## La gestion de la végétation aux espaces naturels périurbains

## Vegetation mangement in periurban natural spaces

# Parco Nord Milano



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### Foreword

Ignazio Ravasi, President of Parco Nord Milano

The word "bios" in greek means life, but also way of life and means of life. It points to the "life" uniqueness and in the same time to its complexity and to the system of relations which keeps together and unite every life.

Biodiversity is the modern word which today express that ancient concept, which was able to open men's view on their own and universal complexity.

Today, humans, especially that part of humanity that lives in big metropolitan areas, cannot get a glimpse on the nature, on wholeness of species, on biological diversity and unity and on Bios' variety, variability and richness.

This blindness is relevant for the loose of sense emerging in contemporary man. Periurban parks, located within big metropolitan European areas, live strictly in contact with modernity in all its positive and negative aspects. So, they are, better than others, able to see changes, disturbances, needs and errors of contemporary man. This we have learnt building and giving life to Parco Nord Milano. Thirty years ago, in the six hundred and fifty hectares which constitute the Parco Nord Milano, there was no nature. Not a tree. Nothing.



Thanks to citizens' struggle and to farsightedness of municipalities, of Milan Province and of Regione Lombardia, (which thirty years ago built the Park), the foundations for safeguarding this immense land value territory from urbanization were lead.



Le prime piantumazioni con la partecipazione dei cittadini

Today, thirty years later, we can proudly say not only that those who have been working in building the Park have not been working in vain, but also that happened a "miracle", that let us realize an extraordinary requalification of the city and of the metropolitan landscape.

Let's say more. Planting about 300.000 trees and building more than 80 hectares of woods, we have consented nature, meant as biodiversity and as that something man comes back to perceive in the connection with himself , to come back within that we call the Big Milan.



Therefore, the big change put in act by the construction of Parco Nord, not only has transformed degraded places of the Milan's outskirts in a point of urban excellence, but has brought nature in the city again. Incredible but true, we have foxes, leverets, wild rabbits. A deer has been living in the park for years. We have birds of prey as sparrows and tawny owls. After years came back wild orchids and scillas, and many others native flowers.



These kind of outcomes must be ascribed mostly to those people who in this last twenty fife years have worked for the Park and in the Park. Active man and women who loves what they do.

For instance, I can talk about Laboratorio Boschi: the Parco Nord could be content in being a vast retrained, renaturalized area, and a modern metropolitan square for two millions of persons at year.



But our "Servizio di Gestione", the Management Office, in 2006 because of the increasing mortality of trees, due to new phytopathologies directly connected with climatic changes, decided to give birth, together with the Universities of Florence, of Bari and with Demetra cooperative, to a project aimed at monitoring our trees, observing pathogenic agents growth (especially of some mushrooms and lepidopters, in order to study, valorize and protect woody and forestal resources of the Park.

Our Director Riccardo Gini, the researchers Giovanni Senesi from University of Bari, and Alessandro Ragazzi, from University of Florence, will show you the results of these two years of work, of studies and experimentations that have a resonance which goes far beyond our Park.

From this study emerge with evidence some of the new challenges that must be faced by those who are called, as the periurban European parks, to the defense of the ground and of water resources, to the protection of landscape and biodiversity and to improving quality of life of men and women of European cities. Old and new challenges which, for us, keep on inter-crossing and interweaving among them.

In fact, besides this new role of being in the forefront as laboratory of analysis and studies in the defense of nature and biodiversity and of being a promoter of concrete actions for improving the quality of environment and life, we still are following the institutional goal of completing the Parco Nord.

Parco Nord is the result of a "work in progress" not yet completed. Thanks to economic funds from our municipalities, particularly from the Milan Municipality, we will realize in the next two years new works which bring us near to this goal. Saturday morning we will show to those who will stay here and visit the Parco Nord, all the projects the we are right now realizing. Some of these works will retrain our water network, increase the presence of the Park's water system, create two wetlands. All this will contribute in making Milan a more attractive city, also in view of the Expo of 2015.

This "work in progress" has also allowed us to realize new forestations. We have planted ten new hectares in 2007 and 7 new hectares in 2008. With these new interventions, and through the collaboration of AzzeroCo2, Dott. Gamberale will talk us about it, we have experimented the application of the Kyoto Protocol, related to new forestations aimed at the reduction of carbon dioxide and at the purchase of carbon credits obtained and certified through the new forestations by those enterprises that have to compensate the carbon debts produced by their activities.

I wanted to talk you about this action because, beside carrying great environmental and social benefits ( the lessening of carbon dioxide in the atmosphere has a positive effect on health and life quality of citizens), it is a chance for parks to obtain financial resources from privates, and not from the public system. It is something very important, mostly in these times of financial difficulties for public administrations, in order to find the necessary resources to develop parks' estate and build new ecological greenways.

The protection of ecological variety cannot obviously be ensured by just one park. We must talk about the promotion, in each country of the UE, of a regional, national and European ecological net.

"Species, nourishment substances – I quote the guide lines of Regione Lombardia for the development of the Protected Areas Plan – and other environmental fluxes do not know this borders and many ecosystems and species live together with developed human activities, in natural environments partially transformed which at present lack a formal protection. It is necessary to assume new models to connect protected areas, building ecological ways and ganglions to extend conservations beyond their frontiers".

The Ecological Net theme becomes fundamental: the real challenge is to create a net system and connections between strongly anthropic areas and isolated areas (big natural national and regional parks, the SIC, the ZPS, the Rete Natura 2000 and PLIS), but also to involve in this effort of connection and requalification all degraded and interstitial residual areas.

By the way, if we look at the situation of the Pianura Padana, we see that between Torino, Milano and Venice, in the last twenty years has grown a city with no continuity solution, where the action of man takes up with an incredible velocity residual empty spaces. In this infinite city, space and time are consumed and nature is moved away from human sight and value systems.

In these places, where the irresponsible anthropos expand the artificial, biodiversity and the quality of life and of living assume a strong and clear priority.

Here arises the urgency for an immediate intervention for identify ecological ways and create ecological net, to protect residual green and agricultural areas, to monitor and protect vegetable and animal species still present. We know that the impact of human action, combined with pollution and climatic changes, determines a real emergency in urban areas.

Also: in big metropolitan areas as the Milan's one, regional parks are more similar to green wedges coming from the "outside" of the city to the "inside" of the urbanized center, rather than to green belts surrounding and defining the city. One of the problem of our metropolis, and Milan in particular, is the loss of identity with the space-time dimension, the chipping of the spaces and the annulment of social connection linked to the relation between man, history, and nature. The creation of Green Belts around our Po valley's cities, connected to the vaster ecological net, appears as an urgent response in order to offer solutions not only for water, ground and atmosphere pollution, not only for the defense of biodiversity, not only for an healthy nourishment of metropolitan man's body and soul, but give our life a foundation in memory of a past which is a movement toward a better future.

The President of Parco Sud Milano, Bruna Brembilla, and Prof. Stefano Boeri, will expose about this point the lines of their political and technical action in the realization of the Metrobosco project: that means the creation of a big Green Belt surrounding Milan.

Other important analysis contribution, proposals and good practices will be exposed by Prof. Sergio Sgorbati from the University of Bicocca, Flora Vallone from the Comune of Milano, and Paola Pirelli from BoscoinCittà. I hope that the work of today and yesterday can enrich our cultural estate; most of all I hope it can be useful to periurban parks for a better promotion of defense, care and valorization of vegetable estate and all natural values, always combined with a special attention for citizens' needs: social, recreational, and of environmental education. The Festival of Biodiversity of Parco Nord Milano represents a testimony of this attention. In the end, two little quotation.

Whitehead effectively said: "No chance of detached and autonomous existence is given", and effectively all that exist is dependent. Edgar Morin, commenting, added: "Living creatures will develop their autonomy and their dependence in relation to their ecosystem in a necessary complementary way: the more complex they will be, the more will result fragile (because they will multiply their ecological dependencies) and the more will develop a disposition to fight again this frailty with the strategy of behavior, which will become intelligence...." And about our intelligent reaction to that frailty caused from the complexity we create, I think the admonition contained in Platone's Critone is effective.

"Not the living is to have in the highest consideration, but the well living "The well living is, today, that which brings us to develop all our intelligence to rebuilt relations, harmony and connections with nature and cosmos. Have a good work.

Ignazio Ravasi Milano,6 Giugno 2008

#### VEGETATION MANAGEMENT IN PERIURBAN NATURAL SPACES Parco Nord Milano, 5 -6 June 2008

Vegetation, whether in the shape of meadows, bush areas, woodlands, agricultural mosaics, alluvial forests, etc., is the most colourful and identifiable part of the natural value of a protected space. It is the essential component of the landscape and is thus the soul of any natural park in Europe.

Vegetation is furthermore one of our main weapons for combating climate change since it operates as a green lung by producing oxygen and capturing CO<sup>2</sup>.

Due to the functions it performs, vegetation is an essential factor in the quality of life of people living in our cities.

Nonetheless, it is in natural and rural areas which are under pressure that the clash between "land protection vs. urban development and its associated imbalances" is most forcefully apparent.

Thus some sources of pressure (electricity lines, marginal activities, vandalism, fragmentation, fly-tipping, pollution, fires, etc.) have a negative impact on vegetation which loses its distinctive character and becomes degraded. As a result in some areas balances and microclimates are broken up, vegetation communities are destroyed, the most delicate species disappear and non-indigenous species spread, some of which are invasive: the tree of heaven (*Ailanthus altisima*), the *Reynoutria japonica*, the mimosa (*Acacia dealbata*) and others which have a harmful impact on human health such as the common ragweed (*Ambrosia artemisiifolia*), etc.

One of the main challenges facing any manager is keeping vegetation in a good state of health. Doing that calls for active management that is geared towards conserving natural values and reducing and/or counteracting multiple threats.

Woodland can also be a source of income if run in a sustainable and profitable way. What's more, the coming into force of the Kyoto Protocol opens up a whole new range of opportunities.

