APAT
Italian Agency for Environmental Protection and Technical Services

under the sponsorship of the Italian Ministry for the Environment, Land and Sea

III ANNUAL REPORT ON URBAN ENVIRONMENTAL QUALITY

Edition 2006 - Summary

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Printed by
I.G.E.R. srl – Viale C.T. Odescalchi, 67/a – 00147 Rome

Finished printing in March 2006

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Impacts and responses

INTRODUCTION

The primary aims of the "Annual report on urban environmental quality in Italy" presented here in summary form are:

1. to gather and calculate accurate information representing the true nature and evolution of environmental problems in urban agglomerates;
2. to ascertain the causes behind the fact that not all cities undertake the best provisions, and identify possible barriers;
3. to present specific actions and measures aimed at overcoming these barriers and acquiring a general overview of what may realistically be pursued in the medium term.

All of the phases of the project are fully coherent with the institutional role of the Italian Environmental Agency System and are implemented in collaboration with local representatives with the awareness and knowledge that only these can have a complete understanding of the outlook of the environmental situation in their territories. The report's added value is to supply a homogeneous and harmonised information overview for the urban areas in question.

The Report is intended as tool to support urban environmental management and planning, the former being essential to the quality of life of a citizen. The Agency is aware that in order to pursue these aims it must develop a relationship based on cooperation with local institutions, and it has worked with this objective in mind from its first year of activity.

Within the scope of encouraging active participation from local representatives, a meeting was held between the Local Councillors for the Environment and Mobility for the cities under examination and their relative provinces. Each councillor was asked to supply the name of a person who was to act as a contact for operational contacts.

This Agency initiative is far from being unique. The concept of urban environment has been under discussion for several years now from a technical-scientific point of view at a national, international and European level. Specifically, starting at the beginning of the 90s, a strong drive towards new initiatives – conferences, magazines, books, projects, etcetera – has focused primarily on the urban environment.

It was within the scope of these initiatives – implemented both from a technical-scientific and political-institutional point of view – that a number of choices minimizing the risk of duplicating any efforts already underway were made to maximise the value of materials already in existence and to nevertheless ensure a reasonable timeframe for products which will later be progressively increased and enriched.

The connection with European and international initiatives on urban environments is dis-

cussed within the scope of the activities carried out as a basis of the report.
The primary objective of the report is to supply the technical-scientific tools needed to understand *if* and *how* environmental information is employed in the decision making processes and the degree of integration achieved by environmental policies in sectorial politics.
The following issues are discussed in the third APAT Report on urban environmental quality: *Metropolitan Areas, Energy, Atmospheric emissions and air quality, Transport, Water, Local sustainability, Nature and ecological networks, Exposure to electromagnetic and indoor pollution, Communication and Information, Soil, Local Planning and Impact and responses.*

METROPOLITAN AREAS – METROPOLITAN CITIES STRATEGIC PLANNING AND GOVERNMENT OF THE METROPOLITAN AREAS

G. Campilongo
ARPA - Environmental Protection Agency of Lombardia Region

1. GOVERNMENT OF THE METROPOLITAN AREAS AND ENVIRONMENTAL PROBLEMS

With an increasing demographic trend, there is a tendency for the world population to settle mainly in urban areas. Urban areas are meant not only as the administrative borders of a city, but also as the surrounding territory, where activities incompatible with either an unbalanced real-estate market or with new life-styles have overflown to.
These involve a demand for more building areas, new uses of spaces and an increasing use of cars.
The typical dynamics of metropolitan areas take place in these areas, such as frequent contacts between the large central city, characterized by a high density of population and activities, and the smaller surrounding towns. Such relations are connected not only to the various economic activities but also to the access to various services present in the city, including cultural and recreational ones.
Urban sprawl has caused, and still causes, a strong impact on the environment, in terms of use of resources, decrease of bio-diversity, pollution, lack of adequate infrastructures and facilities, and traffic.
In order to improve environmental quality and pursue a sustainable use of resources in metropolitan areas, it is necessary to define measures that, in order to be effective, cannot be limited to the city limits, but must involve the entire extended area .
In the previous issues of the report, attention was focused on the concept of Metropolitan City, a new territorial body, mentioned for the first time in the Italian legislation in 1990 (L.142), updated in 2000 (D.Lgs.267) and introduced in the Constitution with the constitutional law n.3 in 2001.
The interested local administrations (Cities, Provinces and Regions) have so far failed to come to an agreement on their specific roles and the management of the areas, thereby preventing the new territorial reality from being actually launched.
Up to now, the new administrative body indicated by law, the Metropolitan City, has not been created in any of the 14[1] urban areas defined as "metropolitan areas" by law. So

far, only the perimeter of some of these metropolitan areas (Venezia, Genova, Bologna and Firenze) has been defined.
On the other hand, the metropolitan areas of Catania, Messina and Palermo represent a particular case. According to previous specific regional legislation[2], they are governed by their respective provinces, without setting up a specific administrative body.
An answer to this situation is the creation of Metropolitan Conferences, a spontaneous and gradual aggregation of municipalities. Their goal is that of promoting and experimenting, on a temporary basis, the role of the Metropolitan City.

2. STRATEGIC PLANNING

It is the aim of this report to verify if, in this transitional phase towards the establishment of the new Metropolitan City, large cities are finding forms of collaboration with the municipalities belonging to the metropolitan area, in order to achieve a better quality of life in general and of the environment in particular.
The Strategic Plan seems to be, at present, the best mean towards this goal. It is a tool for the government of urban areas, based on coordination among the different actors, public and private, and levels of local realities. As such, the Strategic Plan can undertake coordinated actions in order to achieve better results in improving the quality of life and of the environment.
We proceeded to survey the 24 Italian cities with more than 150.000 inhabitants, monitoring the involvement of the municipalities in the government of the metropolitan area and the presence of environmental goals in their Strategic Plan.
For each city provided with a Strategic Plan, final or provisional, the inquiry focused on the following points:

- Involvement of the municipalities of the area for an evaluation of problems and possible solutions;
- Involvement of the municipalities of the area as actors in the process of strategic planning;
- Presence of goals related to the government of the metropolitan area;
- Environmental issues.

The results obtained from the survey are as follows:
Only 11 of the 24 cities have concluded or started a process of strategic planning (Torino, Verona, Venezia, Genova, Firenze, Prato, Napoli, Bari, Palermo, Catania and Cagliari).

[1] Torino, Milano, Venezia, Trieste, Genova, Bologna, Firenze, Roma, Napoli, Bari, Catania, Messina, Palermo, Cagliari.
[2] LR n. 9/6.3.1986 e Decreto Presidente Regione 230/10.8.1995

Government of the metropolitan area: some strategic plans (Torino, Verona, Venezia, Genova, Firenze and Bari) propose coordinated actions as a first step towards the institution of the Metropolitan City;
Involvement of the municipalities of the area in the drawing of the strategic plan: only in 6 cases the neighbouring municipalities participate actively in the process of strategic planning and management (Torino, Verona, Firenze, Bari, Catania and Cagliari);
Environmental issues: all strategic plans address some environmental issues and refer to the need to pursue a sustainable development. In some cases (Torino, Verona, Firenze and Napoli) it is considered necessary to adopt provisions of the local Agenda 21. Among the most frequent goals one finds: environmental protection, waste management, mobility, water management, soil permeability, use of renewable energy sources, energy saving, re-use of abandoned industrial areas with compatible activities, geological safety, reduction of consumption and of pollution of environmental resources, noise, environmental education.

3. METROPOLITAN AREA IN THE WEBSITES OF LOCAL AUTHORITIES AND IN THE GOVERNMENTAL CHARGES

In this issue of the report we also wanted to verify the interest of local and regional authorities towards the specific problems involving metropolitan areas. The survey was made indirectly, by checking two indicators on the websites of the involved local administrations:

- Presence of information pertaining to metropolitan areas and cities;
- Presence of the issue at the level of elected administrators.

The following results emerged from the inquiry:

- Out of a total of 40 websites visited, only 14 of them refer to metropolitan areas and cities;
- In 3 cases (Firenze, Milano and Bologna) a link to this information is present on the home-page of the website;
- In other 3 cases (Genova, Piemonte and Emilia Romagna) the information is found through links not directly present on the home-page;
- References to the metropolitan areas and cities have been found on the websites of the municipalities of Torino, Venezia, Bologna, Roma and Bari using search engines;
- References to the metropolitan areas of Messina, Catania and Palermo are only available on the websites of their respective Provinces;

As far as elected administrators are concerned, the number of administrators with explicit competences regarding the metropolitan area and/or city has increased from 10 to 15.
The municipalities of Torino, Venezia, Trieste, Genova, Bologna Firenze, Roma and Bari have established specific competences for the administrators of the metropolitan area, while the Provinces of Milano, Venezia, Bologna, Catania, Messina and Palermo have created specific commissions on the subject. Only the region Toscana has a specific department for metropolitan and areas and cities.

4. WEBSITES CONSULTED

From August to September 2006
Official websites of the local and regional authorities concerning with the surveys;
http://www.anci.it ANCI (Associazione Nazionale Comuni Italiani)
http://www.recs.it/it/index.php RECS (Rete delle Città Strategiche)
http://www.torino-internazionale.org
http://www.firenze2010.org/
http://www.pianostrategico.verona.it/

ATMOSPHERIC POLLUTANT EMISSIONS IN 103 ITALIAN PROVINCES AND 24 URBAN AREAS

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INTRODUCTION

Emission inventories represent a very powerful tool for planning and managing air quality. Current laws decree that all regions be equipped with an emission inventory which should be created by following common criteria established at European Commission level. This objective has been achieved by a third of local administrations so far; therefore, it is very important to activate a top-down methodology which allows the disaggregation of the national emission inventory down to a local scale. With this aim in mind, it has been necessary to find and process a huge amount of statistical data coming from several data banks, publications or personal communications. This data has been useful in building a variable set (proxy) needed to carry out the spatial disaggregation of national emissions, which are grouped into sectors and activities according to the *Selected Nomenclature for sources of Air Pollution* (SNAP 97). An approach which allows fast detection of the proxies, simplicity and traceability of data has been adopted for this current task, which ensures that top-down methodology can be reprocessed every year with ease. The most important pollutant emissions in over 103 Italian provinces (NUTS 3) and 24 province capitals (LAU 2) with a population exceeding 150,000 inhabitants are presented.

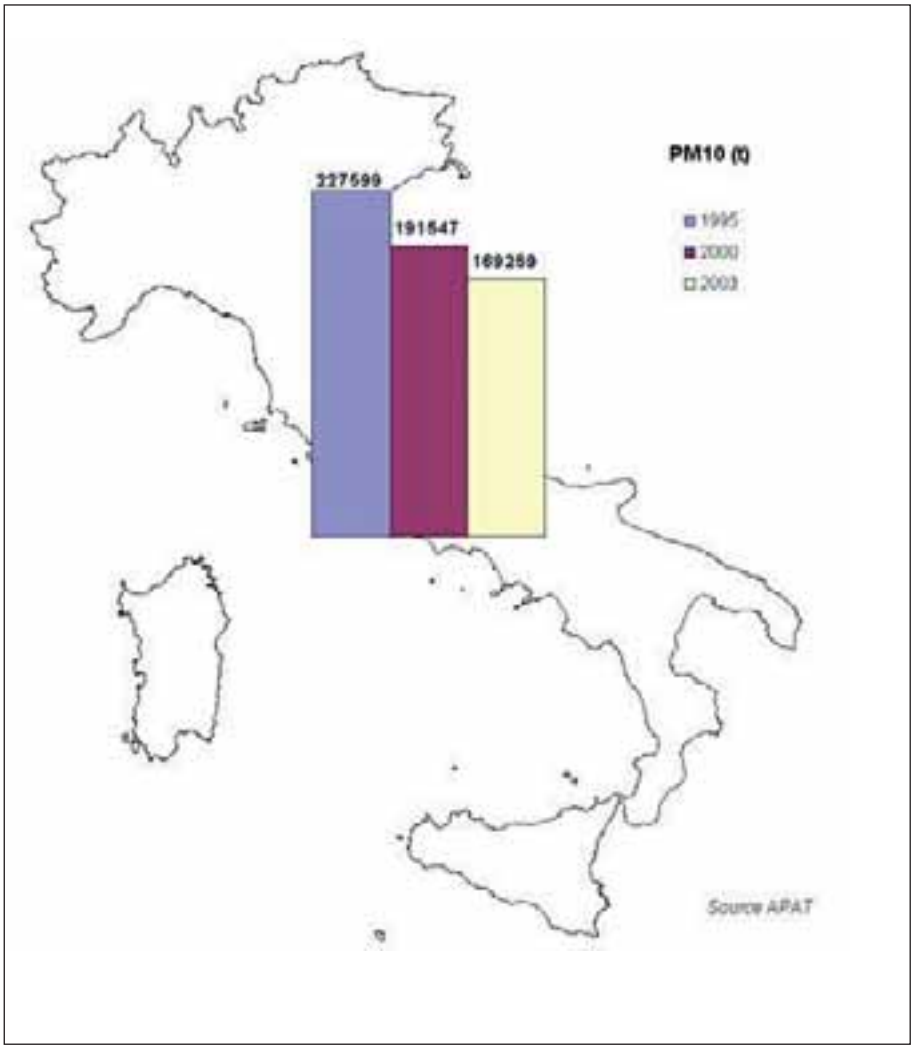
RESULTS

In this work emissions of primary particulate matter which are 10 micrometers or less in diameter (PM10) for 24 province capitals, with a population exceeding 150,000 inhabitants, are presented. Moreover, emissions of precursors to secondary particulate matter, *i.e.* sulphur oxides (SO_X), nitrogen oxides (NO_X), volatile organic compounds (VOC) and ammonia (NH_3) are also reported.

This study aims to develop a simplified top-down methodology allowing for a more homogeneous and faster spatial disaggregation of national data at local level. For each emission activity a suitable proxy variable correlated to the emission estimate

has been chosen and than used to share out national data at provincial level. The methodology adopted for estimating emissions in urban areas follows the top-down approach used for the disaggregation of national data at provincial level: a proxy variable correlated to each emission activity has been used to share out provincial data at urban level. In Figure 1, the decreasing national emissions trend of PM10 for years 1995, 2000 and 2003 is shown.

