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Therapeutic views as an occasion for environmental compensation: the restyling project of Ca' Granda, Niguarda Hospital (Milano, Italy)

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Abstract

The Cà Granda Niguarda hospital was built in the 1930's in the north of Milan, just facing the Brianza countryside. The citadel, its rural landscape and a wide park are the main features of the complex. In the course of time new buildings and a series of adaptations subsequently reduce the green areas and nullify the original green concept. Meanwhile, the city's expansion insists around the walls of the citadel, leaving only the southern border of the Parco Nord as the only ecological connection to the rest of territory. The last and only Hyppotherapy activity centre in Milan remains on the premises. Because of the necessity to modernize, adapt and rebuild the hospital according to current technologies, a significant quota of the tree and vegetation heritage is to be destroyed (removed) to make place for the new asset of the complex. On this basis the project aims to identify the opportunities for the improvement of the remaining green areas, the mitigation of the new buildings and the compensation of the cutting down of trees. In this last case agreements between the hospital and the Parco Nord define strategies for the improvement of the southern part of the park in connection with the citadel, on the basis of continuity with hospital activities; in accordance with the city administration a Botanic garden will be created in the surroundings. The main feature of the master-plan is a rehabilitation path, which winds its way in and outside the citadels' walls; it will be strongly distinguished in an educational and formative sense thus to involve school children, adults and patients. The whole project will be carried out in 15 years time.

Photo 1 - Niguarda Hospital project rendered

Introduction

In 2001, Regione Lombardia, Comune di Milano and Hospital Niguarda Ca' Granda of Milan, reach a Program Agreement that, in accordance with the exigencies of the city of Milan for a new form of Hospital organisation, includes the restyling of a Hospital that welcomes and integrates highly complex healthcare

technologies. This goal must be brought to completion, as indicated by the Program Agreement, with a specific attention for the solution of problems regarding technical aspects of organisation and functionality, the starting point of the project for the new Hospital.

The present Niguarda Hospital was built between 1932 and 1938 along the lines of the Hospital model organised in separate pavilions, mostly 3/4 floors above the ground. At that time as much as today, there was an open debate as to which model could be the most appropriate for a modern Hospital.

The two possible options made use of low isolated pavilions or big buildings in which to concentrate both functions of the Hospital: healing and recovering. The solution chosen for the new Hospital will be a compromise of these two: a complex of pavilions of great dimensions, connected by a protected route. The present complex makes use of an area of about 330.000 sm. and is comprised of 31 buildings, adding to a total floor dimension (SLP) of about 198.000 sm.

The Niguarda complex is formed, besides the Hospital, of a 35 ha park, with a forest complex that is today a mature survivor, comprised by beautiful specimens of mostly exotic and foreign species, many of which now naturalized to the habitat of Lombardia, of high ornamental value. Moreover, the park is a protected environmental system belonging to the continuity of the ecological 'ecomosaic' around it, such as the neighbouring Parco Nord, the residual rural net, the green public services route .

The interventions programmed for the adaptation and architectural restyling of the Hospital have a significant influence on the forest complex; because of this, a census and evaluation of the forest complex has been reputed essential to a precise evaluation of the interventions necessary to compensate and soften the felling of trees programmed for the new architectural interventions.

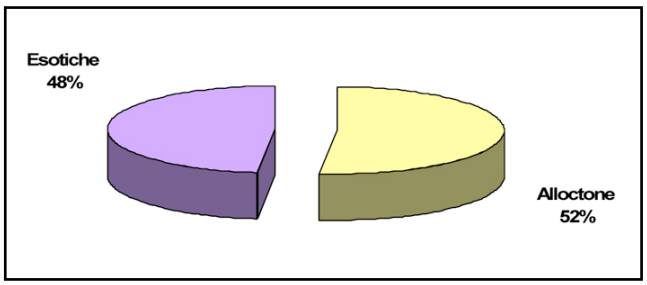


Table 1: Differentiation of the species in exotic species and foreign species

Description of the forest complex

A census has been conducted on the Hospital park's whole forest complex, besides an evaluation of qualitative and phytohealth conditions of the detected specimens.

The population is mostly comprised of specimens of the same age, it originates in the thirties, at the time of the first building of the Hospital, with a number of following interventions. The distribution of heights and diameters is not continuous due to substitutions necessary to replace dead or sick plants with new ones or interventions pollarding and pruning.

On a total amount of 1530 trees registered, 54 species have been recognised, of varying ornamental value. The species registered can be distinguished between foreign and exotic in almost equal proportion, while the evergreen species represent 34% and the deciduous 66%.

In view of the results of the census, for a total amount of 1387 available bed positions (1243 for ordinary recoveries and 144 for day hospital) the equation patients – plants is about 1,11.

The most frequent plantation mode is that of rows, that are characteristic to the compound's structure, in

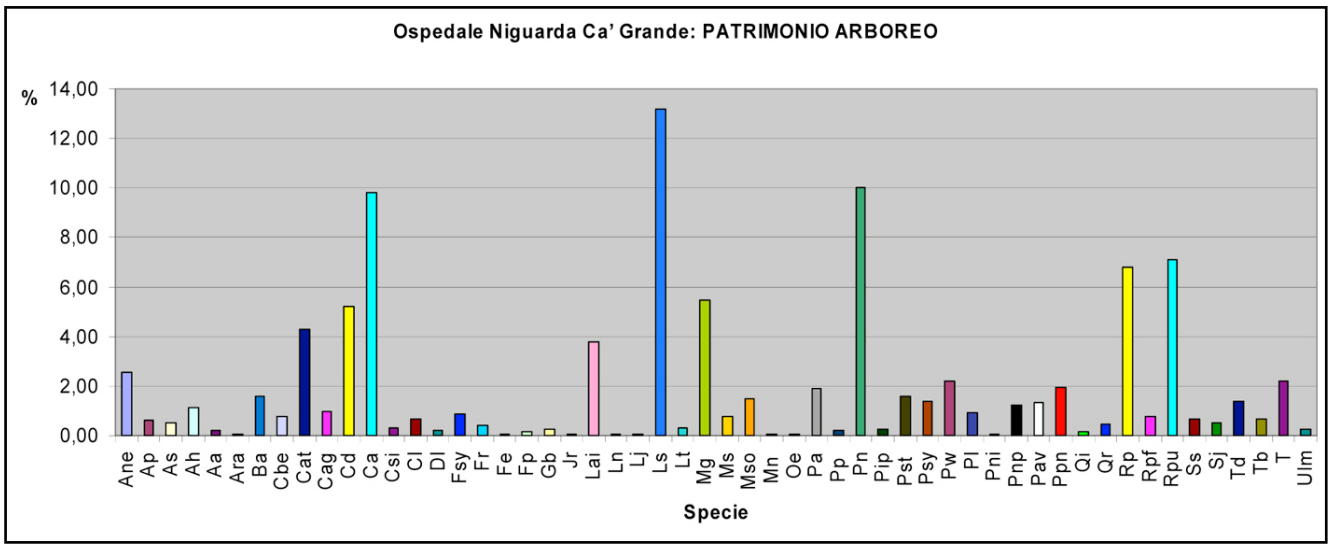


Table 2: Graphic representation of the species detected during the census.