A number of issues in vegetation management which have a daily impact on our parks are to be discussed at this technical conference:

- strategies for organising space so that public use does not have a negative effect on vegetation
- whether firebreaks are really useful and how they should be made
- managing vegetation under electricity lines
- combating the progress of exotic species
- treating vegetation as a niche for fauna
- combating the most common plant pathologies and how to deal with new ones
- how to get a financial return and protect at the same time
- management concerted with private players

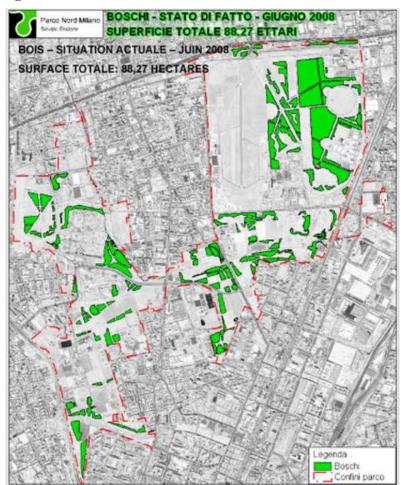
This technical conference is addressed to people in positions of responsibility (directors, managers, politicians, engineers, etc.) who will be able to exchange ideas and enrich their knowledge based on specific examples of other parks and the academic input provided by researchers from Florence, Bari and Milan universities.

### Project wood laboratory

Ricardo Gini, manager of Parco Nord Milano

#### Introduction

Woods - state of things in 2008 - Total surface: 88,27 hectares



The evolution 1970 -2000



#### 1st reafforestation plot Carried out in 1983 by the Regional Agency of Woods (now ERSAF) upon 10 hectares of land situated in the North-Eastern area of the Parco Nord Milano.

11.000 plants have been placed in lines, orthogonal and far each from each other 3 m (planting system of 3 m x 3 m). Some of the species employed are: *Acer pseudoplatanus* (3.000 specimens), *Fraxinus excelsior* (2.500 specimens), *Ulmus spp.* (1.200 specimens), *Alnus cordata* (750 specimens), *Quercus robur* e *Populus nigra Italica* (600 specimens), *Fraxinus ornus* (500 specimens), *Quercus rubra e Pinus sylvestris* (400 specimens), and also other in lower quantity.

The plants were placed in little groups of 5/6 plants per species and they were between 1 and 5 years old and between 20 cm and 5 m in height.

Planting system 3m x 3m	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Planting system 2,5m x 2,5m		
Planting system 2,6m x 1,5m		

Different planting system used for woods in Parco Nord

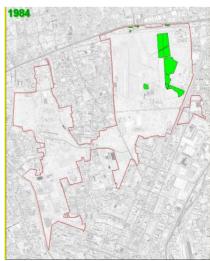
#### 2nd reafforestation plot

carried out in 1984 upon 7 hectares of land situated in the North-Eastern area of Parco Nord Milano.

Unlikely the 1st plot, in this one the installation density is increased from 1.100 plants/ha to 1.600 plants/ha, with a planting system of 2,5 m x 2,5 m; in this way it

was possible to get a quickly closing of leafage and a quickly development of the organic layer of soil. Indeed the linear marking of lines have been preserved.

Some of the species employed are: *Acer pseudoplatanus* (3.700 specimens), *Qujercus Robuir* (2.250 specimens), *Fraxinus excelsior* (2.000 specimens), *Quercus rubra* (1.850 specimens), *Betula pendula* (1.800 specimens), *Alnus cordata* (1.650 specimens), *Fraxinus ornus* (1.500 specimens) and also other in lower quantity.



Starting from year 2000 thinning interventions have been carried out in order to improve the characteristics of park forest soils. Today 62 ha of the total 88 was interested in one intervention at least.

All the data on thinning carried out from the year 2000 are holden in a Data Base Thinning easy to consult. Here below you can find the graphics obtained through the elaboration of data on the first two plots of reafforestation.

We paid particular care to 1st and 2nd plot because they showed a lot of problems: higher density and the consequent setting of trees, specific stock that is not optimum, lacking in the presence of shrub and phytopathologic problems not identified.

The final purpose of the thinning interventions is to obtain the most natural, mixed and with different age wood, formed by vegetal associations of trees, shrubs and weed the most suitable to land, climate and habitat of the area.



#### Projet LABORATORIO BOSCHI.

The observation of the unknown phyto-pathologic symptoms, like the ones pictured in the photos here below taking in the year 2000, linked to the numerous operational problems typical of a metropolitan belt park that is the Parco Nord, pushed the Parco Nord technical-staff to try an multidisciplinary approach, that made concrete in the project WOOD LABORATORY



One of the first and most significant result took place in the individuation of the presence of some pathogenic fungi like Botryosphaeria dothidea, very dangerous because of its polyphagia, and Biscogniauxia mediterranea, dangerous for oak trees..



THEMATIC AREA;	poor state of health of forest population	
Topics	Purposes	Referring persons
Study on pathogenic behaviour of endophytes	Gathering of specimens, laboratory analysis, experiences in the field of inoculation, creation of experimental fields, measurements and texts	A. Ragazzi; S. Moricca; R. Tucci; A. Uccello; E. Zini
D) Execution of phyto-pathologic interventions requested by the researching protocols of Universities	<ol> <li>Health pruning and pulling down, dissection,</li> <li>excavations and sections, 3) surveys, analysis and texts, 4) gathering of specimens</li> </ol>	L. Bonanomi, G. Villa

THEMATIC AREA	: problems in vegetation systems	
Topics	Purposes	Referring persons
E) Emergency Chestnut, identification of resistant subjects to various pathologies and possible reproduction experiences	<ol> <li>Existing pathologies classification, monitoring of their course, research organisation, 2) analysis of soil and of leaves, 3) individuation of resistant subjects, reproduction experiences (piping and something more)</li> </ol>	L. Bonanomi, G. Villa
F) Methods and systems research in controlling the development of roots close to pedestrian crossing	1) Text of experiences carried out in previous years, analysis and publication of results, 2) containment experiences with mechanical interventions, analysis and publication of results.	L. Bonanomi, R. Zanata, F. Campana
G) Research on soil fertility improving	<ol> <li>Found and dubious critical state plan, soil analysis, results, research planning, 2) research and classification of principal symbiosis of micro- roots present in the park, 3) stump reproduction of local micro-root.</li> </ol>	G. Villa, L. Bonanomi, F. Campana
K) Researching study and possible application of methods and systems in the biologic and ecocompatible management in vegetal parasite fight	<ol> <li>Gathering of historical data, gathering of local data, found infestation plan, critical state found,</li> <li>experimental experiences in methods for fight and individuate ecocompatible products</li> </ol>	G. Villa, L. Bonanomi, M. Segabrugo, F. Campana

THEMATIC AREA: constant monitoring system of forest population		
Topics	Purposes	Referring persons
B) Fulfilment of different permanent testing areas to define a method in survey and in systematic data analysis	<ol> <li>Measurement of growing and of other biophysics parameters, 2) elaboration and analysis of climate data, 3) fulfilment of a data processing system management, 4) supplying of geo-coordinates data</li> </ol>	G. Sanesi, C. Rancati, P. Marzillano, B. Selleri, R. Tucci, S. Fiorillo, G. Cereda
<ul> <li>H) Multi-temporal analysis of multi-spectral high definition images and elaboration of the existing cartography</li> </ul>	<ol> <li>Park land satellite multi-spectral images (old and new) acquisition, elaboration and analysis of all the information content, 2) controls and measurement on field</li> </ol>	C. Rancati, G. Villa, S. Fiorillo, C. Dreiser, G. Sanesi, B. Selleri

THEMATIC AREA: resea	rching data management Data Base We	eb
Topics	Purposes	Referring persons
<ul> <li>A) Gathering of all the studying documents product on park's woods and vegetation</li> </ul>	1) Achieve research: arrangement in typology and date, 2) Achieve research: reorganization in	C. Rancati, S. Fiorillo, G. Cereda, B.
A") Reorganisation of technical internal acts on woods	typology and date, 3) file transcription of handwritten acts and notes pursuing the acquisition method of the Park, 4) supplying of geo-coordinates data on web platform in order to consult and to research	Angeloni, B. Selleri, R.Tucci, G. Sanesi, C. Dreiser
J) Complete revisiting of the Parco Nord Operative Management Unit web site section	<ol> <li>Web site section re-design, material organisation, digitalisation, 2) web site section creation, webmaster elaborations, optimisation, 3) data entry, updating</li> </ol>	G. Mauri, G. Villa
H) Cartographic and photographic gathering and elaboration of the existing material to define an historical park soils utilisation \	<ol> <li>Gathering, classification, digitalisation of all the cartographic and photographic material available from the different sources, 2) data entry in a specific software suitable to visualize cartographic data in the web</li> </ol>	C. Rancati, S. Fiorillo, G. Cereda, C. Dreiser, B. Selleri

THEMATIC AREA: Park's future development		
Topics	Purposes	Referring persons
<ol> <li>Financial fund rising for actual and future projects</li> </ol>	<ol> <li>Rising of public national and European announcements and private national ones, 2) feasibility evaluation, gathering of documents, preparation, 3) report management</li> </ol>	G. Mauri, A. Barni
<ul> <li>Professional collaboration in the management of forest problems.</li> </ul>	1) Surveys, analysis, texts, reports, projects, etc., 2) technical coordination of various persons involved in Wood Laboratory	B. Selleri, R. Tucci
Z) Workshop between project actors in order to work out results	Periodical meetings organisation, annual meetings and final one.	G. Mauri, A. Barni

### Managing Vegetation in the Green Belt of Vitoria-Gasteiz.

Jesús Antonio González- Centro de Estudios Ambientales. Ayuntamiento de Vitoria-Gasteiz

#### INTRODUCTION

#### Vegetation in the Green Belt of Vitoria Gasteiz

The municipality of Vitoria-Gasteiz, in the province of Alava, is located in a transition area between two large biogeographical regions, the Euro-Siberian and Mediterranean regions. As a result of this circumstance, its biological and botanical diversity is substantial.