Figure 1: PM10 national emissions (1995, 2000 and 2003)

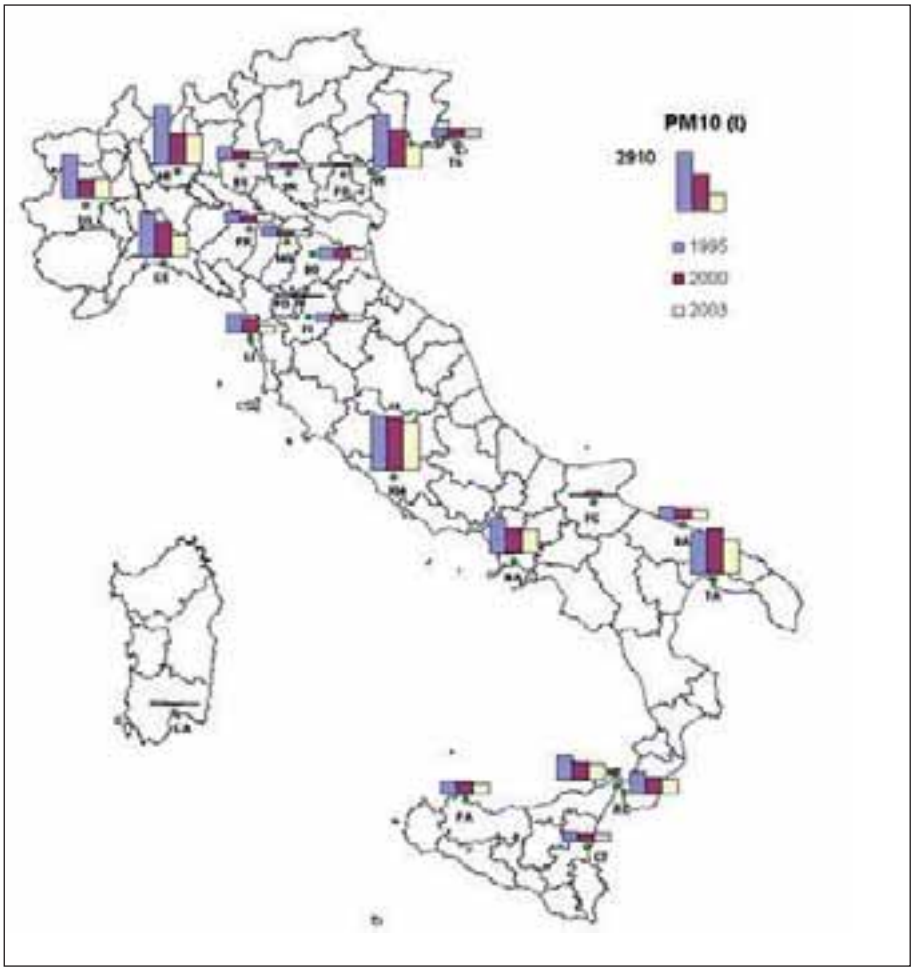


In Figure 2, PM10 provincial emissions for years 1995, 2000 and 2003 are reported. Provinces exhibiting higher PM10 emissions are Turin, Milan, Rome, Naples and Messina. In 2003, each province is characterized by considerable emissions and only a third of the Italian provinces have PM10 emissions less than 1000 t.

Figure 2: PM10 provincial emissions (1995, 2000 and 2003)

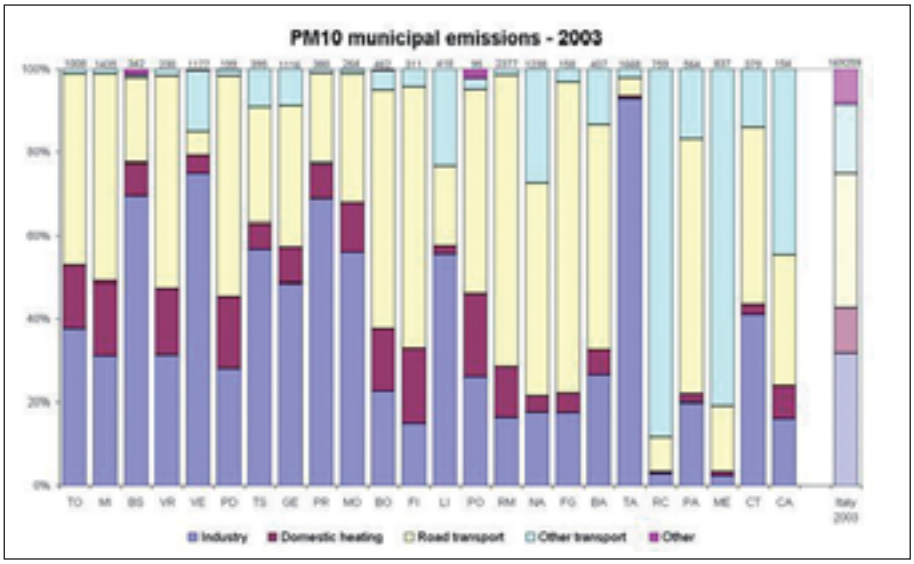
At urban level, PM10 emissions have a downward trend for almost every one of the 24 municipalities being studied, with higher values for 2003 being observed in Rome, Taranto and Milan (Figure 3)

Figure 3: PM10 municipal emissions (1995, 2000 and 2003)



As with PM10, the other pollutants show generally decreasing trends (data not reported) with the exception of NH_3, which shows a progressively increasing trend from 1995 to 2003 - without considering NH_3 emissions originating from agriculture activities. Figure 4 reports PM10 municipal and national emissions for 2003, providing indications on the percentage of emissions specific to main macro sectors (*e.g.* road transport, industry, etc.) as compared to total values.

Figure 4: PM10 municipal emissions (2003)

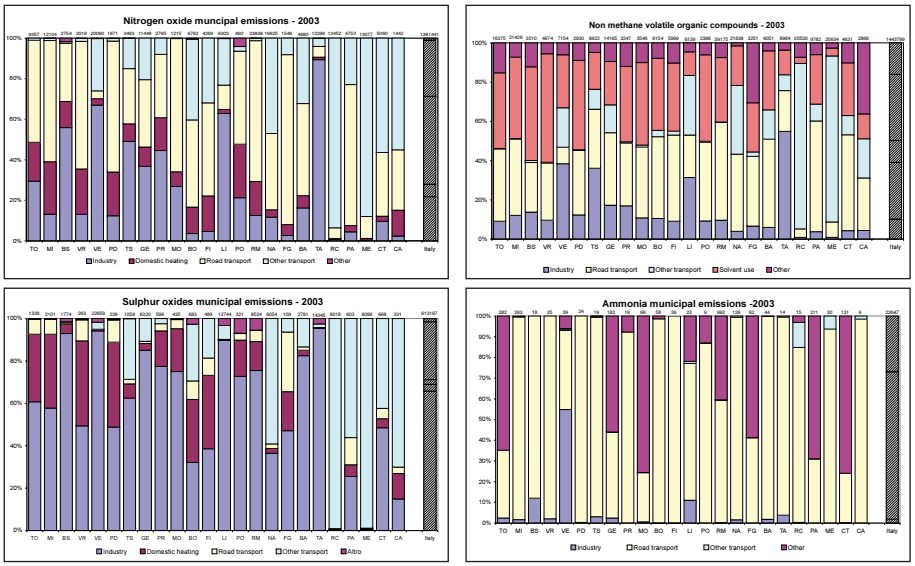


PM10 municipal emissions are mainly related to road transport for more than half of the considered urban areas. As for Rome, road transport contribution to PM10 emissions is about 70%. Industry contribution is particularly hefty for those municipalities where large industrial plants are located within municipal boundaries (Taranto, Genoa and Venice). In Reggio Calabria and Messina maritime transport contribution prevails and is included in the "*Other transport*" category. It is worth noting that domestic heating accounts for a considerable amount of PM10 emissions in the North and Centre of Italy.

As for PM10 precursors, analogous features are reported in Figure 5.
In particular, NO_X emissions are mainly related to road transport and the industrial sector. Seaports (Reggio Calabria and Messina) show a high contribution of NO_X emissions due to maritime transport.
VOC emissions mainly originate from solvent use and road transport. For Messina and Reggio Calabria the contribution of maritime transport is also considerable.
The industrial sector is accountable for SO_X municipal emissions, the highest percentages (90%-95%) being observed in Livorno, Venice and Taranto, where oil refineries, power plants and steel mills lie within the municipal territory.
The highest contribution to NH_3 emissions is from road transport for almost all of the 24 urban areas taken into account. On the other hand, for Turin, Genoa, Rome and Palermo

the weight of waste treatment and municipal dumps included in the category named "*Other*" is relevant.

Figure 5: PM10 precursors of municipal emissions (2003)



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ATMOSPHERIC POLLUTION IN LEADING ITALIAN AGGLOMERATIONS

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Atmospheric pollution is a big problem, especially in urban areas where several polluting sources are present simultaneously and population concentrations are high.
This work is an update to previous air quality analyses which were carried out in 2004 and 2005. In 2006, the analysis has been extended to include 10 new urban areas with more than 150,000 inhabitants.
The purpose of this work is to integrate the analyses, update monitoring station analyses, and update the historical series containing pollutant concentrations as well as the number of days limit values and alert thresholds were exceeded in 2005.
The analysis, carried out employing questionnaires which were sent to the European Commission and data provided by network administrators and the relevant Authorities, demonstrates how almost all agglomerations are comprised of continuous territorial areas excluding three agglomerations: Venice, Padua and Verona; Bari and Foggia; Taranto.
These agglomerations are in fact comprised of portions which are not adjacent. Therefore, when the historical series of pollutant concentrations and exceed limits was carried out, we decided to consider their individually corresponding municipalities (Venice, Padua, Verona, Bari, Foggia, Taranto). This was also applied to Reggio Calabria, because its territory is not included in an zone. As such, we decided to take into account its corresponding municipality. The urban areas of Florence and Prato, on the other hand, are part of the same agglomeration.
The analysis carried out by the monitoring stations illustrates how the Authorities in question have produced a number of changes in the set of monitoring stations, both in terms of the type of station and in their actual numbers. Other changes instead, are the result of a review carried out on the BRACE APAT's database.
A certain degree of dissimilarity in the choices made by the Regions can be found by comparing urban areas.
In terms of exceeded limits and pollutant concentration historical series, what can instead be seen is that the situation is critical for PM10s. In most of all the urban areas limits have been exceed both in concentrations and in the maximum number of days permitted over this limit.

More limits are generally exceeded at traffic stations as opposed to background stations, showing that the relationship between traffic and atmospheric pollution is very high. The situation is quite critical for NO_2 as well. Annual average concentrations exceed limit values in almost of all traffic stations for the entire period under examination. C_6H_6 and SO_2 concentrations, however, appear to have decreased.

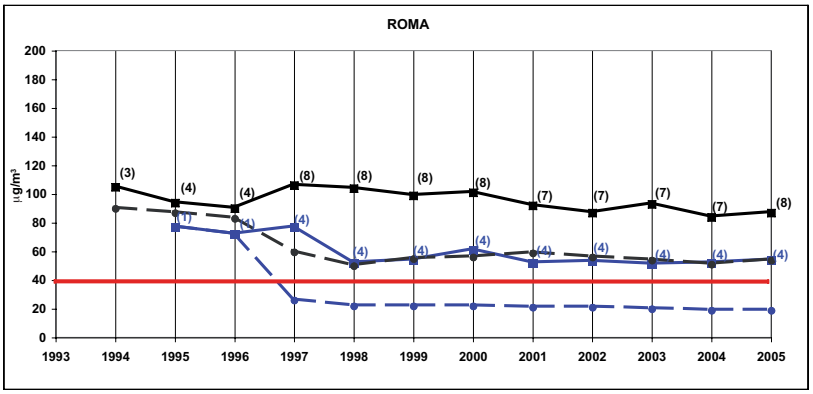
The entire work (Italian version) is available online at www.areemetropolitane.apat.it.

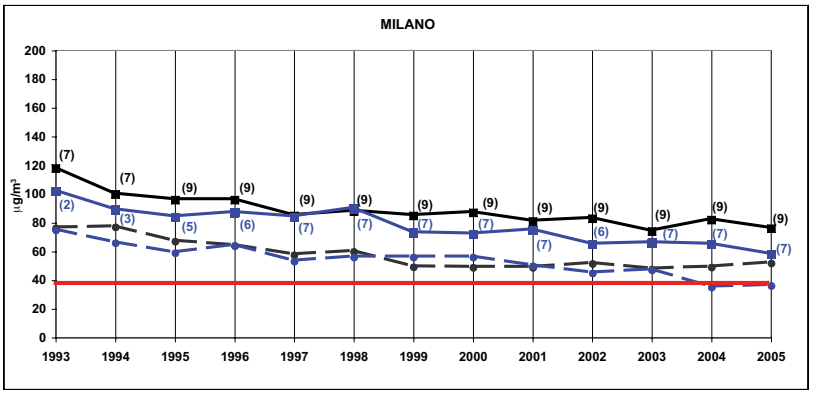
Table 3: Comparison between traffic monitoring stations and background monitoring stations chosen by the Regions to assess and manage air quality in chief Italian agglomerations (year 2002, 2003 and 2004; data from ANNEX XII to DM 60/02 and data from the BRACE database).