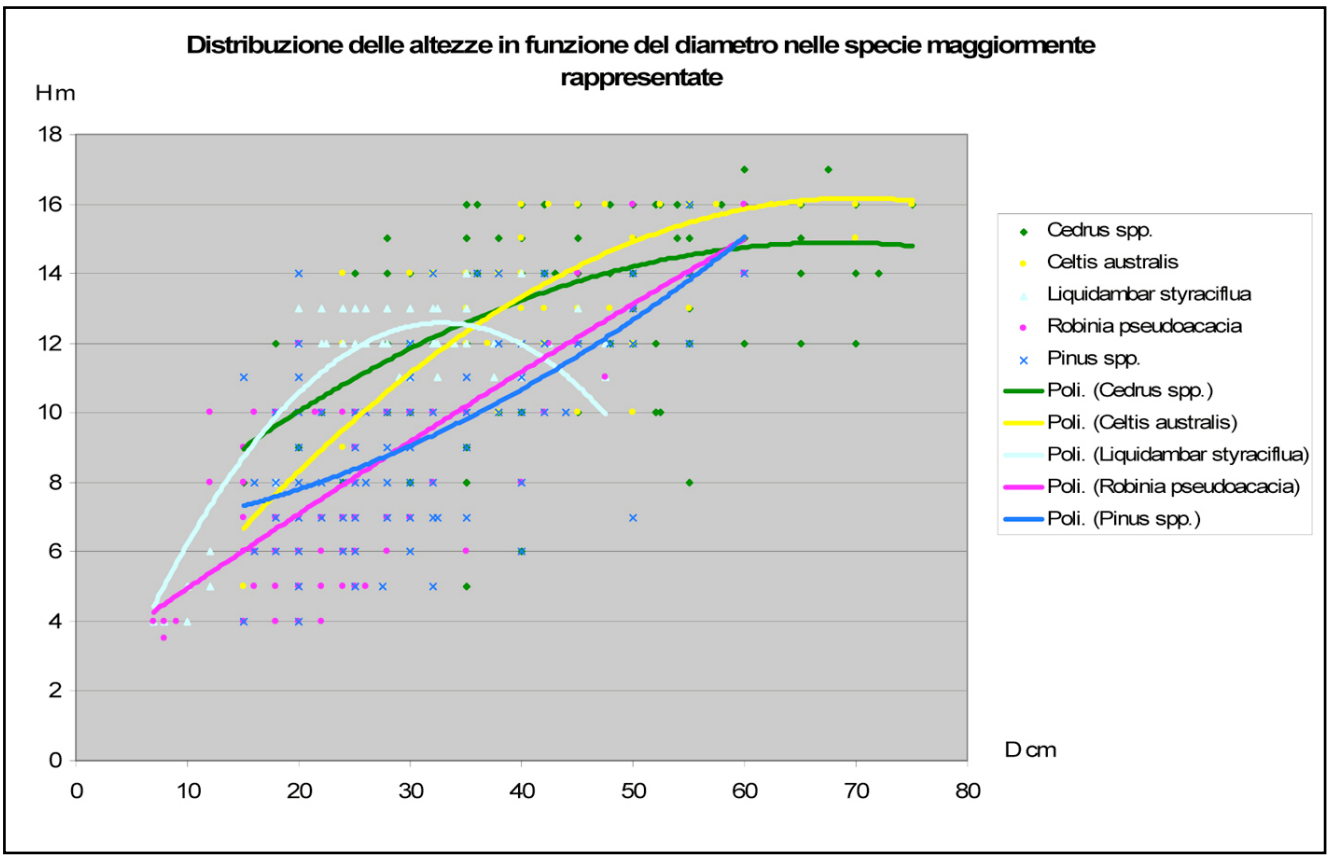


Table 3: Distribution of heights in relationship to diameter in the more widely represented species.

same species groups. The spacing are too close, as too close are sometimes the distances to the buildings.

From a physiognomic point of view, we can distinguish three different areas in the park:

1. a formal one, located in the central and eastern part of the park, structured along alignments and perspectives, with a representative and monumental function.
2. a connecting one, located to the north and south of the analysed area, laid down somewhat like a formal garden, as the previous was, with something also of the natural form. The structure is characterised by great groups of single species, without shrubs.
3. a more natural like shaped area to the west, where the free layout, the low level of caretaking and visiting has allowed the free development of greenery. The continuity of treetops is actually accompanied by shrubs, transforming this area in a kind of environmental connection to the surrounding matrix, especially to the neighbouring Parco Nord.

Description of the phytohealth condition

Table 4, shows a comparison between trees distinguished in species and trees presenting phytohealth problems. We receive from it a picture that is sufficient to enables us to affirm that there is no phytohealth emergency.

The fundamental difficulties are antropic. As a matter of fact conditions of generalised suffering have been detected, especially in *Carpinus betulus* and pines, with clearer manifestations in the black pines (*Pinus nigra*), due to the alien environmental conditions of the plot under exam or to a low tolerance for the environment pollution. To this are added problems due to lack of care and inadequacy of the same, that have damaged the trees, as proven by wounds of varying degrees of gravity detected. Damages due to the excavation of roots for the road maintenance have been detected alongside great damages following uncontrolled parking in close proximity to the trees, that can generate wounds to the more superficial roots and a compacting of the dirt. Wounds to the collar, typical of inadequate use of the machinery for the lawn maintenance , wounds to the trunk, as a result of impact, wounds to the crown testifying cutting interventions of varied intensity, sometimes repeated in time such as the pollarding of *Celtis australis*, on which cavities have been detected sometimes accompanied by hollowing.

To offer a more intuitive graphic representation, the trees registered have been distributed in qualitative classes, analysing the phytohealth conditions and the morpho-structural qualities of each single tree. The resulting classes are 9:

- Trees in ordinary conditions: the trees in this category do not attract attention in any way, neither positive or negative.

