

One of the main aspects of the project is to combine sustainable strategies and technologies with consideration of what the local environment, resources and limits are. On one hand, there is the intention for the building to be energy independent as much as possible, while providing thermal-hygrometry comfort for the inhabitants (A). On the other hand there are number of challenges such as the need to maintain low construction costs (B), to address the problem of designing within an area with a high natural value but which at the moment does not possess the status of nature reserve (C), and to try to enhance that piece of land, while stepping-in a parcel where there are pre-existing abusive buildings with the intention to bring back to that place its authenticity by intervening gently, without creating further damage, but working at its best with the pre-existing marks(D).

SUMMARY of aspects to consider in the project

A Energy independency and thermal-hygrometry comfort of the building

B Low construction costs

C Enhance the natural value of the location.

D Deal with prior abusive structures

Regarding the requirement of energy independency, the main strategy without any doubt is to make use of the abundant availability of solar radiation. It's the climate and geographical location of the area that strongly suggests to integrate solar energy in both passive-design concept (in order to provide heat gain) and active technological systems where solar energy is used to produce electricity, hot water and heating.

A secondary environmental strategy is related to water use, considering the climate of Sicily with mild short winters and long, very hot and arid summers. There can be long periods, even months without any rain and this is why wild fires often occur. The importance of water in arid climates is well-known and this can only motivate project interventions that implement collecting and use of rain water, as well as reuse of greywater.

In addition, future users of the building will be the voluntary fire-fighting teams, who know better than any-

one the importance of water, since they use it to extinguish the flames. These two factors lead to the idea to collect, store, purify and reuse rainwater for domestic needs and for the vegetation of the building during both its intended use: as a base camp for firefighters and as a visitor center. The rainwater systems should be integrated in the architectural design and easy to show to visitors for their educational and environmental value.

buildings and the intended use as a Clay Pigeon Shooting Range, which is completely incompatible with Natural Reserve functions. Therefore the concept is to avoid any further earthworks as far as possible and not to subtract from the area any other non-built land. The idea is to restore a more natural aspect of the project area, by integrating the building in a non-intrusive way. The architectural project should have the value of a landmark in harmony with the land and the natural quality of the area.

Figure 58 - 68. Images of the project area (personal archive)

Figure 58.

Figure 58. Perspective view of the existing building

4.2. Positioning and orientation arguments

Regarding the insertion of the project within an area with pre-existing architectural features, the approach, simply said, will be to build where has already been built and keep intact the existing vegetation. A damage has already been caused to the area, by the unauthorised earthworks, done in the past, together with the illegal

Going into detail, are to consider four elements:

- The existing building
- The existing paved area
- The two platform roofs of the Ex-Clay Pigeon Shooting Range
- The two pits of the Ex-Clay Pigeon Shooting Range
- The two artificial embankments

4.2.1 The existing building

For all the reasons described above, the main idea of the project is to position the new building in the perimeter of the pre-existing one in order to avoid further digging for the new foundations, or in case it should be necessary, to perform it within the perimeter of the existing digs. The surface occupied by the current building is rather limited, and may be necessary to slightly extend it, however limiting the extent of the plan of the new building.
The existing building has a linear typology oriented along the south-north axis. Sustainable and passive design strategies require to prefer south orientation for the main façade (the one with most glazings) so in the case of linear constructions that would be an east-west axis orientation and the main fronts oriented to south and north. It is clear that maintaining the perimeter of the pre-existing building doesn't go together with the necessity for a southern orientation of the main façade. But every challenge can be seen as an opportunity to find a solution that solves all the problems within the existing restrictions. The design choice for the new structure will be to treat a linear building oriented on the south-north axis as a building having an east-west axis orientation. The concept of this design will lead to create properly shaded window openings facing south.

4.2.2 The existing paved area

A similar approach is intended for the preexisting pavement. While the pavement is already positioned into place from years, it can result unsustainable removing it. A similar design choice would require labor for the removal of the pavement, transport and dismantling of the derived material afterwards. All the operation would have a significant ecological footprint, while to the means of the new building, outdoor areas and connections are required. That is why the concept of the project is to use the already existing paved areas, by

Figure 59.

Figure 60.

Figure 59 - 60. The existing pavement of the project area

adapting them to the activities of the new intended use. This allows for the renovation and reorganization on the paved area in the project to be minimised by being restricted to small interventions, designed specifically for the new activities of the area. The advantages of such an approach are: a lower
environmental impact, reuse of building material and to hold down the costs of the new construction.

4.2.3 The two platform roofs of the Ex-Clay Pigeon Shooting Range

In accordance with the conceptual ideas expressed for the previous elements, the project interventions regarding the two platform roofs will be similar. It's hard to imagine a complete reuse of the structures as they exist today, due to their current state of decay. Anyhow, it is still possible to reuse their load-bearing structural elements and with a few construction integrations to provide the canopies of a new mission. Their roofs would lend themselves perfectly to accommodate a system of photovoltaic panels that could produce electricity for "Santo Pietro" District.
The two platform roofs face the panorama of the valley of the Reserve with a privileged view to the wet area with "maquis" vegetation. Considering the fact that the rest of the green area inside the project surface has recently been planted with young saplings of oak, the two platform roofs remain the only two places that will provide a direct view to the Nature Reserve panorama when the trees will be grown, eventually becoming a small wood. Some of the trees are positioned in front of the projecting roofs, but they shouldn't obstruct the view very much, because they were planted far-between.
The platform roofs will host photovoltaic strings, while providing shaded open-air zones, an important advantage during hot months of the year. Metaphorically, those structures, once used by the shooters, become sustainable green landmarks, almost without changing shape and assuming a completely new meaning. Vis-

Figure 61.

Figure 62.

Figure 61. The platform roofs of the project area

Figure 62. View from the artificial embankment inside the project area

itors will no more stand underneath them armed and ready to shoot, but in order to observe and admire nature, while relaxing and refreshing themselves, eventually before the start or in the end of a naturalistic itinerary.

4.2.4 The two pits of the Ex-Clay Pigeon Shooting Range

Every pit is located in front of and aligned to each platform roof. The local Administration has already expressed its intention to remove the concrete structure of the pits and to cover them with earth, restoring the original look of the field.
In line with the design concept of this thesis, the idea of intervention is to “delete the damage”, caused to nature, through the removal of the concrete structures, but at the same time to suggest a reuse of the space by leaving room for the memory of the territory. The previous use of the area as a Shooting Range has existed and cannot be forgotten. It’s a part of the history of “Santo Pietro”’s territory, it has happened and maybe can also be seen as an opportunity - to teach new ways to connect to nature and to approach that territory with respect and without causing damage, to educate visitors to adopt a greener way of life, where nature is a resource to value and not to be exploited.
The idea is to keep the cavities of the pits and shape them in a way to transform them into little open-air green rooms by slightly adjusting the earth to that purpose and by covering all the surface of the cavities with planted grass. It’s a way to transform the existing pits into landmarks and to convert them from containers for traps into green shelters, offering a stopover, covered with vegetation and integrated with sittings made by natural materials (timber for example). Metaphorically the previous concrete pits should become open-air rooms that conserve the memory of what has been before and invite the visitor to stop, observe, appreciate and remember.

Figure 63.

Figure 63. Views of the the two pits inside the projct area

Figure 64.

Figure 64. Panoramic view from the platform roofs

Figure 65.

Figure 67.

Figure 65 and 67. Views of the the two pits inside the projct area

4.2.5 The two artificial embankments

The embankments are already there and a huge earthwork has probably been done in order to create the big difference in height existing between the two paved squares of the area. There is no documentation that proves what exactly has been done, since the Range is an unauthorised structure. It's therefore practically impossible to restore the previous state of the terrain. Hypothetically the earth, extracted when the platforms of the squared have been set and when the pits have been dug, is the one use afterwards to create the artificial embankments. Although this theory is very probable, there is no way to retrace the facts. Any attempt to restore the natural leveling of the terrain would therefore be completely random.

Considering this and the fact that for the purpose of the project it is not necessary to change the layout of the project area, the two embankments will remain as they are, keeping the vegetation that covers them.

Figure 66.

Figure 68.

Figure 66 and 68. Actual state of the existing paved area

4.3. Space definition and measures

The connection to the main road is considered sufficient and requires no additional changes.
The main access to the project area is positioned towards the avenue which brings to the main road. Therefore it has been decided to maintain the position of the existing main entrance.
It has been decided to create a courtyard area (highlighted in yellow in the figure) in order to reuse the existing pavement.
It is intended to maintain a free space as a transition zone in order to allow the connection with the rest of the pre-existing paved area, which is the square at a lower level, connected by a ramp slope.
Consequently, it was decided to place the independent classroom on the other side of this passage so as to face the building project.
By performing the Shadows cast studies on the project area (see figure), it has been traced the most suitable area where to integrate the system of photovoltaic panels. The simulation of shadows projection ensures direct solar radiation even in the case of low winter sun.

Figure 69.

Figure 69. Actual base of the volunteer firefighter teams relative to the project area

Figure 70.

Figure 71.

Figure 72.

Figure 73.

Figure 70 - 73. Development of the space, volume and shape concept of the project

Climate Analysis - Solar diagrams

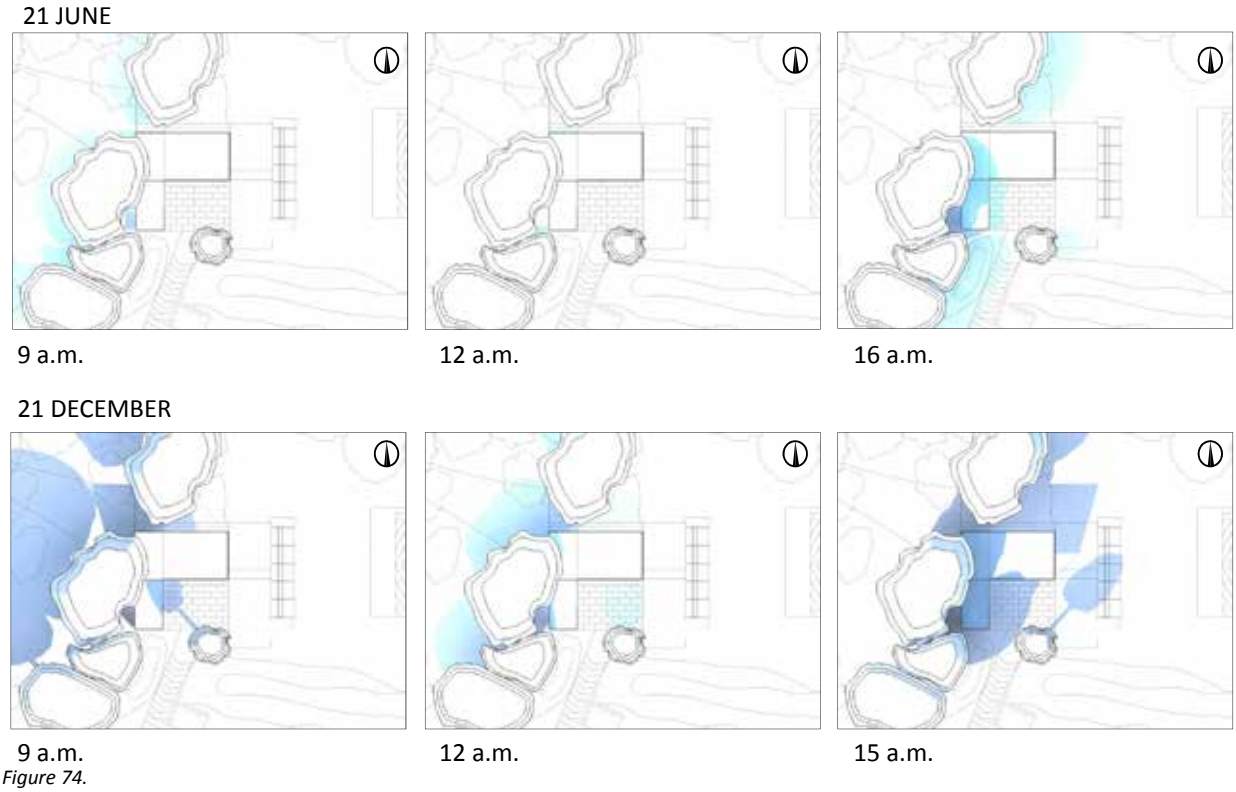


Figure 74.

Figure 74. Shadows cast studies on the project area – impact of the existing vegetation

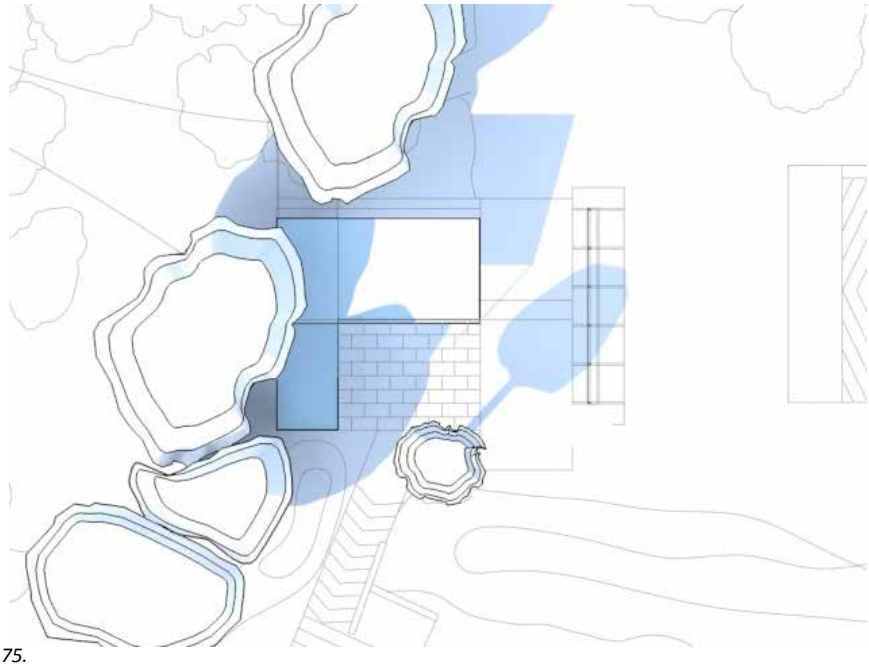
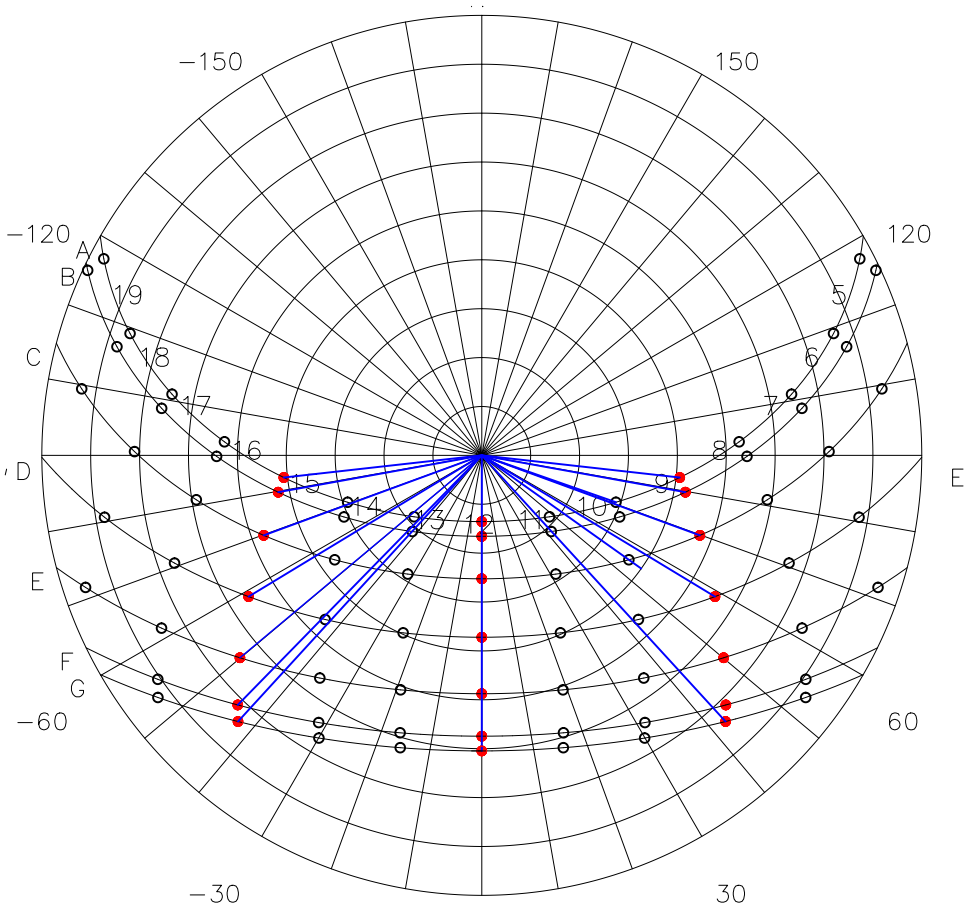


Figure 75.

Figure 75. Optimum location for the Photovoltaic panels



Latitude 37°

A 21 June
B 21 July - May
C 21 Aug - April
D 21 Sep - March
E 21 Oct - February
F 21 Nov -January
G 21 December

Figure 76.

4.4. Solar Diagram of Santo Pietro Forest

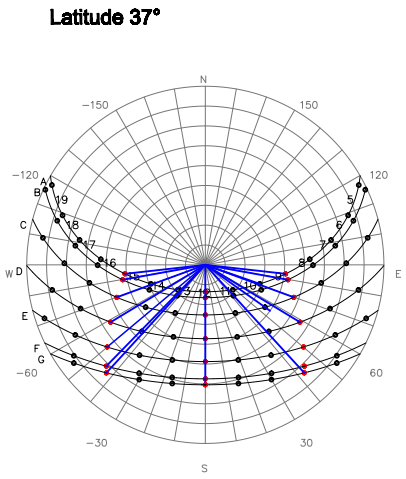
In order analyze the trajectory of the sun on the territory of Santo Pietro Forest

I have traced the Sun-Path Diagram for its latitude, which is 37° 6 ‘23’’ N. For the didactic purpose of this thesis the latitude has been approximated to 37°.

In the figure we find a Summary table of the angles and angular directions of the sun at different hours of the day during all months of the year.

During the design phase of the building these solar angles have been used so as to provide an architectural design that lets to sunlight during the colder months of the year while efficiently screening solar radiation during summer.

Figure 76. Solar Diagram of Santo Pietro Forest



A 21 June
B 21 July - May
C 21 Aug - April
D 21 Sep - March
E 21 Oct - February
F 21 Nov -January
G 21 December

21/01 - 21/11	9:00	18,6°
	12:00	32,5°
	15:00	18,6°
21/02 - 21/10	9:00	25,4°
	12:00	41,2°
	15:00	25,4°
21/03 - 21/09	9:00	34,2°
	12:00	52,8°
	15:00	34,2°
21/04 - 21/08	9:00	42,4°
	12:00	64,5°
	15:00	42,4°
21/05 - 21/07	9:00	47,7°
	12:00	73,4°
	15:00	47,7°
21/06	9:00	49,2°
	12:00	76,4°
	15:00	49,2°
21/12	9:00	16,1°
	12:00	29,5°
	15:00	16,1°

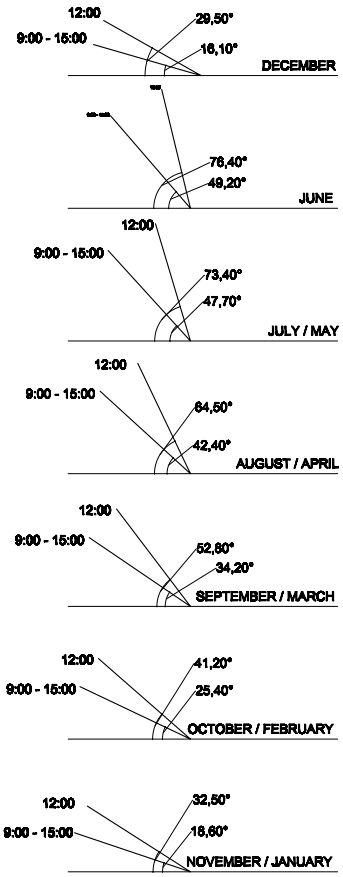


Figure 77.

Figure 77. Solar Diagram of Santo Pietro Forest

4.5. Building technologies and elements

It has been chosen to adopt the following building technologies:
- Replace the existing building with a new construction with load-bearing masonry stone walls

- Build an extension of the Visitor Center, consisting in an independent classroom made of wooden sandwich panels and glazed openings

- Create a light ventilated roofing system in corrugated metal sheet.

The roof has two main functions:
1) Shading system for the courtyard, stone building and the independent classroom

2) Placement for the roof integrated solar heating and photovoltaic system

- Reuse the structure of the two existing project roofs by integrating photovoltaic panels on the top

- Integrate systems for the collection and reuse of rainwater for residential uses

- Use traditional Sicilian dry stone wall technology for the renovation and reuse of the two pits as naturalistic landmarks

4.6. Defining what and how much to develop

There is no availability of a precise and detailed relief of the area and the architectural structures contained in it. Consequently, it is difficult to reach a level of executive detail corresponding to reality. The main measures of the existing building and shelters have been taken on the spot and reported in the general plan. With these measures and with the Territorial Plan in 1:10 000 Scale it has been possible to broadly draw up a general arrangement of the project area. Those measures are not sufficient to make drawings with a level of executive detail for the technical solutions in the reused existing structures, such as shelters and pits.
For the didactic purpose of study and research of this thesis, however, in lack of precise data, it has been decided to assume the available dimensions as a fact and proceed in setting down the project. If we were professional Topographic and Planimetric Survey that reports with precision all dimensions and altitudes of the land and its structures, which would have required the expertise of a specialist of the field.
If we divide the project into two main fields: new-built structures and reused/renovated ones, a general layout for both will be provided, while the new-built part will be developed more into detail. The term “new-built structures” refers to the visitor cen-

ter body, including stone wall house, wooden pavilion and their common roofing and shared porch. While the term “reused/renovated” constructions refers to the two platform and the two pits of the Ex-Clay Pigeon Shooting Range and generally to the layout of the site area.

**Detailed technical drawings of the project are provided in "Appendix 4 - Project drawings"*

Chapter 5 – Project Design for a Visitor Center and Firefighters Base
(technical drawings, schemes, building details)

5.1. Project Body description

For the tables of technical drawings in scale and for more project details, the reader is invited to consult the Volume 2 of this thesis: "Thesis Project Book" with separate Contents.

PROJECT'S MAIN BUILDING ELEMENTS

The Project layout can be split into 5 main units:
- Main (Stone) Building –new-built

Figure 78.

Figure 78. Project Layout - Territorial Plan

Figure 79. 5 Main Units of the Project Layout

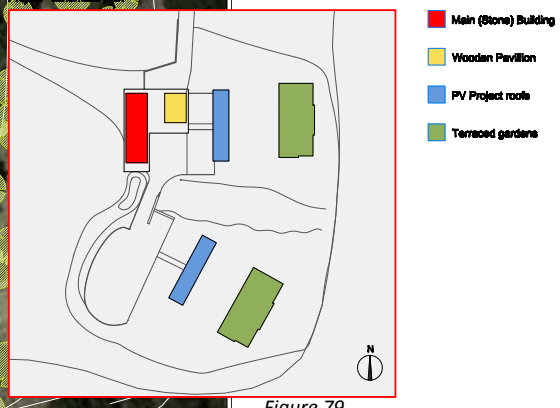


Figure 79.