AGGLOMERATION	**Number of background stations**			**Number of traffic stations**			**Number of traffic and background stations**		
	2002	2003	2004	2002	2003	2004	2002	2003	2004
TORINO	5	6	2	6	8	2	11	14	4
MILANO	5	6	7	6	11	11	11	17	18
BRESCIA	4	4	5	0	0	0	4	4	5
VERONA (1)	1	1	1	2	3	2	3	4	3
VENEZIA (1)	2	2	2	1	1	1	3	3	3
PADOVA (1)	2	1	1	2	2	1	4	3	2
TRIESTE	1	1	1	3	4	4	4	5	5
GENOVA	1	2	3	3	3	2	4	5	5
PARMA	1	1	1	2	2	2	3	3	3
MODENA	1	1	1	2	2	2	3	3	3
BOLOGNA	1	1	1	4	4	4	5	5	5
FIRENZE/PRATO	12	8	15	11	9	9	23	17	24
LIVORNO (2)	4	4	5	9	9	9	13	13	14
ROMA	4	4	4	8	8	8	12	12	12
NAPOLI	1	1	1	8	7	6	9	8	7
FOGGIA (1) (2)	0	2	0	1	0	1	1	2	1
BARI (1)	1	1	2	5	5	3	6	6	5
TARANTO (1)	1	1	2	5	5	5	6	6	7
REGGIO di CALABRIA (3)	-	-	-	-	-	-	-	-	-
PALERMO	1	1	1	7	7	7	8	8	8
MESSINA (2)	ND	0	0	ND	5	5	ND	5	5
CATANIA (4)	1	1	1	4	4	4	5	5	5
CAGLIARI	1	1	1	1	1	1	2	2	2
TOTALE	50	50	57	90	100	89	140	150	146

(1) the monitoring stations are into the municipality's (not agglomerations') boundary
(2) in the year 2002 is not possible to know the tipology of 2 monitoring stations in Livorno, 1 monitoring station in Foggia, 4 monitoring stations in Messina
(3) the urban area of Reggio Calabria is not included in a zone
(4) in the year 2002, 2003, 2004 is not possible to know the tipology of 12 monitoring stations in Catania

Figure 1: Maximum and minimum average annual NO_2 concentrations values in the monitoring stations under examination (limit value at 2010 from DM60/02: 40 μg/m^3)





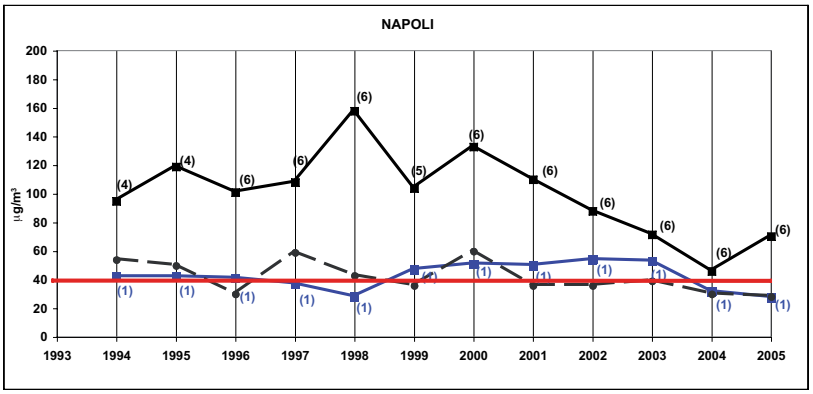


Figure 2: Maximum and minimum values for the number of days where PM10 limits were exceeded for the monitoring stations under examination (maximum number of days allowed in 2005 from DM60/02: 35)

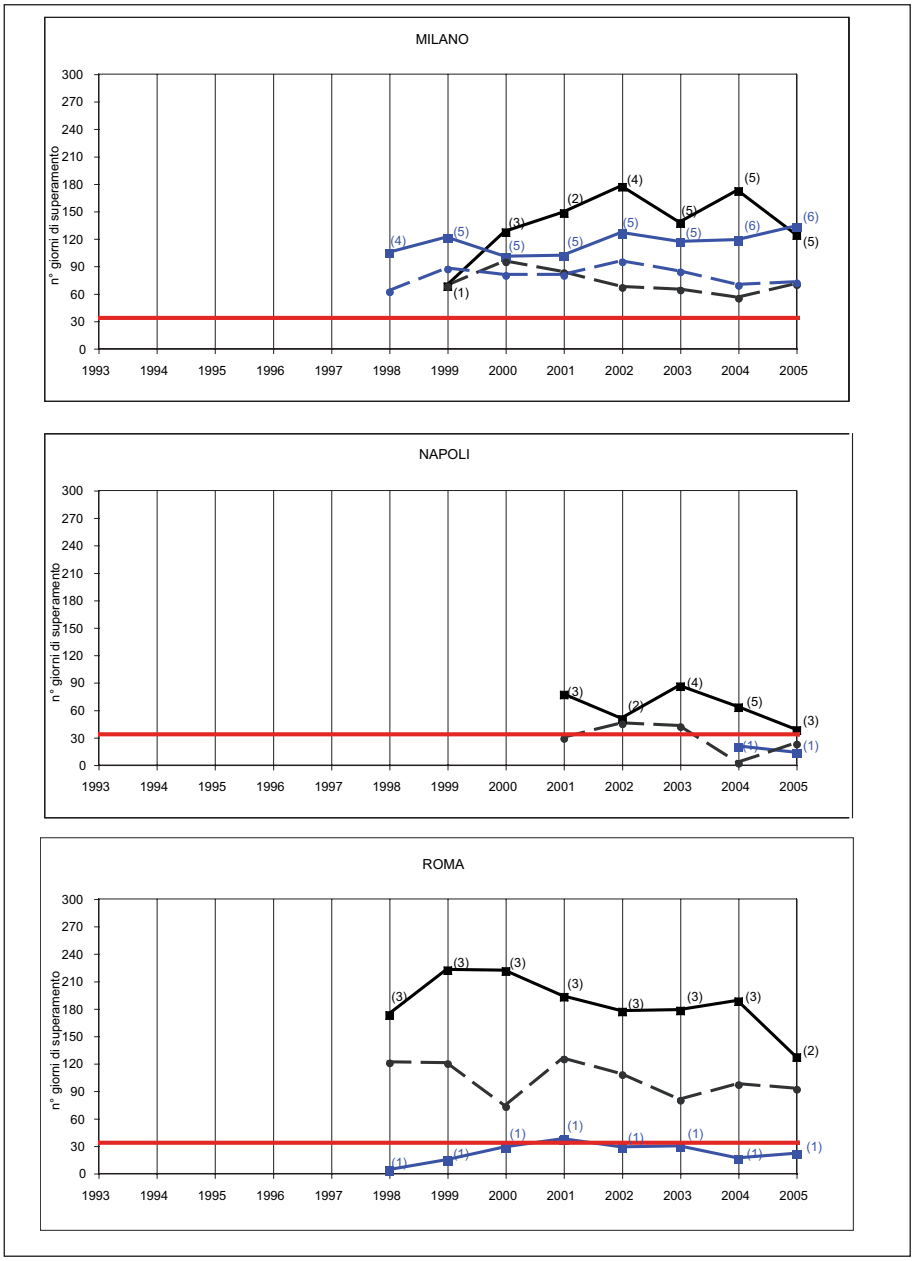
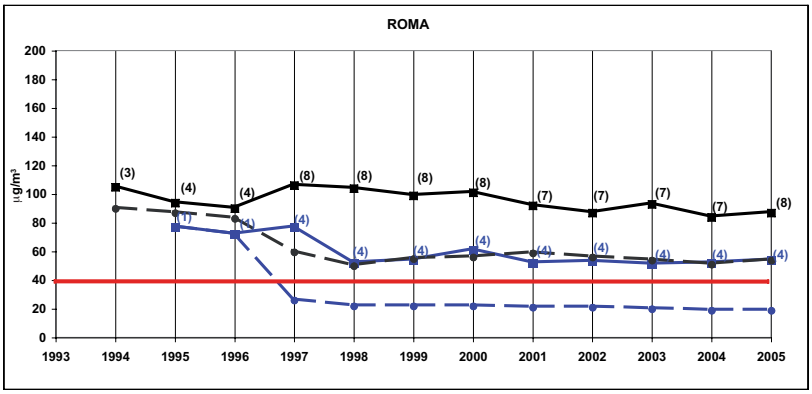
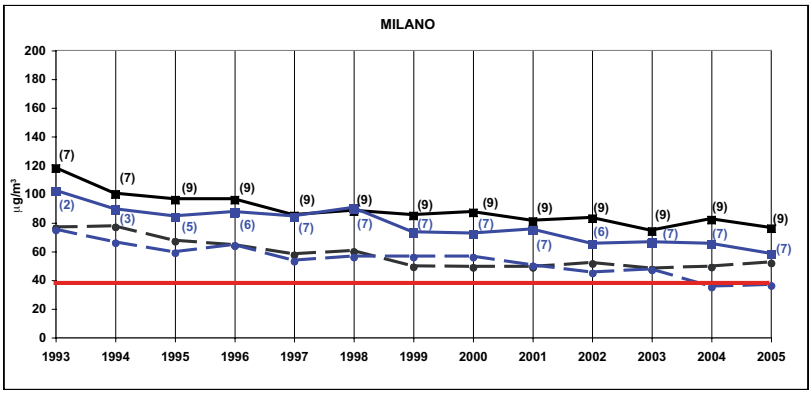
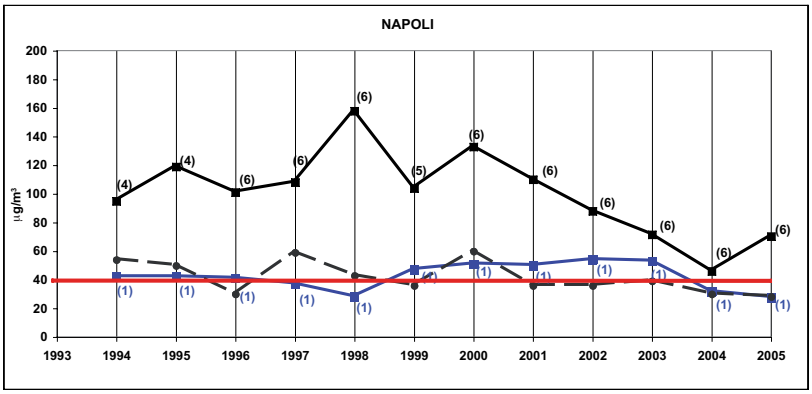


Figure 3: Maximum and minimum days where O_3 alert threshold value were exceeded for the monitoring stations under examination (from Legislative Decree 183/04)







FOSSIL FUEL SUBSTITUTIONS WITH BIO-FUELS AND SOLAR-THERMAL POWER IN THE MAIN POLLUTED URBAN AREAS

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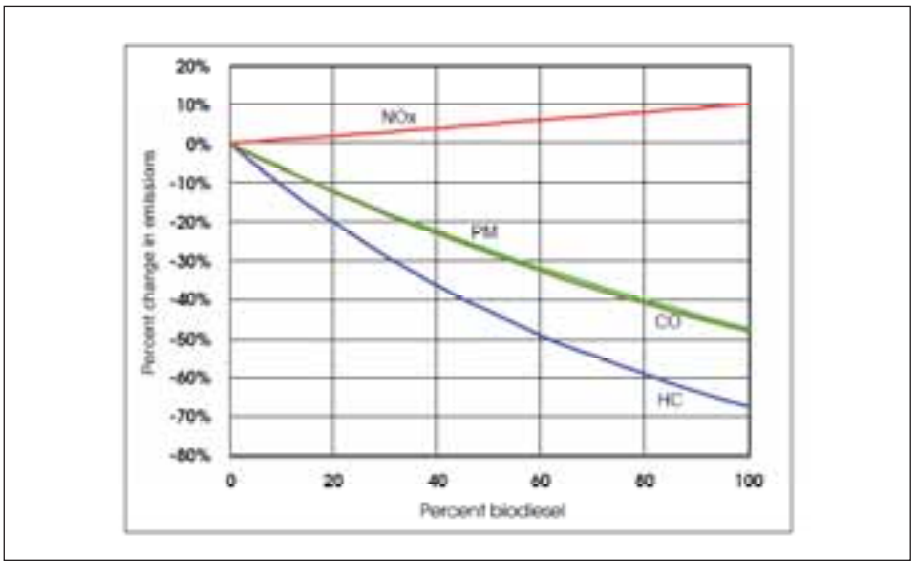
INTRODUCTION

The partial substitution of fossil fuels with Bio-fuels and the use of solar-thermal power in an urban area will have a positive effect on air quality, in terms of a reduction of pollutants and greenhouse gas emissions; it is also to be noticed that fossil fuels are replaced by renewable sources.
Current energy systems, primarily based on fossil fuels, will not be able to guarantee current socio-economic rates of development for much longer. This is particularly clear when seen in terms of environmental and health sustainability, and because the availability of these energy sources cannot be guaranteed.
The EU transport sector accounts for more that 30% of total energy consumption in Europe. 98% of it depends on fossil fuels imported from other countries. As such the increase of CO_2 emissions in this sector is considered to be the main reason why the EU is failing to meet Kyoto targets.
Satisfactory solutions will not be available in the short term and, as we wait for "zero emissions vehicles (ZEV)", internal combustion engines (ICE) using fossil fuels will probably remain the dominant technology at least until 2030.
In the meantime, Bio-fuels derived by biomass (i.e. Bio-Diesel, Bio-Ethanol and Biogas) represent a valid alternative to partially replace fossil fuels. In fact they are compatible with current technologies, do not increase greenhouse gas emissions and can be the source of new opportunities for economic development.
The EU has formulated a common strategy for their development. In fact Directive 2003/30/CE sets "indicative targets" which every Member State must meet within 2010. In Italy this Directive has been adopted by Legislative Decree 128/2005.
However, the debate on the polluting effects of emissions from engines using Bio-Fuels is still open because performance studies are not easily compared. To evaluate the effective improvement of air quality when correlated with their use is a difficult task which depends on several factors (such as Bio-Fuel production technologies, utilisation technologies, the quality of Bio-Fuels produced, etc).

1. BIO-FUELS

The use of Bio-fuels - which are blended with fossil fuels - largely, implies a reduction in pollutants from vehicle exhausts proportional to their mixing percentage. In particular HC (unburned hydrocarbons), CO (carbon monoxide) and SOx (sulphur oxides) emission levels are lower than those of hydrocarbon based fuels, whereas NOx (nitrogen oxides) emissions show a percentage increase, as shown in the Figure 1.
In terms of particulate matter, the studies appear to depict a reduction in total emissions and a qualitative variation of its composition. In fact, an increase in Soluble Organic Fraction (SOF) has been found for the "black carbon" portion.
However, differences in emissions for various fuels are low when after-treatment devices (CRT, FAP, etc.) are used because such systems treat pollutants, and in some cases up to 95% of pollutants.

Figure 1. Pollutant variations with respect to Bio-Diesel percentages (EPA, 2002)



A number of Bio-Fuels reduce greenhouse gases, avoiding variable amounts, depending on the technologies used to produce and employ them. This has been confirmed by a number of studies.
Bio-Methane, produced from landfills, urban waste and manure anaerobic digestion, has been found to be the most effective in terms of greenhouse gas savings , because its use

avoids direct emissions of methane into the atmosphere.
In a simplified approach, the impact of the use of Bio-Diesels on emissions from public transportation in Rome has been examined. The use of 20% Bio-Diesel blend by urban buses (with reference to the ATAC 2005 fleet) could have reduced emissions as indicated in the Table 1.

Table 1. Theoretically avoided emissions (20% Bio-Diels Blend)

	NOx	**VOC**	**CO**	**PM**
Emissions (t)	+ 23	- 38.2	- 40.2	- 4.59
% variation	+ 2%	-21.1%	-11%	-10.1%

Taking the different energy contents of fuels into account, 20% fossil Diesel blends are obtained with 15,190 t/year of Bio-Diesel.
In the same way, better MSW (Municipal Solid Waste) management and separate collection at 20% of wet fraction (Table 2), could feed one or more anaerobic digestion plants and produce enough Bio-Methane for 200-260 urban buses with an average mileage of 48.500 km/year and an average fuel consumption of 22 MJ/km for each bus (VTT, 2005).