- Dead trees standing.
- Trees in phytohealth emergency: in this category are gathered trees presenting rotting hollows, carpophora, bulges, specimens with dirt or debris accumulating at the base, and trees with a strong inclination of the trunk.
- Suffering trees: to this category are ascribed all those specimens presenting spreading brittleness and low vegetative vigour. This state of suffering is due to inadequate environmental conditions, different from those of the phytoclime picture proper to the interested species and their very vulnerability to the conditions of urban pollution.
- Trees protected by the art. 65 of the PTCT of the provincia di Milano.
- Trees in rows with historical and monumental value: the trees belonging to this category are fundamental to the tree rows representing the characteristic element of the park's historical imprint.
- Valuable trees: to this category belong those trees presenting a perfect shape in relationship to the species of belonging, free of evident damages or sickness of any significant dimension.

Quantitative analysis of the health of the existing trees.

Effects of the proposed interventions on the forest complex

Impact of the interventions on the forest complex

In order to evaluate the actual involvement of the forest complex in the restyling and updating of Niguarda Ca' Grande Hospital, the forenamed project has been overlaid on the census. Three different areas of intervention are noticeable:

1. Southern Block: this is, of the zones interested by the intervention, the one with the most formal lay. It is characterised by rows of *Celtis australis*, protected now by the art. 65 of the PTCT of the Provincia di Milano, from the double row of *Liquidambar*. There are *Cedrus* of noticeable dimensions, some of which are compromised by accumulating dirt at the base that could compromise their stability. There are moreover rows and alignments of *Acer platanoides, Prunus avium and Prunus pissardii* "Nigra" and *Magnolia grandiflora*. The presence in this area of two *Cedrus* of value and three *Ulmus minor* of extraordinary dimension and shape, should be noted in the hope that measures will be taken to protect them in the working area.
2. Northern Block: this is the intervention area where three buildings now standing, will be demolished to make space for the construction of new pavilions. The double row of liquidambar, that of *Celtis australis* and, partially that of *Robinia* "Umbraculifera" will be involved. Also a mixed row of *Sophora japonica* and *Robinia pseudoacacia* wil be involved, a formation closely resembling that of a herb garden with some fruit trees at the northern boundary of the Hospital, and a number of conifer, among which a group of *Cedrus* spp. by now definitely compromised by previous interventions that left dirt accumulation at their bases. Another group of *Cedrus* spp. in good conditions and one of valuable *Celtis australis* should be noted in the hope that measures will be taken to protect them in the working area.
3. Western Block, where the technological site and heliport will be located: it is the area of greater natural interest, especially for the connection to Parco Nord. A number of valuable *Celtis australis, Diospyros lotus, Cedrus spp., Liriodendron tulipifera* will be involved in the interventions.

The working area has been sited starting from a medium distance of 15 m from the buildings in project. The previous Table points out the trees that will need protective measures from the work in progress. The trees involved in the intervention are 468.

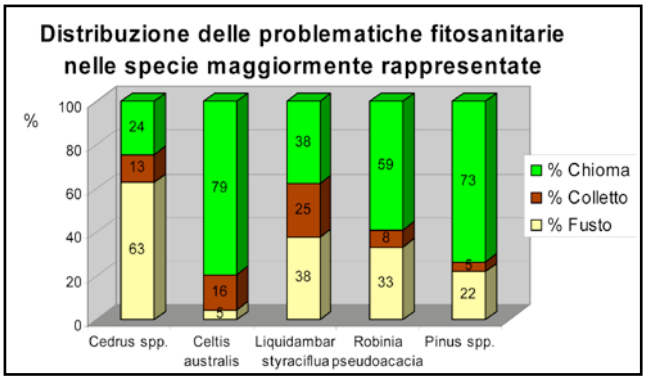


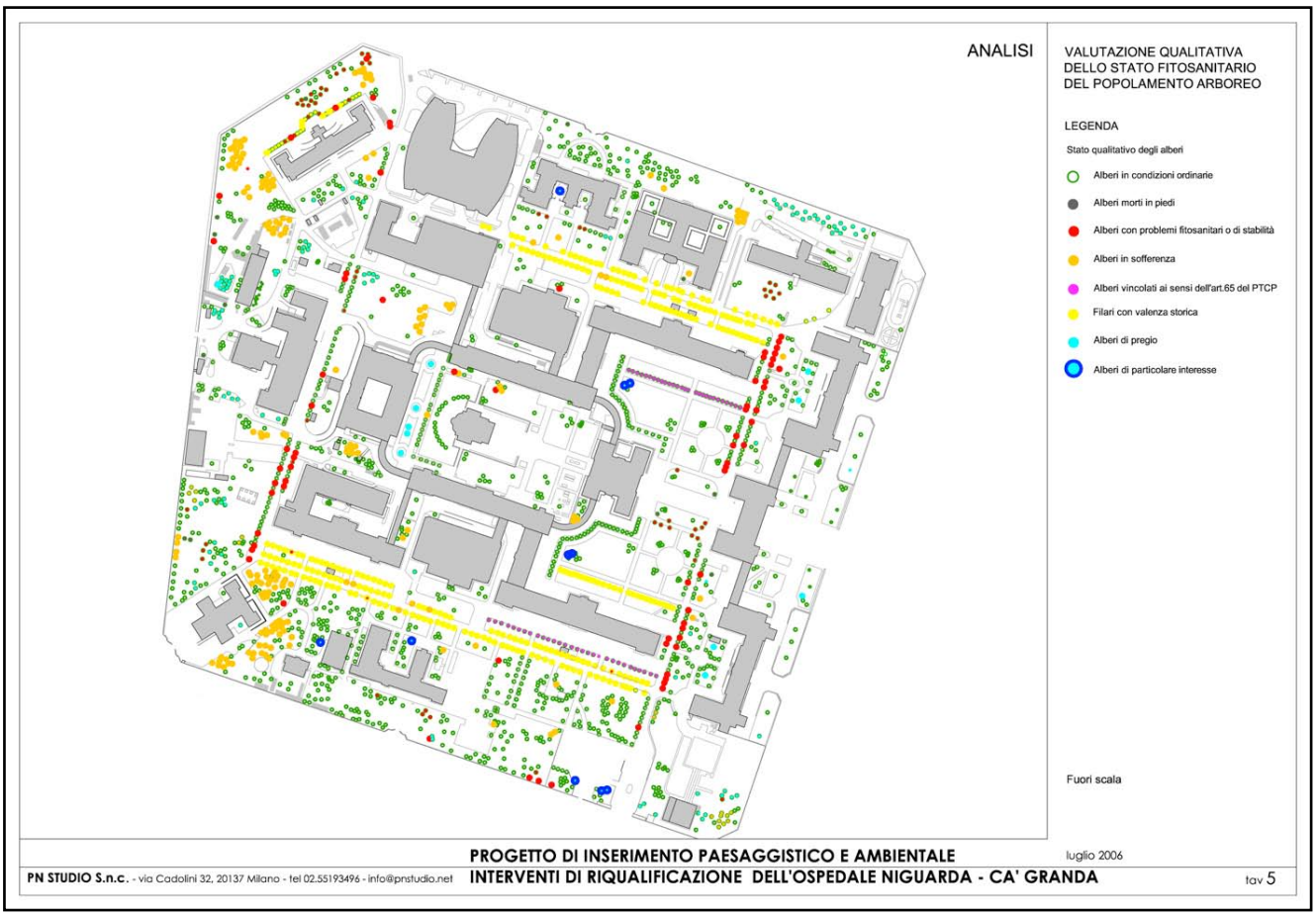
Table 4: Distribution of pathologies or damages in the more widely represented species (green for foliage, brown for collar, yellow for trunk)