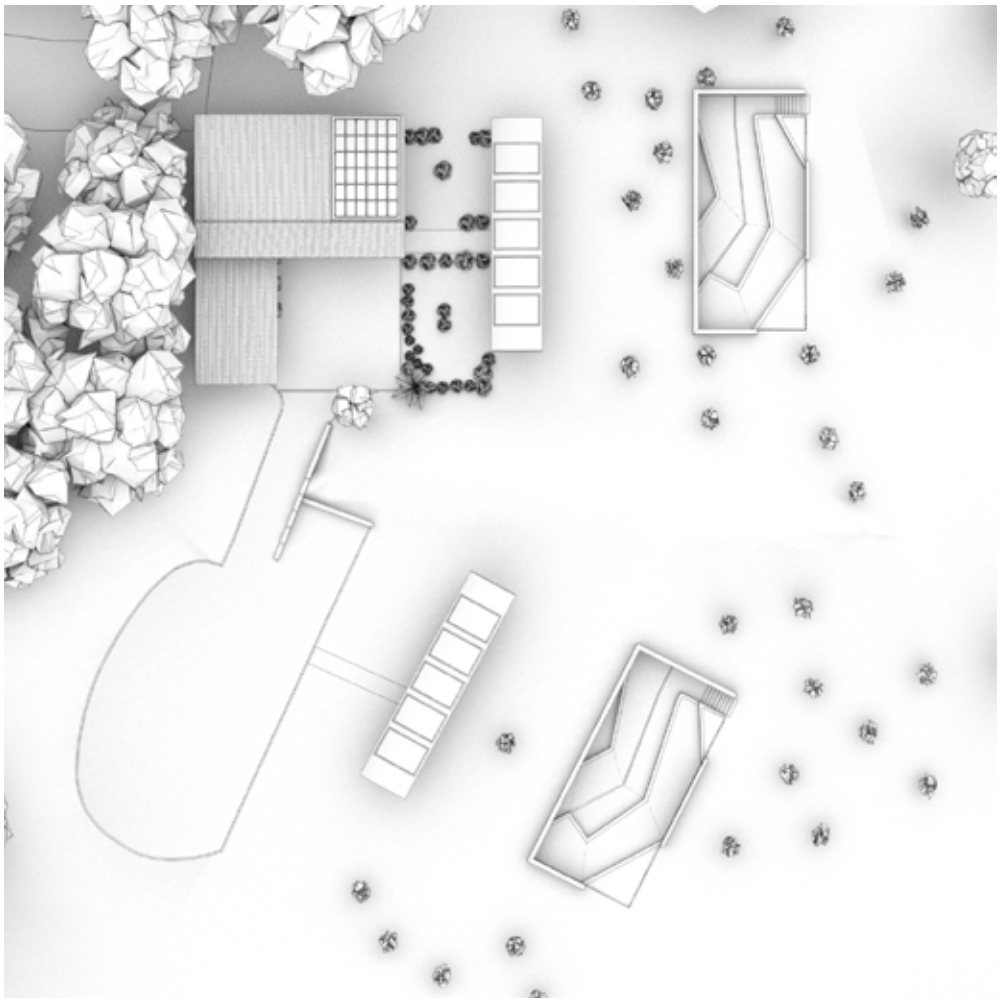


Figure 80. Projecy Layout Urban Scale

Figure 80.

body raised on the foundation dig of the former building.

- Wooden Pavilion – light new-built structure with a box-container concept, made by wall plugs in assembled wood sandwich panels and glass frames, supported by the steel columns bearing the roof structure.

- Sheltered Patio – Outdoor courtyard where the main entrance of the Stone Building faces the Wooden Pavilion. Patio's concept is to extend living space in the Visitor Center where all public activities meet.

- Renovated Project Roofs – intended as sheltered spaces for a stopover and observation points
(two identical structures, one for each paved square).

- Terraced gardens – reused and renovated former concrete pits of the ex- Clay Pigeon Shooting Base (two

identical structures, positioned in front of each Project Roofs).

"SHAPING-THROUGH-ORENTATION" CONCEPT OF THE MAIN BUILDING

It was decided to reuse the excavated foundations of the previous building. The orientation of the new building linear thus obtained is not in line with the concepts of sustainability. It is recommended to have the longest side exposed to the South

To remedy this defect in the design phase we tried to "break" the volume of the building in order to create more openings glass windows towards the the south side, as is shown in section in Fig.

The south façade of the building was covered with French doors and windows, screened from direct sunlight in the summer thanks to the overhanging roof and a system of shutters with adjustable slats.

While the volume of the building stone contained within the patio was equipped with a skylight ribbon in the upper part, which is also properly sloping so as to filter only the solar rays in the cold months.

MATERIALS AND TECNOLOGIES USED IN THE PROJECT

"Stone Building" Wall Structure

Creating the package wall and its stratigraphy has started from the concept of creating a building with visible stonework. Therefore the wall is composed of a first outer layer in stone blocks, which works as cladding and contains the bearing structure in steel columns. A second inner layer in "Ytong"-type cellular concrete blocks has been placed as the internal filling of the walls. This type of blocks have a very good soundproofing function.

Between the two layers is created a ventilated cavity where also a layer of thermal insulation is placed. The interposition of the thermal insulation between the outer stone cladding and the inner layer in blocks permits to exploit the effect of the thermal mass of the second. The stone coating hinders the heat exchange between exterior and interior, which is reinforced from the cavity walls and the layer of thermal insulation. In this way it has a dual function of the wall as a whole for environmental control within: isolate and create thermal mass.

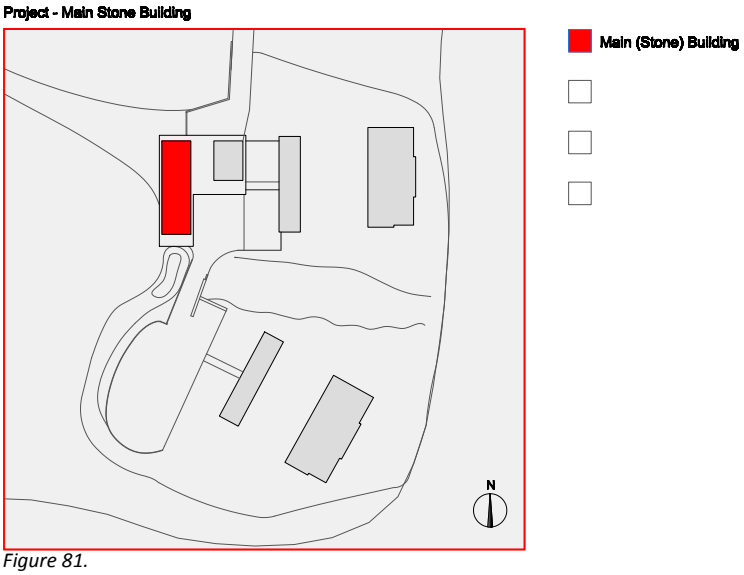
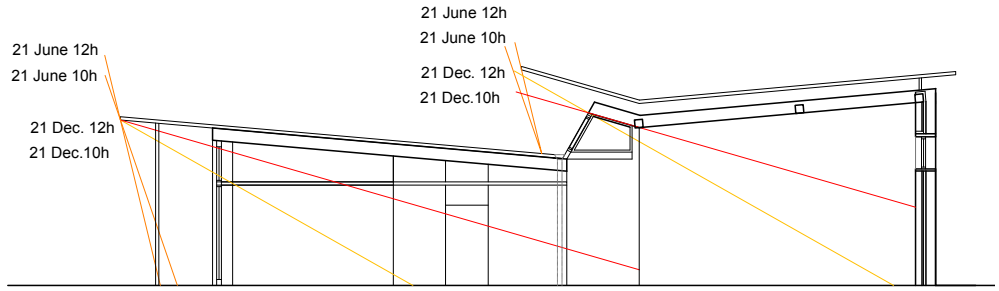


Figure 81.

Figure 81. Stone Building - Plan Reference



Longitudinal Section for Solar Analysis, 1:100
Figure 82.

Figure 82. Stone Building - Solar Analysis, Longitudinal section

Note: This second layer has the function to create "thermal mass" and there are quite a few constructive solutions to achieve the same effect. Due to the complexity and timing of the thesis project it has been chosen to use the technology in cellular concrete blocks, but it would have been very motivating to examine more local and organic-oriented construction technologies, , such as earth walls, for example.

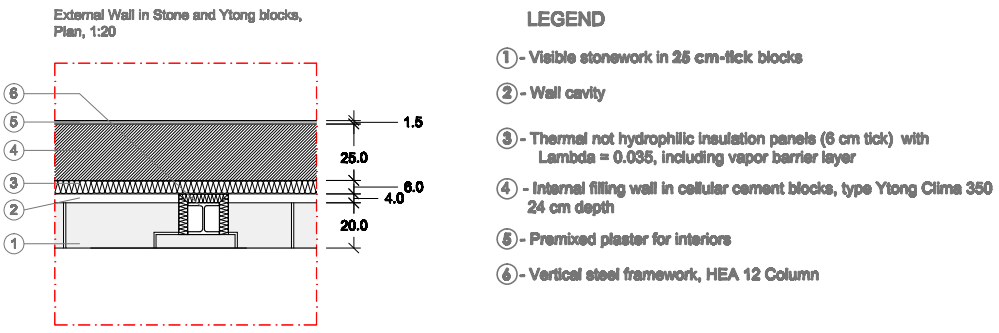


Figure 83.

Figure 83. Stone Building - External Wall Detail

Figure 84 Stone Buildgin, from top to bottom:
East Elevation, West Elevation, South Elevation, Nord Elevation

Figure 84.

“Wooden Pavilion” Panel Structure

The Wooden Pavilion is shaped as a rectangular box, located underneath the project roof. The four facades of the pavilion are screened from the outside in a different way depending on their exposure.

The South façade has large glass windows with folding mechanism, screened by an outer membrane composed of wooden louvre modules with brise-soleil that can be oriented according to the direction of the sun and the needs of the inhabitants. In addition, this facade is protected from the summer sun by the large overhang of the roof corrugated sheet, which lets the low sun rays in winter while screens the summer sun.

The East Elevation of the Wooden Pavilion has also an outer membrane in wooden louvers but there is just one glazed door, since it’s important to have as less openings oriented towards East and West as possible. The only glazed door permits to have a direct access to the garden on that side.

The North Elevation has a double function:

a) it isolates from the cold winter breezes thanks to a double wood membrane with an outer layer of wooden slats, ventilated cavity and an inner layer in sandwich panels.

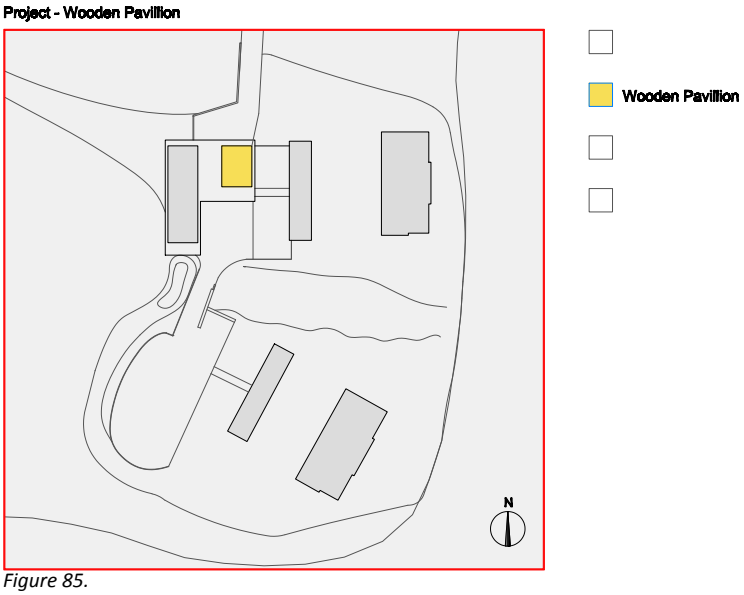


Figure 85.

Figure 85. Woodel Pavillion - Plan Reference

b) a second function as a storage space with a built-in closet typology: The storage space is devided into sections over its entire length and it’s composed of the same sandwich panels.

The Wast Elevation faces the well-screened inner patio and the main entrance of the Stone Building. For that reason it has been chosen to open up the façade by placing a series of glazed doors with folding mechanism, which according to the needs can be completely retracted, expanding the patio’s space towards the interior of the pavilion and creating continuity of public space that starts from the patio and continues through the Stone Building and the Wooden Pavilion.

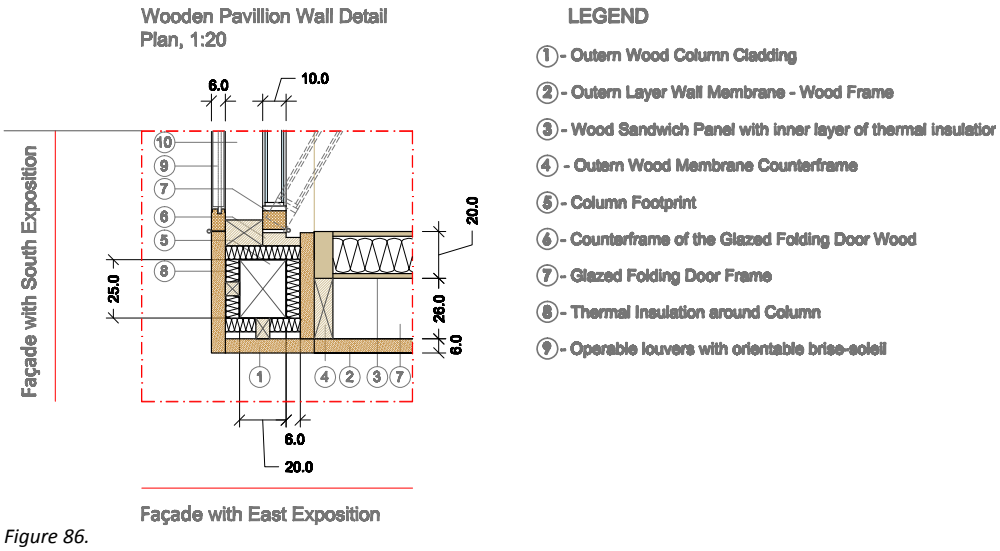


Figure 86.

Figure 86 Wooden Pavillion - Wall Detail

Figure 87.

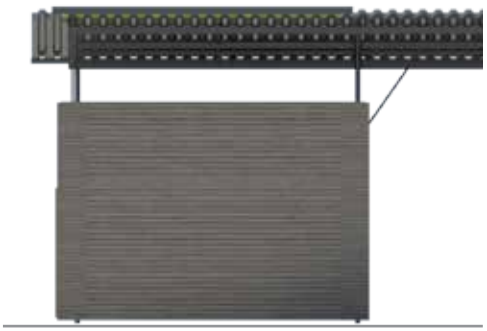


Figure 88.

Figure 87 - 90. Wooden Pavillion: West, Nord, South, East Elevation

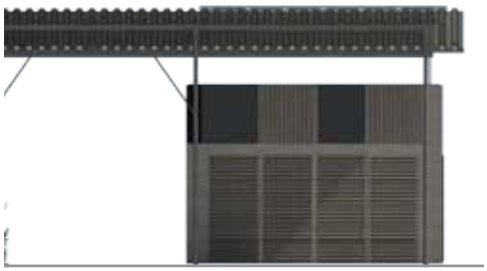


Figure 89.

Figure 90.

Roof Structure

The roof design is supported by a system of steel columns. The two pairs of columns on both sides of the main entrances respectively of the Stone Building stone and the Wooden Pavilion are divided in height into three segments in order to enhance these two accesses.

On the steel columns lays a system of tubular frames that forms the support surface for the corrugated sheets of the roof.

The solar and photovoltaic panels are positioned on the portion of the roof located above the Wooden Pavilion and are assembled on a selected system for integrated assembling of Photovoltaic panels. These constructive elements are compatible with the type of corrugated sheet of the roofing. The assembling system provides for the integration on the roof, but at the same time, thanks to its double framework, leaves a ventilated cavity between the roof and the photovoltaic panels which helps preventing overheating of the installation that would bring to a net decrease in its yield.

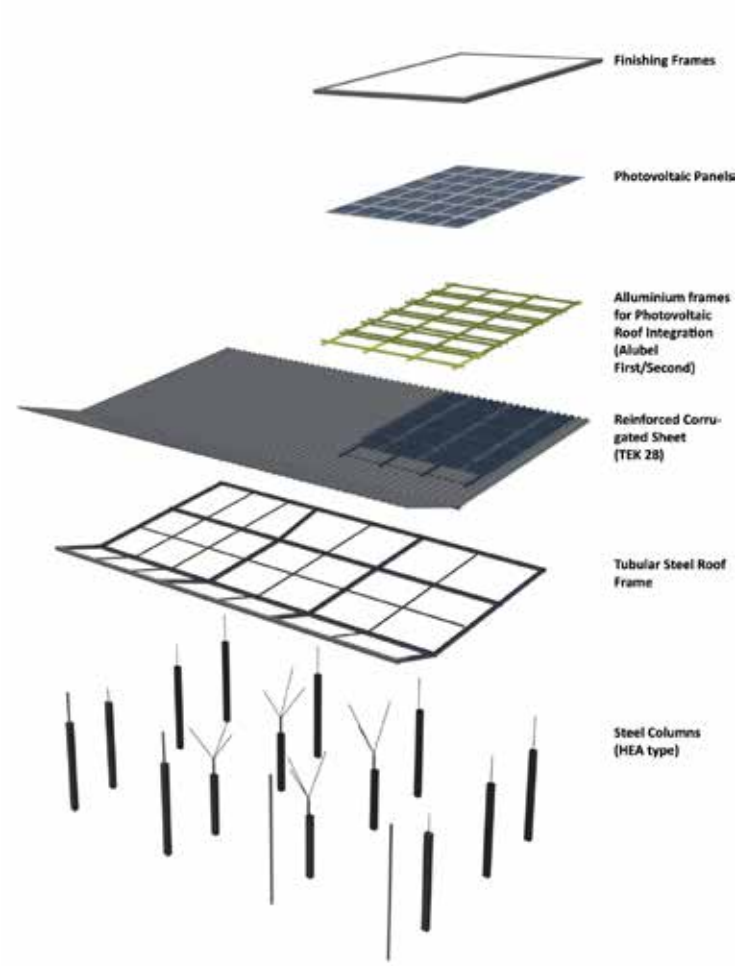


Figure 91.

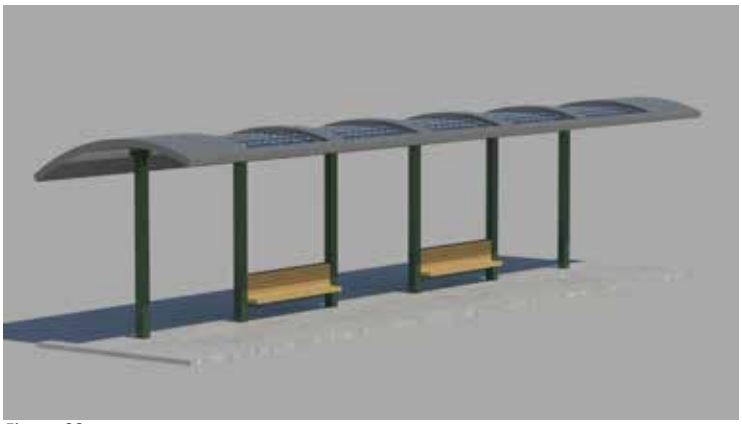


Figure 92.

5.2. Sub-project – general strategies for the arrangement of the outdoor space

This part of the project is defined in global terms, providing indications on generic design elements.

Renovated Project Roofs

The project involves the re-use of the two project roofs of clay pigeon shooting. Is maintained the framework of steel columns and curved rafters on which are assembled cover panels, consisting of photovoltaic panels. The electricity produced in excess will be introduced in the system.

The compositional aspect of the two project roofs remains almost unchanged, significantly changing their function. The two project roofs become places for rest and contemplation of nature. Two benches have been included in the frames of the two arches, positioned on the side of the central one.

Figure 93.

Figure 91. Roof Structure Scheme - Exploded Isometric

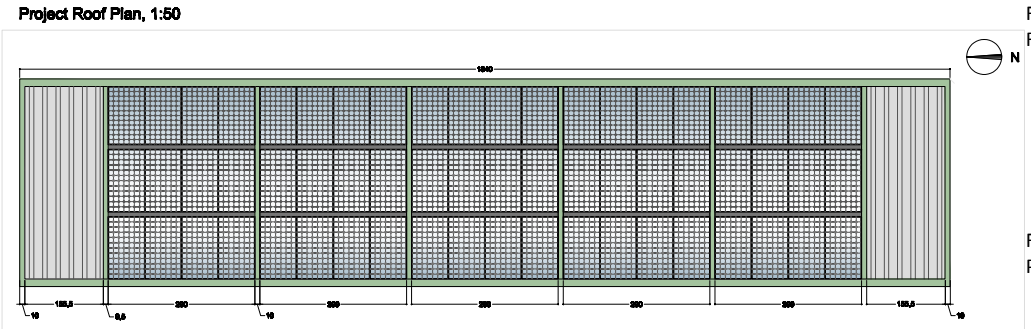


Figure 92. Project Roof - Rendering

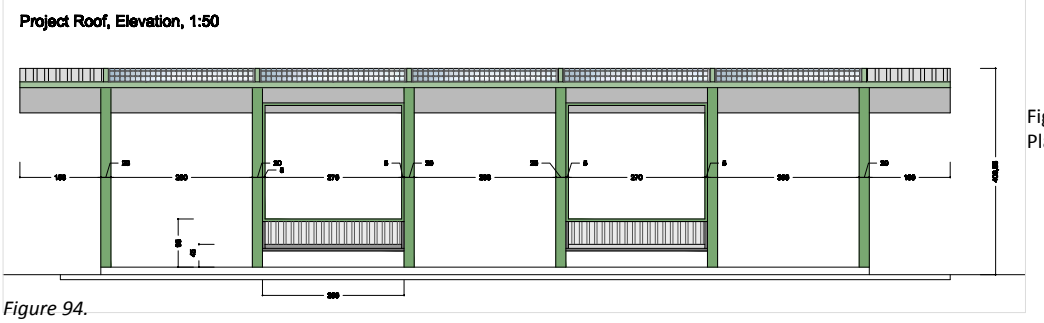


Figure 93. Project Roofs - Plan Reference

Figure 94. Project Roofs Plan

Figure 94.

Transformation of the pre-existing pits into terraced gardens

Part of the project concept provides for taking off the concrete structures of the two pits, previously used for the shooting machines of the former Clay Pigeon Shooting Base. It has been decided to maintain the difference in altitude in the terrain and to turn it into a terraced garden.
The delimitation of the area of the new terraced gardens is done through the construction of dry stone walls with the building tradition in Sicily. The garden area is this way fenced by dry-stone walls that reach the necessary height to act as protective parapets as well. The terraces within the garden are created by dry-stone retaining walls as well. To terraced garden can be accessed by getting down a lateral staircase that leads to a small central paved path. This walkway crosses the garden and serves as a distribution space.

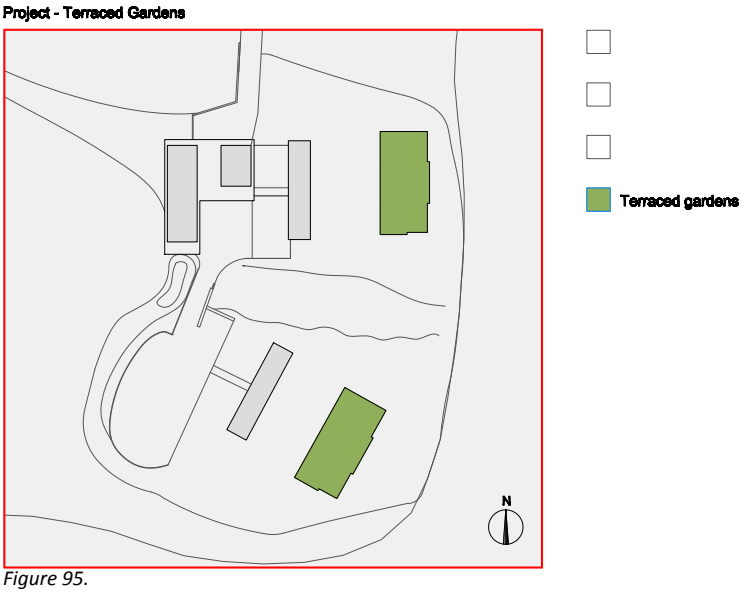


Figure 95.


Figure 96.


Figure 97.