Table 2. Organic fraction availability in Rome MSW (APAT, AMA)

MSW t/year	**Organic Fraction % (OF)**	**Organic Fraction t/year**	**Separate Collection OF %**	**Available Organic Fraction t/year**
2,147,397	25	536,849.25	20	**107,369.85**

Bio-Methane use in urban transportation would both reduce emission factors to levels equal to those of CNG (Compressed Natural Gas) buses and reduce fugitive methane emissions from landfills (Table 3).

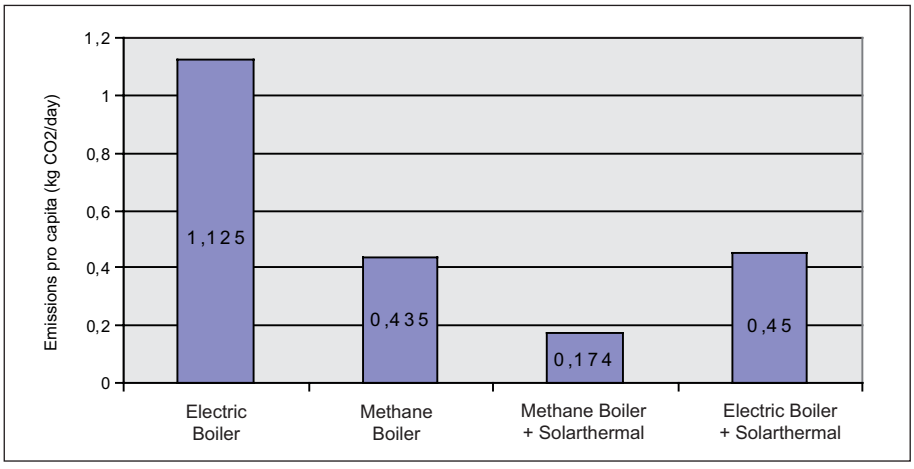
Table 3. Theoretical Bio-methane production by Anaerobic Digestion process (APAT)

	BIO-CH_4 Production			
Anaerobic Digenstion Process	**Biogas Production Nm^3/t**	**Total Production Nm^3/year**	**% CH4**	**Bio-CH_4 Production Nm^3/year**
Dry (Total Solid >20%)	130	13,958,080	55	7,676,944
Wet (Total Solid <10%)	98	10,522,245	55	5,787,234

2. SOLAR THERMAL POWER

In Europe approximately 30% primary energy consumption is employed for heating and air conditioning of buildings. As such, heating /conditioning systems in houses are responsible for the greater part of urban pollution.
The development of solar thermal energy on a wide scale represents a further opportunity to reduce emissions when producing warm water for sanitary uses and air conditioning for rooms.
Italy, in spite of its favourable geographical position and meteorological conditions but with insulation factors comprised between 1750 and 1200 KWh/m^2-y depending on latitude, is positioned in the tenth place in the EU at 15 with only 8 m^2 solar collectors for every one thousand inhabitants compared to an European average of 31 m^2 for every one thousand inhabitants.
Solar energy is an unreliable source of power on land, which is why thermal solar collectors have to be realistically considered as integration to traditional technologies.
For combined systems, a heating stopgap tank will allow for a better boiler management.
Greenhouse gas emissions relative to electric boilers are approximately equal to 1.125 $kgCO_2$/day-per capita, while methane boiler emissions are equal to 0.436 $kgCO_2$/day-per capita, and **solar/gas hybrid systems are equal to 0.174 $kgCO_2$/day-per capita,** while hybrid solar/electric boiler systems total 0.45 $kgCO_2$/ day per capita.
Figure 2 shows estimated $kgCO_2$/day generated by different systems.

Figure 2. Assesment of CO_2 emissions generated by different systems (ISES)



3. CONCLUSION

The potential availability of Bio-Methane, derived from biogas from controlled MSW landfills and plant anaerobic digestion could meet the needs of the urban bus fleet.
MSW landfills, sewage sludge and animal farm waste are important sources of climate-altering gas emissions and the use of their energy constitutes a valid option to alleviate environmental impact. In a study purely based on internal costs, Bio-Methane is the cheapest solution when compared to both Diesel and methane.
Moreover an emissions study has shown that Bio-Methane has a lower impact than Diesel and a lower impact in general than methane.
In terms of a comparison based on the total cost of the emissions, and therefore taking into account internal and external costs, Bio-Methane is less expensive that Diesel and methane.
Similarly, solar thermal power for domestic heating and sanitary water production, in substitution to methane/fuel oil, could contribute to a reduction of pollutants and greenhouse gases.
In the near future, improved MSW, sewage sludge and wet waste management with the separate collection of wet and dry parts of MSW will reduce landfill use. The next step will be the use of gasification technologies for the MSW dry fraction, employing advanced gasifiers (two-stage) to produce a syngas (H_2 and CO) with a low tar content.
Energy systems in co-generation could be fed by syngas to produce thermal and electric power. The wet fraction of waste could be employed in anaerobic digestion reactors to produce Biogases (CH_4 and CO_2) to fuel urban bus fleet with the resulting Bio-Methane. Such plants will be located in low population density boundary areas also leading to a possible reduction in the pollution produced by waste landfills.
In order to create this new type of waste management, dedicated distribution networks for Bio-Methane and/or thermal-electric power from the production sites to the urban users must be created.

AIR QUALITY MONITORING, STUDY ON ATMOSPHERIC TURBULENCE AND THE SIMULATION OF POLLUTANT DISPERSION IN THE HISTORIC CENTRE OF BOLOGNA

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1. INTRODUCTION

From 14/11/2003 to 04/12/2003 monitoring was carried out to evaluate air quality in the historic centre of Bologna, with samples taken in Via Farini, Via Rizzoli, and in Via D'Azeglio at two points (Galleria dei Notai and Piazza dei Celestini) on a pedestrian precinct as shown in fig. 1.

Samples were taken to determine various atmospheric pollutants: particulate matter in the form of PTS, PM10 and PM2.5, benzene, nitrogen oxides, carbon monoxide, sulphur dioxide [1], polycyclic aromatic hydrocarbons [2] and Ozone [3].

In the same period superficial turbulence, specifically the parameters of atmospheric stability, were investigated in a study carried out by CNR IBIMET, Bologna.

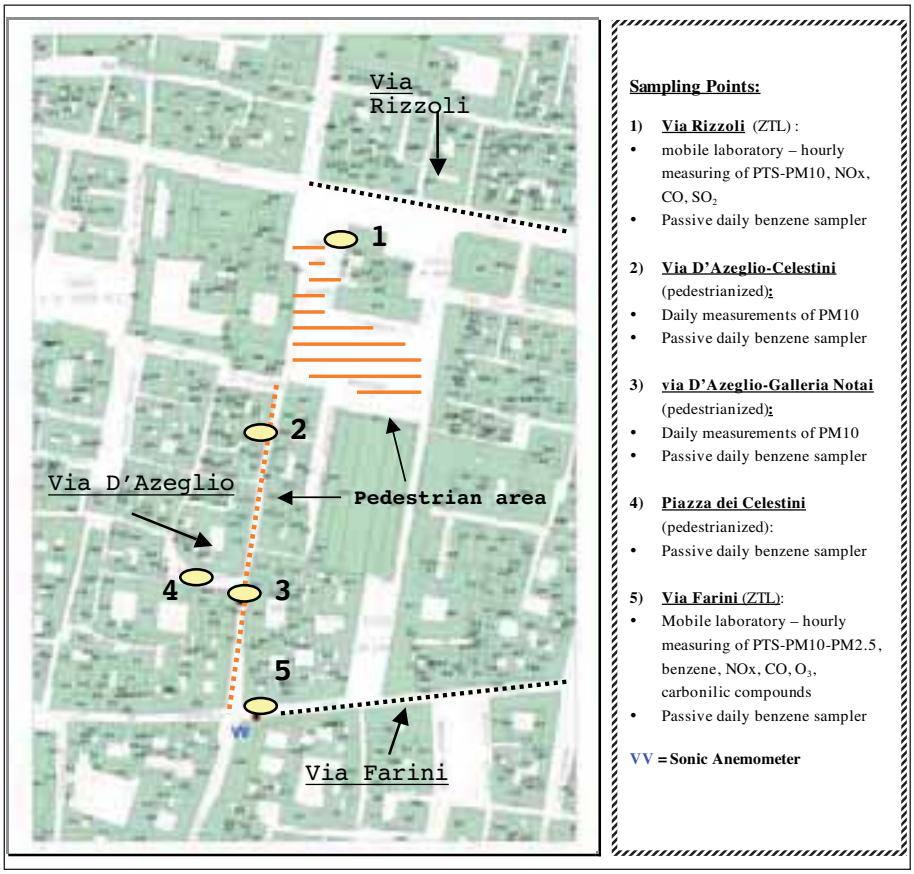
For measurements a sonic anemometer and an infrared gas analyzer were used to sample, at high frequency: wind vector components, air temperature, specific humidity, and carbon dioxide concentration [4].

In order to study the impact of vehicular traffic on concentrations, the Municipal Administration of Bologna measured vehicle transit patterns in Via Ugo Bassi (counted by means of pneumatic tube) and Arpa Emilia-Romagna measured transit in Via Farini (using video recording and automatic counting systems mounted on a mobile air quality monitoring station).

In support of the experimental measurement, ARIANET S.r.l., in collaboration with the Environmental Unit of the Administration Municipal of Bologna, developed a mathematical microscale model to calculate the atmospheric dispersion of pollutants in the area, taking into account traffic emissions in adjacent streets and simulating the effect of the complex layout of urban building on this dispersion.

The object of this study was to assess concentrations of certain pollutants in a pedestrianised area of the historic centre of Bologna surrounded by streets inside the ZTL (Limited Traffic Zone); using parameters of turbulence and micrometeorology, a model was then applied in order to simulate the behaviour of some of the monitored pollutants.
In this article are shown and discussed the main results obtained in the monitoring and modelling the air quality.

Figure 1 – The location of the sonic anemometer and of air quality monitoring points.



2. AIR QUALITY ANALYSIS

The main results of some parameters obtained in the monitoring of the air quality are presented below.

Table 1 – Particulate matter PM10, mediation time 24 hours

Sampling posts	Sampling Period	No. Of values	Minimum value	Maximum value	Mean value	% of value > 50 µg/m3	% of value > 60 µg/m3
			µg/m^3	µg/m^3	µg/m^3		
Via Farini	14/11-04/12/2003	19	43	144	99	94,7	89,5
Via D'Azeglio-Celestini	14/11-04/12/2003	19	28	123	76	84,2	68,4
Via D'Azeglio-Galleria	14/11-04/12/2003	19	29	126	71	68,4	63,2
Via Rizzoli	14/11-04/12/2003	19	28	127	73	78,9	63,2

Data source: Arpa Emilia-Romagna

Table 2 - Polycyclic aromatic hydrocarbons, mediation time 24 hours

	Sampling period	No. Of values	Minimum value	Maximum value	Mean value
Sampling posts			ng/m^3	ng/m^3	ng/m^3
Via Farini (PM2,5)	14/11-04/12/03	19	3,88	11,63	8,02
Via Farini (PM10)	14/11-04/12/03	19	4,06	12,61	8,02
V. D'Azeglio-Celestini (PM10)	14/11-04/12/03	19	1,00	5,86	3,36
V. D'Azeglio-Galleria (PM10)	14/11-04/12/03	19	1,34	6,60	3,38
Via Rizzoli (PTS)	14/11-04/12/03	19	3,25	12,74	6,59

Data Source: Arpa Emilia-Romagna

Table 3 - Benzene, mediation time 24 hours

	Sampling period	No. Of values	Minimum value	Maximum value	Mean value	% of values > 5 µg/m3	% of values > 10 µg/m3
Sampling posts			µg/m3	µg/m3	µg/m3		
Via Farini (G.C.)	14/11-04/12/03	19	7	16	11	100,0	57,9
Via Farini (Passivi)	14/11-04/12/03	19	6	15	10	100,0	42,1
V. D'Azeglio-Celestini (Pass.)	14/11-04/12/03	20	3	7	5	30,0	0,0
Piazza Celestini (Passivi)	14/11-04/12/03	20	3	5	4	0,0	0,0
V. D'Azeglio-Galleria (Pass.)	14/11-04/12/03	20	2	6	4	5,0	0,0
Via Rizzoli (Passivi)	14/11-04/12/03	19	4	8	6	57,9	0,0

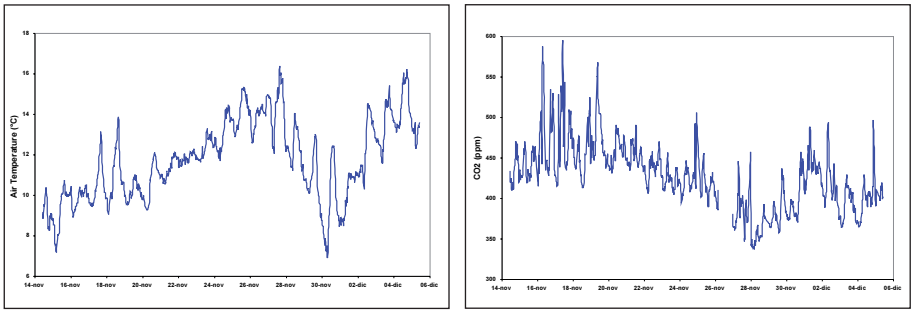
Data source: Arpa Emilia-Romagna

The survey has demonstrated how the pedestrian area analysed is subject to particle values little different to those in the surrounding streets of the ZTL. The relatively small size of the pedestrian area and the minimal possibilty for dispersal of pollutants, due to the formation of the streets, likely combine to create a near stationary effect on concentrations. The data, relatively higher in Via Farini than in Via Rizzoli, can be attributed to the narrowness of the street and the presence of porticoes impeding changes in air masses. This holds true also for benzene, which shows considerably higher levels in Via Farini, but little by way of difference between Via Rizzoli and the posts in the pedestrian area. At the same time, PAH concentration, demonstrates to the contrary a notable decrease as it gets further from the points where vehicle traffic is concentrated.
It is therefore possible that PAHs present in particulate near the site of their emission can be chemically transformed during the migration of this solid material in the adjacent zone: there seems to be a particulate present which contains a lower PAH percentage than those near the point where the same PAHs are formed. It is confirmed, however, that such pollutants cling to the finer part of the particulate.

3. ATMOSPHERIC TURBULENCE STUDY

During the measurement period conditions were almost always covered sky apart from one day of clear conditions, an instance of rainfall was recorded on 26 November. Figure 2 shows changes in air temperature (Figure 2-a) and in CO_2 concentration (Figure 2-b).