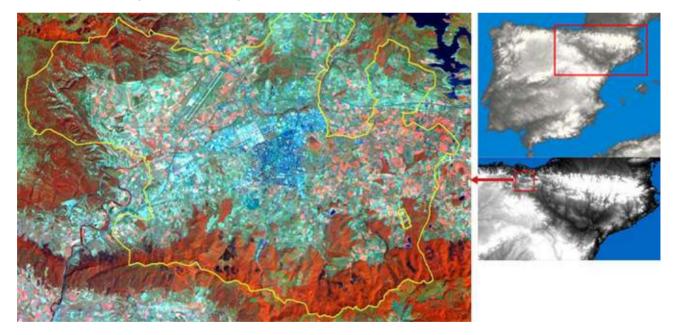
#### Current, native and potential vegetation

When undertaking any initiative concerning the treatment of vegetation in the Green Belt, in addition to an indepth analysis of the physical medium, it is essential to carry out a preliminary and detailed study of the potential vegetation of the area, as well as of its current vegetation and land uses.

There are few maps of potential vegetation at this time and the scales of those that are available are too small to be of any use. Moreover, on occasions, environmental conditions with regard to relief, physiography, soil, humidity, etc., have changed considerably, requiring a certain amount of interpretation in order to determine their status. Determining the status of potential vegetation is worthwhile as this enables us to resolve a key aspect in the choice of species to be introduced into the area: the list of species of all the plant strata that may be present in our community.

#### Territorial organisation of the city

Another key factor to be taken into consideration prior to managing the original vegetation of the Green Belt is the territorial organisation of the city with its inherited residential-urban, industrial-urban and agricultural uses, laid out concentrically, and the forestry areas that lie furthest from the centre.



#### AIMS

General objectives of vegetation management

- Conservation of natural assets and biodiversity
- Environmental restoration of limited, singular or degraded ecosystems
- Foster public use of the periurban space, taking advantage of its potential for educational purposes
- Inform and educate the public regarding the environmental values of plant communities
- Integration of functions: ecology, landscape, economics, hydraulics, social, educational, etc.

#### Specific aims

- Favour the development and expansion of communities and species of interest for conservation
- Increase biodiversity through the diversification of niches and environments
- Protect highly fragile ecosystems
- Guarantee the safety of public use for vegetation
- Favour the development of environmental education activities
- Establish initiatives that favour the participation of the public
- Guarantee the hydraulic functionality of rivers and riverbanks
- Create natural landscapes in boundary areas between the industrial urban environment and the natural agricultural environment.

#### AREAS OF ACTIVITY

- Consolidated forestry masses
- Rivers and riverbanks
- Lakes, pools and ponds
- Groves
- Natural and artificial meadows
- Agricultural and horticultural systems



#### MEASURES

Concerning the introduction of vegetation.

1. Conservation of pre-established vegetation

It is difficult to find a space to restore or transform devoid of vegetation in parks. This may be restricted exclusively to the edges or small stands, and involve just a few scattered or damaged trees, bushes, shrubs or communities of herbaceous plants. This vegetation may be of great usefulness to us both for the preliminary analysis, in order to define the plant treatments, and to comply with the specific aims of the project relating to ecological and landscape issues as well as public use.



The interpretation of pre-existing vegetation may be a magnificent indicator of the potential success of future efforts to introduce vegetation. When masses of natural vegetation are involved, conservation and precautionary criteria are paramount in order to accelerate the approximation of these communities to climatic stages.

We consider it essential to emphasise the importance of undervalued plant communities such as rockland or moorland grasses, present on the hills with very sparse vegetation due to the lack of soil, where restoration work sometimes includes the destruction of the habitat in order to transform this into a simple, ordinary lawn, which can be kept green only by irrigating during the whole summer.

However small these may be, the species present in natural vegetation environments represent a magnificent reservoir of species (animals, plants and fungi) that may colonise the environment we intend to restore.

The respect for singular vegetation requires, in some cases, the modification of the layout of pathways and tracks, expected land use or the introduction of vegetation, and may become icons of a space.

The presence of pre-established elements of vegetation, including isolated plants such as simple rose bushes or a common poplar, allow the resurgence of areas set for restoration and give them a certain significance, creating natural spaces in which recent work gives them a new appearance for many years.



2. Actions to eliminate invasive native species

Concerning introduced vegetation, we are especially careful with species that show themselves to be invasive in our geographical area, for example *Cortaderia selloana*, close to the Salburua wetlands or *Acer pseudoplatanus* near the Forest of Armentia. Other species with which we have had problems up to now are as follows: *Ailantus altísima, Robinia pseudoacacia, Budleiaa davidiii, Artemisia verlotiorum*, just to mention a few examples.



3. Management directed towards the natural colonisation of wild herbaceous plants as an alternative to sowing lawns

Although this requires patience and a nearby genetic reservoir, the possibility of leaving spaces for the spontaneous colonisation of communities of natural herbaceous species allows us to create meadows with a minimum investment and minimum maintenance requirements. This is also a very interesting community considered as an ecological niche in a highly transformed environment in which only herbaceous species of doubtful origin and genetic composition are grown (varieties of agricultural crops and lawns).



#### 4. Measures for the natural regeneration of woody species

The absence of management in some situations may become a magnificent management tool, which, in addition to lowering maintenance costs, represents a magnificent strategy for promoting biodiversity. This "non management" is not only applicable to large parks with highly developed woodland areas and with lower levels of public use, but, without losing a sense of scale, "non management" can be used in small areas, adjacent to zones subjected to high levels of use by the public and of course, by managing communities of herbaceous plants, especially if these are wild. This "non management" approach cannot under any circumstances be allowed to lead to a situation of abandonment and to prevent members of the public from interpreting this as such it is of course necessary to keep it clean and to define its boundaries clearly.

5. Hedges, a key tool for the development of boundary

environments (ecotones). The planting of hedges is a fundamental element in our plant introduction strategy. This involves introducing vegetation in alignments to mark the boundaries that separate the meadow and environments from the woodland environment or to create areas of high-density thickets in meadows. In these, plant density per unit of surface is increased, favouring the development of compact groups of vegetation in which tree and shrubs species are present, the former having a lower presence than the latter.



We could give a talk just about the importance of hedges, but the diversity of their functions can be summed up as follows: hedges allow for a diversification of environments or ecological niches (spontaneously on the edges of forests, hedges tend to form as a high-quality ecotone of biological diversity, delimit physical spaces and land uses in newly created areas, limiting accessibility and they are also of great value to the landscape as these create natural landscapes, direct one's gaze and create privacy screens, etc.

Planting is done on porous plastic sheeting in order to reduce maintenance costs during the first years, avoiding competition with weeds (more exactly, opportunist species) and improving the availability of humidity in plant roots and accelerating their development. With experience, we have broadened the number of plants per square metre and today we can speak in general terms about some 150 plants per 100 square metres. The plants are arranged in staggered lines, forming groups of several individuals of the same species. Although very clear during the first years, the linearity required by plastic sheeting becomes completely unnoticeable as the hedge grows, as the diversity of species generates considerable differences in size, ramification, colour, texture and speed of growth.



6. The production of native plants with plant material from adjoining masses and the general use of native species of young plants in woodland format

Reforestations in parks included within the Green Belt came about as a result of a wish to create a forest, which creates a number of prior requirements such as the suitability of the location, it is functionality, its rarity in its environment and factors in the physical medium that might condition its development such as the scarcity or absence of soil, or its poor quality.

An important factor is the origin and type of plant. We are creating a forest. Our objective in this case involves a long-term project, therefore. The use of young plants allows a gradual adaptation to the environment, and brings about considerable cost reductions, allows a substantial reduction in maintenance work, limited basically to replacing any plants that may have died during the first years, allow us to introduce a high number of plants per hectare and attend to tree and shrub strata, etc. The plants will grow normally with ramifications from the base and therefore the space will become increasingly natural in the future. Patience is more of a necessity than a gift, but after 12 years we can now see the results. Needless to say, all woodland plants have been produced with auto pricking systems and anti root spiralling, with a preference for hardened plants rather than

excessively large plants, and if possible micorrized, which is a key issue in the reforestation of highly degraded and biologically poor land.

With regard to origins, it is logical to say that as far as possible native plants are preferred, not only with regard to species, but also with regard to the origins of the seed and area of cultivation, as there may be ecotypical features that favour the development of the forest. Although there are no large forestry nurseries in our area, there are a number in the city and in neighbouring areas that produce plants with these characteristics. Moreover, the CEA has a small nursery for native plants, mainly for educational purposes, but in which all the plants produced come from seeds produced in the immediate area.

Although we believe this to be an expanding market thanks to the approaches put forward in this talk, one problem relating to native species is the fact that there are key species that cannot be found and on occasions the contractor or nursery manager try to introduce ornamental varieties of the species and in this regard special care must be taken. In our opinion it is preferable to replace those species with others in which we can trust.



7. Diversification of stratas in forestry plantations: use of dominant and accompanying species, as well as trees and shrubs.

In order to determine the dominant species and accompanying species, we must resort to current and potential vegetation maps, and once the reference community has been established, consult botanical studies that determine the species present and their proportions. It is important to take into consideration questions relating to microrelief, with regard to orientation, exposure, depth of soil, basin, slope, that may condition the specific distribution (no resistant species in environments with harsher conditions).

Reforestation allows us to attend to the tree and shrub stratum. The definition of the species to be used will include the tree and shrub stratum and although each community has its own peculiarities, about 50% of trees species and 50% of shrub species are used, and at least half of the main species are used while the other half are used for accompanying tree species. The reference density used is 2500 plants/hectare.

8. Forestry plantation campaigns with the participation of the public; more than 10 years of the "adopt a tree" scheme.

A small proportion of the actions taken in relation to reforestation are taken within the public participation campaign "Adopt a tree and grow with it". This year marks the 12th anniversary of this programme in which more than 24,000 people, mainly schoolchildren, have taken part. Participants have been involved directly in the work of reforestation and besides this, they have also got to know the new areas of the Green Ring.