Estimate of the damages and juridical references

The estimates have been developed moving in two different directions:

a. Estimate of the tree complex according to the estimate methodology
b. Estimate in terms of compensating biomass.

a. Estimate of the tree complex according to the estimate methodology, based on the methodology developed by the I.S.A. (International Society of Arboriculture) and on the methodology developed by Prof. Puglisi S and De Lucia B. of the University of Bari, prof. Fornelli G., dr. Lamesta A., dr. Marrone G., dr. Suriano M., in occasion of the Formulation of



Qualitative evaluation of phytohealth of trees

rues for the maintenance of Green for the Comune of Andria (BA).

The adapted estimate evaluates the value of trees in an urban environment on the base of five parameters:

- *Species or variety (P)* this parameter equals a tenth of the medium cost of acquirement in a greenhouse, The medium price taken into consideration has been acquired from the official prices 2005, as shown in Table n. 1 attachment 3. in all cases the plants taken into consideration should be well rooted, in confined earth;

- *Position (a)* indicating the position of the plant inside the city in relationship to the real estate market. The calculation of this parameter is connected to the application of Table n. 2 of attachment 3. in the specific case, the park under estimation has been located in the middle suburbs with value (a) = 8;

- *Health conditions (b)* is a function of the phytohealth conditions of the tree under evaluation. The calculation of this parameter is connected to the application of Tables n. 3a and 3b of attachment 3;

- *Dimensions (c)* The calculation of this parameter is connected to the application of (diameter of the trunk at ,30 m from the ground) Table n. 4 of the attachment n. 3;

- *Loss of value (d)* is related to the damages caretaking interventions that the tree may have undergone. It is calculated as percentage on the ornamental value as indicated by Table n. 5 of attachment 3.

So the ornamental value of the tree is the result of the price of acquirement in a greenhouse, (*P*) multiplied for the location value, the position value (combined with health conditions) and the diameter value minus the loss of value:

$$V = (P \times a \times b \times c) - d \times (P \times a \times b \times c)$$

b. Estimate in terms of biomass and compensation.

Based on the indications of the Kyoto protocol, the cutting of trees equals a production of gasses. The estimate in terms of total tree biomass, according to a classical methodology would require an experimental campaign on location, taking in consideration trees representative of the population, cutting them down and the measurement of each one's components. Once the total volume of the tree chosen as a model had been calculated (V cormometric + V principal branches + V fascines + V leaves), the values found should be multiplied for the number of trees to be estimated.

In the present case, the above-mentioned methodology has been rated unnecessary in its complete details for two reasons: 1) the intent of the estimate was that

of formulating a general evaluation of the kind of damage resulting from the intervention in order to offer an overview to ides 2) the choosing of model trees should be done by species, and as the species detected are 54, this would have meant a heavy intervention on the forest complex. The experimental campaign can be put in action in case the need for a more detailed estimate should arise

A spedition methodology was applied that took into consideration the calculation of the cormometric volume of the model tree based on medium values of height and diameter of each species. The formula used is

$$\mathbf{Vm = gm \times hm \times f}$$

where

gm = (π/4) x dm

dm = medium diameter

hm = medium height

f = reduction value, function to the trunk's rastremation and has been established as an average of 0,4 for conifer, while for the deciduous it is an average of 0,5.

The resulting values have been multiplied for the number of trees of each species.

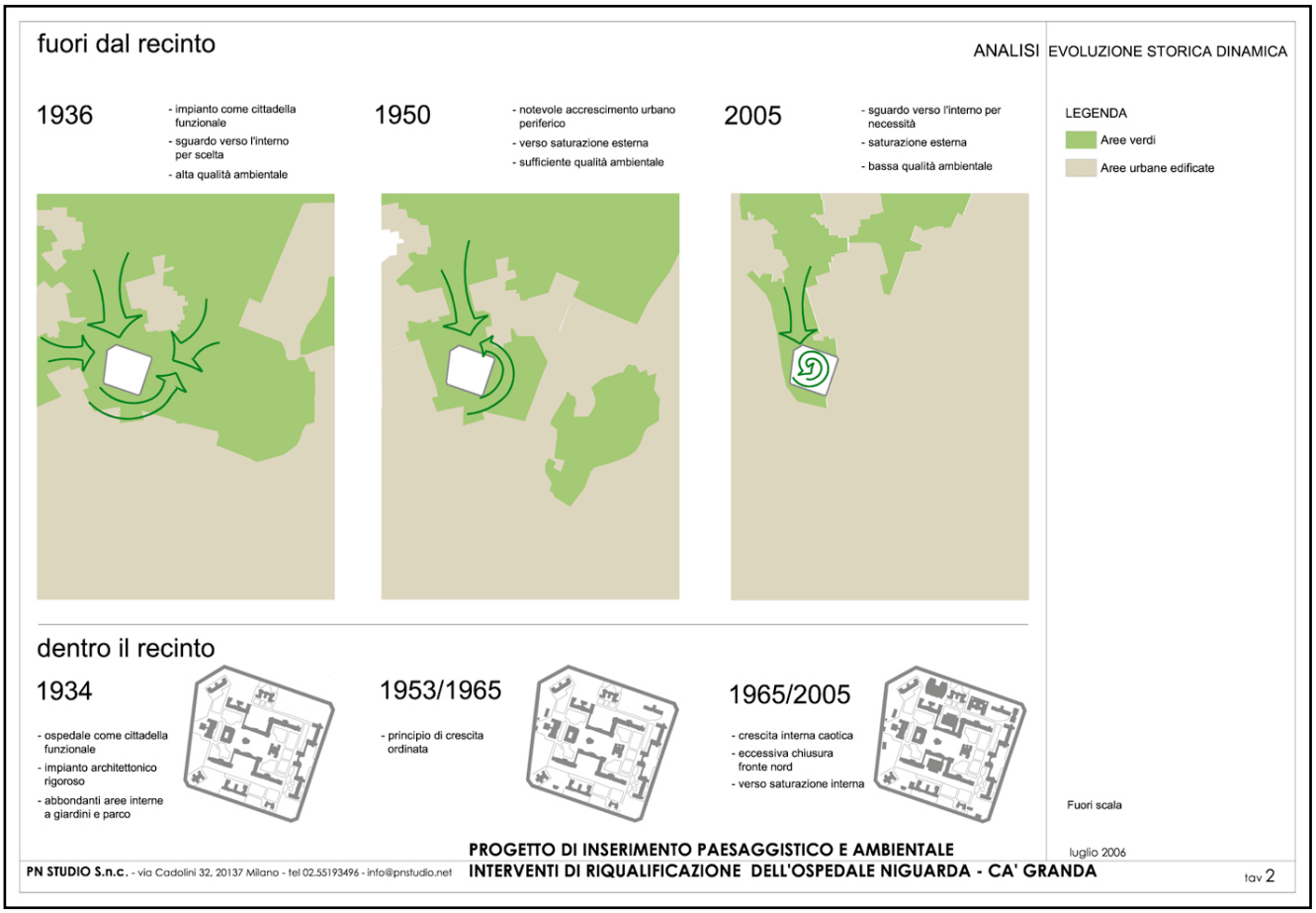
Following the equation 1 m³ wood = 420 m³ CO_2 (Cantiani, 2004), the resulting volumes have been multiplied by 420.