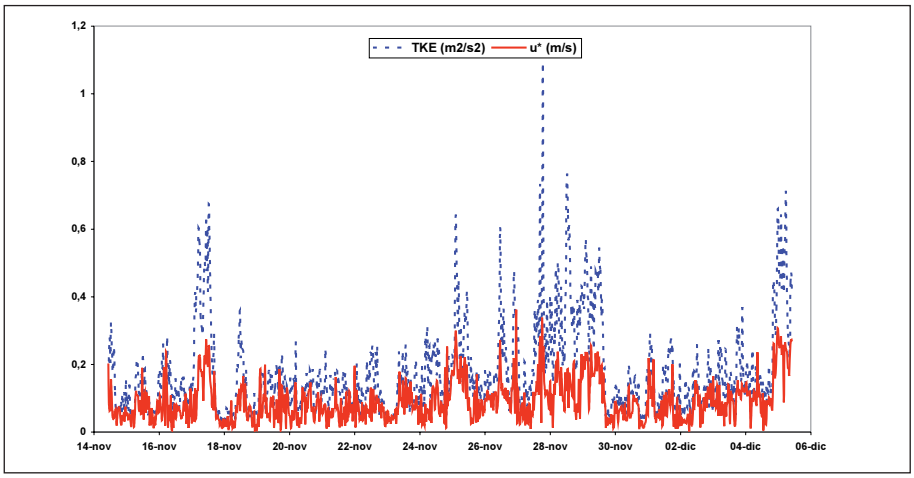
Figure 2- Change in air temperature (a) and in carbon dioxide concentration (b)



Data source: CNR IBIMET Bologna

It can be seen how these two variables are inversely correlated and how the measuring period can be divided in terms of pre- and post-precipitation. The first period is marked by a trend of air temperature increase and decrease in CO_2.
Relating the trend of CO_2 concentration with the atmospheric turbulence (Figure 3), evaluated on the basis of changes in Turbulent Kinetic Energy (TKE), indicator of the intensity of atmospheric turbulence, we see that on 28 and 29 November high TKE values were recorded which caused CO_2 values to drop to their lowest recorded values.

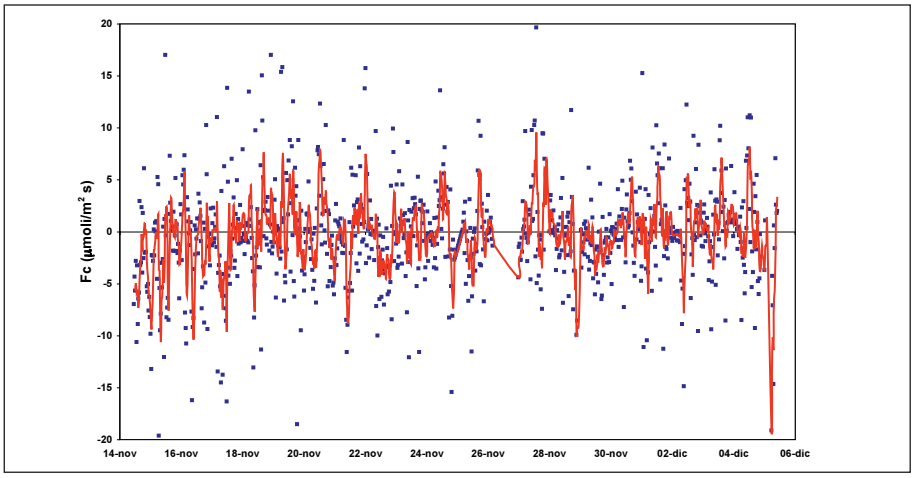
Figure 3 - Changes in Turbulent Kinetic Energy (TKE) and friction velocity (u*)



Data Source: CNR IBIMET Bologna

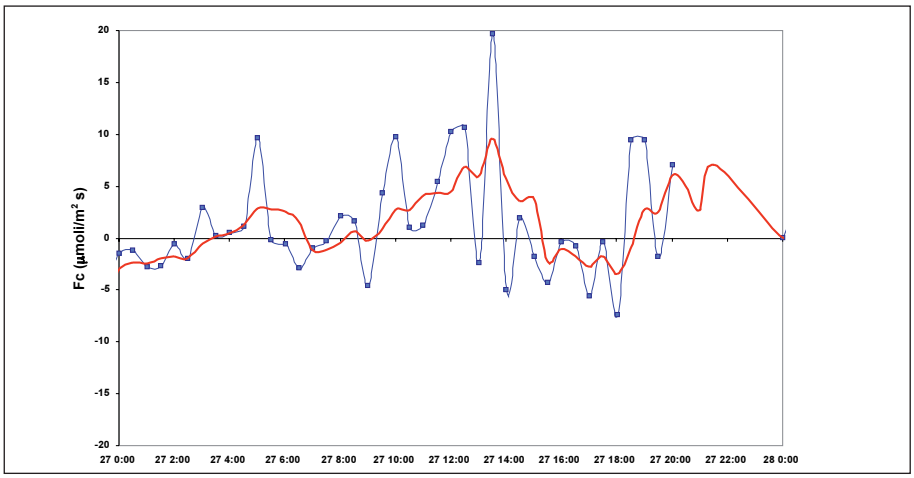
Change in carbon dioxide flux is shown in Figure 4: where positive, imission of CO_2 from the surface towards the atmosphere (CO_2 spring) and vice versa, the negative values indicating absorption of CO_2 by the surface (CO_2 well) .
The alternation of values demonstrates the turbulent character of the phenomenon, which is thus strongly tied to local conditions that develop in the urban canopy.
If we consider a weekday (Thursday, November 27) we can see how the immision of CO_2 in the atmosphere is strongly connected to the time of day at which traffic is at its busiest (Figure 5).
Wind moves in a North-South direction caused by channelling of air masses along the direction of the street, due prinicipally to the presence of buildings. The wind intensity is relatively low, except for the already mentioned instance of increased atmospheric turbulence following the occurence of precipitation.
The intensity and direction of wind vectors are shown in Figure 6.

Figure 4 - CO_2 flux throughout the monitoring period



Data Source: CNR IBIMET Bologna

Figure 5 - CO_2 flux during a working day (Thursday, November 27)



Data Source: CNR IBIMET Bologna

Finally latent and sensible heat flux, obtained from data from the sonic anemometer and from IRGA (LICOR 7500) with the eddy covariance technique, are shown in Figure 7. Latent heat flux is around zero, owing to the lack of transpiring surfaces which distribute vapour into the atmosphere.

On the other hand sensible heat flux is consistently positive, in contrast with that which we would find in a rural situation where there is a high correlation with the daily development of radiation. This is due to the 'island' of heat in the city that causes the urban area to have a greater temperature than the surrounding area due to the presence of asphalt and concrete mass.

Figure 6 - Change in wind vector speed and direction

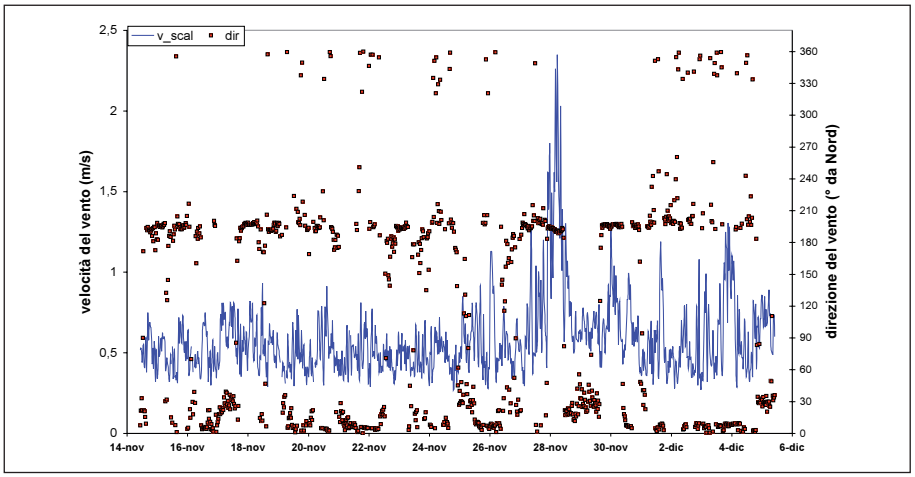
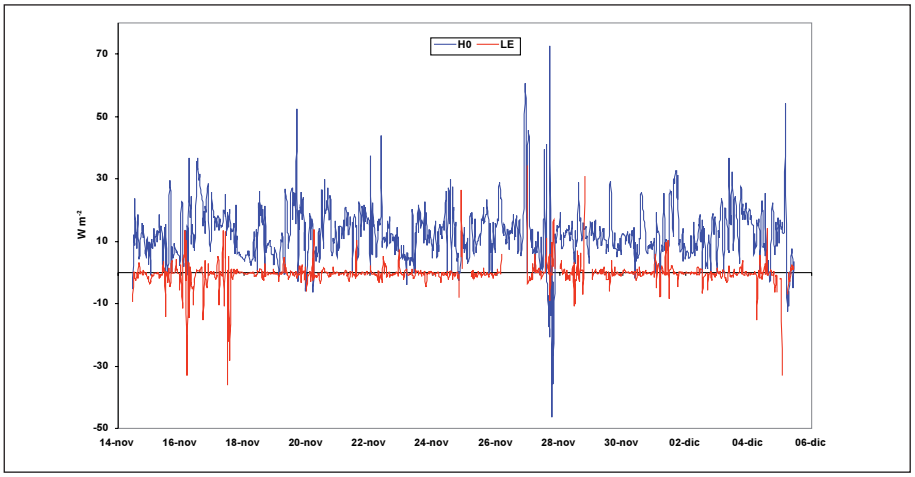


Figure 7 - Change in sensible heat flux (H0) and latent heat flux (LE)

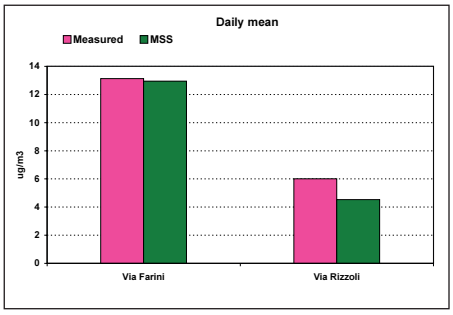


Data Source: CNR IBIMET Bologna

4. ASSESSMENT OF DISPERSION OF POLLUTANTS

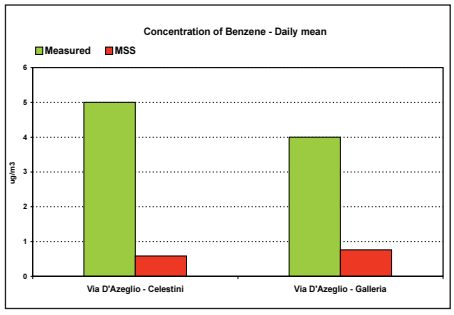
The application of the model took two phases:
1. Calculation of the emission of pollutants generated by the vehicle traffic in the street within the observed area; this was reconstructed using the Arianet software TREFIC (*TRaffic Emission Improved Calculation*) [8,9], used in the Municipal Administration of Bologna, in particular regarding the emission of PM10, which also take into account "non-exhaust" emissions (brake and tyre wear, asphalt abrasion)[5];
2. Simulation of the atmospheric dispersion of pollutants emitted by vehicle traffic , taking into consideration the effect of buildings. Arianet MSS (Micro-Swift-Spray) [7,] consists of a meteorological model [6], capable of building a three-dimensional field of the average flux not diverging around obstacles, paired with a Langrangian particle model [10, 11, 12, 13], in order to reproduce the diffusion of pollutants.

Graph 1 - Benzene in Via Rizzoli and Via Farini



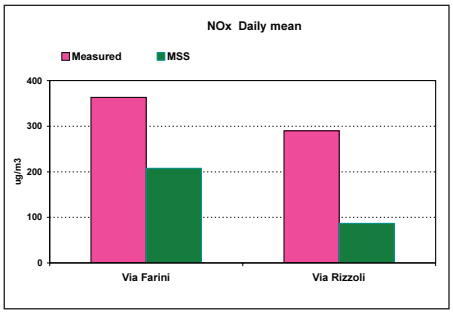
Data source: Arpa Emilia-Romagna, ARIANET S.r.l.

Graph 2 - Benzene in Via D'Azeglio



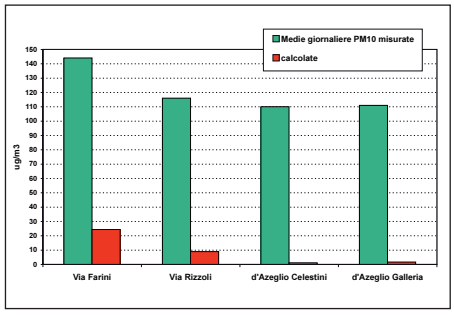
Data source: Arpa Emilia-Romagna, ARIANET S.r.l.

Graph 3 - NOX in Via Farini and Via Rizzoli



Data source: Arpa Emilia-Romagna, ARIANET S.r.l.

Graph 4 - PM10 at all sampling points



Data source: Arpa Emilia-Romagna, ARIANET S.r.l.

The TREFIC + Micro-Swift-Spray suite effectively reconstructs the circulation in microscale in a zone of complex orography such as the centre of Bologna and reproduces correctly the concentrations of benzene measures at points adjacent to street traffic i.e. the measuring posts on Via Farini and Via Rizzoli. Less effective is the representation of benzene diffusion in the pedestrian section of Via D'Azeglio, likely due to the lack of certain emission sources and of anemology in the simulation.
Compared to the measured concentrations, nitrogen oxides and particulate were underestimated by the model. The causes are the omission in the simulation of the emissive contribution of heating equipment of buildings and urban background concentrations (very pollutant and homogenous over a large area). Also important as regards PM10 is the contribution of chemical reactions in the atmosphere which form secondary particulate from other pollutants: this effect has not been dealt with in the model.