Management of communities of herbaceous plants



9.Differentiation between lawns, meadows and grasslands with regard to their management, which requires differentiated or episodic mowing, as a means of expansion of populations of singular species. The different management methods required of lawns, meadows and grasslands are based on the specific nature of each case, and also consider objectives relating to its use by the public.

In our case, lawns are sown with commercial species and are used especially in access areas and areas frequented by large numbers of members of the public. These are mown between 6 and 8 times and cuttings are gathered on half of these occasions.

Grasslands are made up of native herbaceous plants species, fruit of a management method that allows natural colonisation. These are only mown once a year and cuttings are not gathered in order to avoid the appearance of woody species. These can be managed as a protective measure against fires at the end of the summer and as a habit diversification measure in forestry areas or for forestry regeneration.

Meadows are either the result of sowing with highly colonised commercial species or from successive clearing of spontaneous vegetation. These are mown three times a year maximum, and cuttings are not gathered.

These are located basically between lawns and hedge environments, in areas not frequented by large numbers of the public.

In some areas we have been successful in increasingly density and number of singular herbaceous species such as orchids, of which we might mention the following: *Orchis purpurea, Orchis militaris, Orchis piramidalis, Ophrys apifera, Anacampntis pyramidalis, Aceras antropophorum, Serapias lingua, Himantoglosum ircinum.* Their presence is possible thanks to the differentiated handling of mowing and clearing operations, which I delayed until the end of the flowering stage.

10. Herbivores used as an alternative to clearing grasslands, the case of deer and Salburua One alternative to mowing and clearing meadows is the use of herbivores, although these involve a number of specific requirements with regard to their management such as specific infrastructures (enclosures, cattle pens), agreements with breeders, etc. In the Green Ring, this is the case of deer on the Salburua wetlands.



11. Actions taken on the vegetation in the basin of the lake

Stripping the basin of the lake to remove nutrients and favour the development of acquatic species such as charophytes. Clearing the lake basin to limit the development of macrophytes, keep waters clear and favour the diversification of niches in the lake environment.

Spontaneous vegetation may become a veritable icon of a park, as is the case of Iris pseudocorus in Salburua Park, which, based on a small, pre-existing stand, with the recovery of the lake of the Balsa de Arkaute, has colonised large areas of the lake, constituting a visual image of great ecological and landscape relevance.

Measures for the management of the wood, groves and forestry masses

12. Intermediate cutting in order to conserve the hydraulic functionality of riverbeds and banks. A part of the Green Ring is situated on riverbeds subject to repeated modifications in order to resolve ageold problems of flooding in urban areas of the city. The situation requires management of the vegetation that proliferates in these riverbeds, especially in the case of rivers and diversion channels for flood control situated to the south of the city. This situation requires the periodic, annual or two-yearly thinning of woody species that might cause a considerable reduction in their hydraulic capacity.



13. The compartmentalisation of reforested areas through the creation of firebreaks. (See point n. 9)

14. The compartmentalisation of consolidated forestry masses through the creation of strips of lowcombustibility vegetation and the maintenance of access points to forestry tracks for fire extinguishing services.

The largest forest in the Green Ring consists of a mass of 100 hectares of gall oak, *Quercus faginea*, in a number of different states (mature woods, woods prepared for pastureland, stunted masses, etc.). Its conservation and risk prevention, especially with regard to fire and its preparation for public use, require that we carry out periodic clearing in order to compartmentalise the mass with strips of low-combustibility vegetation, pruning,

cutting back and clearing of ditches to guarantee access to forestry tracks for use by the public and emergency services.

15. Thinning treatments in woodlands As a result of inherited situations and erroneous decisions with regard to the choice of species, we are obliged in order to ensure the safety of installations and public use to apply intermediate cutting treatments to woodlands that are resolved more and more often by cutting these down completely rather than by pollarding or cutting back tops by two thirds.

Measures for the management of plant waste: REDUCE REUSE RECYCLE



#### 16. Respect the carbon cycle.

The incorporation of grass cuttings directly into the earth, reducing the number of mowing operations in which cuttings are collected to the absolute minimum, allows us to manage lawns and meadows without the incorporation of chemical fertilisers. In our forests, woody waste produced during the clearing of vegetation and woods is also incorporated directly or after being crushed appropriately.



17. Use of wood, the gathering of dead wood, an interesting niche for some groups of insects and the conservation of standing dead trees

18. "In situ" composting of herbaceous and fine woody waste

In each park in the Green Ring there is one or several composting areas of herbaceous, woody and crop waste. These are placed as near as possible to the area where this waste is generated, minimising costs and energy expenses due to the transport of waste, and its re-utilisation as marching and organic supplements in new plantations.

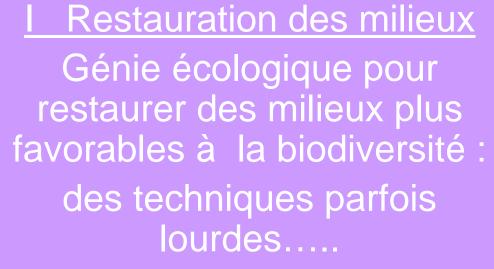
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L'exemple des marais d'Haubourdin





....Des terrassements créent les conditions d'installation de milieux favorables

Ici champs avant travaux...

## terrasser pour recréer des marais...

lci, après travaux

Indispensable gestion fine de ces milieux reconstitués, stratégie d'inventaire, d'évaluation et de suivi des potentiels.

## **Résultats:**

- n Inventaire 2000: 330 espèces
- n Inventaire 2007: 350 espèces
- n les retours: une majorité de plantes protégées et menacées



n Butomus umbellatus



n Blackstonia perfoliata



n Anacamptis pyramidalis



Bidens tripartita

n



n Cyperus fuscus



n Ophrys apifera



n Verbascum blattaria



n Platanthera clorantha



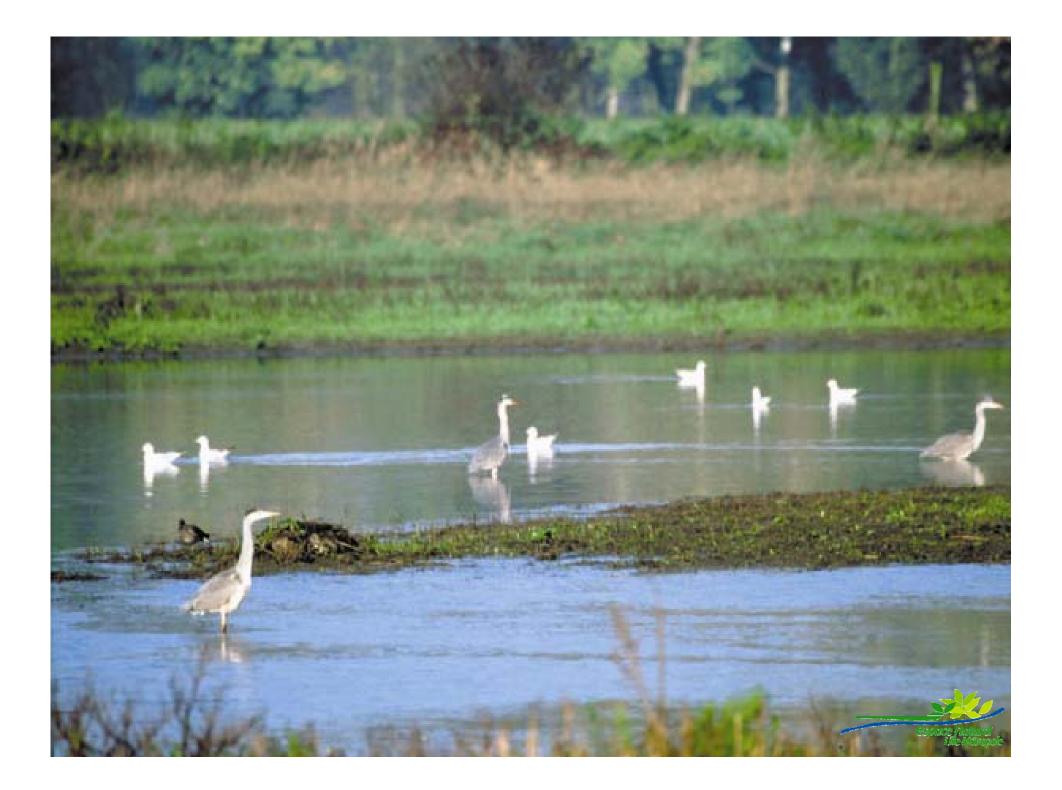
Lathyrus tuberosus

n



n Lathyrus aphaca





Stratégie d'aménagement pour limiter les impacts du public:

Des chemins confortables

Des défenses discrètes mais efficaces -Des clôtures de type agricole -Barrières végétales -Hales d'épineux -Des fossés étudiés

Quelques sites attractifs

# Clôtures de type agricole

## Des chemins confortables





# Le 'pot de miel': NOSAÏC le jardin des cultures

II <u>Gérer la végétation sous les lignes hautes tensions</u>
 L'exemple de Fretin:
 Des échanges et formation des agents RTE
 La reconversion de plantations taillées tous les ans en zone humide herbacée

III Les phytopathologies récentes.