Figure 95. Terraced Gardens - Plan Reference

Figure 96 - 96. Terraced Gardens - Rendering

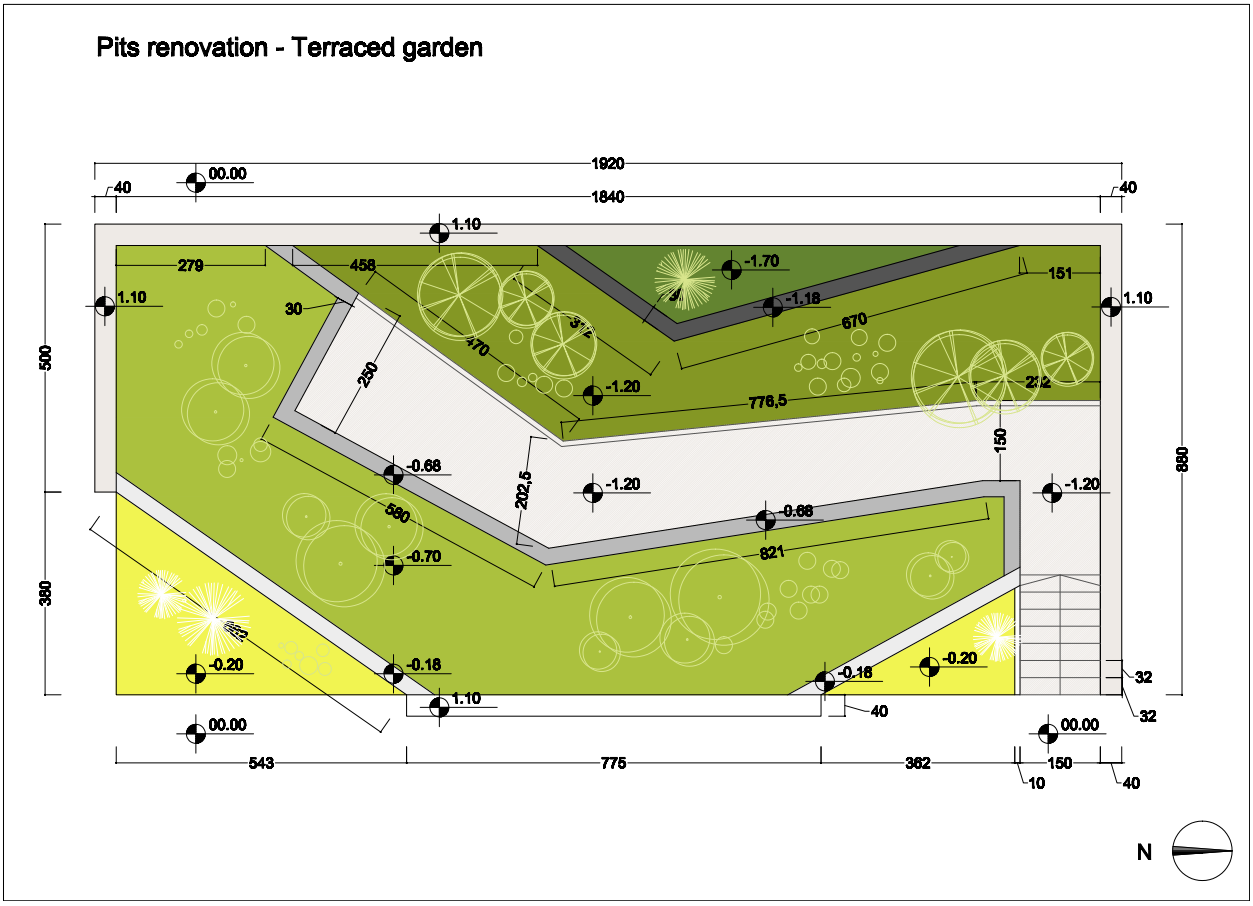


Figure 98.

Figure 98. Terraced Garden Plan

5.3. Overall views of the project

In this subchapter are published drawings of the architectural project as a whole.

Figure 99 - 104. Rendering Project Views

Figure 99.

Figure 100.

Figure 101.

Figure 102.

Figure 103.

Figure 104.

5.4. Lessons Learned – quality check

We arrived at the point of pulling a line and evaluate what has been obtained by the current work. One must recognise the complexity of the project and the many factors of the project area to be considered up from the initial concept.
It has been possible to develop some parts of the project in greater detail than others. Our hope is to have achieved the main goal, which is what the title of this thesis says: " Foster sustainability through revalorisation".
Even by keeping the pre-existing building volumes unchanged, we have managed to give a new face to the analyzed area by requalificating it into A Visitor Center in support of existing Nature Museum of Maquis.
Thanks to the wide use of stone in the project, it has been possible to work in general with locally available materials, as well as typical for Sicily building traditions.
Where the wood has been used, it has been possible to maintain the lightness and modularity of the structures, and therefore also their easy replaceability and deconstructability by using at the same time sustainable and natural materials.
The bearing steel structure has allowed to have a thin framework made of prefabricated elements.
The entire set of building materials is readily available on Italian and Sicilian territory and it keeps low building costs.

With more time available, it would have been possible to experiment

Figure 105.

more with the wall package materials.
It has been difficult to dedicate enough attention to all the construction details of the project due to the complexity of the system and the multiple elements to be developed in the project.
After the experience at Chalmers University and back in Italy, under the supervision of my Italian mentor, it has been possible to re-evaluate in environmental terms some formal aspects of both the Stone Building and the Wooden Pavilion. Glazed openings on the East and West Façades of the buildings have been reconsidered and modified. The windows area has been reduced and screened by solar shading systems in louvers for a major internal environment control.
For a more accurate and reliable analysis of the environmental performance of the building it has been considered to use the software Archisun, for "Renewable Energy Sources Implementation developed by the collaboration of School of Architecture of Barcelona (UPC), Institut Català d'Energia (ICAEN), Politecnico di Milano, Universität Hannover and A.N. Tombazis and Associates. Any analysis obtained through the use of this software will be eventually published in Volume Two: "Thesis Project Book".
In the meantime Santo Pietro Forest stands in the same condition of a dismissed nature reserve in state of decay. The project area of the former Clay Pigeon Shooting Base can also still be found as it has been illustrated in chapter 2.1 Site Survey of the project area. There is a chance to

Figure 106.

Figure 105 - 106. Compared rendering images of project development: In the second one glazed openings have been reduces and screened properly

refer to some Programs for sustainable development of tourism at European level and submit the design project presented in this volume in collaboration with the agronomist of Santo Pietro. It would mean to make request for an approval and financing for the realization of the Visitor Center.
It would be very motivating to submit this project to the test of reality. Almost certainly it would be necessary to review some of its aspects. At the same time it would be very inspiring to see if it will succeed to really get public attention, as expected.

With the hope of a better future for Santo Pietro Forest and for a sustainable reuse of the former- Clay Pigeon Shooting Base, this work finishes here.

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Appendix 1 - Santo Pietro Area Climate Analysis

Figure 107.

Figure 107. Wind Speed in Sicily

Vento al suolo: direzione di provenienza, frequenza e velocità giornali media nel mese, per stazione - Anni 2000-2002 *(frequenza in percentual velocità in metri al secondo)*

MESE	N		NE		E		SE	
	Frequenza	Velocità	Frequenza	Velocità	Frequenza	Velocità	Frequenza	Velocità
ANNO 2000								
Gennaio	6	2,5	39	3,5	17	3,5	4	2,1
Febbraio	7	3,4	29	3,4	14	2,3	5	1,4
Marzo	5	2,5	25	3,8	14	2,6	6	1,9
Aprile	8	3,4	27	4,3	12	3,3	5	2,5
Maggio	5	2,9	40	4,6	14	3,6	4	2,4
Giugno	5	2,6	26	3,0	13	2,2	7	2,7
Luglio	6	2,9	28	2,9	11	1,9	4	1,8
Agosto	6	3,4	30	3,0	13	2,1	5	2,0
Settembre	4	2,3	30	3,1	14	2,2	7	2,6
Ottobre	2	2,1	31	3,9	15	3,0	7	2,1
Novembre	4	3,2	27	3,3	15	1,8	6	1,8
Dicembre	3	2,4	38	3,1	19	2,8	4	2,0
ANNO 2001								
Gennaio	4	3,0	24	3,5	17	2,6	6	2,2
Febbraio	11	3,9	22	3,4	13	2,4	4	1,8
Marzo	5	2,5	21	3,3	14	1,8	5	1,4
Aprile	8	3,7	22	3,7	10	2,4	3	1,6
Maggio	8	3,4	31	4,9	12	3,1	5	2,5
Giugno	5	3,2	22	3,2	10	1,2	5	1,7
Luglio	8	2,9	24	3,0	9	1,8	4	1,8
Agosto	6	3,0	31	3,0	14	2,1	4	1,9
Settembre	5	3,0	26	4,0	10	2,1	6	1,7
Ottobre	7	2,7	36	2,8	12	1,8	4	1,5
Novembre	10	3,6	29	3,3	14	2,5	6	4,3
Dicembre	12	3,8	30	4,1	14	3,2	4	1,6
ANNO 2002								
Gennaio	6	2,5	39	3,5	17	3,5	4	2,1
Febbraio	7	3.4	29	3.4	14	2.3	5	1.4
Marzo	5	2.5	25	3.8	14	2.6	6	1.9
Aprile	8	3.4	27	4.3	12	3.3	5	2.5
Maggio	5	2,9	40	4,6	14	3,6	4	2,4
Giugno	5	2.6	26	3,0	13	2.2	7	2.7
Luglio	6	2.9	28	2.9	11	1.9	4	1.8
Agosto	6	3,4	30	3,0	13	2,1	5	2,0
Settembre	4	2,3	30	3,1	14	2,2	7	2,6
Ottobre	2	2,1	31	3,9	15	3,0	7	2,1
Novembre	4	3,2	27	3,3	15	1,8	6	1,8
Dicembre	3	2,3	38	3,1	19	2,2	4	2,6

iera
e,

S		SW		W		NW		Calma
Frequenza	Velocità	Frequenza	Velocità	Frequenza	Velocità	Frequenza	Velocità	Frequenza
2	1,7	5	2,2	15	3,8	11	3,0	1
4	1,6	9	2,4	20	4,4	11	4,4	1
6	2,1	12	3,3	20	4,0	11	2,9	1
5	3,6	10	4,0	17	4,9	16	3,8	-
3	2,3	12	3,9	15	4,1	7	2,7	-
7	2,9	19	4,1	16	4,3	6	2,7	1
5	2,9	21	4,2	19	4,7	6	3,1	-
5	2,3	19	4,3	16	4,5	5	2,4	1
7	2,9	17	3,7	16	4,1	5	2,5	-
8	2,5	14	3,4	15	4,4	7	3,5	1
9	3,0	15	3,7	15	3,8	8	3,5	1
7	2,6	9	3,0	12	3,8	7	2,7	1
8	2,6	13	3,0	18	3,7	9	3,3	1
4	2,4	12	3,5	20	4,5	13	3,6	1
7	1,9	15	3,1	19	3,5	13	3,2	1
4	2,3	10	3,3	27	4,7	15	3,6	1
6	2,9	14	3,9	15	4,3	8	3,3	1
7	2,5	22	4,1	21	4,3	7	2,8	1
7	2,6	22	4,1	17	4,1	8	4,0	1
5	2,6	19	4,4	15	4,6	5	2,7	1
6	2,2	14	4,0	21	4,9	11	3,4	1
5	2,1	13	3,4	16	3,5	7	2,4	-
6	3,4	7	3,1	28	4,5	12	3,3	-
3	1,7	9	2,9	14	4,2	14	3,6	-
2	1,7	5	2,2	15	3,8	11	3,0	1
4	1.6	9	2.4	20	4.4	11	4.4	1
6	2.1	12	3.3	20	4,0	11	2.9	1
5	3.6	10	4,0	17	4.9	16	3.8	-
3	2,3	12	3,9	15	4,1	7	2,7	-
7	2.9	19	4.1	16	4.3	6	2.7	1
5	2.9	21	4.2	19	4.7	6	3.1	-
5	2,3	19	4,3	16	4,5	5	2,4	1
7	2,9	17	3,7	16	4,1	5	2,5	-
8	2,5	14	3,4	15	4,4	7	3,5	1
9	3,0	15	3,7	15	3,8	8	3,5	1
7	2,9	9	3,7	12	4,1	7	2,5	1

Wind Speed Table for Santo Pietro area

Tavola 1.7 - Valore massimo e minimo delle temperature giornaliere, media delle temperature massime e minime giornaliere, escursione massima e minima delle temperature giornaliere nell'anno per stazione - Anno 2002 *(in gradi centigradi)*

STAZIONI	Massimo	Minimo	Media massima	Media minima	Escursione massima	Escursione minima
Torino Bric della Croce	29,2	-4,2	14,2	8,2	13,0	0,6
Novara Cameri	34,4	-8,8	17,9	8,4	20,2	0,6
Mondovì	32,2	-3,8	16,5	9,6	14,4	1,2
Verzuolo	32,2	-3,3	15,9	8,6	17,7	1,2
Carpeneto	32,8	-6,1	16,4	8,0	16,1	0,7
Brescia Ghedi	36,2	-10,1	17,2	7,8	21,7	0,4
Montanaso Lombardo	35,0	-8,3	17,2	8,5	18,8	1,0
Zanzarina	34,9	-10,4	18,2	7,9	22,0	0,9
Dobbiaco	29,6	-17,4	10,7	1,2	19,3	1,2
San Valentino alla Muta	26,4	-16,0	10,7	1,2	19,6	1,2
Monte Paganella	21,8	-16,0	5,7	0,6	18,7	0,8
Passo Rolle	22,2	-16,6	6,8	0,1	14,2	1,0
Vigalzano	32,4	-9,1	15,7	6,4	18,0	1,0
Verona Villafranca	33,8	-9,1	17,9	10,5	15,6	0,7
Vicenza	36,2	-9,8	18,9	8,9	21,2	1,0
Susegana	33,7	-10,4	16,9	7,6	18,2	1,4
Treviso Istrana	35,8	-9,6	19,4	9,0	21,8	1,5
Treviso Sant'Angelo	35,2	-8,8	19,5	9,2	23,2	1,4
Aviano	34,6	-9,4	18,3	8,9	24,2	1,6
Fiume Veneto	35,3	-9,2	18,6	8,6	20,4	1,8
Cividale	34,2	-7,3	17,1	8,6	19,7	1,4
Tarvisio	30,6	-13,8	13,7	4,6	19,3	0,8
Udine Rivolto	35,4	-10,2	18,9	9,9	18,4	1,0
Trieste	36,2	-3,8	17,9	11,7	13,6	1,0
Capo Mele	32,4	2,0	18,6	14,1	10,1	0,7
Passo dei Giovi	30,4	-9,2	14,9	7,2	18,4	0,8
Sarzana Luni	34,8	-3,2	18,7	9,7	19,0	0,7
Piacenza San Damiano	35,8	-9,0	18,3	8,4	21,0	1,0
Monte Cimone	20,4	-14,0	5,1	1,2	10,4	0,2
Ferrara	36,3	-8,6	19,7	9,6	19,7	0,8
Cervia	33,8	-7,8	18,7	9,0	17,5	0,6
Marina di Ravenna	34,0	-5,6	18,6	11,1	15,2	0,6
Rimini Miramare	33,3	-7,6	18,4	9,7	20,2	1,0
Passo della Cisa	27,1	-7,2	11,6	6,6	11,0	0,7
Passo della Porretta	25,8	-10,0	10,7	6,0	11,0	0,8
San Casciano	36,5	-6,1	18,4	9,5	18,8	1,2
Elba Calamita	32,0	-0,4	..	..	..	..
Pisa San Giusto	37,6	-7,0	20,0	10,3	18,6	2,4
San Piero a Grado	36,4	-7,1	19,5	8,1	21,2	2,2
Arezzo	36,8	-10,4	19,7	7,3	22,2	2,0
Radicofani	33,6	-9,6	15,9	9,0	13,2	1,2
Grosseto	37,6	-6,0	21,9	10,1	22,2	2,2
Monte Argentario	34,8	-4,8	17,7	10,9	13,6	1,0
Marsciano	37,1	-8,4	18,9	8,1	22,3	1,7
Santa Fista	35,4	-10,7	18,8	6,2	24,5	1,7
Fenile	..	..	..	..	..	..
Frontone	35,6	-4,0	17,5	10,2	15,5	1,3
Monsampolo	36,1	-5,3	19,9	9,2	18,3	1,6
Caprarola	32,3	-6,4	15,6	9,0	12,2	1,2
Viterbo	37,1	-6,8	19,9	8,6	24,9	2,3
Monte Terminillo	24,4	-15,6	8,4	3,1	11,0	0,6
Civitavecchia	31,8	0,6	20,7	14,4	24,8	1,0
Guidonia	37,8	-5,6	22,0	10,5	19,4	2,6
Pratica di Mare	33,0	-0,4	21,0	12,4	16,2	2,0

Minimum and Maximum Temperature values for Santo Pietro area

STAZIONI	Massimo	Minimo	Media massima	Media minima	Escursione massima	Escursione minima
Roma Ciampino	34,4	-4,0	20,8	11,3	21,8	2,0
Roma Collegio Romano	35,2	-1,7	21,0	12,6	14,1	1,4
Vigna di Valle	35,6	-1,6	19,3	11,4	13,8	1,2
Borgo San Michele	35,7	-4,7	20,7	9,8	17,8	2,4
Latina	35,2	-3,8	21,2	11,5	15,6	2,6
Ponza	30,6	4,6	18,9	15,4	10,0	1,2
Frosinone	36,0	-9,8	20,4	8,9	21,0	1,8
Castel di Sangro	31,4	-15,9	16,4	3,3	22,9	1,5
Campobasso	32,8	-5,4	17,0	9,6	24,8	1,4
Campochiaro	34,1	-13,2	14,7	3,5	25,3	2,4
Termoli	34,8	0,2	19,9	14,7	12,4	0,6
Grazzanise	36,6	-4,4	21,4	10,2	20,2	4,2
Piano Cappelle	36,7	-6,9	19,1	7,4	22,5	3,0
Capri	35,0	0,0	22,8	14,5	20,4	1,8
Trevico	30,6	-10,0	14,4	7,5	13,2	1,0
Capo Palinuro	34,0	-0,2	20,8	13,8	12,8	2,2
Pontecagnano	33,9	-4,2	21,0	9,4	20,1	3,0
Foggia Amendola	41,2	-4,8	21,9	10,4	22,2	1,8
Monte Sant'Angelo	33,8	-6,2	16,6	9,6	13,4	1,2
Gioia del Colle	35,8	-3,6	19,1	9,9	19,8	1,2
Palo del Colle	36,1	-4,6	18,9	7,9	19,2	1,4
Turi	35,1	-3,1	19,4	9,7	18,0	1,7
Marina di Ginosa	38,0	-0,8	21,9	12,5	17,8	0,8
Brindisi	35,6	0,4	21,5	13,7	15,0	2,2
Lecce Galatina	37,4	-3,2	21,7	11,3	21,6	2,0
Santa Maria di Leuca	34,8	-0,8	20,4	14,3	11,6	1,2
Latronico	31,2	-6,0	16,0	9,5	13,0	0,6
Aliano	39,3	-7,1	20,4	7,0	26,5	2,6
Matera	38,5	-5,4	18,7	8,4	22,3	1,4
Bonifati	35,0	-2,6	20,5	12,7	14,6	1,6
Montescuro	26,4	-12,0	10,8	4,9	16,0	0,4
Sibari	37,9	-2,0	21,8	10,6	18,8	2,3
Pantelleria	37,8	5,4	21,3	15,4	21,6	1,6
Trapani Birgi	38,8	1,0	22,5	13,8	18,4	2,6
Palermo Bocca di Falco	39,8	3,8	22,4	15,2	14,0	2,4
Prizzi	37,2	-4,8	16,4	8,8	16,2	1,6
Ustica	32,6	3,0	20,9	14,9	10,4	1,4
Messina	39,0	2,8	22,3	15,8	12,6	1,6
Pietranera	41,1	-3,6	23,2	8,5	24,4	2,6
Gela	35,8	2,0	21,7	14,6	14,8	2,6
Enna	37,4	-3,2	19,6	10,9	20,8	1,2
Catania Sigonella	43,2	-2,0	24,1	12,2	24,6	2,4
Libertinia	43,3	-5,5	22,9	9,4	27,7	2,3
Santo Pietro	40,4	-2,1	21,4	10,8	19,1	2,6
Cozzo Spadaro	37,8	2,8	22,6	16,0	11,6	1,2
Capo Caccia	33,0	2,6	18,5	13,3	13,8	1,2
Chilivani	36,5	-7,5	14,2	4,2	25,4	2,1
Capo Bellavista	38,4	4,0	21,7	14,6	15,8	1,8
Fonni	26,6	-3,0	13,4	7,2	12,8	1,2
Capo Frasca	35,6	1,6	19,4	13,8	12,8	1,2
Santa Lucia	40,5	1,3	21,6	10,2	21,3	4,2
Cagliari Elmas	38,6	-2,8	22,7	12,7	16,8	2,4
Decimomannu	39,0	-3,2	23,1	11,2	19,8	3,0
Capo Carbonara	34,2	5,4	22,0	15,7	13,8	1,6

Tavola 3.1 segue - **Umidità relativa media rilevata alle ore 6:00 per decade nel mese, secondo stazione - Anno 2002** *(in percentuale)*

STAZIONI	Gennaio			Febbraio			Marzo		
	Decade			Decade			Decade		
	I	II	III	I	II	III	I	II	III
Roma Ciampino	82	94	94	94	93	91	91	92	83
Roma Collegio Romano	57	74	85	82	82	76	74	75	64
Vigna di Valle	63	87	91	92	93	86	88	82	74
Borgo San Michele	65	80	86	89	88	85	81	89	..
Latina	79	93	93	94	95	94	94	87	86
Ponza	62	76	87	81	88	79	80	77	62
Frosinone	89	90	88	90	92	89	88	86	88
Castel di Sangro	61	73	83	82	82	80	76	76	72
Campobasso	63	85	93	85	85	77	72	59	78
Campochiaro	93	99	..	97	98	92	87	91	94
Termoli	57	73	82	87	83	66	78	86	73
Grazzanise	69	80	94	89	91	85	86	84	81
Piano Cappelle	81	97	98	94	89	89	86	86	84
Capri	....	....	..	87	82	79	69	71	64
Trevico	....	....	....	....	....	....	....	....	....
Capo Palinuro	55	88	93	89	76	85	62	81	70
Pontecagnano	72	98	..	..	..	..	86	..	69
Foggia Amendola	81	89	97	91	92	81	83	86	79
Monte Sant'Angelo	71	85	75	76	74	77	71	63	75
Gioia del Colle	76	88	92	94	87	88	91	88	85
Palo del Colle	75	92	95	97	89	81	84	90	76
Turi	78	95	95	99	90	88	92	95	85
Marina di Ginosa	87	87	90	93	87	87	84	85	85
Brindisi	64	87	85	89	79	78	84	78	70
Lecce Galatina	79	95	94	94	92	90	95	90	85
Santa Maria di Leuca	73	81	81	82	83	78	..	79	77
Latronico	78	..	90	94	82	83	67	67	75
Aliano	75	88	86	88	82	74	84	82	78
Matera	82	92	93	..	..	88	94	93	87
Bonifati	71	..	88	..	70	..	53	63	74
Montescuro	90	90	72	94	57	88	57	68	87
Sibari	72	93	89	89	84	70	88	85	72
Pantelleria	69	80	86	86	82	77	71	77	81
Trapani Birgi	77	88	90	86	84	85	72	80	78
Palermo Bocca di Falco	69	79	76	77	73	66	59	69	70
Prizzi	..	..	68	..	52	..	..	63	..
Ustica	64	75	90	87	84	81	69	89	68
Messina	67	81	87	87	85	81	68	82	75
Pietranera	82	96	98	97	87	95	83	94	89
Gela	73	82	83	79	76	78	66	75	75
Enna	83	88	75	88	67	91	62	71	86
Catania Sigonella	90	97	99	98	95	91	93	87	85
Libertinia	78	93	94	95	89	86	81	86	78
Santo Pietro	85	93	96	96	90	95	73	88	88
Cozzo Spadaro	77	79	79	83	83	84	83	79	73
Capo Caccia	77	87	86	88	85	87	87	85	84
Chilivani	84	..	..	89	90	83	88	90	80
Capo Bellavista	61	67	68	68	71	62	81	73	66
Fonni	..	..	54	..	77	..	..	71	..
Capo Frasca	83	85	84	85	87	89	85	81	77
Santa Lucia	..	91	96	96	94	90	92	91	86
Cagliari Elmas	84	87	92	91	89	86	88	86	89
Decimomannu	87	89	90	92	93	85	88	88	81
Capo Carbonara	74	78	81	81	69	80	76	69	66