The estimate obtained has an indicative value and is actually an underestimation since the total epigeal volume of the trees under evaluation has not been considered.

The estimate of the compensation value has been conducted on the base of the methodology indicated by the D.g.r. of the 21th of September 2005 n.8/675 "Criteria for the transformation of forest and the relating compensating interventions, as in art.4 comma 8 , l.r. 27/2004 and modification of the d.g.r. 7/13899 of the 1st of August 2003".

This decree is reputed applicable to cases foreseen by the PIF (forest oriented program) of the Provincia di Milano. This last is applicable to forests, defined by the PIF itself and to minor protected elements. With this terminology the plan indicates such elements protected by the PTCP of the provincia di Milano. In this category fall a rows of magnolias and one of *Celtis*, as shown in the cartography (Table.1). the PIF though, does not include public or private gardens in the urban environment.

Nonetheless we have chosen to apply the estimation method of the d.g.r. 8/675, in order to reach an indicative quantification in terms of compensation. According to the legislation on the subject, any intervention on the forest complex resulting in a modification of utilisation finality of the woods in question must be accompanied by compensating measures or by the payment of the cost of the compensation to the competent administration, from the subject producing the change, as indicated



Historic evolution of the environmental matrix

by the Kyoto Protocol. The costs of the compensating interventions are determined as follows:

C compensating = C. aboveground + C ground

C aboveground = 2,1114 € x m^2 involved in the intervention x the compensating relationship fixed at, in the specific case, 1:2.

C ground = average agricultural ISTAT value of the property on which the intervention will be taking place. In the case of woods in the plains, the decree indicates the average agricultural value of the watering crops at 4,48 € x m^2 of property involved in the intervention x compensating relationship fixed, in the specific case, 2.1

From the estimates so conducted we have the resulting reference values necessary to quantify the interventions required for compensation and mitigation.

The restyling project of compensation and mitigation

Landscape analysis

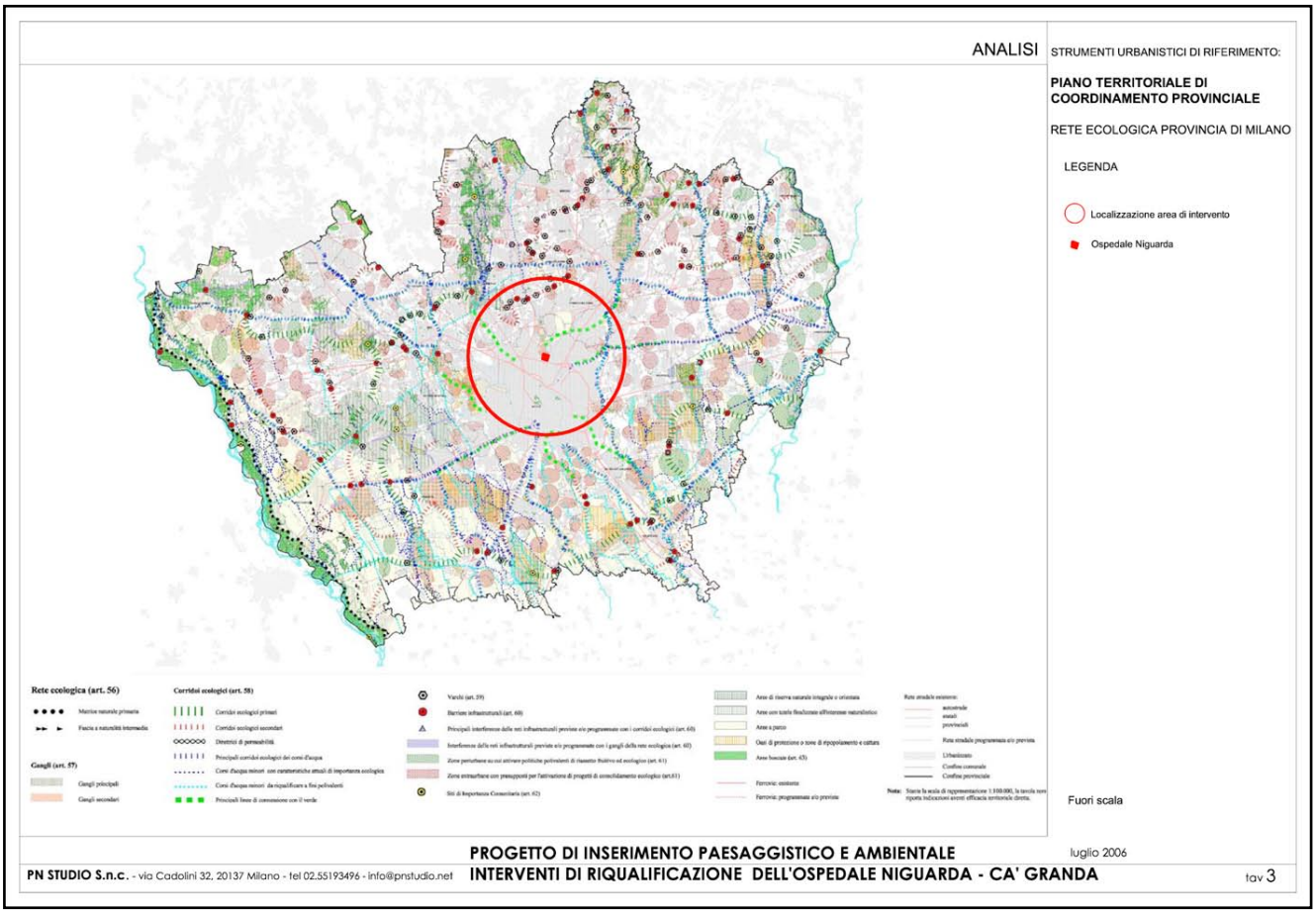
The Niguarda area can be seen as the extreme SW offshoot of the Parco Nord of Milan. Connecting directly to it is the via Zubini seat of the Parks and Gardens of the Milan Municipal. From the PTCP ecology Network one can presume that there is a relevant ecological connection touching the Niguarda area.