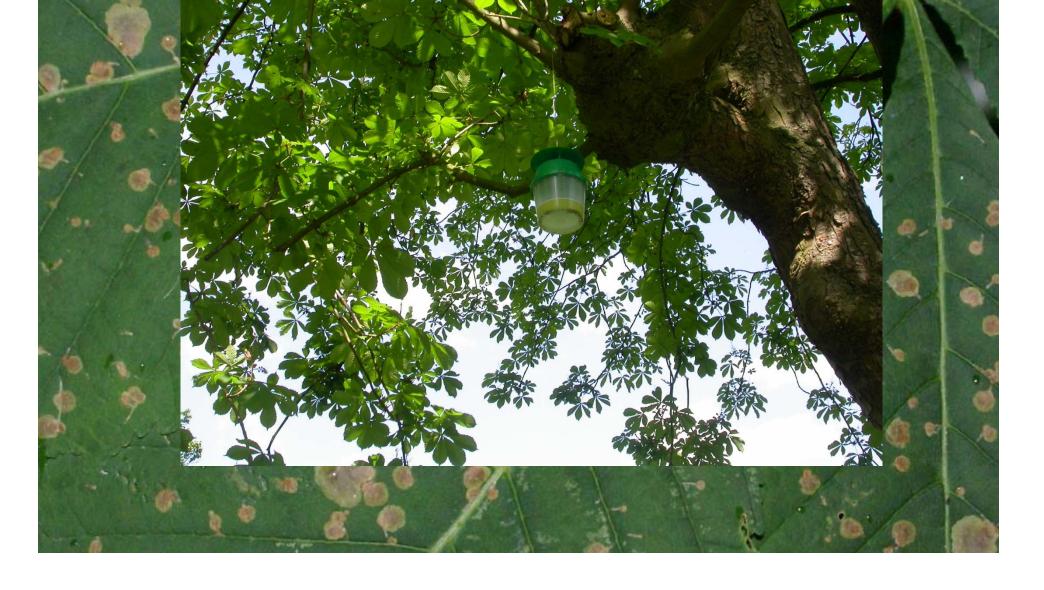
-<u>La mineuse du marronnier :</u> piégeage sexuel sur les sites stratégiques, élimination des arbres sur les autres sites

Lutte contre les moustiques:

traitement biologique agrobactérium tumefaciens, bacille

<u>-Gobalement très peu interventionnistes</u> : Priorité à un grand choix d'espèces accueillant des auxiliaires

# La mineuse du marronnier : Utilisation de pièges à phéromones



A.

**Espace Naturel** Lille Métropole

IV Les invasives: Les cyanobactéries : un essai intéressant La myriophylle du Brésil: intervention manuelle La renouée du japon: deux méthodes

# Lutte contre les invasives: Myriophyllum aquaticum avec un lycée horticole

# Les cyanobactéries:

Suite à des expérimentations canadiennes : premiers essais d'utilisation de paille d'orge : 1 tonne/hectare

Cet essai fait partie d'un protocole de

Deux méthodes pour lutter contre Polygonum japonicum:

 une fauche tous les 15 jours durant la saison de pousse pendant 3 ans

 trois traitements au glyphosate à un 1.5 mois d'intervalle pendant 1 an Difficile d'avoir assez de constance et d'organisation pour passer durant 3 ans sur les mêmes sites avec rigueur pour réaliser le fauchage

Bilan carbone Passages Consommation Energie Bilan IOE nécessaire à en litres essence essenc pour 2000 m2 carbone a fabrication de renouée en gr de par passage en litres CO2fauche 3 ans 18 1080 g 2 36 glyphosate 3 0 30 g 3

V <u>L'exploitation du b</u> Reconversion de peu leraies: L'exemple des marais d'Haubourdin

Une peupleraie de 45 ans sur 9 hectares explotée et reconvertie en boisement pérenne avec adhésion • au PEFC, • à un centre de la gestion de la • conseils de l'ONF

Vente du bois sur pied 3000 M3: 78 500 €



### The management of forests and natural sites in the Park of Portofino

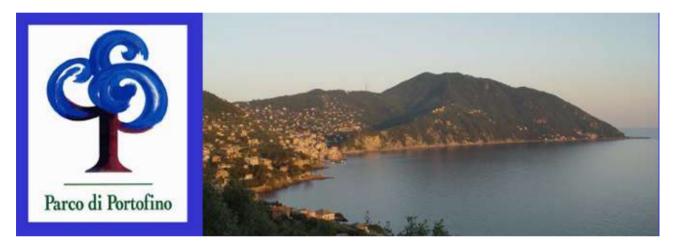
Dr. agronomist Antonio Battolla Park Authority of Portofino

The park of Portofino is a small protected area that stretches over 1,056 hectares of the Portofino promontory with the same name that opens up towards the open sea for about 3 km, interrupting the even coast line on the eastern side of Genoa.

The area of the park represents a break of the continuum of settlements that occur with almost seamless continuity along the coastline from the metropolitan city of Genoa.

The proximity to the region's capital (10-15 km) and its characteristic territory not or little installed, embedded in a densely populated coastal area, give it to all intents and purposes the characteristics of a peri-urban park.

The conservation so far of this sparsely inhabited, "natural" matrix, is to be attributed mainly to geological and orographic characteristics of the promontory.



In fact, the geological nature of the promontory (mostly made up of extremely compact conglomerates and resistant to erosion, formed by sedimentation in the seabed and subsequently emerged) is the basis of the accentuated acclivity that marks the southern slopes and that has prevented the construction of passable roads and major settlements important in the past centuries, with the exception of some ancient fishing villages of religious or rural origin, which it circumscribes, constraining their size.

On the other hand the territory of the Mount of Portofino, just to be located in a densely populated area, although spared by urbanization, has suffered profoundly the action of man who, until the beginning of 1900, has exploited it also intensely for the supply of raw materials needed to meet various needs of an economic system based primarily on agriculture.

Looking at the historical sources shows how over the centuries the needs of conservation and protection of the heritage of forests and more generally of the environment of Mount of Portofino have repeatedly alternated with periods of intense and sometimes irrational exploitation; similarly devastating phenomena such as fires or floods occur periodically, as local archives and official documents of the nineteenth and early twentieth century show.



The exploitation of the forest, which dates back to the Iron Age (V-II sec. BC) took place until the first decades of last century, and the intense and sometimes irrational exploitations have been alternating with periods of regulation and levy interventions to reforestation with which, however, some not native species (domestic pines, cypresses, thuja, cedars, sequoias, locus trees, etc.) had been introduced.

The maximum of man's intervention pressure took place at the end of 1800. Cultivated areas, on terraced bands supported by stone walls, extended on the slopes of the mountain up to where acclivities allow it.



The summit areas on the ridge instead, and in the most ascending areas produced woods and scrubs and were also used for agricultural purposes. The mixed wood mesophyllic (*Ostrya carpinifolia, Fraxinus ornus, Quercus pubescens, Quercus ilex, Castanea sativa*, etc.), present on the cacuminal sides or exposed to the north, used to be cultivated by short periods of coppicing for the promotion of paleria and firewood. The shrubs of the Mediterranean marquis (*Arbutus unedo, Erica arborea, Myrtus communis, Pistacia lentiscus, Rhamnus alaternus*, etc.) were also taken for the use of firewood and for feeding livestock.

In both environments charcoal used to be produced and the herbaceous layer served for grazing and the production of dried fodder, in particular Lisca (*Ampelodesmos mauritanicus*) fulfilled an infinite number of domestic uses (plant-covers for roofs, ropes and baskets, food for livestock).

Looking at historical photographs from the beginning of the 20th century, a landscape profoundly different from today's can be observed, barren and with little vegetation especially on the southern slopes.

The establishment of the Park in 1935 took furthermore place in order to preserve an environment that the academic and scientific world today regards highly for its exceptional natural value, for the presence of rare enations and floristic and zoological endemisms, as well as for the coexistence of ecosystems and species that usually occur in completely different areas and yet can here be found in close proximity to each other.

In fact, the vegetation differs greatly from other parts of the promontory in its particular orographic and geological conformation/shape/form, due to the influences of exposure, acclivity and altitude.

The natural uniqueness is therefore represented by the simultaneous presence, sometimes within the space of a few tens of meters, of species and plant linkages that are typical of both cold-temperate environments (mainland) and the Mediterranean.

The establishment of the Park in 1935 changed the framework described above profoundly and, apart from a period during the Second World War, in which for autarkic reasons the withdrawal of materials was still authorized, the park fell under a strictly conservative regime, facilitated by changing economic conditions of the population for whom agriculture played an increasingly marginal role. The rules of the time strictly prohibited the cutting of plants and the removal of any specimen of the present flora. Thereby began a period of "passive protection" that was rigorous and sheltering and that lasted for about 50 years, until 1995.

During the long period of the forest use for firewood of mixed mesophyll woods, the cutting of coppices gave rise to the growth of many shoots that periodically, at the end of the forest turn, needed to be trimmed. The woods maintained through the alternation of growth and reduction of wood material an silvicultural type equilibrium governed by man.



With the abandonment of farming practices and felling, the "antropizzati" woods had therefore begun evolutionary process in search of diverse conditions for an equilibrium with the environment, in which the conditioning factors were solely natural: characteristics of the soils, orography and climate.

But this course, which took several hundred years, passed through intermediate states of an apparent degradation of the vegetation.

The no longer coppiced (trimmed) stems increased the amount of wood mass to such a degree that the soil was no longer able to support them and frequently, under the pressure of wind, they would break and fall. This way glades arose that were then colonized by different young plants, which initiated a series of evolutions, leading to the formation mixed, multilayered woodlands and compounds from predominantly native species.

With the establishment of the Regional Park Authority in 1995 (which replaced the previous Regional Instrumental Authority and the earlier National Authority) began a management of the terrain based on policies of "active protection".

A research to find a balance between the need to improve and to eliminate some of the park's sites that visitors and local people often regarded as dilapidations of the environment and landscape had been carried out (paying close attention to public opinions and political battles under way in those years, which often spoke against the establishing of parks, as their organizations were prejudiced by inactivity and mere prohibiting) and solutions that would respect the natural evolutionary processes of the park were researched.

First of all, a coherent plan had to be drawn up of the wildlife, forestry and environmental reorganization and upgrading of the park's area that was adopted in 1997, based on the above represented opposing needs.

The plan parts from the analysis of existing vegetation, based on a "forest types" methodology, which provides the classification of the forest vegetation on an ecological and dynamic (evolutionary) basis for the practical aims/results of the silvicultural management (del Favero, Andrich, De Mas, Lasen and Poldini 1990). Presupposition of this methodology are knowledge of climate, geology, soil and the vegetation in the broadest sense, which expresses in its variability the ecology of the current position and evolutionary stage of the forest. Thus the species of herbaceous shrubs and undergrowth become, as they are observed in their entirety and various

linkages, indicating species under sinecological aspects and of the vegetation's maturity, which contributes to determine further "types", the fundamental unit of classification.