Relative Humidity values for Santo Pietro area

Aprile			Maggio			Giugno			STAZIONI
Decade			Decade			Decade			
I	II	III	I	II	III	I	II	III	
91	93	94	93	94	93	90	83	89	Roma Ciampino
76	82	80	80	80	84	79	70	70	Roma Collegio Romano
88	91	82	88	85	88	85	76	78	Vigna di Valle
..	87	93	86	94	95	90	92	88	Borgo San Michele
89	90	92	92	94	91	91	90	89	Latina
82	82	81	79	82	86	82	83	81	Ponza
89	88	90	87	87	87	84	84	86	Frosinone
85	87	84	83	90	95	88	97	97	Castel di Sangro
85	89	79	68	71	73	59	55	73	Campobasso
97	96	97	90	99	94	..	99	..	Campochiaro
82	81	75	77	82	79	65	57	71	Termoli
85	92	91	90	89	87	81	79	77	Grazzanise
93	93	94	87	94	93	84	84	81	Piano Cappelle
80	85	85	71	88	83	77	83	81	Capri
....	....	....	....	....	....	....	....	....	Trevico
88	92	84	86	95	93	90	96	94	Capo Palinuro
88	85	85	83	90	89	85	90	84	Pontecagnano
89	92	88	92	91	85	80	67	75	Foggia Amendola
68	86	78	76	72	70	67	53	61	Monte Sant'Angelo
90	89	94	95	89	77	71	61	74	Gioia del Colle
91	89	90	86	86	87	64	59	57	Palo del Colle
95	94	95	90	89	89	75	75	70	Turi
..	88	88	87	86	86	85	78	79	Marina di Ginosa
87	87	90	87	85	84	78	76	79	Brindisi
93	91	93	94	91	88	84	72	77	Lecce Galatina
76	80	79	79	81	78	78	61	68	Santa Maria di Leuca
89	93	83	70	89	83	73	66	78	Latronico
88	84	90	88	83	83	79	77	76	Aliano
..	..	92	91	87	90	79	68	68	Matera
79	84	..	69	..	81	..	86	..	Bonifati
75	87	73	81	87	78	73	74	69	Montescuro
88	84	90	88	78	80	78	71	65	Sibari
85	81	88	72	73	63	72	68	58	Pantelleria
72	71	81	70	79	70	71	74	74	Trapani Birgi
71	65	71	70	70	67	60	61	71	Palermo Bocca di Falco
..	..	..	..	..	50	..	34	..	Prizzi
87	84	85	74	73	81	77	64	83	Ustica
83	83	83	80	85	86	86	87	83	Messina
92	92	97	82	92	81	69	65	68	Pietranera
81	78	78	71	74	68	64	67	69	Gela
84	87	88	..	83	89	78	68	71	Enna
96	91	94	88	79	79	75	67	71	Catania Sigonella
91	88	..	..	77	77	66	54	58	Libertinia
94	89	92	89	87	68	63	53	55	Santo Pietro
80	74	75	82	77	74	71	71	73	Cozzo Spadaro
83	86	87	86	84	78	....	....	....	Capo Caccia
88	86	88	87	90	83	77	72	..	Chilivani
71	61	61	79	70	63	74	61	70	Capo Bellavista
..	..	..	..	..	..	..	54	..	Fonni
78	78	77	77	77	78	74	76	80	Capo Frasca
89	92	95	90	85	79	74	79	77	Santa Lucia
89	90	91	86	90	84	81	78	83	Cagliari Elmas
87	86	88	86	88	83	73	71	77	Decimomannu
77	76	..	83	81	78	79	66	62	Capo Carbonara

Tavola 3.1 segue - **Umidità relativa media rilevata alle ore 6:00 per decade nel mese, secondo stazione - Anno 2002** *(in percentuale)*

STAZIONI	Luglio			Agosto			Settembre		
	Decade			Decade			Decade		
	I	II	III	I	II	III	I	II	III
Roma Ciampino	84	93	88	89	95	96	95	96	93
Roma Collegio Romano	73	80	73	77	81	84	85	83	78
Vigna di Valle	81	87	81	87	88	91	91	87	83
Borgo San Michele	86	94	89	89	94	94	98	97	92
Latina	89	92	88	..	94	94	94	95	94
Ponza	80	79	75	86	87	84	75	78	73
Frosinone	85	89	87	88	88	88	92	90	92
Castel di Sangro	95	98	91	95	97	99	100	99	92
Campobasso	72	80	72	71	79	86	84	82	83
Campochiaro	..	93	88	91	95	99	..	98	89
Termoli	72	69	71	73	73	78	78	81	78
Grazzanise	76	86	87	93	94	93	94	92	87
Piano Cappelle	..	..	81	84	89	92	97	92	90
Capri	75	83	84	73	88	81	85	74	63
Trevico	....	....	....	....	....	....	....	....	....
Capo Palinuro	89	94	87	86	96	92	95	94	88
Pontecagnano	78	86	77	86	88	88	89	84	79
Foggia Amendola	79	74	80	86	80	93	95	92	88
Monte Sant'Angelo	64	66	68	62	82	76	77	73	86
Gioia del Colle	74	73	81	..	85	95	97	94	90
Palo del Colle	62	65	74	71	80	94	97	93	85
Turi	75	78	82	78	88	97	99	98	92
Marina di Ginosa	80	78	81	84	85	88	86	88	85
Brindisi	81	72	72	75	75	83	87	77	77
Lecce Galatina	81	75	83	83	84	94	94	93	93
Santa Maria di Leuca	64	62	68	70	76	86	85	81	79
Latronico	75	86	76	78	90	86	95	87	87
Aliano	73	75	74	74	81	89	92	..	..
Matera	70	70	73	72	75	90	94	91	81
Bonifati	79	87	80	84	..	80	93	77	..
Montescuro	73	88	80	68	99	83	96	84	97
Sibari	66	63	70	67	75	85	87	91	84
Pantelleria	74	80	73	65	85	76	81	79	78
Trapani Birgi	69	76	80	71	84	83	83	83	80
Palermo Bocca di Falco	65	64	69	65	72	75	73	75	75
Prizzi	47	..	..	..	..	....	....	..	..
Ustica	83	84	81	74	82	90	86	79	71
Messina	76	90	79	75	90	89	89	90	81
Pietranera	63	82	61	61	72	83	87	81	90
Gela	..	72	72	71	82	84	85	86	84
Enna	66	78	79	70	92	92	87	97	97
Catania Sigonella	81	78	69	68	80	89	92	91	89
Libertinia	58	60	55	54	63	77	80	74	68
Santo Pietro	59	68	65	56	75	80	86	86	79
Cozzo Spadaro	79	72	71	76	79	81	78	82	76
Capo Caccia	81	82	77	83	83	83	81	86	78
Chilivani	69	75	....	....	....	....	....	....	....
Capo Bellavista	80	69	67	62	66	77	72	75	62
Fonni	53	..	..	....	....	..	..	71	..
Capo Frasca	79	83	82	83	83	85	83	84	82
Santa Lucia	73	81	71	76	83	82	85	79	73
Cagliari Elmas	80	85	84	82	85	85	83	86	85
Decimomannu	76	83	80	82	83	86	87	88	81
Capo Carbonara	77	75	..	76	..	79	80	79	74

Ottobre			Novembre			Dicembre			STAZIONI
Decade			Decade			Decade			
I	II	III	I	II	III	I	II	III	
97	96	96	96	89	85	95	95	98	Roma Ciampino
81	86	84	80	84	79	81	86	89	Roma Collegio Romano
84	89	89	83	87	87	80	86	92	Vigna di Valle
97	..	96	89	92	85	87	90	95	Borgo San Michele
96	94	93	88	86	85	91	94	96	Latina
78	83	78	72	81	82	75	82	88	Ponza
88	88	89	92	87	85	89	89	92	Frosinone
99	95	95	93	80	..	89	91	90	Castel di Sangro
84	80	84	83	69	80	95	94	92	Campobasso
99	94	..	92	70	88	93	94	93	Campochiaro
80	70	71	78	80	77	80	78	76	Termoli
90	91	89	85	85	85	84	88	94	Grazzanise
95	93	85	85	72	85	85	89	94	Piano Cappelle
80	81	85	62	74	71	70	73	81	Capri
....	....	....	....	....	....	....	....	....	Trevico
93	74	67	57	64	63	70	66	84	Capo Palinuro
86	91	89	81	85	91	82	87	98	Pontecagnano
89	86	73	86	81	88	92	89	92	Foggia Amendola
72	64	57	79	73	78	92	89	77	Monte Sant'Angelo
94	94	89	89	93	94	96	94	95	Gioia del Colle
97	93	88	87	93	93	99	96	97	Palo del Colle
99	97	94	95	100	99	100	99	100	Turi
86	87	85	88	94	94	93	93	92	Marina di Ginosa
81	86	83	78	86	91	84	82	90	Brindisi
91	92	89	93	92	93	91	87	93	Lecce Galatina
83	84	82	79	80	79	77	80	82	Santa Maria di Leuca
90	80	81	..	74	86	94	94	..	Latronico
96	93	86	88	93	96	....	93	97	Aliano
86	86	78	75	85	87	89	86	87	Matera
78	..	77	..	67	75	86	87	..	Bonifati
90	66	64	86	66	89	..	..	..	Montescuro
88	86	80	80	85	90	91	87	92	Sibari
79	83	88	81	73	80	84	84	87	Pantelleria
84	87	90	85	87	84	84	87	87	Trapani Birgi
77	72	75	75	60	67	76	76	81	Palermo Bocca di Falco
82	..	72	..	81	..	..	82	..	Prizzi
79	78	84	76	76	77	77	79	87	Ustica
85	82	89	87	88	89	89	84	88	Messina
89	..	94	93	94	94	97	98	99	Pietranera
85	85	83	81	84	85	83	83	83	Gela
99	74	92	99	..	99	..	98	97	Enna
91	95	91	89	92	91	90	91	91	Catania Sigonella
74	..	77	77	..	..	93	92	93	Libertinia
87	87	86	87	88	92	96	92	94	Santo Pietro
79	81	84	86	85	87	87	87	82	Cozzo Spadaro
82	81	84	83	85	79	83	78	81	Capo Caccia
..	91	92	92	84	91	94	93	92	Chilivani
75	64	67	67	78	75	73	75	75	Capo Bellavista
....	..	59	..	..	..	..	..	....	Fonni
83	84	84	85	84	83	86	84	86	Capo Frasca
78	83	86	81	80	81	84	84	86	Santa Lucia
83	81	82	87	86	91	91	90	92	Cagliari Elmas
87	87	93	87	89	..	..	89	..	Decimomannu
79	73	80	..	82	80	78	80	..	Capo Carbonara

Tavola 3.2 segue - **Umidità relativa media rilevata alle ore 12:00 per decade nel mese, secondo stazione - Anno 2002** *(in percentuale)*

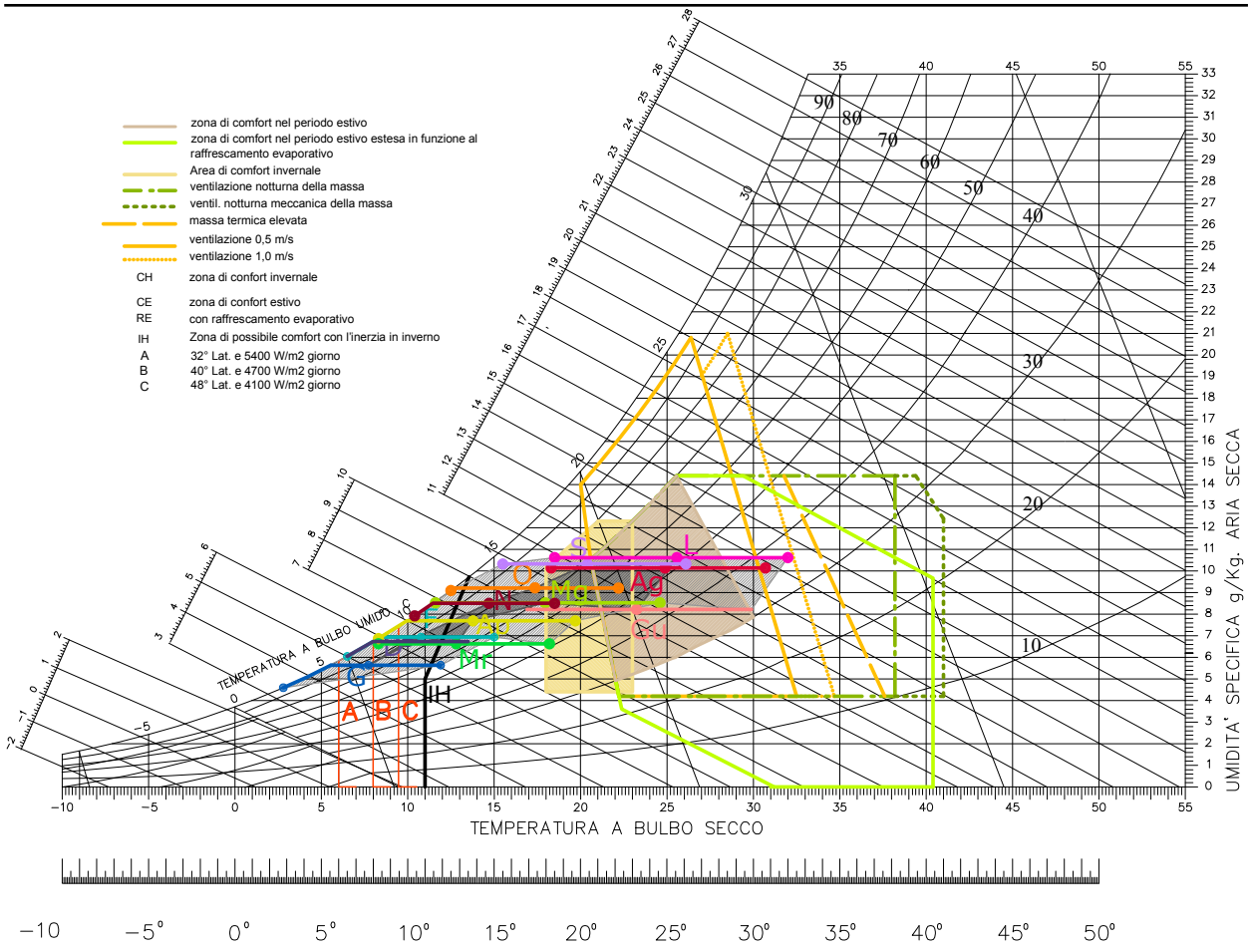
STAZIONI	Gennaio			Febbraio			Marzo		
	Decade			Decade			Decade		
	I	II	III	I	II	III	I	II	III
Roma Ciampino	43	68	82	73	73	69	67	56	46
Roma Collegio Romano	42	61	73	69	69	62	58	54	42
Vigna di Valle	47	72	85	73	75	70	67	56	51
Borgo San Michele	44	60	72	69	70	68	..	60	..
Latina	51	67	80	67	71	72	67	60	44
Ponza	49	74	83	76	84	79	77	74	55
Frosinone	48	66	75	65	57	65	57	38	43
Castel di Sangro	44	63	71	62	57	59	55	42	52
Campobasso	53	72	69	70	62	60	62	37	63
Campochiaro	66	84	..	75	64	67	63	52	67
Termoli	54	71	75	81	73	56	71	79	73
Grazzanise	36	64	70	65	63	65	55	49	51
Piano Cappelle	57	79	78	74	61	68	60	51	57
Capri	46	68	80	74	69	69	60	52	56
Trevico	65	79	74	85	64	..	67	58	83
Capo Palinuro	45	77	93	85	72	81	56	75	63
Pontecagnano	48	75	84	78	68	76	55	64	47
Foggia Amendola	60	76	73	76	56	49	64	59	53
Monte Sant'Angelo	60	80	62	66	64	68	75	52	59
Gioia del Colle	60	66	64	73	57	52	75	64	63
Palo del Colle	55	76	74	87	63	50	66	55	52
Turi	64	79	77	88	69	64	79	70	64
Marina di Ginosa	56	72	73	78	61	66	81	70	57
Brindisi	50	68	68	74	61	46	67	61	52
Lecce Galatina	53	74	75	70	60	43	64	62	50
Santa Maria di Leuca	56	73	77	76	68	68	..	64	53
Latronico	57	..	69	83	58	74	59	55	68
Aliano	50	68	63	66	55	49	68	60	58
Matera	60	74	72	..	..	57	76	63	64
Bonifati	57	..	81	..	60	..	53	57	58
Montescuro	76	84	64	87	43	..	56	68	85
Sibari	53	74	67	71	62	55	77	65	50
Pantelleria	64	77	79	82	78	63	67	76	72
Trapani Birgi	46	71	82	72	64	66	50	69	54
Palermo Bocca di Falco	54	65	67	66	61	51	55	54	53
Prizzi	..	..	62	..	41	..	..	45	..
Ustica	55	65	82	75	77	67	62	66	55
Messina	56	74	74	77	70	62	67	65	54
Pietranera	55	68	80	71	59	70	54	49	54
Gela	58	72	72	66	61	68	63	60	57
Enna	71	82	73	77	72	65	64	62	66
Catania Sigonella	53	58	57	66	65	49	65	54	42
Libertinia	58	70	65	73	64	56	63	53	51
Santo Pietro	69	77	83	83	75	77	64	64	62
Cozzo Spadaro	65	71	76	76	76	73	76	66	52
Capo Caccia	67	83	87	85	81	83	78	78	74
Chilivani	61	....	74	71	67	65	63	53	41
Capo Bellavista	61	65	70	61	66	63	82	64	56
Fonni	..	..	48	..	62	..	..	55	..
Capo Frasca	65	72	81	80	81	87	79	72	52
Santa Lucia	..	74	78	72	69	69	64	64	51
Cagliari Elmas	60	75	82	79	73	68	64	60	49
Decimomannu	49	61	63	63	53	53	41	47	36
Capo Carbonara	67	74	81	73	68	71	69	71	54

Aprile			Maggio			Giugno			STAZIONI
Decade			Decade			Decade			
I	II	III	I	II	III	I	II	III	
63	66	49	54	63	57	55	46	49	Roma Ciampino
60	60	53	54	57	55	53	42	46	Roma Collegio Romano
63	69	61	61	58	56	54	44	50	Vigna di Valle
..	66	68	61	70	66	63	63	61	Borgo San Michele
72	65	64	55	67	63	55	54	58	Latina
82	79	70	73	75	73	71	68	66	Ponza
57	55	49	54	51	53	50	46	49	Frosinone
62	64	59	56	64	64	67	51	65	Castel di Sangro
69	66	69	49	54	49	54	38	50	Campobasso
65	62	60	52	60	56	..	38	..	Campochiaro
80	73	74	69	84	80	64	70	68	Termoli
61	64	53	53	59	53	52	54	53	Grazzanise
66	64	60	55	56	53	53	36	46	Piano Cappelle
64	62	56	49	65	61	60	60	56	Capri
83	68	..	68	62	60	55	46	54	Trevico
80	86	84	71	96	87	86	97	93	Capo Palinuro
65	62	59	53	68	61	64	65	57	Pontecagnano
65	63	57	53	57	56	48	37	43	Foggia Amendola
68	72	56	57	55	55	60	37	50	Monte Sant'Angelo
61	67	66	60	61	49	45	38	40	Gioia del Colle
67	65	59	48	53	54	45	31	33	Palo del Colle
75	71	66	59	62	55	53	45	44	Turi
..	62	62	75	68	66	72	48	67	Marina di Ginosa
65	66	63	56	64	60	47	52	53	Brindisi
61	67	55	53	56	45	46	35	32	Lecce Galatina
74	71	55	65	68	55	61	51	57	Santa Maria di Leuca
68	72	65	61	66	64	56	44	56	Latronico
59	64	59	56	51	45	44	27	37	Aliano
..	..	62	57	55	52	52	29	35	Matera
73	79	..	64	..	74	..	84	..	Bonifati
74	85	68	68	90	86	70	69	78	Montescuro
66	65	67	59	51	52	47	33	38	Sibari
78	76	75	73	63	54	66	52	50	Pantelleria
54	61	58	42	58	49	55	57	63	Trapani Birgi
61	44	54	55	57	52	56	51	51	Palermo Bocca di Falco
..	..	..	..	..	29	..	26	..	Prizzi
71	56	62	56	62	54	57	51	57	Ustica
66	70	66	66	67	69	66	69	71	Messina
65	59	58	50	49	42	45	31	37	Pietranera
69	72	72	63	72	75	74	77	77	Gela
74	68	76	79	72	66	67	48	55	Enna
56	49	46	58	43	44	38	39	41	Catania Sigonella
58	53	..	..	45	44	39	28	31	Libertinia
68	63	66	58	58	44	37	33	39	Santo Pietro
68	59	63	72	63	67	60	60	66	Cozzo Spadaro
74	79	79	81	75	74	....	....	....	Capo Caccia
61	56	46	58	48	41	41	25	..	Chilivani
72	59	62	71	72	60	61	65	70	Capo Bellavista
..	..	..	..	..	..	..	35	..	Fonni
64	74	72	66	65	69	64	60	76	Capo Frasca
62	64	54	58	54	45	44	33	36	Santa Lucia
65	61	47	62	59	46	54	45	44	Cagliari Elmas
51	52	29	45	40	29	37	21	21	Decimomannu
71	67	..	79	78	71	76	65	61	Capo Carbonara

Tavola 3.2 segue - **Umidità relativa media rilevata alle ore 12:00 per decade nel mese, secondo stazione - Anno 2002** *(in percentuale)*

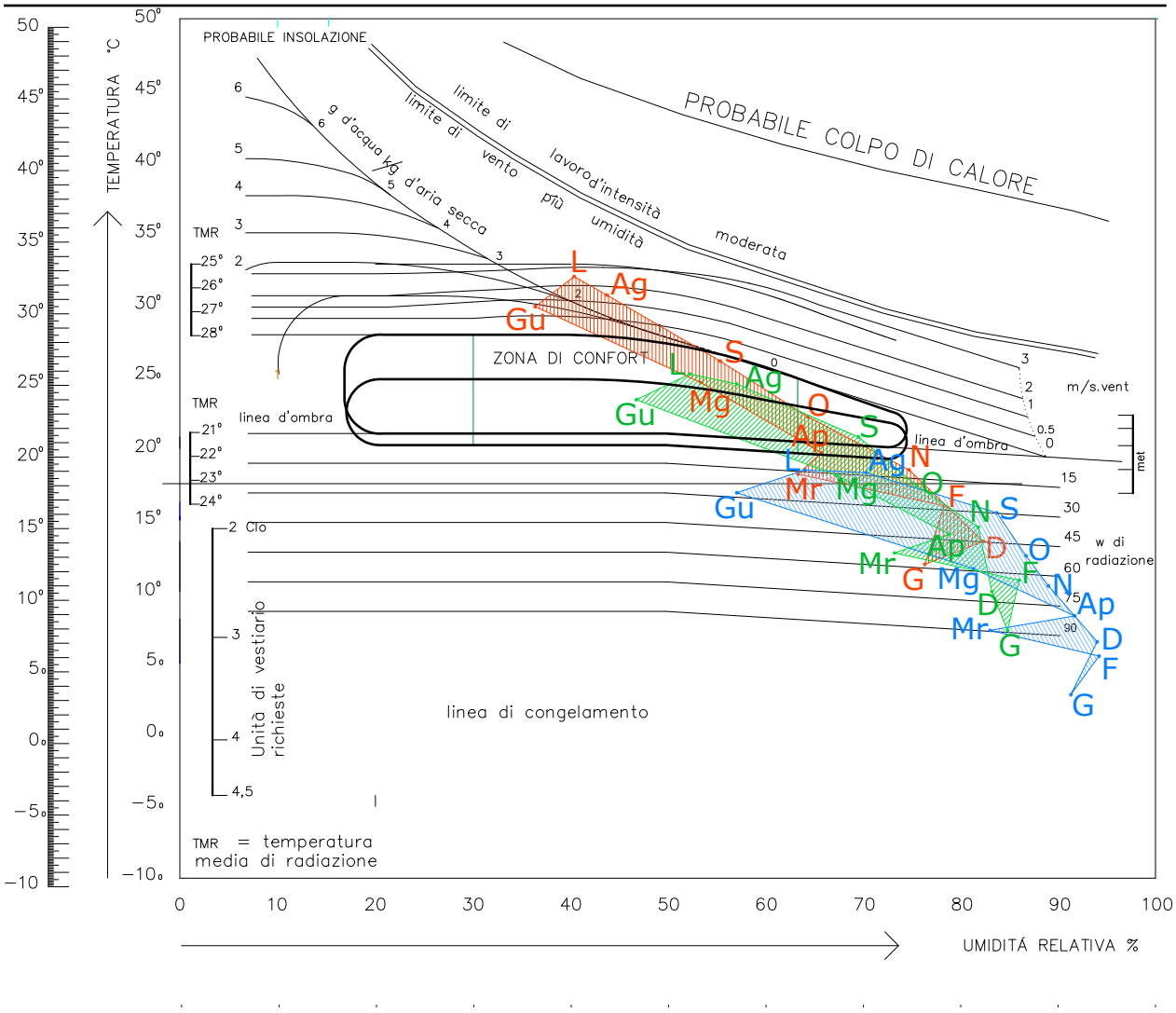
STAZIONI	Luglio			Agosto			Settembre		
	Decade			Decade			Decade		
	I	II	III	I	II	III	I	II	III
Roma Ciampino	47	65	51	60	61	75	67	66	59
Roma Collegio Romano	50	59	48	57	56	66	64	63	56
Vigna di Valle	47	63	51	62	60	72	69	66	61
Borgo San Michele	56	65	62	61	69	72	76	74	70
Latina	53	64	57	..	68	77	75	73	63
Ponza	65	69	65	78	73	78	70	68	70
Frosinone	43	54	47	55	55	65	67	59	60
Castel di Sangro	53	65	61	55	64	71	74	72	77
Campobasso	46	54	50	44	46	60	57	51	74
Campochiaro	..	53	..	44	52	61	..	56	72
Termoli	69	67	73	63	71	76	74	68	60
Grazzanise	49	65	62	62	60	65	67	51	61
Piano Cappelle	..	..	49	43	51	56	61	50	70
Capri	53	67	65	49	63	61	63	51	59
Trevico	44	56	..	49	..	73	67	59	77
Capo Palinuro	85	96	88	87	94	92	90	80	75
Pontecagnano	49	59	58	56	60	61	59	51	60
Foggia Amendola	41	45	52	41	44	63	64	60	58
Monte Sant'Angelo	46	49	52	47	51	63	71	60	66
Gioia del Colle	43	50	53	..	51	54	68	64	62
Palo del Colle	36	42	53	35	43	64	71	56	64
Turi	47	54	62	47	59	70	80	69	73
Marina di Ginosa	68	65	64	69	56	82	73	67	65
Brindisi	54	50	56	51	50	54	65	45	45
Lecce Galatina	33	41	60	39	44	57	72	62	61
Santa Maria di Leuca	42	51	55	57	62	69	66	64	67
Latronico	47	63	68	52	66	68	70	68	71
Aliano	35	42	49	39	46	64	64	..	..
Matera	40	42	47	37	43	60	62	54	57
Bonifati	68	78	77	70	..	78	74	71	..
Montescuro	65	93	80	70	97	82	97	84	97
Sibari	40	40	54	44	47	61	62	60	57
Pantelleria	62	66	57	51	74	68	75	70	62
Trapani Birgi	56	67	60	57	73	65	73	61	64
Palermo Bocca di Falco	55	49	53	57	56	60	59	58	55
Prizzi	..	..	..	..	..	....	....	..	..
Ustica	58	58	59	60	56	66	72	55	56
Messina	65	67	70	58	68	73	76	73	68
Pietranera	37	45	38	35	45	49	54	50	57
Gela	..	77	75	77	80	80	79	80	75
Enna	55	51	60	51	59	65	66	67	75
Catania Sigonella	45	43	41	36	41	46	43	51	38
Libertinia	31	29	34	28	38	46	48	49	41
Santo Pietro	37	42	42	33	48	50	56	58	52
Cozzo Spadaro	66	57	55	50	61	69	65	69	58
Capo Caccia	74	79	72	76	77	79	76	78	66
Chilivani	31	..	....	....	....	....	....	....	....
Capo Bellavista	65	60	68	67	60	70	68	70	54
Fonni	34	..	..	....	....	..	..	46	..
Capo Frasca	73	79	77	75	77	80	76	77	74
Santa Lucia	37	46	41	45	49	48	50	50	51
Cagliari Elmas	50	53	47	49	56	68	55	64	56
Decimomannu	25	32	27	31	29	48	43	42	43
Capo Carbonara	71	..	..	71	..	73	69	68	66