The historical analysis of the site shows three periods of evolution:

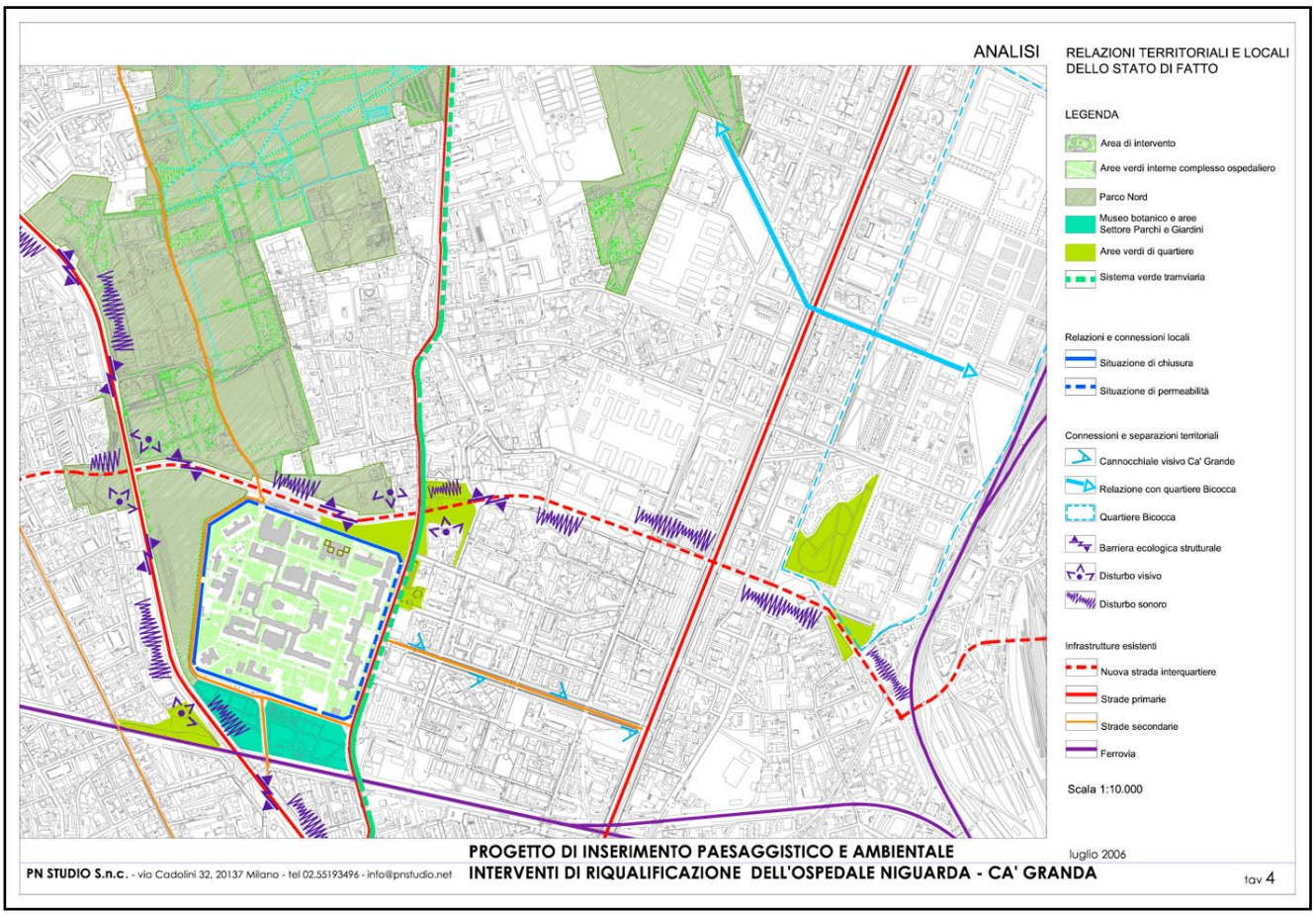
- The thirties structure is styled as a functional township, self contained but surrounded by the agricultural area: the architectural building is rigorous and there is a generous proportion of greenery.
- An orderly growth principal (1953/1965) in which some hospital blocks are added and outside the city begins to expand, however the environmental quality is still suitable
- A chaotic internal growth (1965/2005), other blocks, manufactured produce, but also disordered parking and traffic greatly reduce the availability of and amount of green areas; the landscape quality and environment is strongly invalidated, whilst the surrounding urban structure has saturated the environmental matrix, except for the Parco Nord.

The landscape analysis has marked the crisis areas of the site, recognisable as:

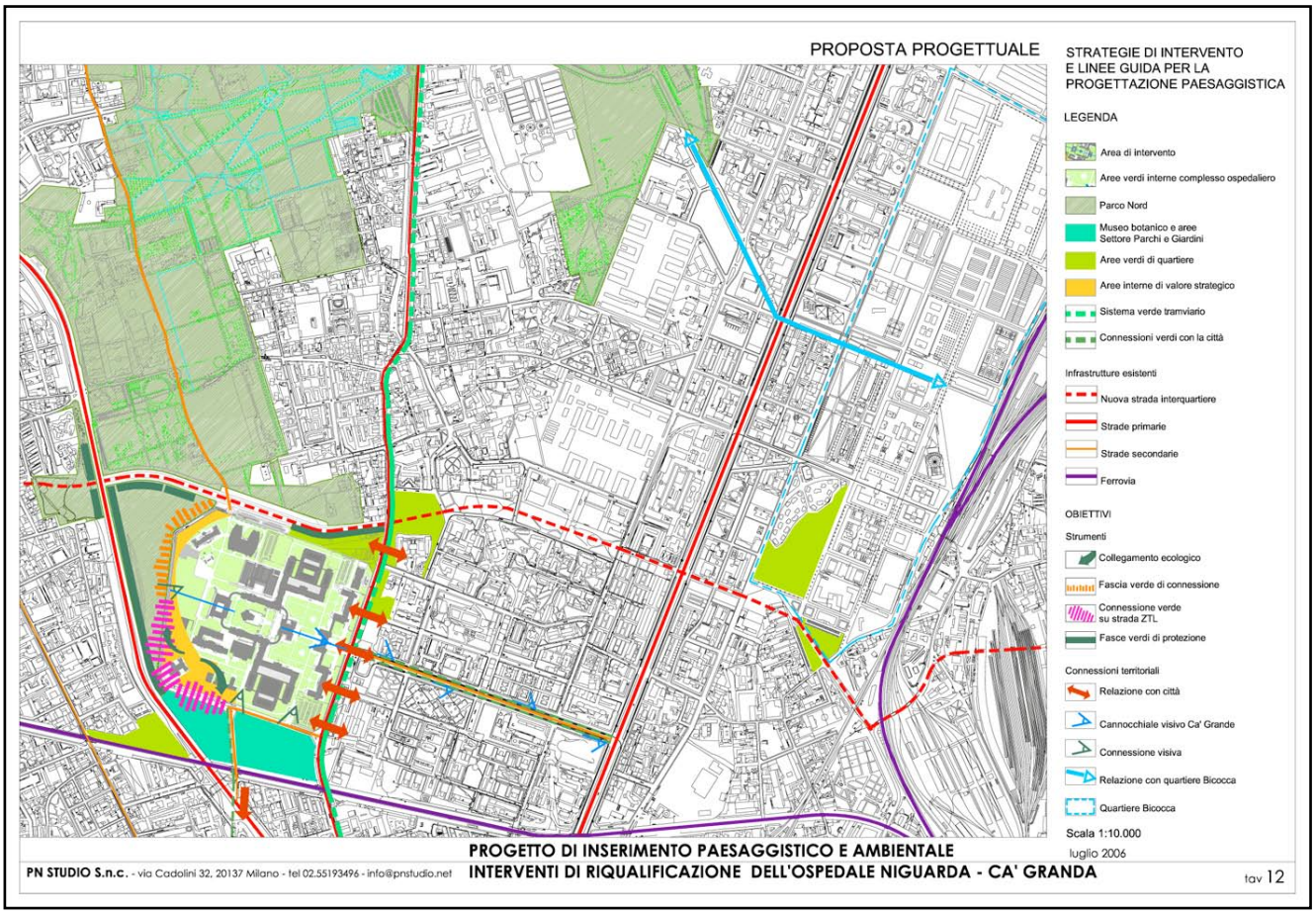
- Heavy saturation of urban structure
- Diminution and degradation of the surrounding green wealth
- Heavy vehicle disturbance, in particular the construction of the inter-quarter road to the north.
- Structural ecological barriers, among which the roads, with deriving acoustic and visual disturbances and pollution.



Ecological network of Milan



Actual territorial relation of the hospital with the city



Planning strategy of the re-qualification of Niguarda

Among the elements of potential value, the analysis showed the following:

- The monumental architectural arrangement in relation to the arboreal structure.
- The remaining of functional and visual telescopic views for example the road axes.
- The environmental connections with the urban green area network
- Moreover, from a careful estimation of the arboreal wealth, as shown above, the examples to maintain, protect or substitute have been recognised.

Building new blocks on the green areas is clearly a heavy impact. Thus it will not be possible to put to work the compensation and mitigation measures necessary. To this end it will be necessary to carry out these interventions outside the walls, to favour a new relationship between the city and the hospital.

To this end, various types and phases of compensation works have been established.

References to the project

The necessary rethinking on the Niguarda park's mutated functions suggests to widen the view on the "externality" of the re-planned environmental matrix. From a merely ornamental and its own "healthy" role during its period of construction, today we recognise further and important roles connected to the environmental matrix, the fauna component, to CO_2 absorption, as well as the social, preventative, educational and therapeutic functions

According to the inspiring principle of Ecotherapy, there is an insuppressible bind between man and nature and, in particular conditions of suffering, a reconnection to the natural world can be of great help to healing. In the international fields there are many inspiring references, the Institute for Child and Adolescent Development, Wellesley, Massachusetts, where an accurate landscape design suggests a renewed relationship with life, or the Children's Hospital, San Diego (USA), recreated areas in a playful-educational theme. In Italy some themes are already being developed, for example the ludic-recreation course for long term children at the G. Gaslini Hospital in Genoa, as well as various examples or gardens inspired from Horticultural therapy, in particular for Alzheimer patients and under-sighted or blind people.

The predicted works

As previously mentioned the hospital modernisation project can become an opportunity to re-qualify and enlarge the park's functions. The park still requires ample restoration and re-qualification to the green areas, as the analyses have shown. Moreover, compared to an undoubtedly heavy price to pay in terms of felling and knocking down, the mitigation and compensation works can really modify the perception of a vaster area than the Niguarda perimeter, and take on a district or even city bearing, in giving a diversified role and value yet connected to the environmental matrix and ecological network

The drawn project, defined as master-plan, considers different types of work, ranging from the phases of hospital yard work which should be completed in 2018.

Environmental and landscape reconstruction and re-qualification of the vast Niguarda area include:

- **restyling, restoration and mitigation**, or relative to each yard works sector, the trees will be protected, withered ones will be substituted, rows completed, lawns renewed and bush groves replanted, according to the original design but also adhering to the new roles taken on by the hospital complex. Firstly, it will be necessary to restructure the basic structure that is the central and front plant in the park. Today most of the vegetation is degraded and abandoned, needing substantial work to restate the cultural and historical value of the whole complex. The first and most essential step, in part already completed is the reorganisation of parking, with underground lots and a drastic reduction of land-level slots. Also the Niguarda monument portion will take on a more "urban" role, inherent to the city, for example re-qualification of the front square and re-evaluation of the telescope view along the via Ca' Granda; and also with new roles aimed at the citizen, such as housing, restaurants shops, cultural activities.
- **Internal compensation works** in the west sector of Niguarda, where the two bocks will be demolished: in this layer the actual arboreal covering will be revalued and enriched by other arboreal plants and shrubs, according to a less formal design than the previous one with a higher grade of naturalness suitable enough to be a connecting element with the North park areas. The perimeter wall will be opened with check points to support this connection also in functional terms. It will be possible to follow a rehabilitation course that leads to the North area, in the same way that Hippotherapy can use a wider area than the actual confine.
- **External compensation works**, in an area of approximately 10 ha in the Parco Nord area, including:

  1. visual and environmental connection to the public green areas and the adjacent internal Niguarda areas that contain the stables and Hippotherapy activity. Reducing the road to local traffic use will allow higher permeability and accessibility to external confine areas
  2. The structural link between Niguarda and Parco Nord
  3. Creation of a therapeutic course from the bo-

tanical gardens to the educational arboretum, this pathway is protected by a vegetation strip, and highlighted by a row of trees, from which ramify ecotherapy rooms for rehabilitation and accompaniment to health.