We identify the types, subtypes and their relative variations (ostrieto, chestnut, robinieto, mesophilic and thermophilic ilex, strawberry tree and heather plants, secondary scrubs, Mediterranean pinewoods, ampelodesmeto, vegetation of rupicola and in debris, etc..) leading to the Charter of forest types and of other activities and uses of soil.

On the basis of naturalness attributed to different uniform particles of the various elaborated forest types, the Charter of purposes and management objectives is then drafted, classifying the various sections of the park in areas of high, medium and low naturalness.

Finally, the Charter of management operations indicated for the various elements /subdivisions the interventions to be carried out to support and accelerate the natural evolutionary process on site and to improve precisely the spots with waning vegetation and "trivialization" of the landscape.

In the steep slopes exposed to the south where the Mediterranian maquis prevails, characterized by a high degree of biodiversity in equilibrium with the environment, which tends to evolve naturally toward formations to ilex if not crossed by a forest fire, the plan has indicated the free development and the free evolution of the vegetation.

The management of these environments, which for their spectacular coastal landscapes are the most visited in the park, is limited to constant maintenance of the rich network of paths, which offer different levels of difficulty, and other interventions aimed at the prevention of forest fires.

In contrast to the mixed woods, mesophylls are used to indicate interventions of cutting of indirect conversion through thinning and selection of mass of the current formations to excessive density, favouring native species. Intermediate directions are given for associations stand with a pine forest.

These indications are based on the zoning in which the Plan of the Park Area operates, approved by DCR No 77 33, 26/06/2002, and the Regulation of interventions on vegetation approved by DCR No 41, 4/11/2005 that controls the operational modalities for the implementation of various interventions.

But as early as 1997 the Park Authority park began to plan the implementation of interventions, of which the first, carried out up until 2002, were of a predominantly experimental value and were intended to monitor the effects on the vegetation, as well as to make some important excursion routes safe, where recurring falls of big trees endangered the safety of visitors.

Since 2002 an operational plan for improving forest divided into 5 interventions has been approved, which is to be carried out on the same number of homogeneous lots over a surface of public property of approximately a total of 120 ha.

At the same time a regulation has been adopted for the payment of economic aid to individuals who wanted to have improvement work done of the woods on their property.

The interventions so far achieved on the first 2 lots of public property consist of thinning cuts and of introducing/preparing/starting higher stems/stalks, eliminating plants and shoots that are in excessive, malformed, in bad condition or affected by other plants. These operations, handled by agricultural cooperatives and local forestry, are being performed according to the methods of forestry and wildlife, and in respect of its inhabitants and protected species by the UE (SCI Park Portofino).



The removed materials are partly left on the terrain in order to enrich the necromass of the soil, or defoliated to be used as firewood and partly used as wood to work with.

In collaboration with a local cooperative, which has set a place for chestnut woodworking, we are making tables and wooden benches to equip all parking areas, and wood panels to replace hiking signs, information screens and boards of welcome.

We started a small local chain, virtuous and ecologically sustainable, which allows you to re-place timber from cuts of improvement over the equipped areas of the park and also for the implementation of works by consolidating the slopes through the techniques of 'Engineering nature.

The good finishing material produced, according to a simple design and straightforward but effective and functional, and the relative abundance of chestnut wood allow in the coming years to extend the intervention of development parking and picnic areas adjacent to the park and to the various coastal municipalities in the province of Genoa.

# Strips of low levels of combustibility and the fight against invasive species: key points of the vegetation management strategy in Collserola Park.

Lluís Cabañeros, Head of the Natural Environment Service

Collserola Park, with a surface area of 8,465 ha, is home to 6 distinct natural environments, associated with habitats, for different species of wildlife.

Forested environments predominate:		
Mixed forest of pines and holm oaks	58,4%	4.944 ha
Mixed forest of holm oaks and deciduous oaks	2,1%	178 ha
Maquis and garriga scrub	5%	423 ha
Riverine forest	0,5%	42 ha
		5.587ha
over environments of open areas:		
Meadows and matorral scrub	17,6%	1.490 ha
Farmland	6,3%	533 ha
	23,9%	2.023 ha

Both forested areas and open areas were abandoned by their owners in the 1950s and 1960s leading to the growth in the tree and shrub layer which has increased the amount of combustible material and exposed these areas to high risks of forest fire.

The prevention of forest fires is one of the greatest concerns and one in which most money is spent in order to prevent destructive events of irreparable consequences in short periods of time.

There were an average of 57 fires between 1990 and 2007 with an average burnt area of 27 ha a year. For this reason the prevention of forest fires has influenced the actions taken on vegetation.

#### Fire breaks

These are areas in which extinction teams can work safely. The shrub layer is completely eliminated and the tree layer is thinned out reducing the density from approximately 2,000 trees/ha to 500-600 trees/ha. The areas are cut back along fire prevention tracks to a width of 25 m on each side of the track. They are not utilised unless the fire fighters make use of them. Where slopes permit, machinery is used to shred the vegetation, while in other areas manual cutters are employed. (images 1, 2, 3 and 4)

The result can be seen in the figures. Creating fire breaks costs 2,700 €/ha in addition to 930 €/ha for maintenance (VAT included). These prices are for this year (2008), and were awarded after a public tender applied for by 7 companies.



Mediterranean vegetation is characterised by the ability of species to re-sprout, and thus to keep the breaks clean, it is necessary to carry out maintenance work at a maximum interval of 2-3 years. In urban breaks (25m wide until inhabited area), maintenance work must be carried out every 1-2 years.

In order to reduce costs and increase the efficiency of the breaks we have employed alternatives to mechanical maintenance involving the use of grazing with flocks of sheep and goats (image 3). Considerable thought needs to be given to the infrastructures that these animals require, because as these breaks run along great distances, the flocks need to travel many kilometres to find sufficient food to counteract the energy expenditure involved. The quality of the pasture, the lack of water, rest areas, etc. are factors that need to be taken into account in order to achieve the desired results.

Once the minimum level of risk of a large forest fire is achieved, we attempt to manage the different environments separately in order to prevent the vegetation from developing naturally towards the type of vegetation which would develop in the case that no intervention had taken place; that is, Mediterranean holm oak wood.

#### Maintenance of open areas

As far as the maintenance of open areas is concerned, fire is our unwanted ally. The majority of fires are declared in open areas on the Barcelona side of the range. The slopes, wind and combustibility of the type of existing vegetation (herbaceous), helps the fire to rapidly make its way up to the crest of the mountain, where, in most cases, it is extinguished by fire-fighters. As with fire breaks, grazing is the best solution, but the lack of infrastructures hinder comprehensive management of these areas.

Another option is the recovery of farmland. Of the 533 ha catalogued, no more than 200 ha are currently cultivated. We are drawing up a Special Farming Plan which will provide an inventory of the farmland,



independent to its ownership and state of abandonment, in order to revitalise these environments, keep them open and prevent or delay their natural development towards forest. (image 5)

#### Plant health treatments

We carry out work against specific highly aggressive pests such as the pine shoot beetle *Tomicus destruens*. (images 6 and 7) This beetle first appeared after several heavy hailstorms in 1994 and attacked specific but extensive areas of the park. The main action involved felling the affected trees. Treatments were carried out using insecticides derived from pyrethrins on the tree trunks piled up in order to prevent the adults, when they leave the trunks, from attacking healthy trees.



Pine processionary (*Thaumetopoea pityocampa*) (image 8). Since 1988 we have been carrying out an annual monitoring programme on the flight pattern of the adult male with 63 pheromone traps distributed around the eastern side of the park. The treatments are designed in function of the annual number of individuals trapped and are performed exclusively on young replanted areas and pinewoods in contact with urban areas or leisure

areas such as the case of the figures; the Paseo Mirador which receives almost 30,000 people a month. The principal reason for the treatment is to prevent allergies produced by the caterpillars when they fall from trees or when people touch the stinging hairs of the caterpillars. The work is done from the air, generally with a helicopter, using Bacillus Thuringiensis as an insecticide when the caterpillar has not reached 2 cm long. The approximate cost of the treatment is  $45 \notin$ /ha (VAT included)

#### Control of exotic invasive species

We act against species which we consider are expanding and are present in all the environments of the park, as is the case of tree of heaven (*Ailanthus altissima*) or when a species occupies an environment in its entirety, as is the case of pokeweed *Phytolacca americana* in all shady and riverine environments.

Prickly pear (*Opuntia ficus-indica*), Agave americana, aloe (*Aloe maculata*) and giant reed (*Arundo donax*) are in a stage of consolidation and beginning to expand. Unlike the tree of heaven, these species are not as widespread and are localised in the sunnier areas of the park in the case of the first three and in the streambeds and riverine environments in the case of the reed.



In the picture 10 we can see a group of trees of heaven which, taking advantage of a particularly dry period, during which time autochthonous species such as pines and holm oak died due to the accumulated drought, were cut at ground level in August 1994. After 15 days they had re-sprouted and they were the only green patch on this stretch of road. These were the first attempts to try and combat a species with very considerable survival and colonisation abilities.

With the help of the volunteers of the Park, we have attempted to pull out shoots and young trees, but we discovered that individuals of less than 1.5 cm in diameter and seedlings could only be pulled out in accessible and flat areas. The problem was that new plants would sprout from the roots of the plants which had been pulled up. We also tried 10cm-wide bark ringing in trees of distinct diameters but the trees sprouted again.

Another method which has been tried involved the use of specific herbicides in the grease of the chainsaws. We stopped using this method due to the difficulty in controlling the effective doses necessary and the fact that the grease would often continue to drip a considerable distance from the area of action, causing undesirable effects on plants.

When we saw the results, we decided to opt for chemical means, using herbicides (image 11). In order to prevent dispersion in the air of the products, we injected the herbicide inside the tree. The method involves drilling a series of holes in the tree trunk and at ground level using a 10mmdiameter drill bit, in a lateral direction and towards the root and separated at between 5 and 7 cm. (image 12)



Ailanthus altissima



A battery-powered electric drill was used with a small portable generator to recharge the batteries in the field.