Ottobre			Novembre			Dicembre			STAZIONI
Decade			Decade			Decade			
I	II	III	I	II	III	I	II	III	
72	69	73	73	83	70	75	80	87	Roma Ciampino
66	..	68	68	76	68	71	79	82	Roma Collegio Romano
66	62	72	70	80	74	75	79	84	Vigna di Valle
..	..	80	72	84	71	70	82	87	Borgo San Michele
75	74	76	64	81	70	71	84	88	Latina
75	76	76	66	81	78	75	80	85	Ponza
70	67	72	61	82	70	75	79	89	Frosinone
77	71	70	75	70	..	81	78	83	Castel di Sangro
62	53	53	57	55	71	92	89	78	Campobasso
70	58	..	67	60	68	85	86	81	Campochiaro
75	62	57	76	63	61	76	71	71	Termoli
61	61	60	57	65	65	62	72	79	Grazzanise
68	65	59	62	57	66	74	82	83	Piano Cappelle
64	68	72	56	70	66	60	63	75	Capri
77	68	68	..	60	71	93	..	..	Trevico
73	60	53	45	58	59	51	56	79	Capo Palinuro
62	64	64	60	66	68	63	75	86	Pontecagnano
59	54	36	55	50	66	87	75	78	Foggia Amendola
66	55	46	65	60	71	90	81	71	Monte Sant'Angelo
71	60	47	53	77	82	85	83	81	Gioia del Colle
79	65	55	63	71	79	94	90	87	Palo del Colle
82	72	63	..	89	94	99	97	95	Turi
77	73	59	69	90	92	92	88	90	Marina di Ginosa
56	61	50	55	62	69	71	69	69	Brindisi
64	65	51	57	68	75	84	74	76	Lecce Galatina
66	67	66	63	76	72	77	73	75	Santa Maria di Leuca
75	67	65	..	63	81	88	82	..	Latronico
65	60	49	60	65	76	....	81	83	Aliano
67	58	49	57	71	77	81	79	78	Matera
73	..	70	..	63	77	82	76	..	Bonifati
92	68	63	89	65	90	100	83	89	Montescuro
70	64	54	60	65	78	82	73	78	Sibari
61	66	76	72	70	77	80	75	79	Pantelleria
72	69	72	64	70	76	76	74	79	Trapani Birgi
63	59	56	61	47	55	71	63	71	Palermo Bocca di Falco
55	..	50	..	57	..	..	75	..	Prizzi
68	62	70	63	61	75	71	67	79	Ustica
72	72	71	73	79	80	80	74	77	Messina
63	..	66	68	75	84	..	87	93	Pietranera
78	81	80	78	81	81	80	79	81	Gela
79	78	77	86	83	..	96	94	..	Enna
53	46	48	51	61	74	69	62	57	Catania Sigonella
54	54	49	54	..	..	79	71	71	Libertinia
62	65	66	68	74	82	83	79	85	Santo Pietro
65	73	69	74	76	73	71	73	68	Cozzo Spadaro
77	73	84	82	83	76	81	75	80	Capo Caccia
..	58	63	75	69	72	83	79	79	Chilivani
71	66	63	68	70	73	69	71	71	Capo Bellavista
....	..	54	..	..	..	..	..	....	Fonni
75	73	81	78	74	83	84	80	83	Capo Frasca
55	54	65	63	68	64	72	70	75	Santa Lucia
61	62	62	71	79	82	81	78	85	Cagliari Elmas
47	45	49	55	61	..	..	61	..	Decimomannu
70	67	73	..	77	77	76	79	..	Capo Carbonara



MONTH	Tmed	Tmed max	T med min	Ur med	Ur 12h	Ur 6h	T max	T min
January	7,3	11,9	2.8	83,8	76,3	91,3	17,5	-2,1
February	10,8	15	6,5	86,0	78,3	93,7	19,8	1,8
March	12,7	18,2	7,3	73,2	63,3	83,0	27,0	-0,7
April	14,0	19,7	8,3	78,7	65,7	91,7	26,7	4,4
May	18,1	24,6	11,6	67,3	53,3	81,3	28,8	8,0
June	23,4	29,9	16,9	46,7	36,3	57,0	35	9,9
July	25,2	32	18,5	52,2	40,3	64,0	40,4	15,3
August	24,5	30,7	18,3	57,0	43,7	70,3	38,2	14,0
September	20,8	26,1	15,5	69,5	55,3	83,7	29,4	10,6
October	17,4	22,2	12,5	75,5	64,3	86,7	26	10,3
November	14,5	18,5	10,4	81,8	74,7	89,0	23,6	4,9
Dicember	10,0	13,5	6,5	88,2	82,3	94,0	15,9	4,1

Givoni Diagram Santo Pietro - Chart elaborated by the Author



MONTH	Tmed	Tmed max	T med min	Ur med	Ur 12h	Ur 6h	T max	T min
January	7,3	11,9	2.8	83,8	76,3	91,3	17,5	-2,1
February	10,8	15	6,5	86,0	78,3	93,7	19,8	1,8
March	12,7	18,2	7,3	73,2	63,3	83,0	27,0	-0,7
April	14,0	19,7	8,3	78,7	65,7	91,7	26,7	4,4
May	18,1	24,6	11,6	67,3	53,3	81,3	28,8	8,0
June	23,4	29,9	16,9	46,7	36,3	57,0	35	9,9
July	25,2	32	18,5	52,2	40,3	64,0	40,4	15,3
August	24,5	30,7	18,3	57,0	43,7	70,3	38,2	14,0
September	20,8	26,1	15,5	69,5	55,3	83,7	29,4	10,6
October	17,4	22,2	12,5	75,5	64,3	86,7	26	10,3
November	14,5	18,5	10,4	81,8	74,7	89,0	23,6	4,9
Dicember	10,0	13,5	6,5	88,2	82,3	94,0	15,9	4,1

Olgyay Diagram Santo Pietro - Chart elaborated by the Author

Appendix 2 - Building Systems

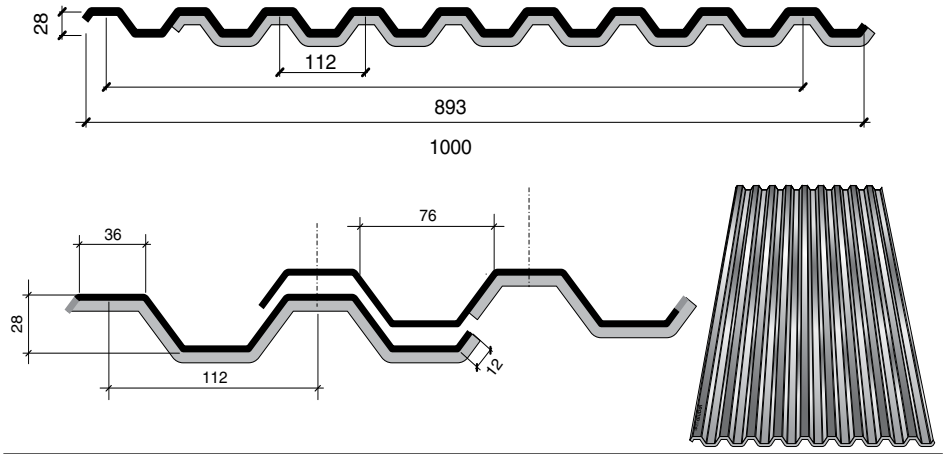
Corrugated Metal Sheet - Tek28

alubel tra la terra e il cielo

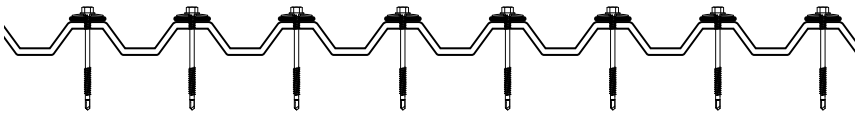
TEK28

Profilo Tek 28

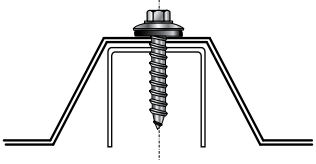
Prodotto in: **Acciaio**



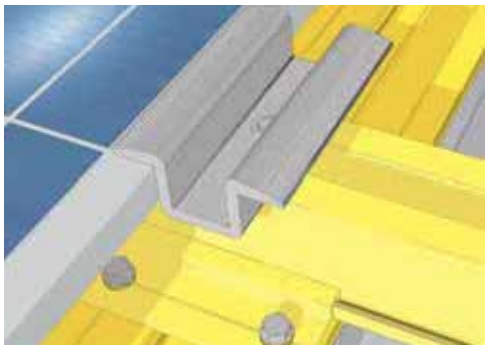
Coperture curve: fissaggi esterni. Fissaggio ogni sommità

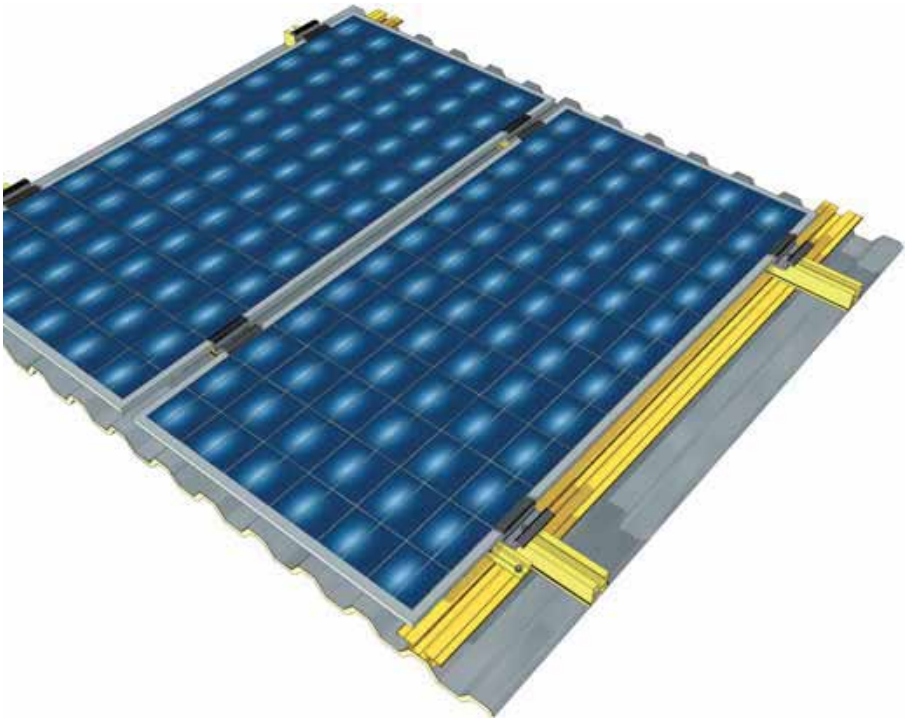


Profilo metallico sormonti laterali



PV Panels Installation System





Ytong - Cellular Concrete building blocks Technical Data

Scheda Tecnica di prodotto

Rev. 0.1

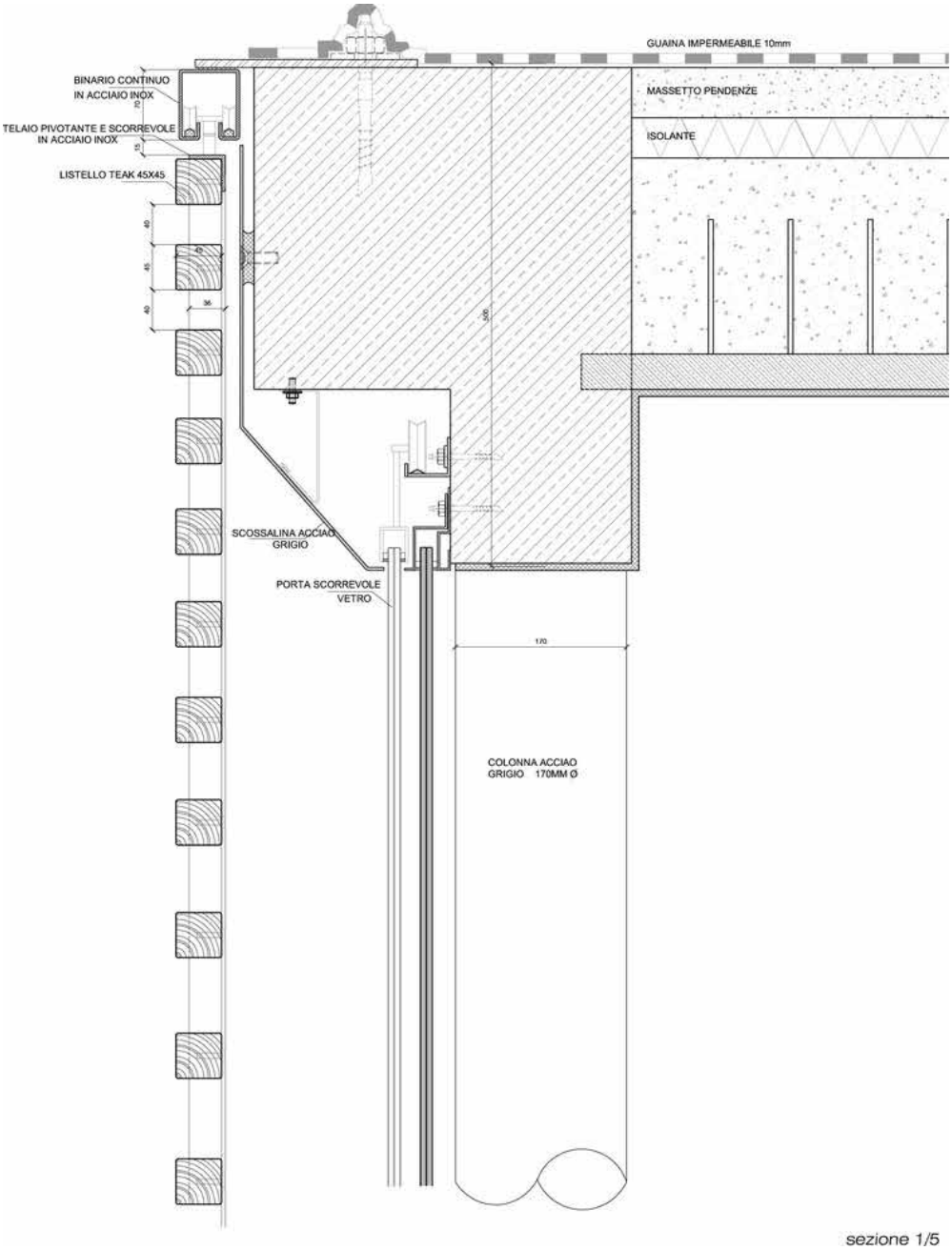
Nome del prodotto		Blocco	CLIMA 350				
Dimensioni *Stabilimento di POE (I)*		Lunghezza Altezza Spessore	mm	625 200			EN 772-16
				240	300	360	400
Massa volumica lorda a secco			kg/m³	350			EN 771-4
Calore specifico			kJ/(kg K)	1,05			EN 12602
Fattore di resistenza al vapore acqueo			-	da 5 a 10			EN 1745, Prosp. A.10
Permeabilità al vapore acqueo			kg/(m s Pa)	$32*10^{-12}$			-
Conduttività termica a secco λ_{10dry}			W/(m K)	≤ 0,098 P=90% ≤ 0,084 P=50%			EN 1745, Prosp. A.10
Conduttività termica di progetto λ_U			W/(m K)	0,103			EN 1745
Spessore			mm	240	300	360	400	-
Trasmittanza termica U			W/(m² K)	0.40	0,32	0.27	0,25	EN ISO 6946
Inerzia termica	Trasmittanza termica periodica Y_{ie}		W/(m² K)	0.18	0,09	0.05	0,03	EN ISO 13786
	Sfasamento		Ore	8.10	10.7	13.3	15.1	
	Fattore di attenuazione		-	0.44	0.28	0.17	0.12	
Potere fonoisolante *legge di massa per calcestruzzo cellulare* *R_w = 26,1*log m – 8,4 per m≥150 kg/m²* *R_w = 32,6*log m – 22,5 per m<150 kg/m²*			dB	43	45	48	49	Tech. Recomm. EAACA
Reazione al fuoco			-	Euroclasse A1 (ex Classe 0)				EN 13501-1 DM 10.3.2005
Resistenza al fuoco			-	EI240				DM 16.2.2007 ASSOBETON

ISOLAMENTO TERMICO aggiornato a D.Lgs. 311/2006 UNI EN 1745 fino a U = 0,18

	Dimensioni			Caratteristiche Meccaniche					Caratteristiche Termo-igrometriche											
				Densità nominale blocco [1]	Densità di calcolo muratura [1]	Resistenza caratteristica a compressione blocco f_{bk}	Resistenza caratteristica a compressione muratura f_k	Resistenza caratteristica a taglio muratura f_{vk0}	Coefficiente di diffusione del vapore acqueo μ [3]	Permeabilità al vapore δ_a	Capacità termica specifica (calore specifico)	Conduttività termica $\lambda_{10,dry,(P=50\%)}$ [4]	Conduttività termica di progetto λ_U [5]	Resistenza termica di progetto R_U [5]	Trasmittanza termica U [6]	Inerzia termica [7] Sfasamento	Inerzia termica [7] Fattore di attenuazione	Trasmittanza termica periodica Y_{ie} [7]	Resistenza al fuoco [9]	Potere fonoisolante R_w [8]
	cm l x h x sp			kg/m³	kg/m³	N/mm²	N/mm²	N/mm²	-	kg/msPa	kJ/kgK	W/mK	W/mK	m² K/W	W/m² K	h	-	W/m² K	min	dB
Blocchi da tamponamento	**BLOCCHI ISOLANTI PER PARETI ESTERNE DI TAMPONAMENTO**																			
	Blocchi con incastro M/F e con maniglie di sollevamento																			
	300  **CLIMAGOLD**																			
	62,5	20	36	300	400	1,8	-	-	5/10	32*10-12	1,05	0,085	0,089	4,04	0,24	13,2	0,17	0,04	[9]	46
	62,5	20	40											4,49	0,21	14,9	0,12	0,03		47
	62,5	20	42											4,72	0,20	15,8	0,10	0,02		48
	62,5	20	48											5,39	0,18	18,3	0,06	0,01		49
	350  **CLIMA**																			
	62,5	20	24	350	450	2,4	[2]	[2]	5/10	32*10-12	1,05	0,098	0,103	2,33	0,40	8,1	0,44	0,18	EI 240	43
	62,5	20	30											2,91	0,32	10,7	0,28	0,09		45
	62,5	20	36											3,50	0,27	13,3	0,17	0,05		48
	62,5	20	40											3,88	0,25	15,1	0,12	0,03		49
Blocchi portanti	**BLOCCHI ISOLANTI PER MURATURA PORTANTE**																			
	Blocchi portanti con incastro M/F e con maniglie di sollevamento																			
	450  **THERMO**																			
	62,5	25	20	500	600	3,3	2,2	0,10	5/10	32*10-12	1,05	0,13	0,137	1,46	0,61	6,9	0,55	0,34	REI 120/EI 240	45
	62,5	20	24	450	550	3,0	[2]	[2]				0,12	0,126	1,90	0,48	8,5	0,41	0,20	REI 180	46
	62,5	20	30											2,38	0,39	11,2	0,26	0,10	REI 240	49
	62,5	20	36											2,86	0,33	13,9	0,15	0,05		50
	62,5	20	40											3,17	0,30	15,7	0,10	0,03		51
	Blocchi portanti lisci con maniglie di sollevamento conformi all'O.P.C.M. 3431 del 2005																			
	575  **SISMICO**																			
	62,5	20	24	575	675	5,0	2,8	0,3	5/10	32*10-12	1,05	0,153	0,16	1,50	0,60	8,7	0,39	0,23	REI 180	49
	62,5	20	30											1,88	0,49	11,4	0,24	0,12	REI 240	51
	62,5	20	36											2,25	0,41	14,1	0,14	0,06		53
Tavelle e blocchi sottili [12]	**Blocchi maschiati per tramezzi, divisori, controfodere, ecc. (non portanti)** [11]																			
	Tavelle e Blocchi con incastro M/F																			
	550 																			
	62,5	25	8	550	650	3,8	-	-	5/10	32*10-12	1,05	0,145	0,152	0,53	1,44	-	-	-	[9]	37
	62,5	25	10											0,66	1,21				EI 180	39
	62,5	25	12											0,79	1,04					41
	62,5	25	15	500	600	3,3						0,13	0,137	1,09	0,79	4.6	0,76	0,60		42
	Blocchi sottili e tavelle per lavori di ristrutturazione e di interni (non portanti) [11]																			
	Tavelle e Blocchi lisci																			
	550 																			
	62,5	25	5	550	650	3,8	-	-	5/10	32*10-12	1,05	0,145	0,152	0,33	2,00	-	-	-	[9]	34
	62,5	25	8											0,53	1,44				EI 120	37
	62,5	25	10											0,66	1,21				EI 180	39

Brise Soleil - Reference Material

Bagni Pinuccia, Stabilimento Balneare a Varazze - SV



sezione 1/5

Project in Mahallat, Iran

SD Darmstadt 2007

a3e studio Housing Sociale

Appendix 3 - Project Inspiration and References

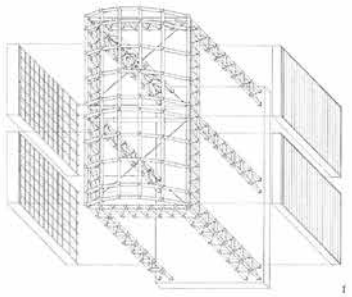
Glenn Murcutt - Selected Projects
(Pictures from Web sources)

Shigeru Ban - Bamboo Library

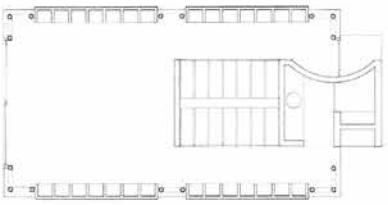
Library of a Poet

This library was built as an annex to the House for a Poet, which had been previously extended and improved by the architect. The project's genesis was based on the insight of the owner, who, having seen the Odawara Pavilion, expressed his opinion that "since books were made from paper, it would be a good idea to make a paper library." It was decided to employ a development of the paper tube truss used in the East Gate at Odawara. In this case, the tubes were 10 cm in diameter and 12.5 mm thick, slightly smaller than those used at Odawara, but with similar post-tensioned steel wires used for the spanning sections. Previously, steel angles were used to form the joints, whereas here 10 cm square timber pieces were employed. The four full-height bookshelves arranged along the sides are structurally independent of the paper tubes and are cantilevered from the floor, absorbing the horizontal loads. The bookshelves, which contain insulating material and have an exterior finish, were fabricated separately in the factory.