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MOBILITY MANAGEMENT

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Euromobility

Mobility Management can be considered as an interdisciplinary way to approach mobility subjects crosswise. Actually, it does not simply apply to technical and structural aspects but also to those related to behaviour and knowledge by promoting the development of the culture of sustainable mobility.
The analysis carried out confirm a steady growth of mobility management in terms of number of mobility managers appointed as well as of number and quality of the activities developed, showing a growing involvement just of those Italian areas where many problems aroused in the past which delayed the introduction of mobility management itself.
In Italy, since its introduction mobility management has not just widespread itself throughout the application of mobility plans but it also developed an educational and communication side which has widened its meaning.
Currently in Italy, 57 area departments have been surveyed and, in comparison to 2005 data, 4 new departments were identified: the municipality of Perugia, Pozzuoli (NA), Terni and the province of Bergamo. In further areas appropriate tools have been prepared in order to officially introduce mobility management into the Administration objectives. On the other hand, some others have either abandoned (e.g. the municipality of Cagliari) or have not put their plans into practice (e.g. the municipality of Livorno). The most interesting survey result comes from the south of the country where, after a slow and difficult initial stage, activities towards sustainable mobility are being carried out.
As far as the increased number of mobility managers appointed, this is due to an increase of appointments within the same areas, in comparison to the previous year, as well as to the appointment of mobility managers in areas which have not officially set up a specific department yet. Besides, in the area department of the province of Bergamo, whose official institution is dated December 2005, there are 20 company mobility managers of which 14 operate in companies/boards which meet the requisites set by the Ministry Decree of 27/03/1998. Since 2005 the number of company mobility managers has risen from 632 to 711. In some areas, which promptly supported the introduction of mobility management in Italy, the percentage of managers appointed is very high reaching in some places 100%. The survey also showed that 23 out of 24 Italian towns having more

than 150.000 residents, had took up mobility management. Nevertheless, not all the departments were actually working. Some towns have preferred province based offices to the traditional municipality based office. In the areas of the municipalities of Milano, Parma and Roma, the organisation and management of the mobility area department has been given outside. It is the case of AMA in Milano, Infomobility in Parma and ATAC in Roma. All together there are 608 company mobility managers, 195 shifting plans, 109 of them have been entirely completed and 39 partially. Home-school shift plans as well as those to and from Sites of particular attraction are not common, instead. Nevertheless, it has to be underlined that the latter interventions require agreements with the company of public transport and measures involving employees and users.
12 Shift Plans for Sites of particular attraction have been prepared and 5 of them have been carried out. But out of 11 home-school shift plans only 1 was carried out giving evidence that environmental education project are useful tools to back up sustainable mobility strategies. Mobility management while pushing forward sustainable mobility aims at the dissemination of a more environment friendly approach to mobility. Therefore, even when a mobility plan is not put into practice, the area departments often promote initiative towards users information and awareness. Communication and educational actions are taken to help citizens be conscious of the use of private means and how they can affect environment, health and social relationships.
Leaflets and other material to be given out on special occasions, are the most employed ways to reach the highest number of users, along with websites which provide also operative tools for their activities to company managers as well as general information on mobility management and sustainable mobility. As already mentioned, special attention is given to communication at school level.

THE CAR FLEET ACROSS THE MAIN ITALIAN CITIES

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1. INTRODUCTION

In industrialized countries there is a strict correlation between growth in gross domestic product (GDP) and mobility demand in general.
The level of car ownership is closely related to car use (and thus to the volume of mobility) and — especially in urban areas — to traffic congestion. Thus, this paper provides information about what is driving transport demand.
The size of the privately owned vehicle fleet (cars and powered two-wheelers) is therefore an important driving factor behind road transport demand and the environmental pressures it causes.
This paper presents an overview and analysis of trends in the Italian vehicle fleet within the main Italian cities.
Vehicle fleet data, based on Italian Ministry of Transport registrations and kept by the Italian Automobile Club, is available for the number and type of vehicles, power supply, power volume and emission standard. This data is available for the different municipalities and districts. Passenger cars[1], two wheelers (motorcycles[2] and mopeds[3]) and light duty vehicles[4] were the vehicle categories taken into account during the survey.
In particular, we focused our attention on the vehicle fleet circulating within the municipality borders and the so called "area vasta" i.e. the totality of the municipalities belonging to the province excluding the capital. The towns examined were the 24 Italian cities with more than 150,000 inhabitants.

[1] Road motor vehicle, other than a motor cycle, intended for the carriage of passengers and designed to seat no more than nine persons (including the driver).
[2] Two-wheeled road motor vehicle with or without side-car, including motor scooter, or three-wheeled road motor vehicle not exceeding 400 kg (900 lb) unladen weight. All such vehicles with a cylinder capacity of 50 cc or over are included, as are those under 50 cc which do not meet the definition of moped.
[3] Two- or three-wheeled road vehicle which is fitted with an engine and having a cylinder capacity of less than 50cc (3.05 cu.in) and a maximum authorised design speed in accordance with national regulations.
[4] Road vehicles designed, exclusively or primarily, to carry goods, of less than 3,500 kg gross vehicle weight (GVW). Vehicles with more than 3,500 kg GVW are referred to as heavy duty vehicles (HDVs).

We analysed the vehicle fleet numbers by comparing the 1996, 2000 and 2005 figures. Data on motorization characteristics (splitting by power supply, engine displacement, legislation classes according to emission standard steps) analysis has been carried out by comparing only the 2000 and 2005 figures (data was available starting from 2000).
Only a rough estimate has been possible for mopeds: in Italy they are considered unregistered property; thus there is no single official figure on the existing and circulating total in each geographical unit.
According to the national association of cycles and motorcycles the total number of mopeds in Italy was estimated at 5,000,000 in 2005. The total number of license plates requested and supplied by the motor vehicle department within the provinces has been used as proxy variables to estimate the number of mopeds circulating in each of the provincial areas.
To estimate the number of mopeds circulating within the municipality border we have introduced a further hypothesis by considering the ratio between mopeds circulating within the municipality and within the province equal to the ratio of motorcycles circulating within the municipality and within the province. Furthermore the legislative classes have been estimated by starting with the number of license plates requested during the years when different emission standards were valid.

Historical Analysis

The Stock of road vehicles, i.e. the number of road vehicles registered at a given date and licensed to use roads open to public traffic, has increased through the years following economic growth in both the main cities (accounting for half of the Italian vehicles) and across the whole country.
The number of vehicles increased five fold between 1951 and 1961; three times more in the following decade; during the ten next years it continued to increase: between 1971 and 1981 and during the 80's it increased by 63%; only between 1991 and 2001 did this trend seem to be slowing down ("only" +17%). A decrease in the inter-annual growth rate appears for the first time in 1996 (- 0, 5% with respect to 1995). In spite of this, in the following years the car fleet began to increase again.
Italy is at present in second place in Europe for number of cars per inhabitant. Unfortunately this growth has not been accompanied by a suitable growth in the transport infrastructure and public transport systems as needed in urban areas. This type of development could explain why in Italy more than 80% of mobility needs are absorbed by using private means.

Passenger Cars

At national level, after decades of continuous growth, passenger car numbers showed

a downturn in 1996 for the first time. During the following years, however, the number of cars started to rise again and continued to increase year by year. Focusing on cities at municipal level the figure is heterogeneous: Milan, Trieste, Genoa, Bologna, Florence and Cagliari car numbers went down slightly both in 2000 and in 2005, compared to 1996. In Verona, Parma, Modena, Prato, Rome, Foggia, Bari, Taranto, Reggio Calabria, Palermo, Messina and Catania, car fleet numbers rose in 2000 as well as in 2005, compared to 1996. More widespread and intense passenger car number increases were observed in surrounding suburbs moving outwards from the central city rather than within the communal borders.
Car numbers in many Southern cities increased in 2005 by 20% compared to 1996.
Passenger cars per capita at national level, is the highest in Europe; all the 24 cities show more than 500 cars per 1000 inhabitants, except Venice and Genoa. Many of these exceed 600 cars per 1000 people; the highest number has been recorded in Rome (732). The same figure appears from the "area vasta" municipality. People living far away from the city centre, needing to get there daily, seem to have no alternative but to use private cars: this cannot be ignored when we evaluate traffic congestion and the contribution to air pollutant emission from mobile sources in urban areas.

Car Fleet by Engine Displacement or Size

The majority (more than 50%) of the passenger car fleet utilizes an engine displacement of less than 1400 cc. 30-40% utilize an engine displacement which is between 1400 and 2000 cc; less than 10% are over 2000 cc. However, by comparing 2000 and 2005 data we can observe an overall increase in cars with over 2000 cc (+30 - 40%) and medium-displacement (up to +20%) cars throughout all the cities analyzed. Flexibility, comfort, reliability, safety, need to travel for long distances daily, are the decisive factors that affect people's choices versus the high powered car. However, this trend could have a negative impact on mobility issues: higher space occupancy may lead to congestion and parking problems; higher fuel consumptions may lead to higher pollutant and greenhouse emissions by these kinds of vehicles compared to cars with less engine power. Moreover, comparing two cars using the same fuel and of the same age, higher engine displacement will lead to higher purchasing and operating costs: present trends seem to highlight the fact that people do not find this aspect a priority when making their decisions.

Car Fleet by Type of Fuel Used

Passenger cars may be classified according to the type of energy used by the motor, the main ones being Gasoline (petrol), Diesel, Gas-powered and Electricity.
Most of the cars are gasoline powered (from 60 to 90%). Diesel powered cars represent a portion of the car fleet ranging from 11. 9% (Trieste) to 30.2% (Foggia).

Gas powered cars (GPL or Methane) are generally less than 5% of the whole car fleet, except in the towns of Emilia Romagna and Puglia. Only Foggia accounts for more than 10% of gas-powered cars.
The share of diesel cars in the entire passenger car fleet has increased continuously during the last five years: the increase was higher than 50% in all of the cities. Contemporary gasoline powered car numbers fell (from - 7% in Reggio Calabria to - 20% in Milan). The same figure (except for Reggio Calabria + 5%) was observed for gas-powered cars (GPL) (from – 4% in Padua to – 45% in Livorno).
Methane powered cars represent a minimal part of the car fleet but have shown a rapid increase in some cities, strongly related to the availability of filling stations (still not spread over the whole country).

Car Fleet by Legislative Steps: Legislation Changes
This gives some indication of the time needed for new technologies to be introduced into such fleets.
Car numbers meeting the most stringent emission standards (Euro III and Euro IV) increased remarkably, as shown by comparing car fleet legislation changes in 2005 with respect to 2000.
There are some slight differences between the cities: in Northern - Central Italy the pre-Euro cars in 2005 were 20% of the fleet (whereas they were more than 40% in 2000). In 2005 Euro III become the majority (more than 30% of the fleet). The Euro IV cars were about 10% in 2005 (not yet available in 2000). In Southern cities the pre-Euro cars in 2005 were still up to 40%, though decreasing (they were about 60 - 70% in 2000). The percentage of Euro III and Euro IV cars was slightly lower than the Northern figure.

Motorcycles
Overall, remarkable increases in motorcycle figures (more than double in many cities, comparing 2005 with 1996) have been seen. More than 70 motorcycles per 1000 inhabitants have been recorded for 2005, some cities exceeding the value of 100x1000.
This phenomenon can be explained by the need for fast mobility throughout the cities, which is hard to achieve either by passenger car, mainly due to traffic congestion, or by public transport which is rarely competitive if not underground.
Most of the motorcycle fleet was placed within the first three engine displacement classes (less than 125 cc, from 126 to 250 cc, from 251 to 750 cc). The highest class (higher than 750 cc) generally accounts for less than 10% of the fleet. The favourite engine displacements were 126 -250 cc and >750 cc: in general these classes increased during the last few years much more than the others. The motorcycle numbers up to 125 cc even decreased in some cities (Prato, Naples, Foggia, and Venice).

The motorcycle fleet is rapidly changing due to market activity. This has lead to improvements in the fleet quality due to an increase in the number of vehicles which now respect the most stringent emission standards.

Moped

As underlined in the methods section, a precise estimate of the total number of mopeds in Italy is complicated by the fact that mopeds are considered unregistered property, thus there is no single official figure for the existing and circulating total in each geographical unit.

However the results of our estimate show that moped numbers in 2005 were much lower than in the past and the trend towards better quality, regarding emission standards, seems to be slower than for motorcycles.

Light Duty Vehicles

In analyzing urban mobility it is particularly important to focus on the light duty vehicle class (vehicles used for the carriage of goods and having a maximum weight not exceeding 3.5 metric tonnes and mainly diesel powered), because of their widespread use, high distances covered daily within the communal border, bad driving conditions (frequent stop and starts due to loading and unloading operations), high fuel consumption and often poor maintenance.

LDV vehicle fleet share cannot be considered negligible when taking into account these preliminary comments. Moreover, the last five year trend shows a sharp LDV number increase (up to + 58% in Rome). As for the other vehicle category, the fastest growth has been seen in the rise of vehicles respecting the most recent emission standards, although in 2005 there were still important difference between the Northern cities (less than 30% LDV pre-Euro) and most of the Southern cities (more than 40% LDV pre-Euro).

Conclusion

The analyses carried out cover a few indicators which are useful in understanding urban mobility status and trends in the main Italian cities. The information that arises concerning the vehicle fleet cannot be put to one side because it is a first step towards the monitoring of unsustainable mobility effects on the environment, health and quality of life for citizens living in highly urbanized areas.

Although the picture is not completely negative (the improvements on engine quality - i.e. meeting the euro III and euro IV standard - could lead to a relevant reduction in pollutant emission) the increase in private vehicle ownership and use has led to a significant impact on street congestion, air pollution, road accidents, health and quality of life for citizens themselves. Therefore, the main question is how can we sustain this high lev-

el of accessibility and mobility demand whilst reducing the negative impact? Sustainable transport policies based on the integration of transport and environmental strategies could be the right way to deal with the increase of traffic volume and street congestion, as well as the resulting noise and air pollution issues. Moving from road to rail as well as from private transport to public transport is the step needed to achieve this ambitious goal. Quality of life will still be threatened by mobility issues if fast, integrated and incisive action is not taken.

PUBLIC TRANSPORT FIGURES ACROSS THE MAIN ITALIAN CITIES

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Our objective is to give a general overview of the public transport network (in operation, under construction and planned) operating in the main Italian urban areas, in order to monitor the main factors that affect both public transport service quality and efficiency. There is special focus on supply, accessibility, environmental impact and modal integration.
The data analysed refers to the year 2005. Short term trends as well as medium term perspectives have been analysed when sufficient data was available.
Data collection has been carried out by submitting a questionnaire to the 48 public transport companies operating within the municipal territory of the major 24 Italian cities (with more than 150.000 inhabitants).
Supplementary information, in addition to info from the questionnaires, has been collected from the companies' web sites as well from the "*carta dei servizi*", a document on company performance and customer agreements which are published yearly, as decreed by law.
Tables 1 and 2 give an overview of key figures.
The urban transport network for each city generally includes the suburbs and often extends out away from the city's outskirts; many surrounding municipalities are connected, in the main, by the same local transport network (as with Milan, Venice, Naples, and Turin).
Buses are the most commonly represented surface public transport mode, being present in all of the cities.
Larger cities, in terms of population, show the most densely developed transport networks with the widest variety of public transport modes and are the most likely to have metro systems and heavy urban rail networks, which provide rapid transit to central areas and are unaffected by road traffic congestion. On the other hand smaller cities (less than 300,000 inhabitants) are largely reliant upon bus services for the delivery of their public transport.
The supply/demand relationship in public transport has been measured using the total public transport seat kilometres by the total public transport boarding ratios as indicator, which ranges between 17 and 71.