In each hole  $\sim 5 \text{ cm}^3$  of the following mixture was injected: (image 13)

50 % water, 25 % roundup (glyphosate 45 %), 12.5 % Tordon 22 K (Picloram 24 %) and 12.5 % Banvel Triple. (2.4-D 29.6 %+Dicamba 10 %+MCPA 26.5 %)

The best time of the year for application is autumn. We have not had good results in other seasons as the following spring the plant has re-spouted. The treatment must be complemented the following year by attacking the plants germinating from the seeds dispersed by the trees which were treated. This action can be done by spraying with a backpack on each seedling and only using glyphosate in autumn. Maintenance must be carried out in successive years because the seeds in a latent state can germinate. With this methodology we have begun to put a brake on the unbounded expansion of the species by concentrating our efforts on the elimination of isolated colonies.

### Restoration of the margins of torrent de Colobrers - Ripoll fluvial Parc

Miquel Baldi, Ajuntament de Sabadell



The River Ripoll forms part of the basin of El Besòs, which has an area of 1,000 km2, a network of 180 linear km, and covers a territory populated by approximately 2,000,000 people in which there are around 10,000 industries.

The Ripoll is a tributary of El Besòs and it is located, together with the river Riu Sec, on the westernmost slope of its basin.

It appears at El Sot del Galí, in the Granera range, 640 metres above sea level, and flows into the River Besòs at Montcada i Reixac, 35.5 metres above sea level. Along its 40 km course, it crosses the municipalities of Sant Llorenç Savall, Castellar del Vallès, Sabadell, Barberà del Vallès, Ripollet and Montcada i Reixac, all of which are located in the county of El Vallès Occidental.

The core areas upon which the project is based are:

- The improvement of water quality.
- The recovery and improvement of industry and of its sorroundings.
- The management of historical kitchen gardens and the elimination of marginal kitchen gardens.
- The recovery of industrial and architectural heritage.
- The recovery of recreational and leisure zones.
- The recovery and protection of the river banks and bed.
- The recovery of the landscape.
- Maintenance, surveillance and promotion of awareness.



The Torrent de Colobrers is one of the most characteristic riverside zones of the municipality of Sabadell; this site is traversed by the GR-97 path. Along the initial stretch, this stream, which has its source at Castellar del Vallès, is simply a typical Mediterranean-regime course with few days of constant volume flow. When it enters the municipality of Sabadell, however, the continuous spring of Can Moragues creates a constant volume flow and turns the surroundings of the stream into one of the most environmentally and scenically valuable riverside landscapes in the county of El Vallès. Downstream, numerous run-in points and a second spring, La Tosca, increase the volume flow and therefore the quality of the zone. Despite heavy anthropic impact, evident in plane trees and bay laurels, the zone has some interesting riverside vegetation.

In 1981, this zone was affected by a fuel spillage that considerably damaged the stream. From 1991-1994 it was cleaned and restored by an environmental school-workshop. Subsequently, in 1996, Naturalea Conservació, SL undertook a second round of restoration work with funds from the saving bank Caixa de Sabadell Foundation, and since then it has been periodically maintained and improved by the City Council.

At the point where the GR-97 path, in the direction of the River Ripoll, leaves the stream to head to Can Pagès, the stream's condition worsened. The Ripoll river was in a deplorable state and so this stretch was constantly ignored. Once it had been recovered, however, Sabadell City Council has regained the final stretch of an extremely emblematic zone.



Prior to restoration, this section of the stream was in the following condition:

- Heavy deterioration of the riverside vegetation because of human impact on this section of the stream and of the River Ripoll, as both zones have suffered numerous spillages, clearing and occupation of the riverside zone. Mass colonisation of reeds have also had a negative impact on the development of the riverside vegetation.
- The changes in the river mouth prompted instability in the geomorphologic structure of the banks and the slopes of the final stretch of the stream. Moreover, despite recovery of the riverbanks achieved through expropriation in this last stretch, the active changes of the river bed and the impermeabilisation of the headwaters at Castellar del Vallès, increasingly frequent torrential phenomena hindered the establishment of these banks considerably.
- These situations caused landslides and jeopardised the kitchen gardens at the top of the slope. The instability of these unprotected slopes was increased by their deforestation.

Before starting restoration on the confluence, we realised that the work would not be possible in the zone without first resolving the problems of this last section of the stream.



Restoration of the stream has involved the following measures:

- Selective removal of allochthonous species in the river, particularly giant reed (*Arundo donax*) and narrow-leaved ragwort (*Senecio inaequidens*).
- Control of the erosion caused on the banks of the river bed and of the stream.
- Elimination of discharges onto the river bed and cleaning of the slopes.
- Solution to problems of river bed dynamics that were causing regressive erosion and making the base of the slopes unstable.
- Protection of the water outlet 80 metres downstream.
- Continuation of the riverside woodland structure to the outflow zone.
- Enhancement of the plant structure of the confluence by creating grass and reed zones, and other characteristic riverside herbaceous communities.
- Connectivity between the two trickles has been guaranteed.

Many riverside herbaceous plants have a great biotechnical capacity, which makes them suitable for solving structural problems. The table below details those used in this project:

Olant especies	Common name	Biotechnical properties
Iris pseudacorus	Yellow iris	1, 2, 3, 4,5
Scirpus holoschoenus	Round-headed club-rush	1, 2, 3, 4
Scirpus lacustris	Common club-rush	1, 2, 3, 4, 5
Carex vulpina	True fox sedge	3, 4
Lythrum salicaria	Purple loosestrife	3, 4
Juncus acutus	Spiny rush	1, 2, 3, 4
Phragmites australis	Common reed	2, 3, 4, 5
Phalaris arundinacea	Reed canary grass	4, 5
Mentha aquatica	Water mint	4, 5
Arum italicum	Cuckoo pint	4, 5

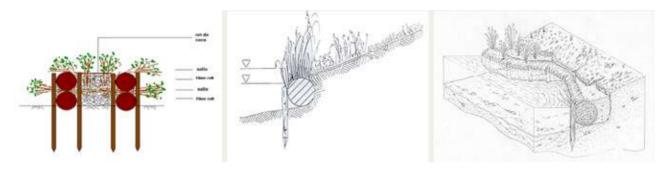
1 Deep root system

2 Resprouting capacity

- 3 High elasticity of the aerial part
- 4 Adaptation to periodic immersion
- 5 Intervention in natural-green filter purification processes

#### TECHNIQUES USED

#### 1. Installation of fibre roll



#### Front section

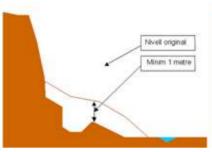
Side section

Perspective

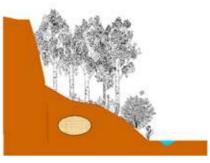
#### 2. Elimination of reed (Arundo donax)



Elimination of aerial and rhizome part.



Digging, lay out of reed and covering.



Planting

3. Production of terracing



Sinking of wooden stakes where the material is structured horizontally.

Final appearance.

## Vegetation management in the Monsanto forest park (Lisbon)

Carlos Souto Cruz - Departamento Municipal de Ambiente Urbano, Câmara Municipal de Lisboa

The Monsanto park has an area of approximately 1000 ha and it is located in a hill nearby the center of Lisbon. It is the main element of the city green structure. Created in 1938 as a peripheral park of Lisbon, it represents now the role of the central park of the Lisbon agglomeration (with about three and a half million inhabitants).

The vegetation management of the Park of Monsanto changed its main strategy over the years: between 1938 and 1960 it is the "creation of a forest" between 1960 and 1990 it is the "natural plant succession" from 1990 onwards it is the "control of invasive plants"

#### 1. Creating a forest:



Fig. 1: In 1938 the Monsanto hills are covered with agricultural fields and pastures.

The only trees are those along roadsides and in old gardens and "tapadas" where we can find some old wild olive trees and other species as *Phyllirea latifolia*, *Phyllirea angustifolia*, *Arbutus unedo, Viburnum tinus*, etc.

In the park there are two different types of soils, one of a basaltic origin and the other one of a limestone origin.



The basaltic soils which are very effective in wheat production due to the development of small cracks in summer that destroy the invasive grasses, represent nevertheless a problem for the growing of trees. During the first plantings, most trees did not survive.

In 1939 the selection of species to be planted in Monsanto Park was determined by their functions: stands for recreation (mainly with *Cupressus* and *Acacia melanoxylon*), pioneer stands with pine trees (like *Pinus halepensis* and *Pinus canariensis*) and also umbrella pine (*Pinus pinea*) with its dual function (pioneer and recreation). Some elements of indigenous forests as the green oak (*Quercus rotundifolia*) and the cork oak (*Quercus suber*), the climax species in more arid areas, have been introduced, as well as the pedonculate oak (*Quercus robur*) in wetlands.

But the slow development of the trees was only partially solved by introducing several *Eucalyptus* species (14 in total)

But some problems appeared:

a) The Aleppo pine on basaltic soils does not develop its roots vertically, but horizontally, which is not adequate for fixation. Then the older trees fall down.

b) During the driest years *Acacia melanoxylon* dies quite rapidly, even after more than 40 years without problems.

2. The natural plant succession

The original vegetation of Monsanto has been totally eliminated more than 3 or 4000 years ago, although some patches of natural vegetation were noticed during plantations (in farms and "tapadas") as well as some areas with root shoots of species that were not introduced such as *Prunus spinosa, Ulmus minor, Quercus coccifera* and *Quercus pyrenaica*.

It was also found that close to areas where natural brush have developed a large number of species, some indigenous trees were growing (the most abundants are *Phillyrea latifolia, Viburnum tinus* and *Olea europaea* var. *sylvestris)*. Other species have also settled, such as *Pistacia lentiscus, Rhamnus alaternus, Rhamnus lycioides* subsp. *oleoides, Phillyrea angustifolia, Myrtus communis, Quercus coccifera, Juniperus turbinata,* and so on. (Fig. 3) Those trees came from seeds transported by birds.



Fig. 3

In fig 4 the evolution of ecological corridors between 1960 and 2000 can be seen.