4. The ecotherapy rooms will be characterized by plant drawings and compositions varying according to the level of difficulty and foreseen ecotherapy.

5. the educational arboretum structure, with its fruit trees, the productive mulberry and elm, construction, ornamental, fauna interest, local or well inserted in the phytoclimatic framework and reference landscape.

6. The arboretum together with the therapeutic course and the ecotherapeutic rooms, also has an educational role. Like a single complex: the course and the ecotherapeutic rooms, marked by the rows of arboreals joined at the vine, want to recount to the visitor the history of the Lombardy agricultural landscape through the reconstruction of the planet, hydraulic-agricultural organisation characterising the region for centuries, now but all vanished. In the arboretum the visitor is given information on the various vegetable species there, their origins, their present and past uses. The arboretum is also experimental for the Parco Nord, which can make use of an area of acclimatisation and experimentation for the introduction of new species.

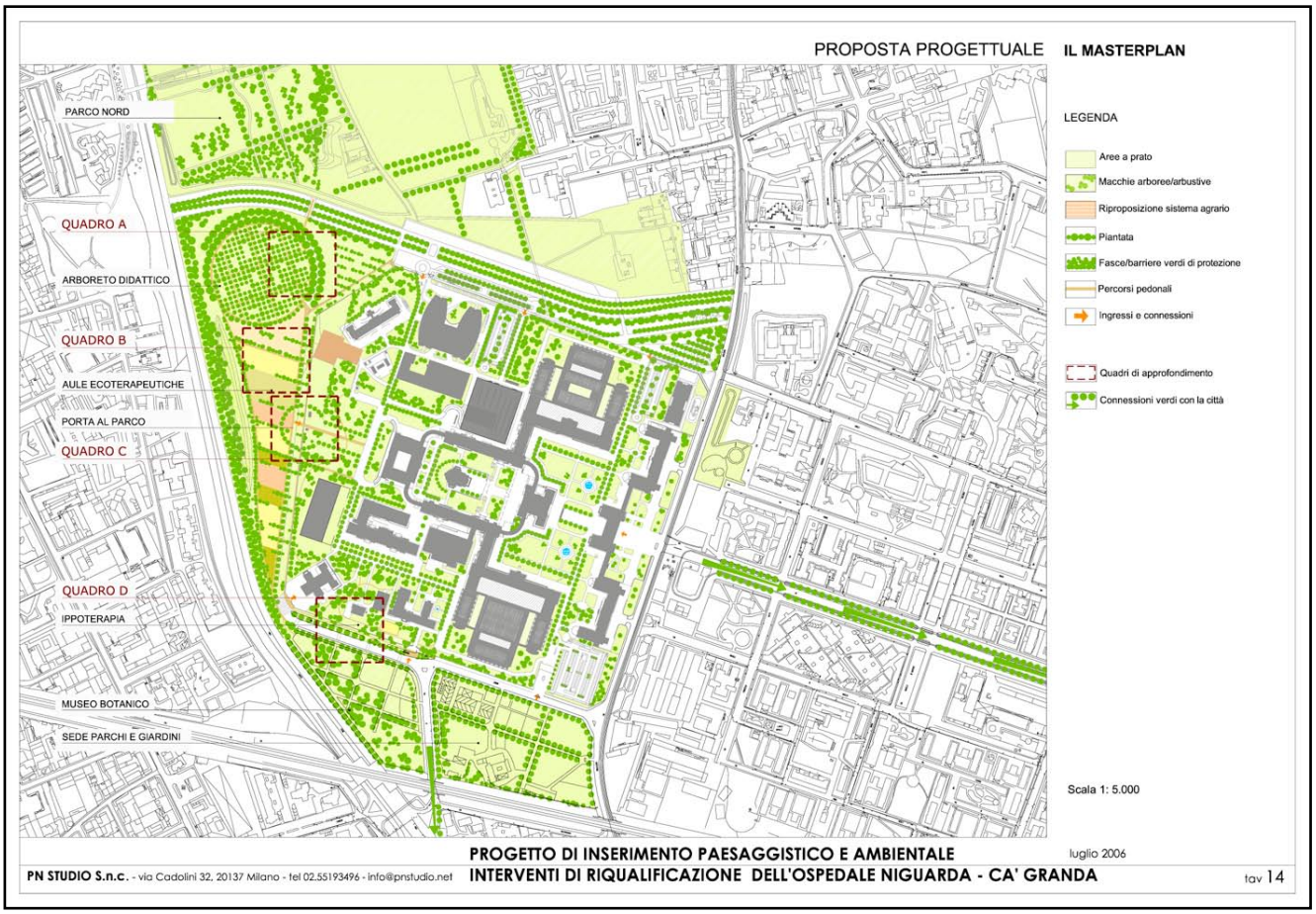
The external compensation works will concentrate on multifunctional aspects, taking on ecotherapeutic, educational and experimental functions to bridge the gap between medical sciences, environmental sciences and the patient/visitor; cure for the body and mind.

Conclusions

The works undertaken should necessarily have the aim to restore the previous structure and requalify the area under a new prospective. True to say, the requests for which the new hospital and consequently the adjoining park must face, have changed. From the years of its foundation the hospital was deep in an agricultural milieu, surrounded by a high wall. Today circumstances are different, the hospital is included in a dense urban context, even if in this milieu there are residual agricultural plots and green corridors of land.

The architectural requalification project encompasses a series of demolitions and construction of new blocks. Because of this new architectural work, 468 trees will be felled, while future systemisation and plantations will largely compensate this even in the surround areas available.

It is possible to see the transformation that the hospital will undergo through a complex process that



Masterplan of the interventions

Details of the project

includes many others at a institutional, political and social level.

The project foresees therefore the environmental landscape and functional reconnection on all four sides of the enclosed area, with a growing scale of naturalness from the urban context to the rural landscape of the Parco Nord. To be highlighted is the return of Niguarda Park to the city, not only in terms of valuable green areas, however relevant in a dense urban context, but also for the new synergies and roles that they carry out: a moment of meeting for hospital guests, children and youths, adults and the elderly. The human life cycle unwinds and is recognised in the various park spaces, where one can know, learn, respect and meditate, listening to the sounds of nature.

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