Completion Date: February 1991
Location: Zushi, Kanagawa, Japan
Project Team: Shigeru Ban, Hiromi Okusa
Structural Engineers: Gengo Matsui, Minoru Tezuka, Kazuo Ito
Mechanical Engineers: Urban Mechanical Engineering
General Contractors: Kadomatsu Komuten



1



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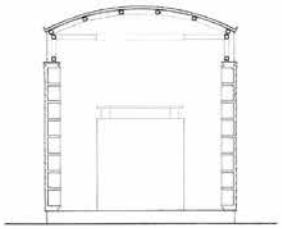

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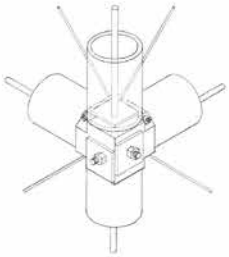
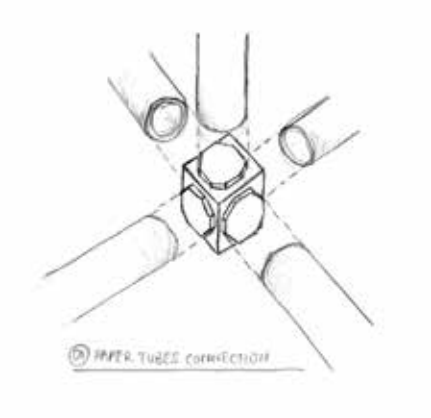
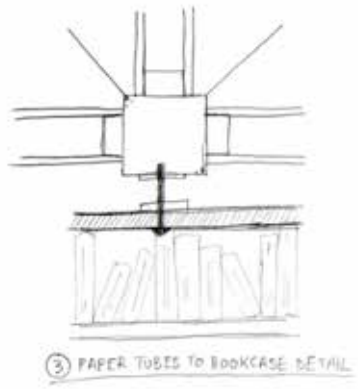
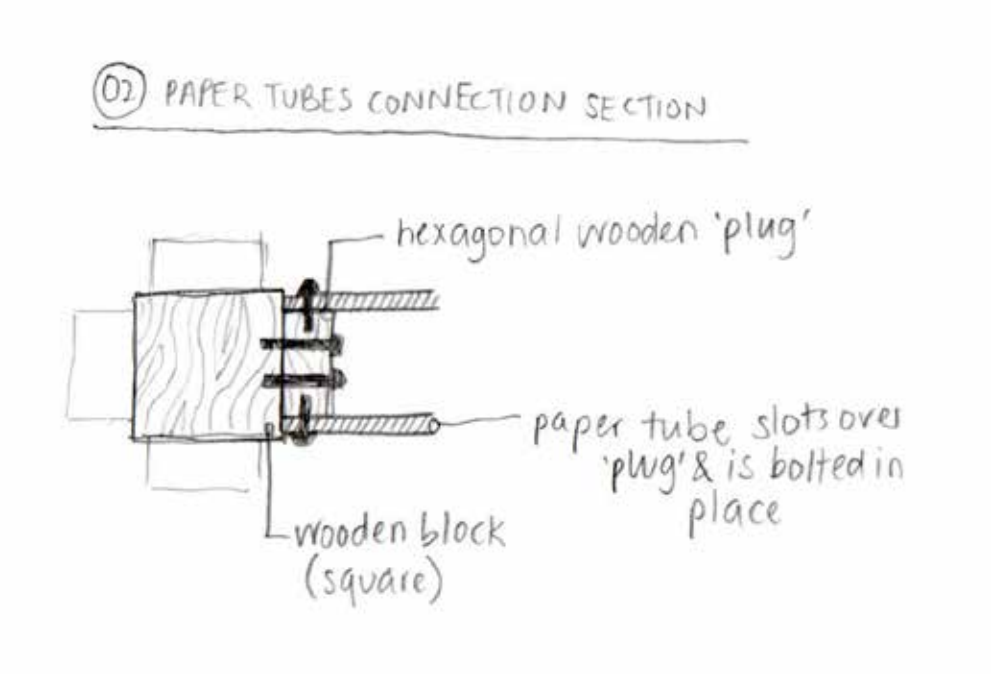


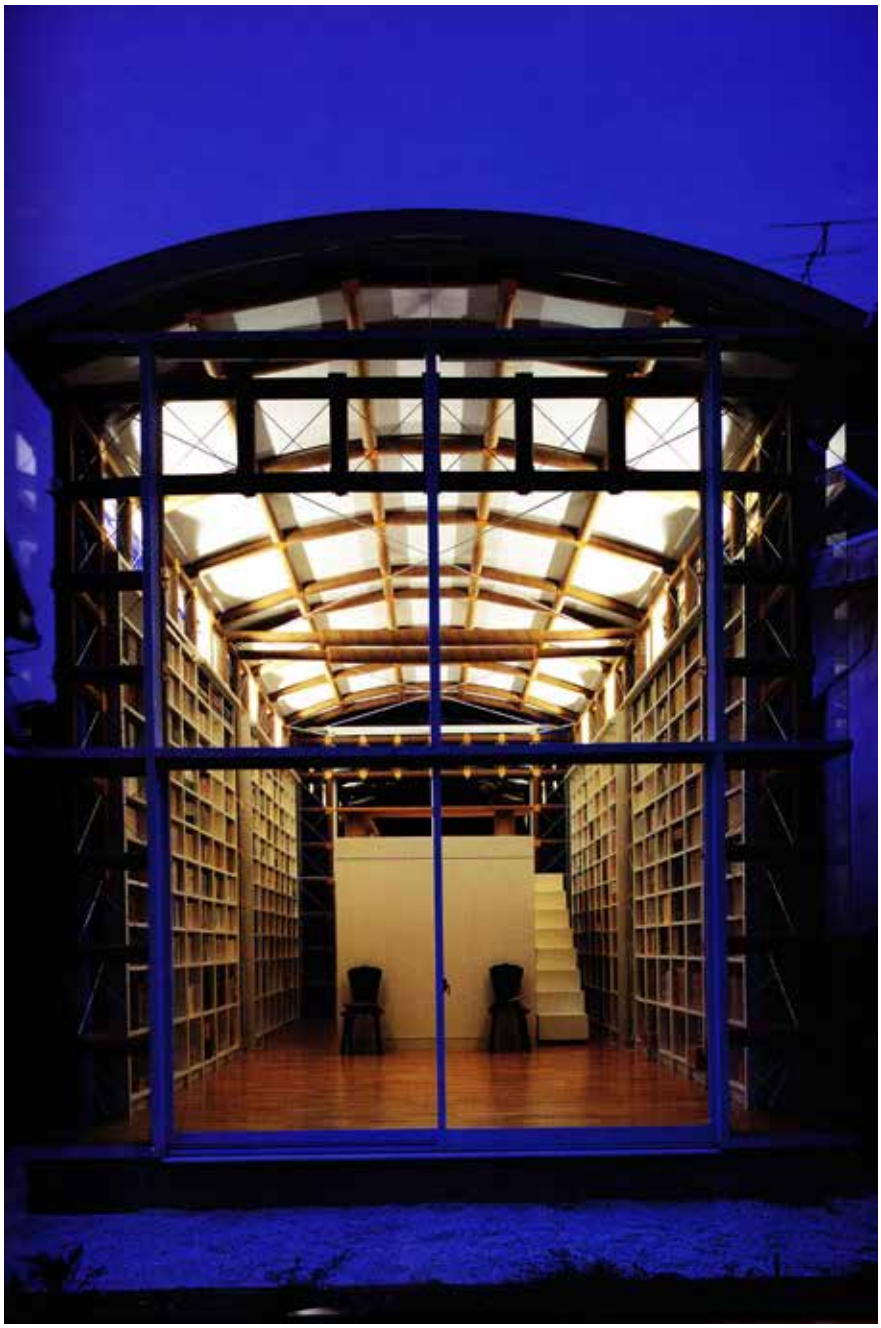
4

1 Axonometric view
2 Ground floor plan
3 Section
4 Detail of wood joint


01 PAPER TUBES CONNECTION


3 PAPER TUBES TO BOOKCASE DETAIL


02 PAPER TUBES CONNECTION SECTION
hexagonal wooden 'plug'
paper tube slots over 'plug' & is bolted in place
wooden block (square)



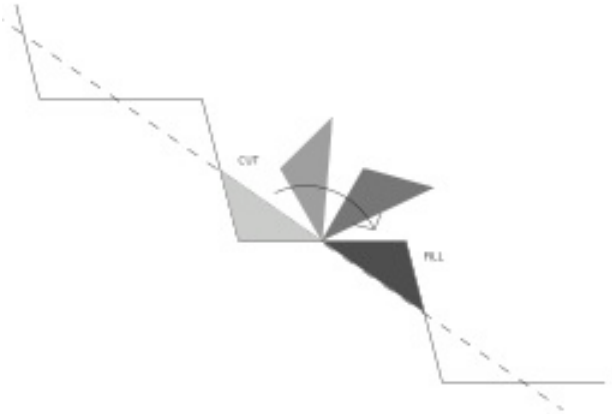
Landscape terraces

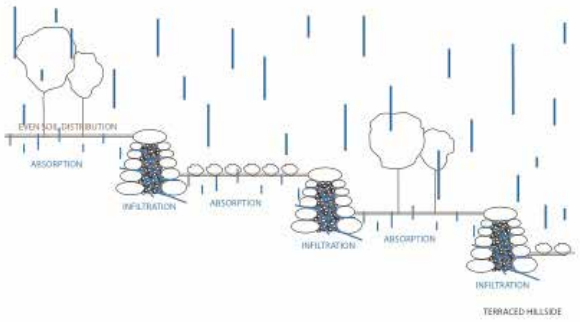
Advantages of terracing

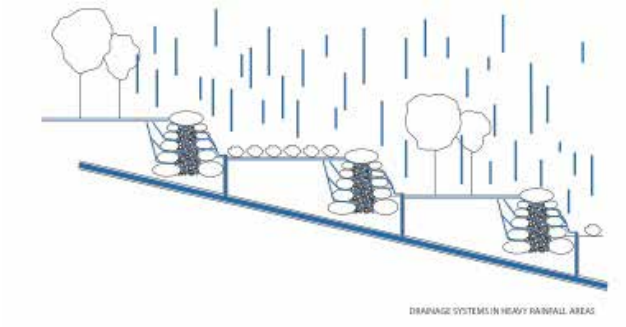
There are important historical evidences for the use of landscape terraces from ancient times and on different scales for their agricultural benefits. Important examples are found in the Andes of South America where terracing was commonly used by farmers for growing different crops from over a thousand years, but are also largely used in Asia in growing rice and in drier climates. In the Mediterranean Basin, for example in South Italy, in the Spanish region Catalonia and on the Canary Islands they are used for vineyards, cork oaks, olive trees and other plants.

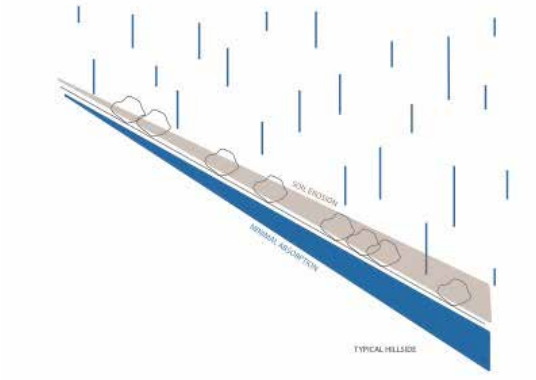
The benefits of using terraces in gardening and agricultural lands are explained with the fact that this type of fields decreases surface erosions and runoffs and is effective for both growing crops that require a lot of water, like rice, and for optimizing irrigation in climates with scarce water, such as mountains and dry sloping terrains.

For that matter terracing is already used in agriculture in Sicily and therefor can be a valid way to do gardening on smaller scale, too. This land is threatened by the unfortunate phenomenon of deforestation and desertification, while a skilful use of terrace irrigation can lead up to increase the fertility of the soil and to allow original maquis vegetation to grow again.







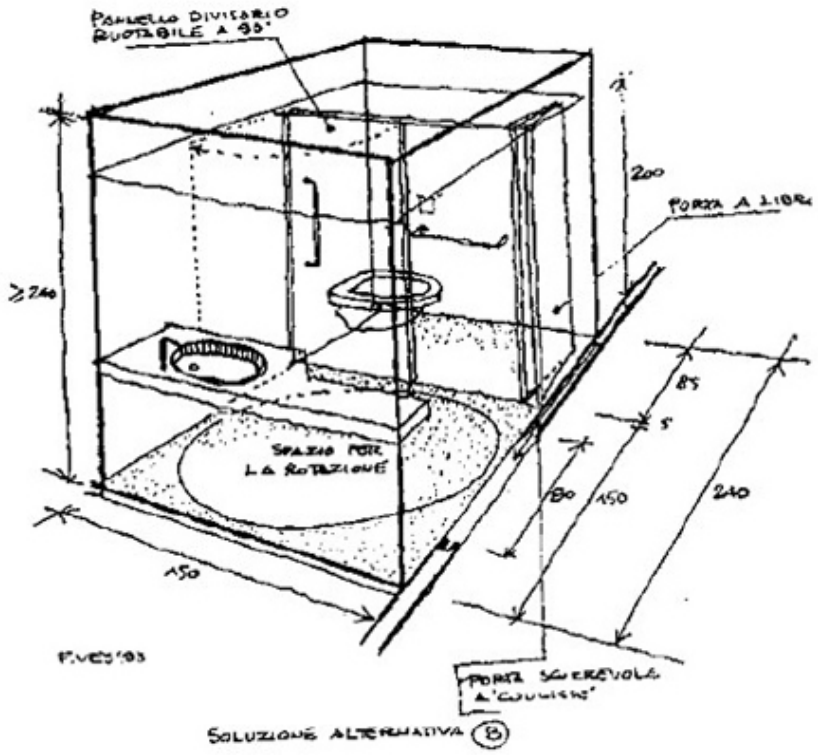


Terracing on architectural level - urban gardens

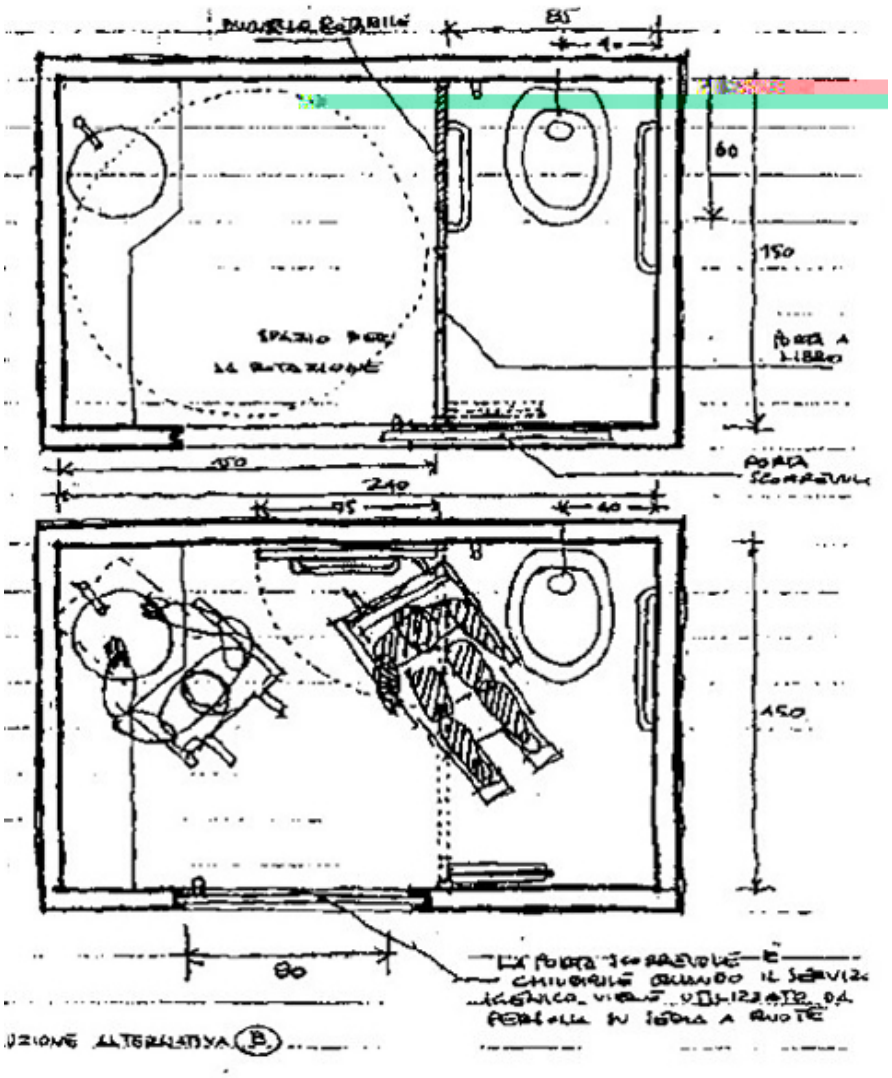
Toilette

UN BAGNO ALTERNATIVO PER LUOGHI APERTI AL PUBBLICO

Progetto dell' architetto Fabrizio Vescovo

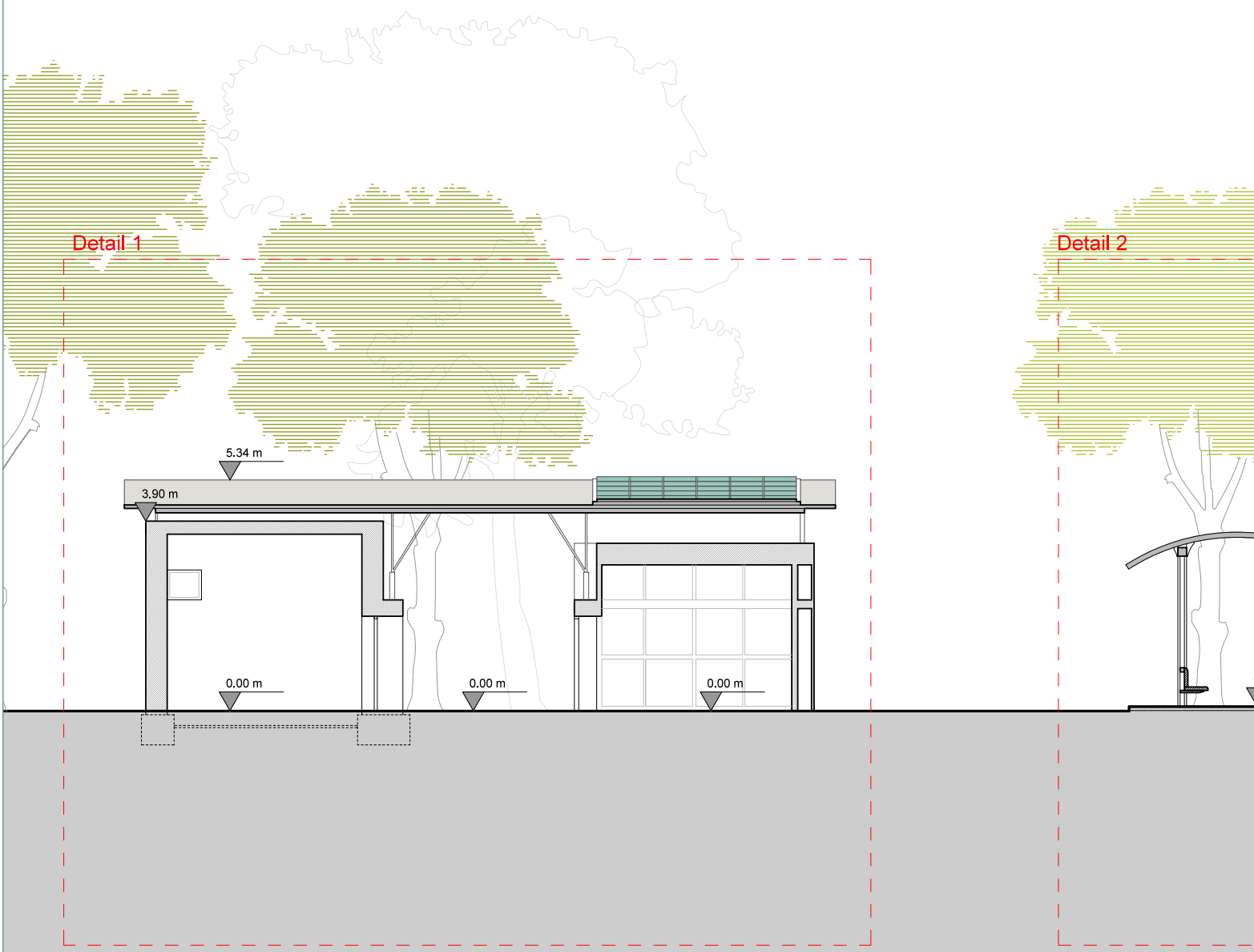


Questo progetto si pone come soluzione alternativa per realizzare servizi igienici accessibili in spazi ristretti, ed è stato immaginato avendo come riferimento essenzialmente spazi di non grandi dimensioni aperti al pubblico ove si prevede una limitata presenza di persone (ristoranti, bar, sale convegni, uffici bancari).
La soluzione consente una notevole economia di superficie. Prevede di contenere, in uno spazio ridotto, l'antibagno con lavandino, che è comunque accessibile, e la toilette, divisi da una porta a libro e da un pannello ruotabile. Nel caso, non frequente, in cui il locale igienico debba essere utilizzato da una persona con sedia a ruote, con una semplice manovra di sganciamento e rotazione del pannello divisorio verso l'antibagno, si ottiene un unico ambiente, più ampio, che consente l'agevole avvicinamento della sedia per il trasferimento sul wc. Mediante l'uso di opportuni



maniglioni. Naturalmente, in tale circostanza deve essere chiusa la porta scorrevole prevista tra il locale ove si svolge l'attività aperta al pubblico e l'antibagno.