The cities (Rome, Trieste, Genoa) showing lower values (from 17 to 19) probably suffer from excess in demand during rush hours. The higher values, which are mainly recorded in the Southern cities, rely on low public transport competitiveness versus private transport.
In the short term (2003-2005), some cities have increased both public transport seat kilometres and total public transport boarding (Turin, Brescia, Parma, Florence) whereas others have shown public transport boarding increases in spite of reduction in the public transport service (seat-km) (Padua, Venice, Genoa).
The attractiveness of surface public transport also depends on average speed, ranging between 13.3 (Catania) and 18.5 km/h (Livorno): still too low to become a critical factor in convincing people to migrate from private transport to public transport in the medium term. These figures are mainly due to traffic congestion and to the low availability of reserved public surface transport routes (generally a few percentage points of the total length of the public transport networks).
Another critical point appears to be the increase of the public transport operating cost per vehicle kilometre (from 3 euro-km in Modena to 5.75 euro-km in Naples, increased by 7.1% vs 2003 in Turin up to 19.2% in Brescia) mainly due to fuel cost increase.
Environmental concerns, in particular, have been taken into account during the last few years, by the majority of the public transport network.
Even if diesel powered buses represent a portion of the bus fleet ranging from 60% to 100% and older vehicles are still in force (pre-euro, more than 13 years old, from 2.4% in Milan to 100% in Bari), buses meeting the most stringent emission standards (Euro III) have increased remarkably. The share varies largely between the cities (from 0% in Messina and Bari, to 56.3% in Rome).
Low impact fuels (low sulfur diesel fuels, water diesel emulsion) as well as continuously regenerating trap systems are becoming widespread. 96% of the Padua fleet was biodiesel powered.
Methane gas powered bus fleets range from 0.3% (Rome) to 32.5% (Florence).
Some cities have not introduced methane powered buses yet (Trieste, Modena, Livorno, Reggio Calabria, Messina, Cagliari).
There are plans for renewing (from 7.6% in Taranto to 63.3% in Cagliari) or extending the existing public transport fleet (from 1% in Naples to 47% in Bari). Many of these plans provide for a large increase in the methane powered fleet.
Trolley-bus, tram and metro systems are much less common than diesel or methane powered buses: only Milan, Rome, Turin and Naples out of the 24 cities, have all three sets of electrical-based public transport services in place.
In some of the cities with smaller populations trolley-buses are in circulation (Genoa, Parma, Modena, Bologna, and Cagliari).
Small tram systems exist in Trieste and Messina.

Cities with networks serving populations greater than 500,000 inhabitants have a metro system.
Palermo and Florence are notable exceptions. Genoa (610,000 people served by the city network) is the least populous city to have a (small) metro system. Existing Italian metro systems are much less extensive compared to Europe's main metro systems.
The majority of the cities are served by strong rail links, although some are only medium-sized and most of the larger cities have a service within the metropolitan area. For instance the presence of a capillary city rail network is clearly shown by data for the Rome province: 85% of citizens are fifteen minutes walking distance from a local train station, 8 lines extend through the province for 550 km, 1,400,000 travel daily with 350,000 people travelling daily from home to work by train. Considering the ongoing projects into the 24 cities.
More than 200 km of new rail based systems (metro, light rail) will be set up in the short to mid term (2007 - 2015).
Distribution of bus stops is generally medium in density (six stops per square kilometre on average). This leads to an average 300m walk to get to the nearest bus stop. This figure, however, can vary greatly in different areas of a particular city (historical centre, suburb etc.); quantitative data analysis is still in progress.
Improving bus stop infrastructure for public transport users could be the way to increase the level of customer satisfaction and to maintain or even increase the number of users.
Bus stop support features (bus shelters, seats, dynamic real time passenger information, improved access and usability for mobility impaired people etc.) were still in short supply or lacking, not withstanding that some cities seem to be improving (for instance more than 30% of the Bologna, Turin, Brescia, Milan and Palermo bus stops provide bus shelters and seats).
Ordinary fares range from 0.77 euros to 1.05 euros per fixed time ticket. There is widespread application of special fares (student, elderly, etc.) together with ordinary monthly and annual season tickets. Notwithstanding the many complaints, fares seem to be still really competitive compared to private transport costs. Several cities and regions offer integrated public transport fares with fixed time tickets and season tickets that allow access to the different public transport modes available (metro, train, buses, tram) even when run by different companies.
Responsive demand public transport systems (DRTs) have been implemented in several cities (18 lines, throughout six cities) with increased demand and agreements (up to 130.000 yearly boardings in Florence).
Intermodality could be enhanced by increasing parking facilities within the areas surrounding the metro, tram and train stations and by planning affordable fares for public trans-

port users. This goal seem to have been pursued through the development of parking facilities managed by the public transport company themselves (up to 54,000 parking places managed by the public transport company in Turin for instance) although this practice is still not widespread throughout the cities that were analysed (13 of the 24 cities sampled manage interchange parking facilities).

Table 1. Italian cities - surface public transport network figures

	network density [km-1]	places-km/boardings	speed [km/h]	boardings trend [%]	costs trend [%]	user friendly stops [%]	tickets fares €	DRTs boardings	parking facilities
Turin	159	33,7	17,3	2,8	7,1	39,9	0,90 (70')	-	54.107
Milan	139	25,6	n.a.	n.a.	n.a.	n.a.	1,00 (75')	-	39.000
Brescia	104	25,4	17,5	15,7	19,2	33,4	1,00 (75')	-	-
Verona	92	n.a.	15,2	10,5	9,4	15,6	1,00 (60')	-	250
Venice	85	22,3	n.a.	5,5	6,3	23,6	1,00 (60')	-	-
Padua	94	21,8	14,0	4,0	n.a.	19,7	0,85 (60')	-	n.a.
Trieste	163	17,7	14,8	-6,4	8,1	20,0	1,05 (75')	-	-
Genoa	387	19,1	15,0	1,7	9,4	0,8	1,00 (90')	31.058 (3)	-
Parma	45	24,6	17,3	3,1	11,6	16,1	0,90 (60')	117.615 (1)	-
Modena	72	70,8	18,0	0,1	0,0	15,2	0,88 (n.a.)	20.119 (2)	1.810
Bologna	n.a.	26	n.a.	n.a.	n.a.	34,0	1,00 (60')	-	30.195
Florence	88	25,1	n.a.	7,1	n.a.	2,8	1,00 (60')	127.150 (2)	-
Livorno	305	n.a.	18,5	-7,3	n.a.	11,1	1,00 (75')	n.a. (6)	1.700
Rome	170	16,9	13,9	n.a.	n.a.	7,4	1,00 (75')	n.a (4)	-
Naples(a)	280	n.a.	17,0	n.a.	12,3(b)	13,9	1,00 (90')	-	1.725
Foggia	55	49,7	n.a.	n.a.	n.a.	8,9	0,80 (60')	-	-
Bari	478	50,5	18,0	-5,7	9,5	17,1	0,77 (75')	-	-
Taranto	154	51	16,0	1,3	7,5	29,2	0,80 (90')	-	-
R. Calabria	200	60	n.a.	n.a.	n.a.	n.a.	0,80 (90')	-	2.997
Palermo	95	24,7	14,7	-4,6	15,7	36,9	1,00 (120')	-	17.000
Messina	n.a.	n.a.	15,0	n.a.	n.a.	14,8	0,90 (180')	-	4.800
Catania	134	46,4	13,3	-9,5	12,4	18,4	0,80 (90')	-	1.000
Cagliari	100	37,8	16,0	n.a.	n.a.	-	0,77 (90')	-	671

network density: network length (km) per surface area served (km^2)
places-km/boarding's: number of places km offer yearly by number of yearly boardings
speed (km/h): mean operational speed
boarding's trend: yearly boarding's variation (%) (2005 vs 2003)
costs trend: yearly operational costs variation (%) (2005 vs 2003)
user friendly stops: portion (%) of stop's provided with bus shelter at least
tickets fares: ordinary tickets fares (in brackets time validity)
DRTs boarding's: Demand Responsive public Transport systems yearly boardings (line's numbers supply in brackets)
parking facilities: parking places supplied by the public transport companies
n.a. data not available

Table 2. Italian cities - Public transport fleet by energy system

	diesel powered	pre-euro	euro 3	methane powered	new rolling stock	rolling stock increase	electrically powered	metro systems (km)	new rail based systems
Turin	69,1	44,6	6,0	13,7	28,2	-	17,2	7,5 (1)	14,4
Milan	n.a.	2,4	54,8	n.a.	n.a.	n.a.	-	74,6 (3)	12,5
Brescia	77,2	44,9	-	22,8	14,7	7,9	-	n.a.	18
Verona	66,5	54,2	1,5	29,4	25,4	-	4,1	-	n.a.
Venice	96,7	42,9	22,7	2,4	11,0	3,2	0,9	-	20
Padua	79,7	30,9	42,8	19,7	11,1	11,1	0,7	-	10,5
Trieste	97,9	10,0	56,3	-	54,7	0,7	2,1	-	n.a.
Genoa	93	-	26,6	1,3	37,7	2,1	5,7	5,5 (1)	4
Parma	59,6	46,5	16,5	11,3	38,5	-	29,1	-	12
Modena	85,7	35,4	11,8	-	n.a.	n.a.	14,3	-	n.a.
Bologna	76	47,2	8,4	6,8	n.a.	n.a.	17,2	-	11,5
Florence	61,6	13,6	31,5	32,5	n.a.	n.a.	5,9	-	35
Livorno	90,7	28,2	24,4	-	n.a.	n.a.	9,3	-	n.a.
Rome	89,8	18,3	56,3	0,3	55,4	39	9,9	36,6 (2)	29,3
Naples[a]	85,3	30,7	8,9	4,5	25,2	0,5	10,2	40 (2)	8,8
Foggia	81,1	-	43,3	14,4	n.a.	n.a.	4,5	-	n.a.
Bari	94,4	100,0	-	5,6	22,4	46,5	-	-	10
Taranto	88,0	49,4	22,7	10,3	7,6	-	1,7	-	n.a.
R. Calabria	99,9	n.a.	n.a.	-	n.a.	n.a.	0,1	-	n.a.
Palermo	88,2	48,9	6,1	7,8	14,9	-	4,0	-	14,8
Messina	100,0	51,3	-	-	n.a.	n.a.	-	-	n.a.
Catania	90,6	55,1	5,6	7,9	17,7	-	1,5	3,8 (1)	n.a.
Cagliari	81,7	58,6	10,6	-	63,3	0,7	18,3	-	6,45

diesel powered: diesel powered buses
pre-euro: older diesel powered vehicles still in force portion (%) of the bus fleet (pre-euro, more than 13 years old)
euro 3: portion (%) of the bus fleet meeting the most stringent emission standards (Euro III)
methane powered: methane powered buses portion (%) of the bus fleet
new rolling stock: portion of rolling stock planned to be renewed by 2010.
rolling stock increase: planned increase of the bus surface public transport fleet by 2010.
electrically powered: portion (%) of the surface public transport fleet electrically powered
metro systems (km): length of the existing metro systems (number of lines in bracket)
new rail based systems: planned increase (km) of rail based systems by 2010.
n.a. data not available

Increased availability and safety of the service, comfort, accessibility, costs, efficiency (particularly punctuality, routes, number and frequency) seem to be the determining points for making public transport more competitive compared to private transport, since they are the main factors that affect the citizen transport modal choices.
Although progress has been seen during the last few years, the public transport companies' efforts still seem to be feeble and patchy in making a real change to attitude of Italians towards public transport.

ISHTAR SUITE APPLICATION TO 7 EUROPEAN METROPOLITAN AREAS

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Worldwide, cities face common challenges concerning their quality of life: degradation of the urban environment, significant risks to citizens' health, stress caused by traffic congestion as well as economic inefficiency and progressive damage to the artistic and monumental heritage. Additional difficulties derive from the lack of integrated tools that could allow cities to make balanced decisions on a wide range of issues. In this context the European Commission co-funded the ISHTAR Project in 2001, aimed at building an Integrated Suite of software models to assess the impact of urban policies and actions on citizens' quality of life, and in particular on traffic congestion, air quality, people's health and conservation of monuments. The aim is to provide a prototype tool to be used for the planning of activities in the years to come.
The ISHTAR Project had several scientific and technological objectives:
- The integration of a large number of software tools and the creation of specific modules to simulate key processes such as transport behaviour and its direct impact on the urban environment.
- The achievement of a high spatial and temporal flexibility in the use of the tool in order to maximize opportunities for the use of this application, from local short-term actions to widespread long-term policies.
- The development of specific modelling areas such as the representation of the policies' effects on citizen behaviour, the integrated 24hr simulation of traffic emissions, noise and safety and the disaggregate and dynamics in the estimation of population exposure to air pollution.

The scientific core value of the Suite is largely linked to a few crucial modelling developments on which the Suite's accuracy and significance of results strongly depend. These areas are:
a) Prediction of the effects of citizens' reactions to postulated measures.
b) Improvement of the modelling of vehicle emissions, particularly concerning the consideration of speed variability along the network links, and the spatial-temporal distribution of 'cold start emissions'.

c) Development of an urban road safety model, which can take into account the variable flow levels in the network.
d) Disaggregate estimate of the effects of pollution on people's health, based on the analysis of group mobility within the population.