3. The control of invasive species

Over the years Monsanto has been populated with various species of invasive, little aggressive, trees, such as Acer negundo, Robinea pseudacacia and Schinus terebenthifolia.

In very degraded habitats, some species are found such as *Nicotiana* glauca, *Ricinus communis, Albizzia lophanta* and *Phytolacca dioica*, which are very aggressive species but with a reduced longevity.

The most dangerous invasive species in Portugal is *Acacia dealbata*, fortunately located in small, well controlled spots in the park.

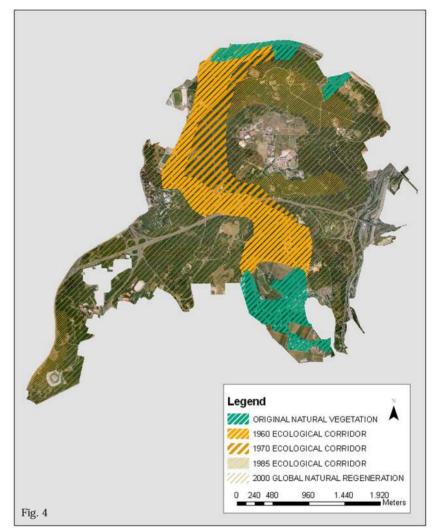
The *Ailanthus altissima* is another highly invasive species spread across the park and very difficult to control.

Another group of invasive species are the vines "tree killers" as *Polygonum baldschuanicum* and

*Ipomea acuminata* among others. Some forested areas in the park have been partially destroyed by these species and their control has taken several years. Root cutting has been tried (it is not possible to use systemic herbicides because of trees) but this did not solve the problem so that the following procedure was to cut plants

twice a year at the soil level as if they were grass and then cutting the climbing branches every two years. The problem has been solved in eight years.

Nevertheless, the most dangerous invasive species in the park are those that possess a similar strategy to that of indigenous species. Stands of *Acacia longifolia* and mainly *Pittosporum undulatum* have been subjected to major interventions in the years 2000 to 2004.





### "The Metrobosco Project"

Bruna Brembilla, President of Milan South Agricultural Park

More and more European towns are having to handle the question of peri-urban green zones, farming and natural ones, places where country and nature meet the town and vice versa. That is the institutional and planning reality of the Milan South Agricultural Park.

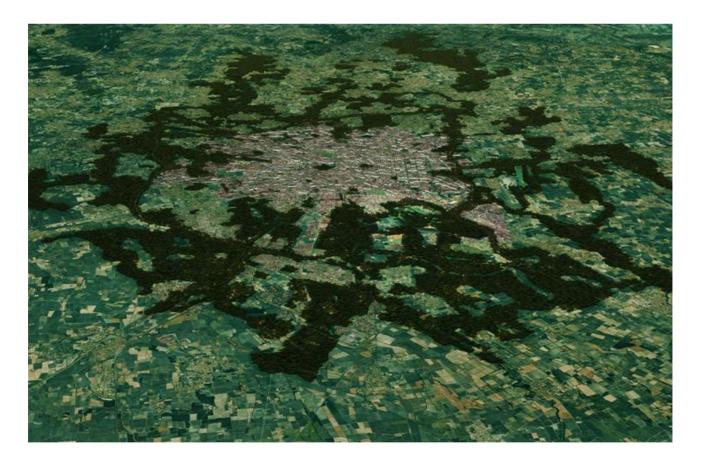
These parks have a very special connotation and anyone expecting to find clearly defined borders and configurations could be disappointed. In fact, they merge with the urban realities or farming land they are immersed in or surrounded by.

These simple remarks enable me to say that growth strategies required are thus generated through policies that can be summed up in two basic areas: the environment and preservation, as elements maintaining and increasing biodiversity.

These subjects are closely linked and, for someone like me who handles the governance of a park from a political point of view, are not only indivisible but become the engine generating the territorial environmental preservation, growth and valorisation needed.

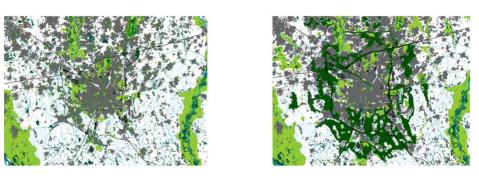
Our parks cover parts of the territory showing how hybrid the areas are; these are generated by that mosaiclike mixture: natural areas, rural areas, and those linking the two. This mosaic identifies our peri-urban spaces and gives them, in metropolitan areas, a complex re-establishing, linking role, along with adding value to non built-up areas which, due to their intrinsic nature, contribute to that strategic, new, urban wellbeing.

That variety of roles and identities taken on by protected peri-urban spaces gives them a certain importance in the sustainable growth of the metropolitan areas we live in and generates high identifiability for local players going from local administrators to citizens using that same space.



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... domani



I will now tell you about an experience launched by my councillorship in July 2006 involving all potentially interested local players.

The "metrobosco" project: promoted by the Milan Province Councillorship for the Environment, this is a great metropolitan idea for people's wellbeing and one of 6 pilot habitability projects in the Strategic Milan Province "Città di Città" project, inaugurating new environmental intervention in the Milan South Agricultural Park.



The main "metrobosco" project means to increase new forestation of provincial areas and integration with existing ones, adding specific value to those implemented in the Milan South Agricultural Park areas; this to create a large wood embracing the metropolitan area.

This chance to create a large, continuing ring of green areas in the urban and Milanese peri-urban metropolitan area redefines relations between city and countryside creating new forms of forestation; this by creating new woods or recovering rows and typical hedgerows of the South park's farm landscape, and affects the areas remaining in and around infrastructures present in the area.

Projects to be integrated by the "metrobosco" go from those at citizen level with Milan Town Council's "Raggi verdi" (Green rays) to the wider Lombardy Region one called "10,000 hectares of green infrastructures and systems".

In various ways, these are also linked to projects involving strips outside the Milan South agricultural park such as: the "Dorsale Verde Nord" (North Green Dorsal) of the Milan Province's Territorial Planning Councillorship and compensatory projects linked to large existing or imminent infrastructural works.

Such a vast forestation project impacts on both environmental and socio-economic variables and, for that reason, the first two years of the project meant we had to travel down a complex shared confrontation path between:

- Central Administration (Ministry for the Environment and Territorial Protection, Ministry for Agricultural, Food and Forest Policies),
- Regional Administration,
- Milan Province Councillorships involved,
- Administrations of Milan Town, towns in the metropolitan area, Town Associations and Town Consortiums;
- Farms, parties owning areas (infrastructural companies, foundations, real estate companies, single owners, etc.).

- University and research institutes,
- Farmers Associations,
- Associations of landowners and the entrepreneurial world,
- Road Infrastructure Management,
- Environmental and local associations.

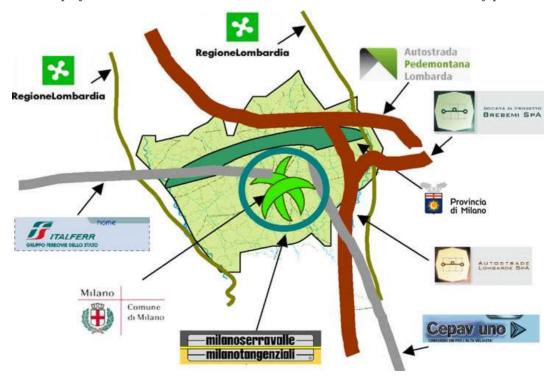
The right forecasting models and scenarios are enabling enabled us to plan with the integrated, systemic vision of a "Milanese Metropolitan Area Wood". Where maintaining biodiversity tries to intersect in the right way with productive farming present in the park area.

Agriculture, a connective subject for the Milan South Agricultural Park, can now constitute that strategic growth element if combined with preservation. In fact, the farming area covering almost the entire park hosts and influences biodiversity; and if, up to a short while ago, community farming policies facilitated support of production, now sustaining the "metrobosco" project becomes an important multi-functionality challenge; the priority is to create green areas responding to the needs of a farm area that is going to change considerably, especially close to the large city.

The following are some of our goals:

- Transfer large-scale scenarios to a local level by sharing needs and availability of the different interestholders.
- Redefine relations between city and outlying areas
- Do things that can then lead to public use
- Reduce emissions of CO<sup>2</sup> and particulate matter
- Improve the quality of air in towns with worse environmental problems
- Protect biodiversity by creating an ecological network
- Maintain and develop compatible, multi-functional farming
- Define a supporting economic framework for forestation finding financing, and finance methods to maintain and manage said forestation.
- Long-term offer of an alternative to present types of economic support for farming.
- Cost/benefit analysis related to forestation purposes, also searching for alternative production possibilities (use of valuable wood trees, recovery of biomasses for energy).

The complex job done so far has meant we can now draw up a balance sheet of the first two years of the "metrobosco" project, and be satisfied with these first results which I feel are extremely positive.



Players present in the area have been really available; in fact, the "metrobosco" has put together availableareas of circa 770 hectares plus 1160 hectares of metropolitan area Town areas made available for new compensatory and forestation works ready to become wood-parks, wood farms, woods with new hedges and rows, woods as natural oases, historical agricultural landscape woods, technological-environmental woods.

All the support for the "metrobosco" project has also meant a sizeable contribution from public and private entities such as Milano Serravalle, Fondazione Ospedale Maggiore, and Fondazione Cerba for a total of 870 hectares.

The total is 2,800 hectares available for forestation distributed over 80 Towns in the Milan province; of these over 200 hectares will be workable in 2008.

Then there are 36 ongoing forestation projects for a total of 255 hectares spread over 25 towns in the Milan Province.

Sighting this experience, I am sure that the chance to create such a project increases to the extent that periurban parks become a unitary reference element to:

- Strengthen identity and visibility of projects externally
- Strengthen the common action towards local communities
- Promote use of the entire peri-urban territory
- Add value to local specificity of territories next to the metropolitan area by developing pubic use models
- Recover and add value to that heritage of eco-systems present in the protected peri-urban areas creating the right conditions for maintaining biodiversity.