Appendix 4 - Project Drawings

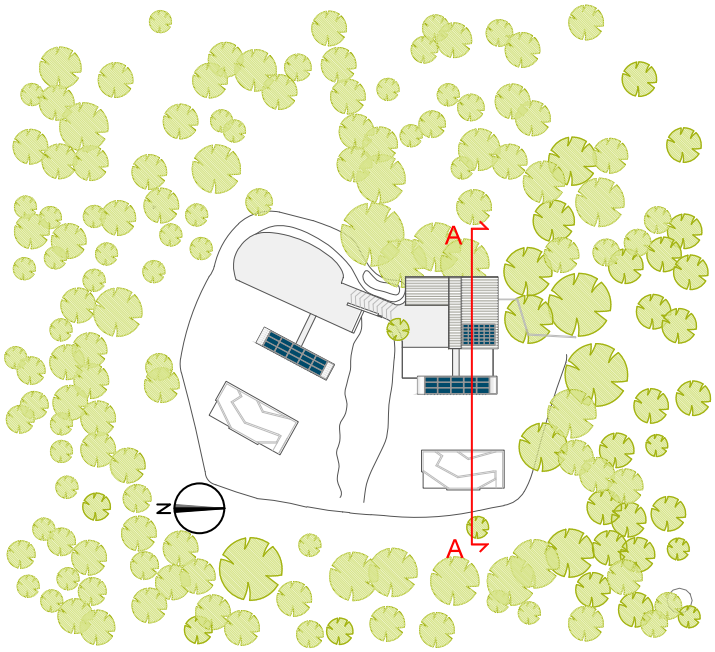

Detail 1
Detail 2
5.34 m
3.90 m
0.00 m
0.00 m
0.00 m

Master Thesis in Architecture
Student: Lyuba Ivanova Katerova

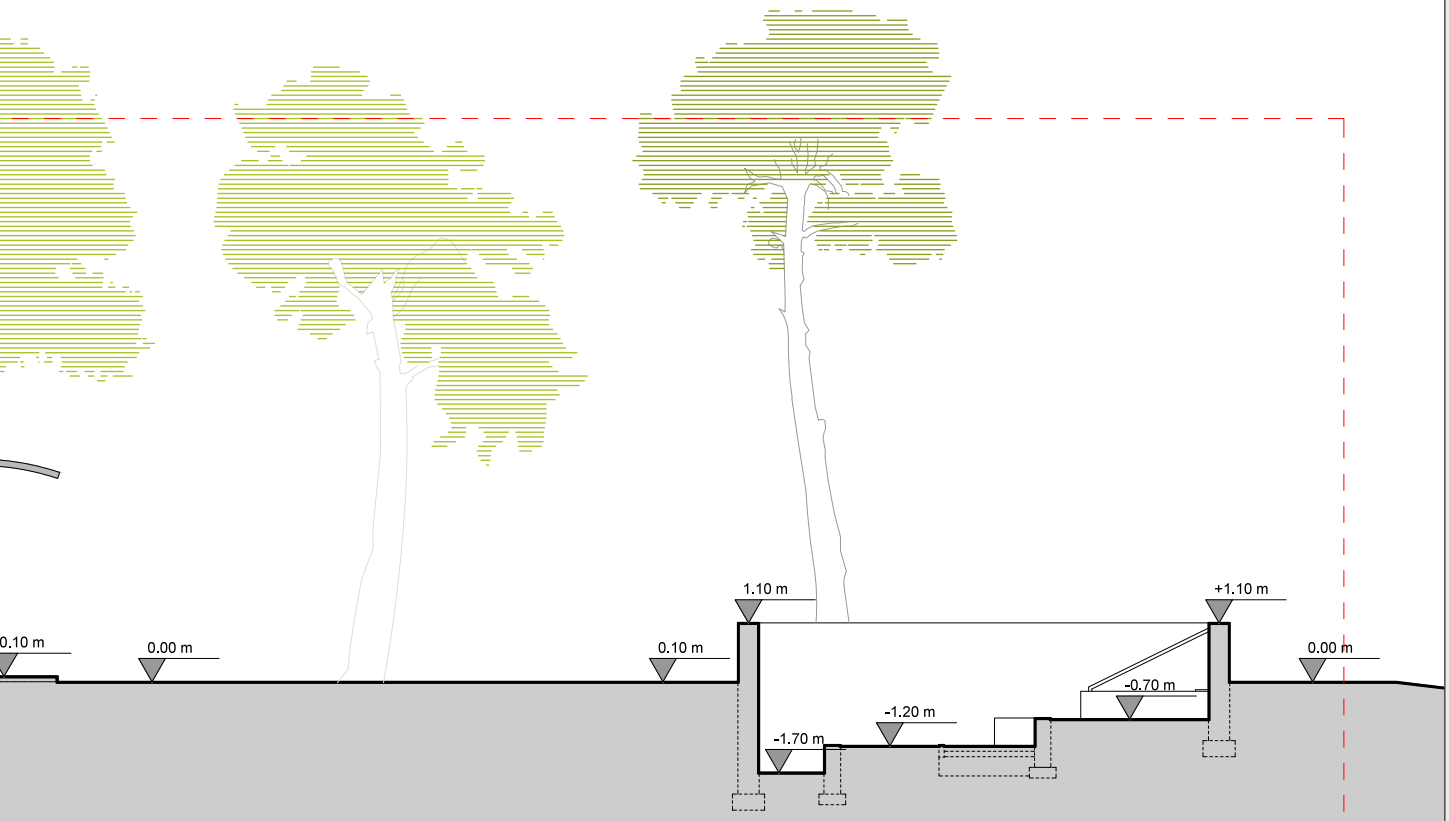
Foster sustainability through revalorisation.
A Project in a dismissed nature reserve in Sicily

Supervisors: Prof. Alessandro Rogora
Prof. Inger Lise Syversen

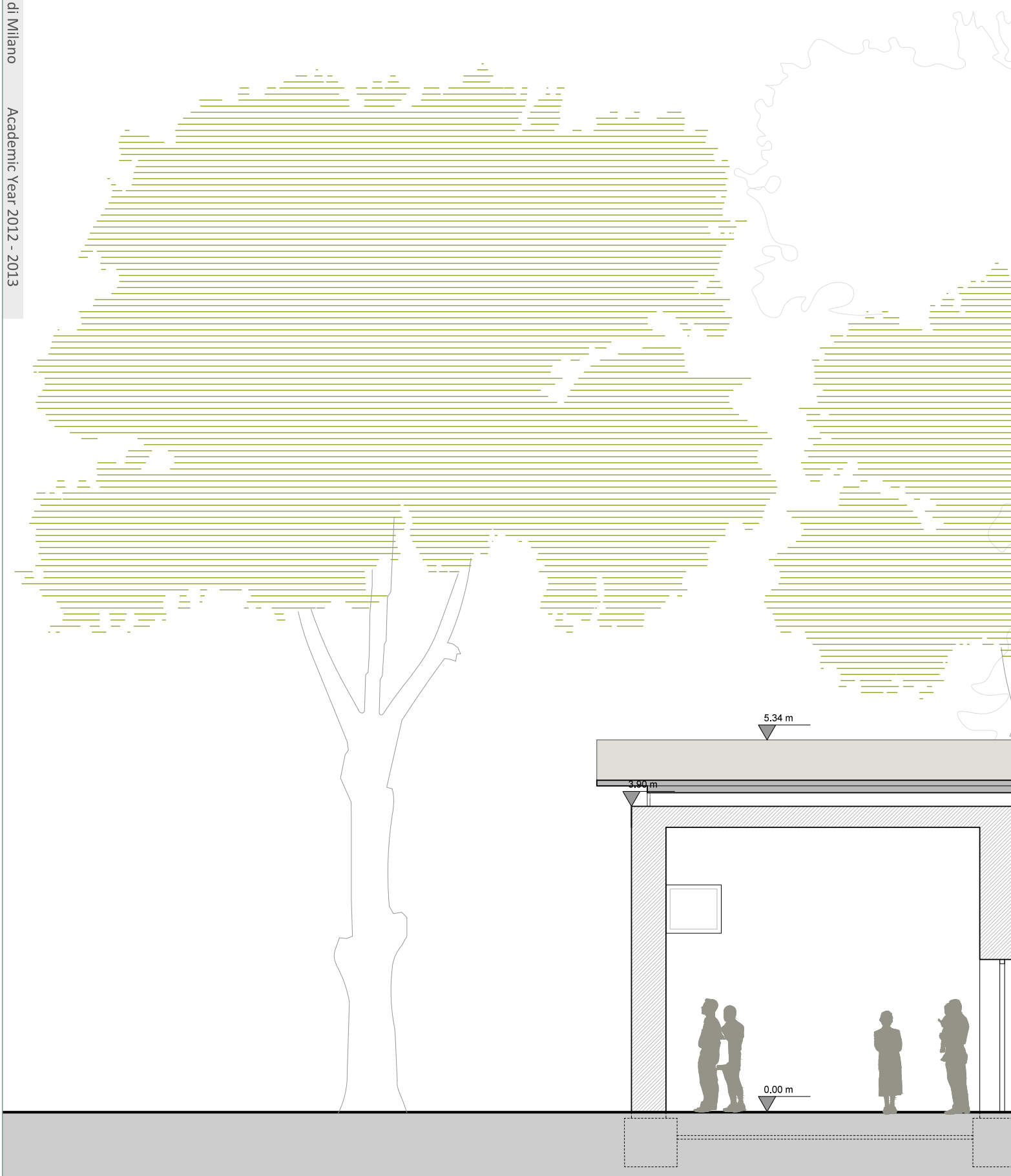
Project Area Section
SCALE 1:100

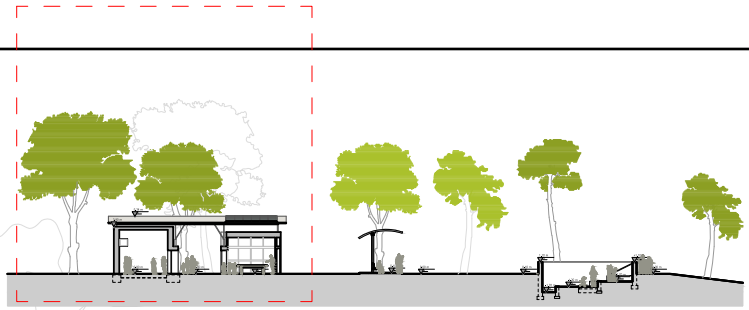


General Plan



Section **A-A**, Scale 1:100


5.34 m
3.90 m
0.00 m



Detail 1, Scale 1:50

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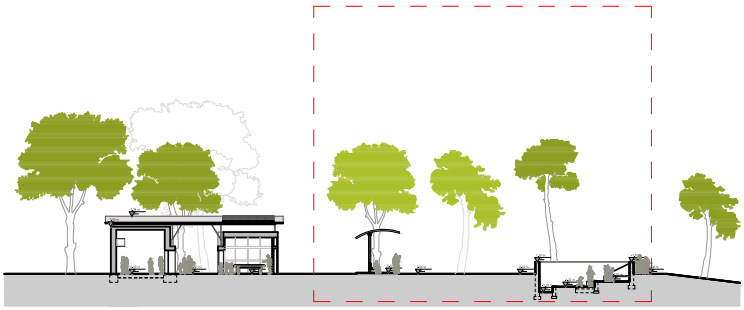
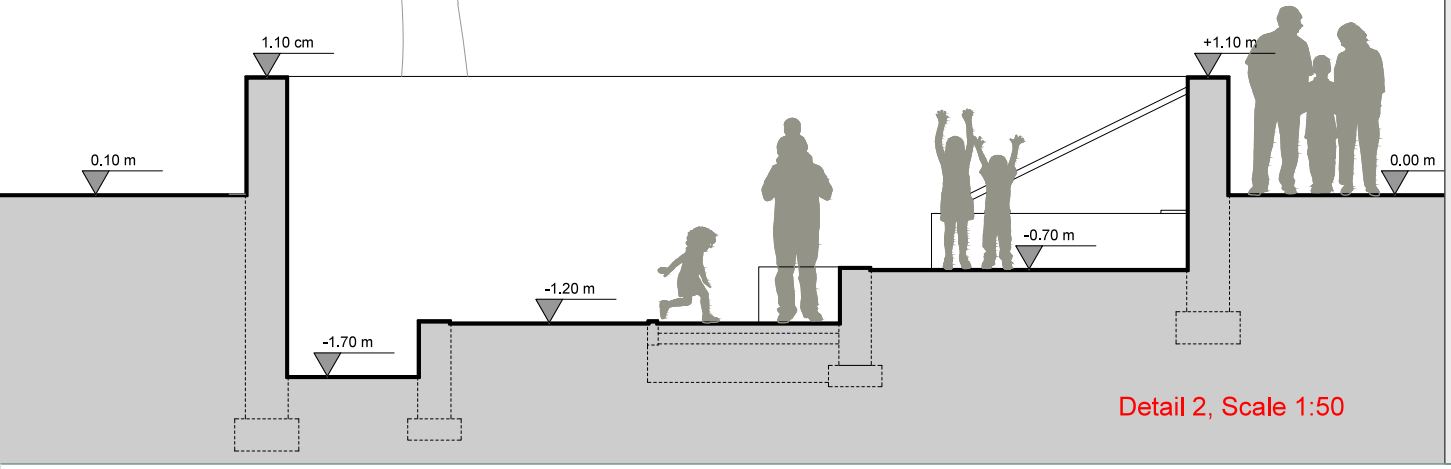
Project Area Section
SCALE 1:50


0.10 m
0.00 m





Detail 2, Scale 1:50

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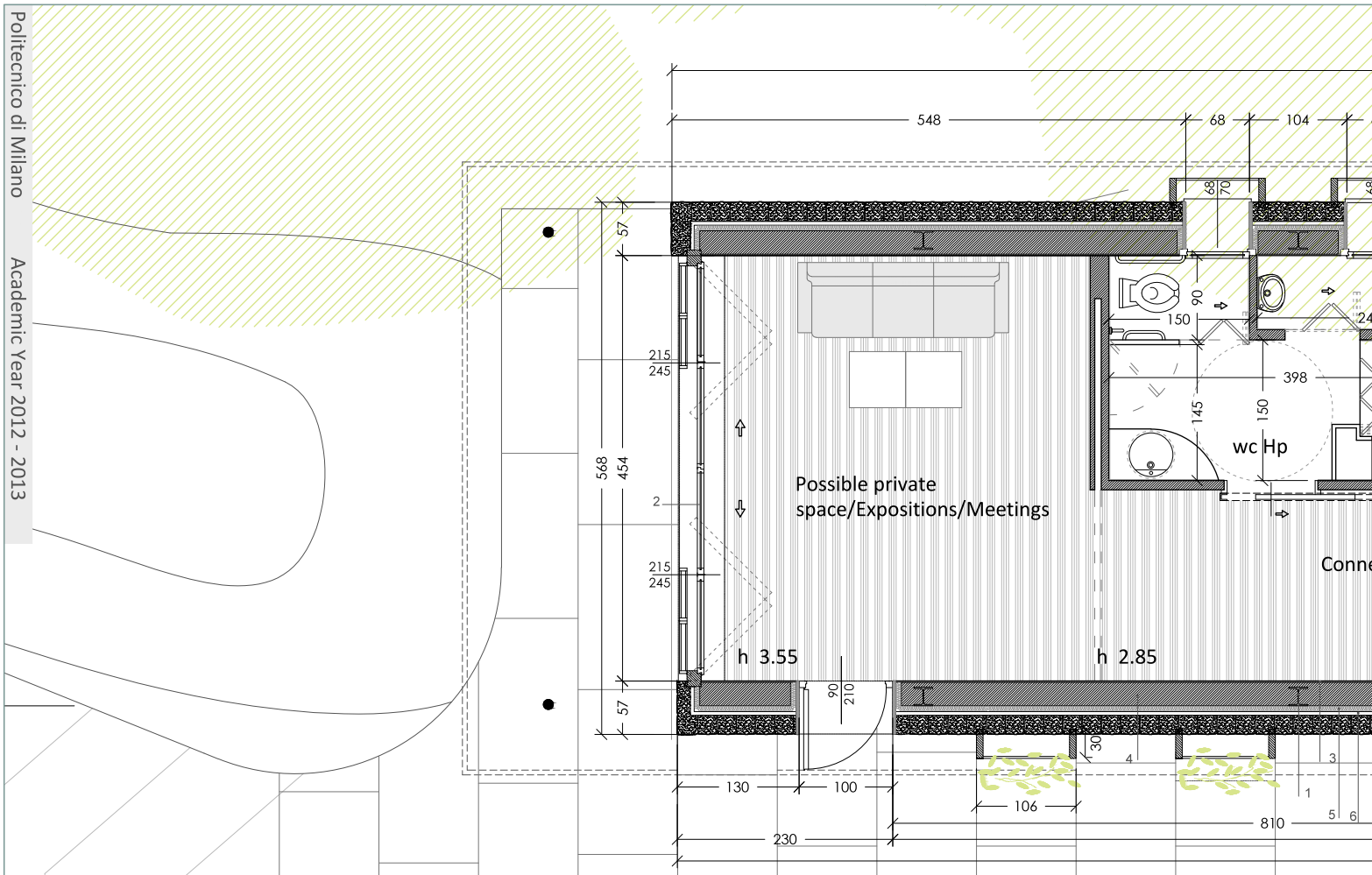
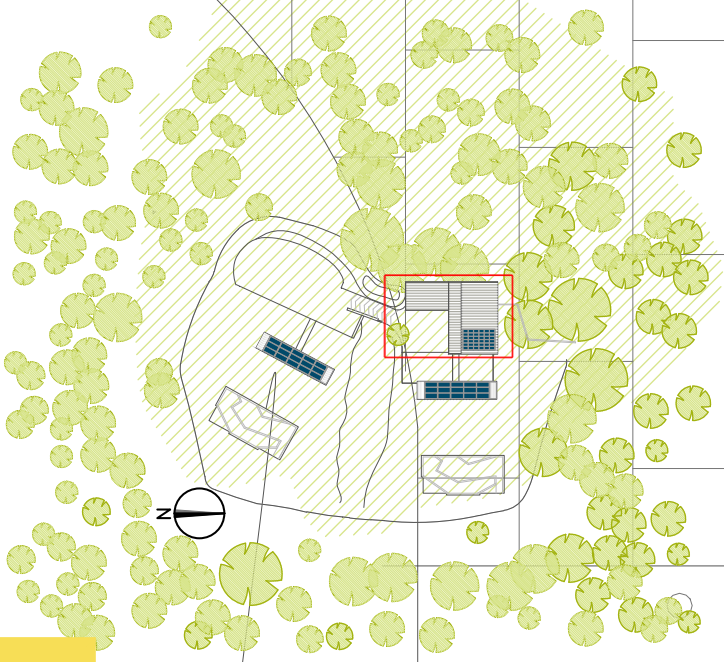
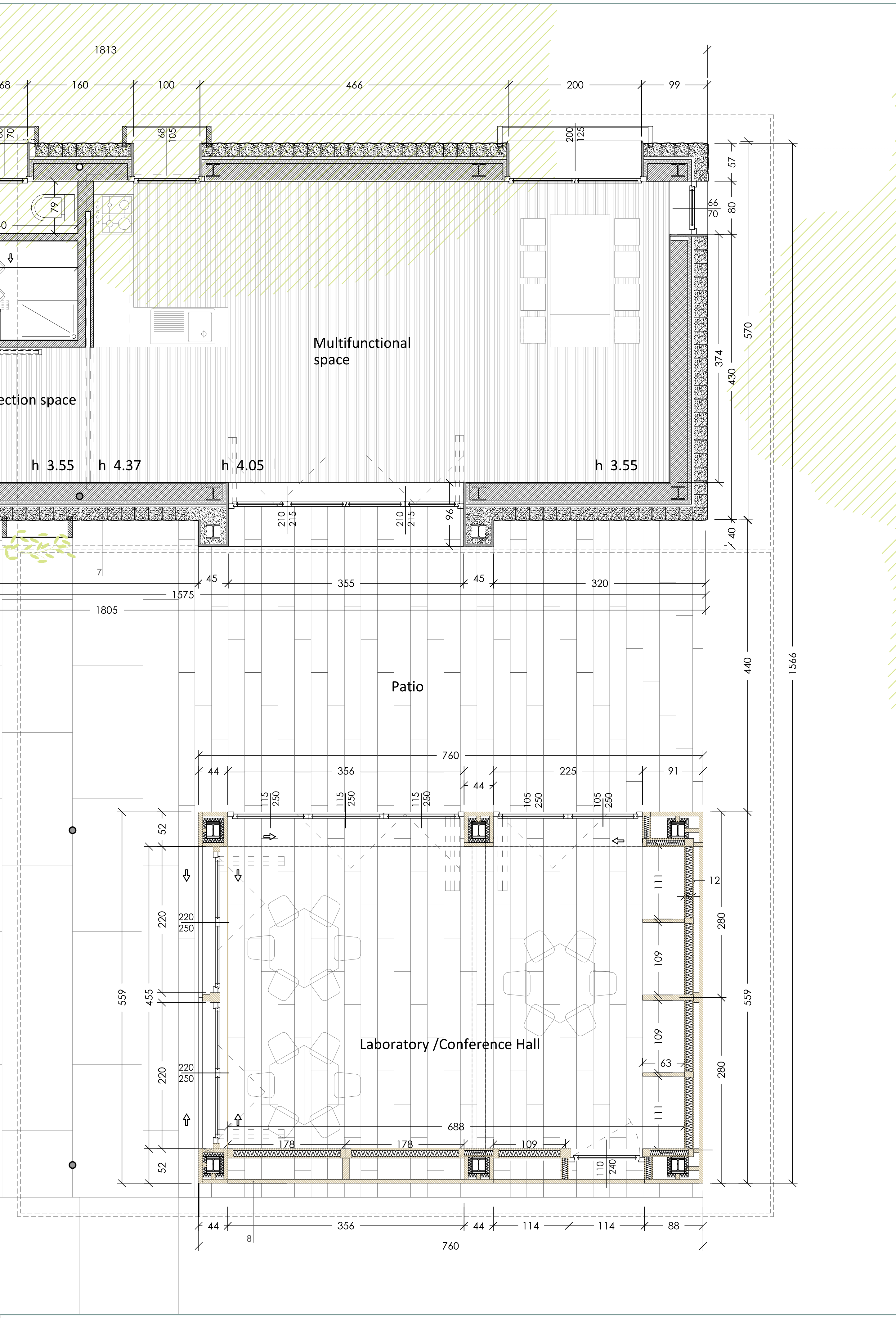
Project Area Section
SCALE 1:50





LEGEND

1. Bearing element - steel beam
2. Wood window frame with insulated glass and double glazing
3. Civil plaster for interiors
4. Y-tong blocks , series "Climate", in aerated concrete
5. Insulation in stone wool, 60 mm
6. Space for ventilation / air
7. Stone non-structural cladding



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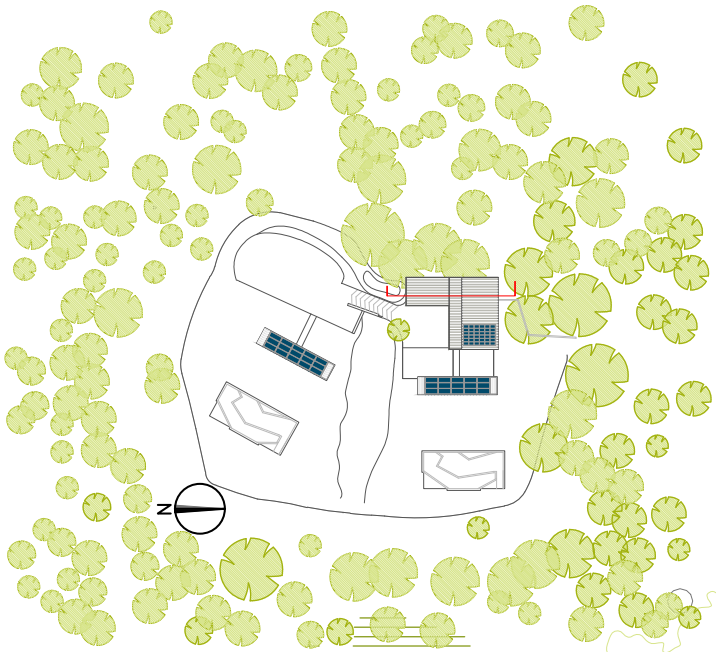
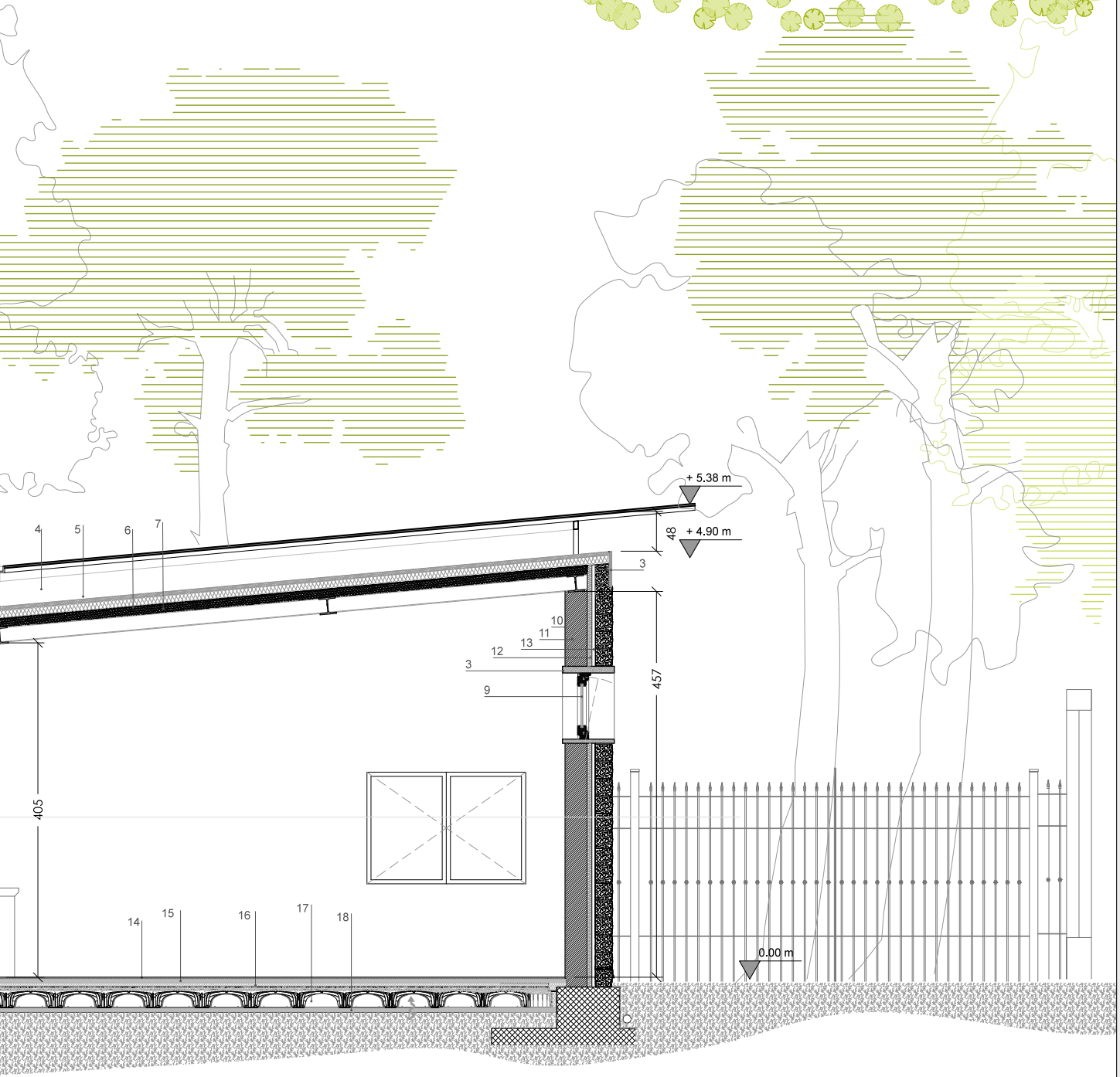
Project Plan
SCALE 1:50


+ 4.20 m
0.00 m
1
2
3
4
5
6
7
8
9
360
355
285
437

LEGEND

1. Reinforced corrugated metal roofing sheet, 8cm
2. Tubular metal bearing structure, section of the cover sheet 80 * 100 * 4mm
3. Smooth stone band, 3cm
4. Rockwool 211 panel coated with copper foil
5. Stone wool insulation, 90mm
6. Vapor barrier polyethylene sheet
7. Bearing element, corrugated steel slab casting and reinforced concrete
8. Bearing element - steel beam
9. Wood window frame with insulated glass and double glazing
10. Civil plaster for interiors
11. Y-tong blocks, series "Climate" in aerated concrete
12. Insulation stone wool, 60 mm
13. Space for ventilation / air
14. Non-structural stone cladding
15. Wood Floor
16. Screed
17. Insulation with polyethylene sheet
18. Armor hood with reinforced concrete supply
19. "Igloo" elements
20. Lean concrete
21. Natural terrain





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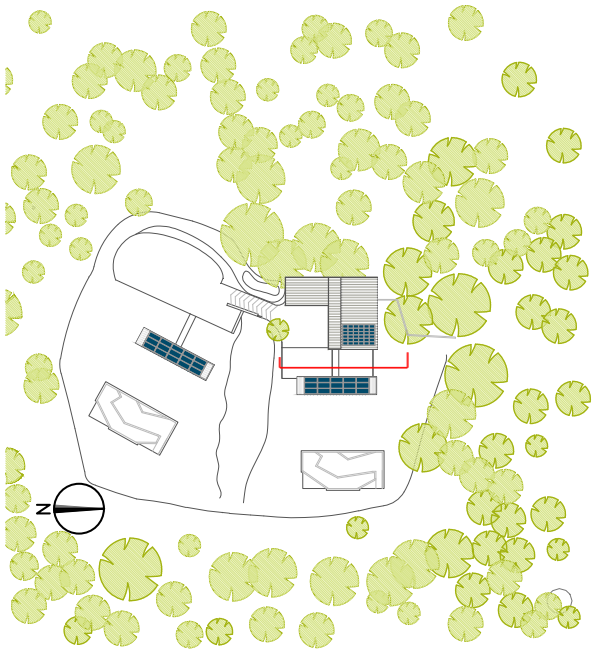
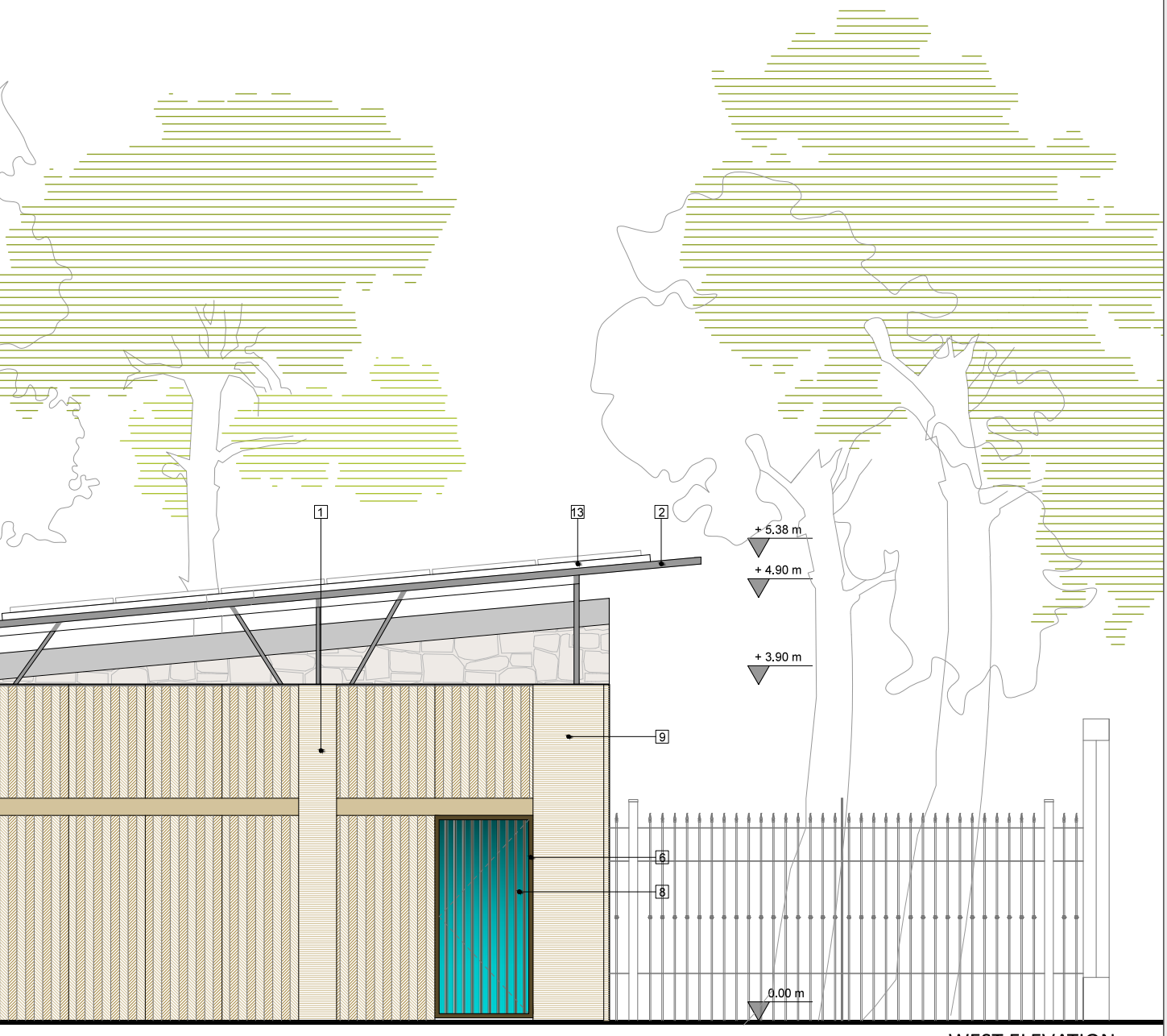
Project Section
SCALE 1:50


+ 5.45 m
+ 4.20 m
2
3
1
4
5
10
12
0.00 m

LEGEND

1. Steel framework
2. Corrugated reinforced metal roofing sheet
3. Smooth stone band
4. External sandstone cladding
5. Fixed brise soleil with wooden adjustable slats
6. Foldable brise soleil with wooden adjustable slats
7. Wood frame and clear glass
8. Wood frame and reflecting glass
9. External wood cladding
10. Wooden door
11. Smooth stone cladding
12. Wooden frame for climbing plants
13. Photovoltaic panels





WEST ELEVATION
SCALE 1:50

Master Thesis in Architecture
Student: Lyuba Ivanova Katerova

Foster sustainability through revalorisation.
A Project in a dismissed nature reserve in Sicily

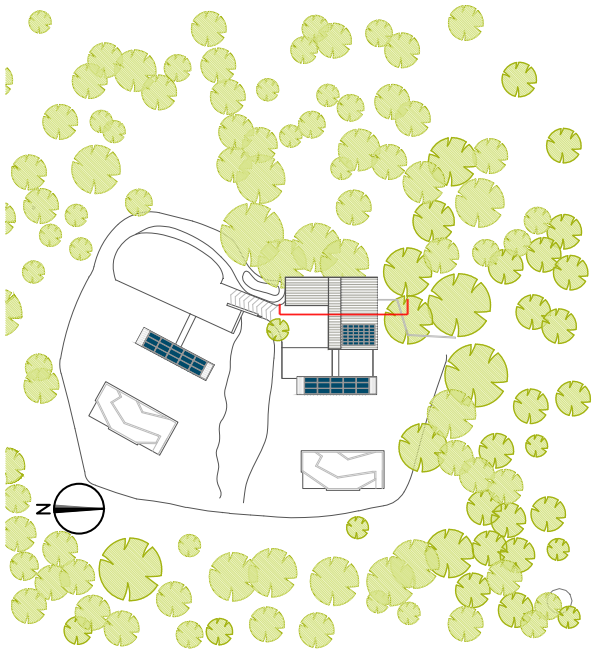
Supervisors: Prof. Alessandro Rogora
Prof. Inger Lise Syversen

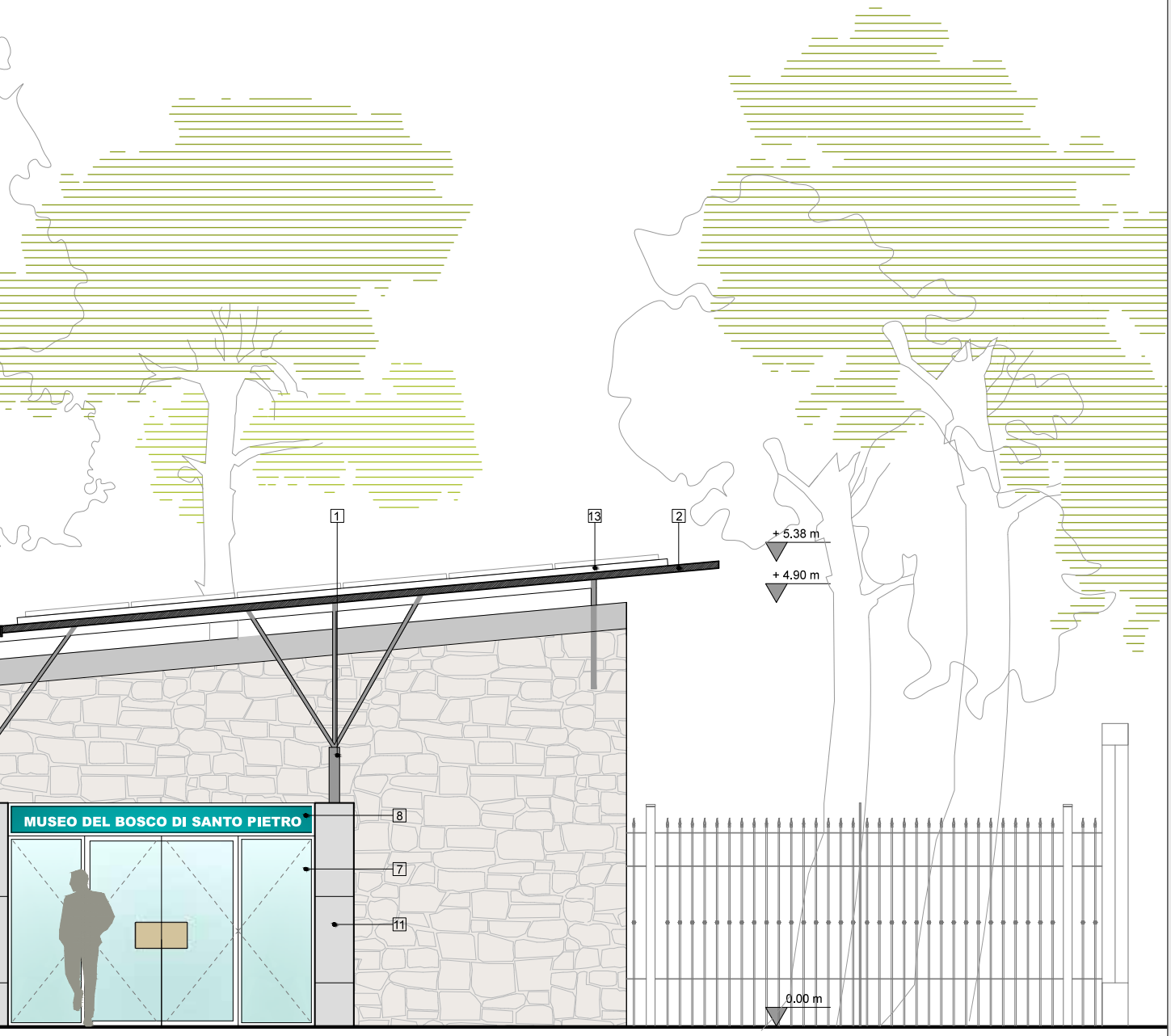
Façades
SCALE 1:50


+ 5,45 m
+ 4,20 m
2
3
1
4
5
10
12
5
0.00 m

LEGEND

1. Steel framework
2. Corrugated reinforced metal roofing sheet
3. Smooth stone band
4. External sandstone cladding
5. Fixed brise soleil with wooden adjustable slats
6. Foldable brise soleil with wooden adjustable slats
7. Wood frame and clear glass
8. Wood frame and reflecting glass
9. External wood cladding
10. Wooden door
11. Smooth stone cladding
12. Wooden frame for climbing plants
13. Photovoltaic panels





WEST ELEVATION WITH PATIO
SCALE 1:50

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Supervisors: Prof. Alessandro Rogora
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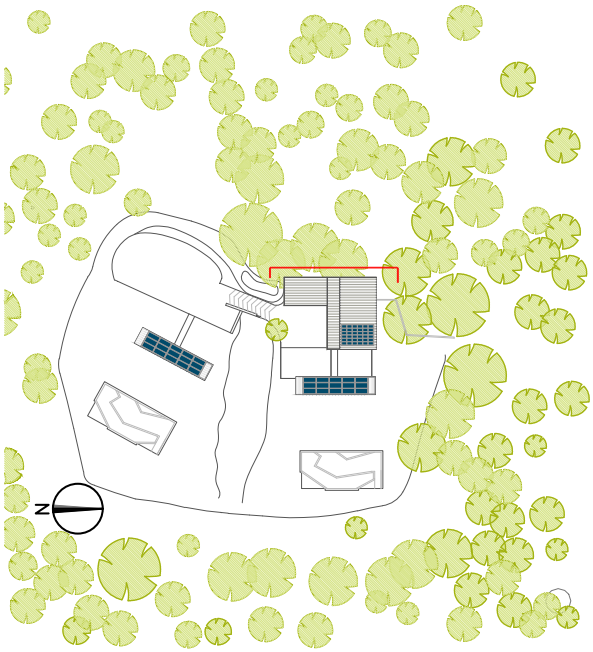
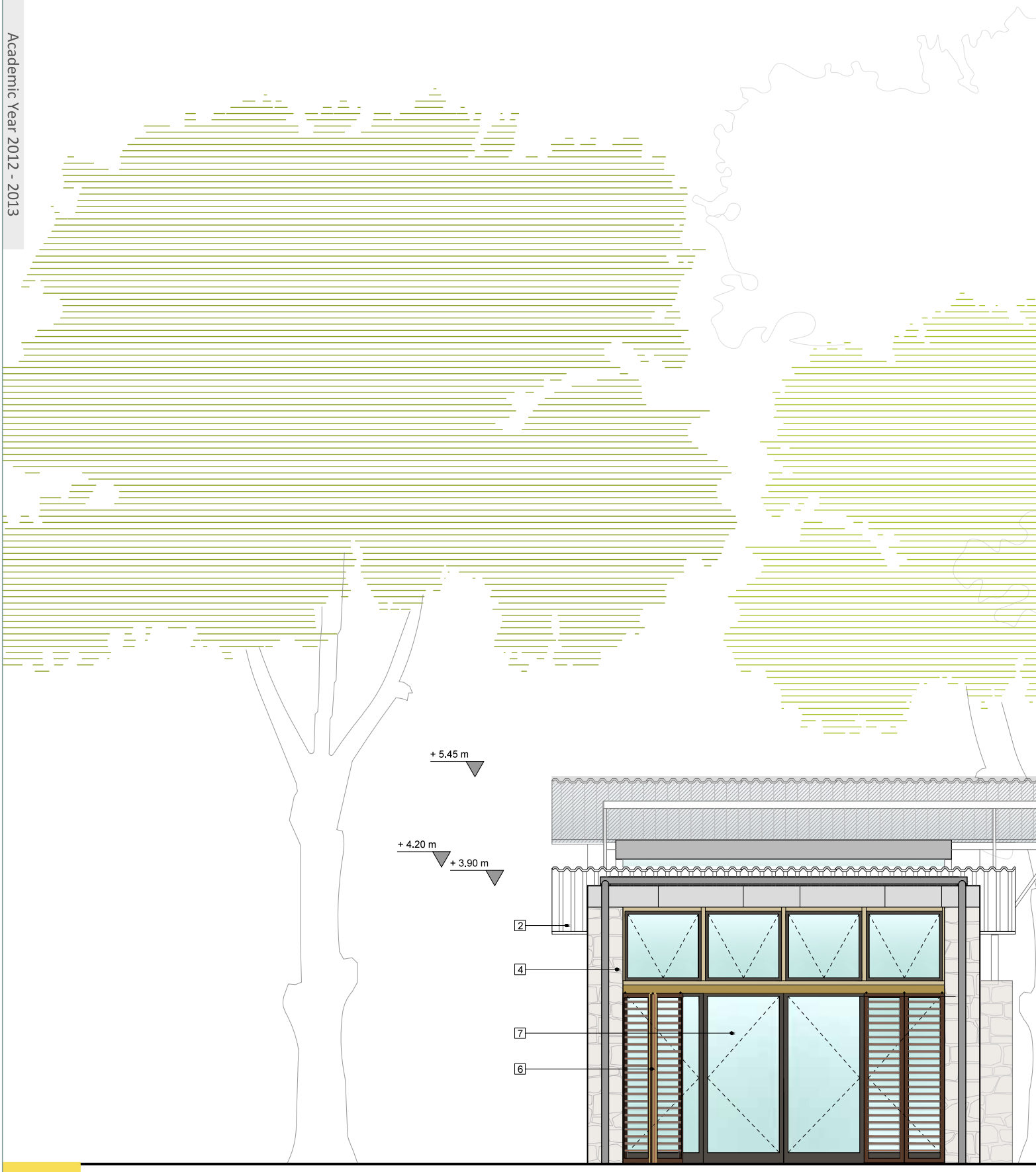
Façades
SCALE 1:50



LEGEND

1. Steel framework
2. Corrugated reinforced metal roofing sheet
3. Smooth stone band
4. External sandstone cladding
5. Fixed brise soleil with wooden adjustable slats
6. Foldable brise soleil with wooden adjustable slats
7. Wood frame and clear glass
8. Wood frame and reflecting glass
9. External wood cladding
10. Wooden door
11. Smooth stone cladding
12. Wooden frame for climbing plants
13. Photovoltaic panels

EAST ELEVATION
SCALE 1:50


+ 5.45 m
+ 4.20 m
+ 3.90 m
2
4
7
6

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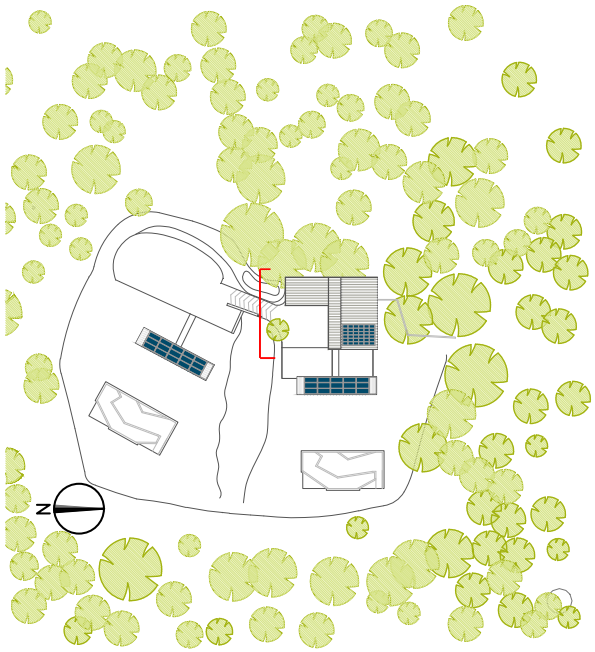

LEGEND

1. Steel framework
2. Corrugated reinforced metal roofing sheet
3. Smooth stone band
4. External sandstone cladding
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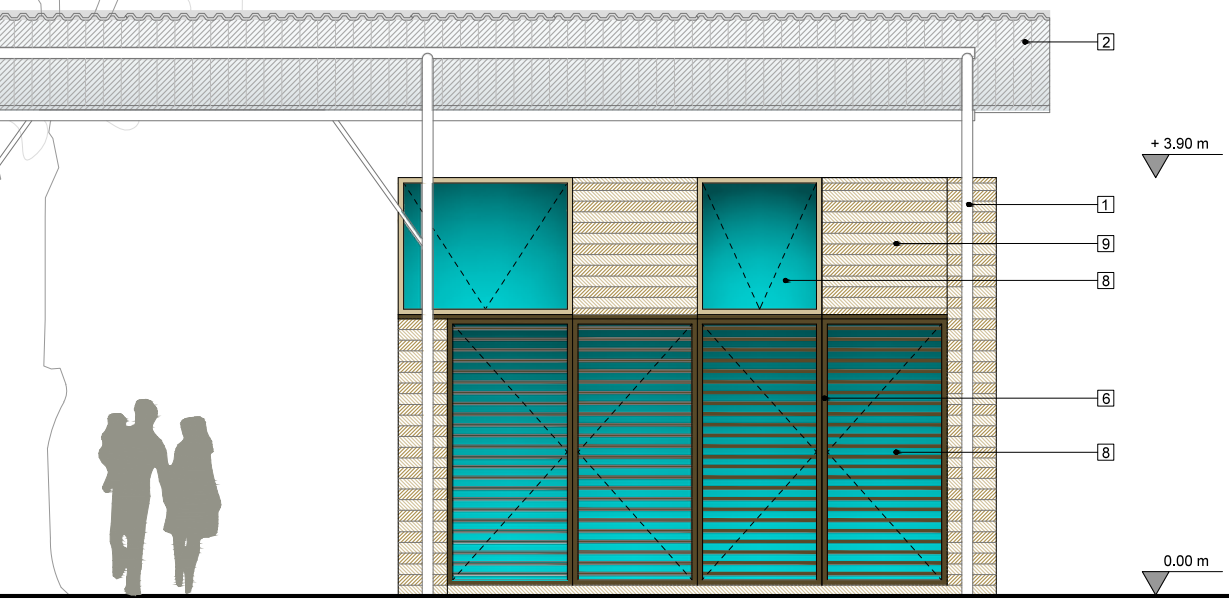

SOUTH ELEVATION
SCALE 1:50

Façades
SCALE 1:100