The ISHTAR Suite was built on the following software modules including one or more software tools:

1. The Citizen Behaviour Model: The Cellular Transport Methodology (CTM) is a new software tool developed by ISIS (Italy) that simulates the effects of policies and measures on the behaviour of citizens in terms of mobility, thus producing the modified Origin-Destination matrices.
2. The Transport Toolbox: the VISUM model, developed by PTV (Germany) was further enhanced during the course of the Project, with the innovative algorithm of 'Metropolis' for an improved simulation of the congestion phenomenon. However, the potential suite users are free to continue to use their own traffic model.
3. The Transport Direct Impacts Module: the TEE2004 software, by ENEA and ASTRAN (Italy), was chosen for its particular flexibility in terms of space and time. This includes advanced modelling of kinematics and cold start effects on the emissions, the feeding of several downstream suite elements by calculating the emissions of pollutants and noise and the occurrence of accidents. The tool is compatible with most of the traffic models output.
4. Noise Propagation and Pollutants Dispersion Module: for urban scale and long term analysis the suite relies on ARIA Impacts software, while for meso-scale and short term events ARIA Regional will be the future reference. Both models are developed by ARIA Technologies (F). For noise propagation the Soundplan software (by Braunstein & Berndt GmbH, Germany) has been integrated into the Suite.
5. Exposure and Impacts on Health Module: the TEX (Transport Exposure) module has been developed by the WHO-ECEH office in Rome to provide results on exposure of population groups in their residential areas or on journeys within the city network. The evaluation of the health risks related to the exposure to pollutants, noise and accidents is run with H.I.T. software, which is also developed by WHO. It provides estimates of life years lost due to air pollution, noise annoyance and accident side-effects.
6. Impacts on Monuments Module: Software purposely developed for ISHTAR by ENEA (Italy) and PHAOS (Greece), capable of assessing the loss of material or the deposition of the earth's crust and the money needed for maintenance and repair.
7. Overall Analysis Tool for Policy Scenarios: the Cost-Benefit Analysis model and the Multi-Criteria Analysis model gather the data from the upstream models and give the results of the comparison between the scenarios developed. Both of them are developed

by TRaC – LMU (UK).

8. Software Integration: developed by INRETS (France) to integrate the various tools into a Software Suite. The integration is done by a Manager that launches the so called 'connectors'. These connectors are pieces of software that upload the data needed by the single tools into the appropriate format, launch the tool and then download the results of the run into the ISHTAR Suite Database. These are made available for other tools, or for output through the Geographic Information System (ARCGIS) which is used for managing geographic data.

The ISHTAR suite was tested in seven case studies on cities involved in the ISHTAR project:

– The **Athens** Case Study: focused on the recent construction of the "Attica Road" motorway in the Athens region.

There were many extremely useful outcomes as a result of this case study, helping the operators involved to soften some of its impact and improve on the main negative effects caused by the motorway. Therefore, "Attica Road" motorway derived huge benefits from this case study and managed to improve its operational status.

– The **Bologna** Provincial Authority case study: it concerned an Environmental Impact Assessment of new infrastructure for the City of Imola, a Municipality belonging to the Province of Bologna, in order to increase levels of environmental protection.
Different infrastructural scenarios were simulated with reference both to direct interventions of traffic management (new paths, roadway adjustment, and intersection regulation) and indirect interventions (public transport services, etc.).
The air concentration of NOx, CO and PM10 from road emissions has been modelled.
The simulation of some of the different scenarios provided the opportunity to test the suite as an integrated tool in supporting decision-makers when adopting environmentally friendly policies.

– The **Brussels** Capital Region (BCR) traffic banning options and related accompanying measures: to be implemented when air pollution forecasts exceed specific thresholds.
The results were that a car free day appears to be efficient in reducing pollutant concentrations like NOx, CO and particles, but is useless in decreasing ozone levels in the short-term. Other conclusions were: the most efficient scenario was the one banning all EURO 3 non-hybrid vehicles; the Diesel banning scenario had a very significant impact in terms of PM10 emissions reduction and fleet evolution has at least as much impact as the traffic reduction in itself.

– The **Graz** case study: concerned the local environmental impact of a new tunnel on the

residential buildings close to one of its portals.
A detailed inter-comparison between different emission and dispersion tools has been carried out. The tests proved that with TEE software, reliable emission estimates are to be expected.
The results of the dispersion calculations using ARIA Impact and GRAL show that the overall effect of air quality control is not very high, and only by looking at direct differences can the local effects be interpreted.
On a noise pollution level, the study showed strong noise reduction in the central part of the residential area and no remarkable changes around the boundaries of the study area.

– The **Ville de Grenoble** measures, for the improvement of public transport, the monitoring of effects of the installation of reserved lanes for public transportation and new traffics lights on boulevards with heavy traffic in Grenoble centre.
The implementation of the measures led to a small reduction in emissions overall (~ 3% for CO, NOx and VOC). With regards to noise pollution, a reduction of 2 dB(a) is reported for one part of the domain while in a second part no changes could be found.

– The **Paris** case study concerned the car free days, implemented in the historical centre of Paris (area concerned: 3 x 2 km), between 7 a.m. and 7 p.m. and accessible only to public transport, taxis, "green" vehicles (LPG and electric cars) and professionals.
The temporal and spatial scale of the experiment focuses the assessment on the short-term roadside air quality impact.
The traffic model estimates that the traffic decreases by 11.5 % in volume over the whole of Paris, and congestion shifts from the centre to surrounding Boulevards.
Impact on emissions was estimated as 6 pollutants (NOx, CO, COV, SO2, PM and CO2) at each traffic link. The car free day impacts directly on the concentration of pollutants in the central area.
The Aria IMPACT dispersion model was tested too and it was able to depict the general trend of air pollution, but was not able to follow the peaks as in these cases it is local influences (near source location and buildings) that dominate the scenario. However, the concordance between calculation and measurement is good.
Globally, an evaluation of Car Free Day 2003 impact on Air Quality in the central area was estimated at a ~ 60 % decrease for road-side pollution. On the boulevards, the enhanced traffic model pointed clearly to increased congestion.

– The **Rome** traffic banning policy case study for non-catalysed vehicles, implemented within the "Rail Road" area, which surrounds the historic centre.

The main effect of this measure was a change in the fleet composition and no major effects were expected on traffic flows. Pollutants modelled both by the Emission and Dispersion modules were CO and PM10. Noise emissions were calculated by TEE while noise propagation and exposure in a smaller area were calculated by Soundplan. The PM10 dispersion modelling output was used to generate an exposure and health effects assessment.
The simulation showed a small difference between the two scenarios in terms of health impacts from the policy tested. The small difference in the scenarios, and between the scenarios and the background, can be explained by the reduced dimensions of the area under analysis, which has been greatly affected by its surroundings and includes sources that have not been modelled.

Application of ISHTAR Case studies in the seven cities involved, were really useful in helping to understand the city planner's requirements and for the testing of the tools. In particular, the need for an increase in collaboration between planners and experts of all areas involved in the planning phase (policies, land use, transport, air quality, noise, health, monuments) was considered a priority. This should avoid the incoherent planning work that is normally the result of several departments working in parallel without a common and coordinated policy framework being set up. With the ISHTAR Suite, and its ability to analyse the many effects of the 'land use and transport' planning task, the local authorities experts and planners will be encouraged and aided in their task to work together, thus enhancing the ability to design and assess successful urban policies, as recommended by the European Thematic Strategy on Urban Environment.
The case studies have highlighted, on the one hand, the general good or satisfactory performance levels of the tools in the suite, and on the other, they have allowed the developers to take note of bugs or features to be improved and that will provide the basis for the production work of the second prototype of the tool. This second step is expected to be achieved in the frame of a large demo initiative in the Italian metropolitan areas. Moreover an ENEA spin-off project for the creation of new Advanced Technology Based Firms (see www.consorzioimpat.it – IMPACTS proposal) based on the development and marketing of decision support tools (such as the ISHTAR suite) has been approved and funded by the Italian Ministry of Industry, and is now in the incubation phase. This initiative will very probably lead to the creation of an Italian SME that could be the first legal entity having agreements with ISHTAR software providers and rights/responsibilities for marketing the suite, either in terms of providing a full package or in terms of selling calculation services based on the use of the suite.

QUALITY OF LOCAL POLICIES FOR BIKE MOBILITY

R. Canesi
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When talking about planning of urban mobility, transport strategies, interventions to reduce car pollution and improve the quality of air (and life), the great contribution that bike mobility can give should not be overlooked.
Italian cities have cycling infrastructures far below the European average. The percentage of citizens employing the bicycle as a daily means of transport is lower than that of northern Europe.
Since about 50% of trips in towns are shorter than 5 km, it is easy to understand the role that the use of bicycles could play in order to shift the balance of mobility in Italian urban centres towards a more ecological situation.
This research could be preparatory to an onging and more widespread audit and benchmarking system in the sector of Italian urban bike mobility.

The research on bike mobility in 24 Italian city centres

To assess the level of the policies supporting the employment of bicycles in 24 main Italian city centres a questionnaire was sent three times in spring 2006 to the councillorships entrusted with duties for Mobility and/or Environment.
The questionnaire included 9 questions related to subjects such as:
1) the institution of the Bicycle Office;
2) the percentage of citizens employing the bicycle daily;
3) infrastructures set up and/or provisions issued in favour of the use of the bicycle;
4) the budget set aside by the municipalities involved in the sector;
5) promotion strategies for bike mobility;
6) the involvement of other stakeholders;
7) communication strategies;
8) a survey of customer satisfaction;
9) the implemented/planned rate.

Turin, Brescia, Verona, Venice, Padua, Genoa, Parma, Bologna, Florence, Livorno and Rome returned their questionnaires appropriately filled in, that is to say only 13 cities of the 24 the questionnaire had been sent to replied.

2.2 The results

Due to the lack of co-operation from 13 of 24 cities chosen, the data collected does not make it possible to define a clear and complete picture of the state of the policies for bike mobility in the main Italian city centres. It must be said that the centres which did not answer the questionnaire were mainly located in the south of the country where, unfortunately, the state of bike mobility cannot be compared to that in the centre and the north of Italy. But also the northern cities of Milan, Modena, Trieste and Prato did not reply. In the very early stage of the research the difficulties encountered in finding the right person to address made clear the lack of bike mobility policies in the administrations which did not reply to our proposal. On the contrary, the centres that joined the research had all, though not without problems, set up their Bicycle Office.
The most interesting outcome is that bike mobility policies have better chances to be put into practice in medium size centres rather than in big ones. The centre which has the greatest modal split is, in fact, Parma (21-25%) followed by Venice (16%) and Padua (11-15%). Rome, the biggest Italian city, rates below 5%, while Turin along with Florence and Bologna range between 6 and 10%.
8 cities out of 10 have their Bicycle Office. Only 1, that is Genoa, does not have bikeways, though this can be explained by the peculiar orography of the city. The Municipality is planning bikeways along the coastline and in the valleys of the Bisagno and Polcevera.

The city having the longest and most developed network of bikeways is surely Rome with 160 km, being also the largest and most inhabited among the municipalities object of the research.

Should we proportion these data to the size of the centre and the number of its residents, the list would be reshuffled and the first place would be taken by Brescia with 1.3 km of bikeways per square km and 1.633 residents per km of bikeway. (Brescia would then be followed by Parma with 2.184 inhabitants/km). The last in the list, apart from Genova, is Livorno with 80 metres of bikeway per square km and 16.460 inhabitants per km of bikeway.

 The average number of residents per km in the 11 studied cities is 8.077.

It must be said, however, that the development of urban bike mobility is not necessarily measured by the length of the bikeways. Just think about the particular shape of Italian ancient city centres, their history and their town planning. In some centres, though there is not a well developed network of bikeways, thanks to clever policies of traffic limitation, the employment of bicycles has been strongly encouraged (compare "zone 30" and Ztl).

As far as other infrastructures, only Genoa and Rome do not have public rent-a-bike points. 5 cities out of 10 have bike-stations (roofed-in areas where bikes can be parked to continue travelling by other means of transport. 5 out of 10 have park&ride nodes. out of 10 have prepared "zone 30".

Florence, Padua and Verona like many cities in North Europe adopted provisions allowing two-way bicycles circulation on bikeways which caused a little uproar in Italy.

Rome invested more in the bike idea than any other centre in the current year with about 10.000.000 €, followed by Padua with 6.880.000 € which amounts to 1.9% of the whole municipality budget.

Padua is the city that invested more per inhabitant in the last year with about 34 €/inhabitant followed by Parma with about 19 €. Genoa spent the least with only 0.3 €/inhabitant, second-last Livorno with about 1 €.

In most cases, the making of bikeways was made possible by the co-operation among Municipalities, Public Boards and Schools. In Brescia, Venice, Bologna, Florence and Rome, local public transport companies contributed too. Private enterprises were involved in the case of Turin, Brescia, Parma, Bologna and Florence.

At least 5 cities developed specific projects on bike mobility, from the "bikes in the courtyards" ("bici nei cortili") of Torino to the incentives to purchase electric bicycles in Brescia, Parma e Livorno, to bike-marking for thefts prevention and bike-racks in the schools of Bologna.

In every city taking part in the research dedicated events have been organised along with communication campaigns. Some of them, that is Brescia, Bologna and Rome, attended the European Weeks of Mobility. Others promoted meeting, seminars, workshops (Verona, Venice, Parma and Turin). Rome, Brescia and Parma promoted bikers gatherings. Other cities joined European projects. This is the case of Florence with Urbike (project focused on how to expand the use of bicycles) and Parma with the organisation of the European Conference on Mobility Manager 2005. Almost all the eleven municipalities, except Padua, Genoa and Livorno, published leaflets, pamphlets and maps of bikeways. In particular, Parma and Venice made a great use of such tools.

Some municipalities took part in the contest 'Premio Città Amiche della Bicicletta'. Brescia won the first edition in 2002. Parma got a special mention in the second edition in 2004 and won, ex-equo with Turin, in 2006.

It is of great importance before planning serious policies of bike mobility to know habits and opinions of users and verify at the same time, when possible, customer satisfaction. Eight cities out of 11 carried out surveys on mobility in general and bike mobility in particular. Turin in 2003 took a survey on a 1.000 resident sample, age ranging between 14 and 75, on the use of the bike. In Brescia questionnaires were distributed in co-operation with a local paper in 2005. Padua, Parma, Bologna, Florence and Livorno carried out also similar surveys. The result shows that if bikeways were safer and more functional (bikeways continuity is a key aspect) the percentage of bikers would dramatically increase. In Venice interviewees judged as almost sufficient the bikeways available but showed no satisfaction as far as parking options and information. Interesting data were obtained in Florence analysing a sample of companies whose employees use the bike for their daily going to and from home and work (14%). The potential is much higher if we think that 41% of these employees cover a distance of less than 4 km.
As far as future plans, interesting as much as ambitious is the case of Turin where the municipality has planned to increase from 90 to 280 km the length of bikeways within 10 years. In the past 5 years 50 km have already been created. Positive results have been obtained in Brescia too where the figure has gone up from 33 km in 2000 to 115 in 2005. The objective is to reach 100 km by 2010. In Venice 60 % of the Biciplan has been put into practice with 60 km of the 100 km planned by the year 2010 have been created. Bologna plans to add 22 km of bikeways to the present 80 by 2008 and plans interventions for 18 more km, though no fund have been allocated yet. Genoa, which plays the role of Cinderella in this research, is planning 6 cycling routes in the Valleys of Polcevera and Bisagno as well as connections between the Principe and Brignole train stations.

THE GRACE URBAN TRANSPORT EXTERNALITIES ACCOUNTS FRAMEWORK FOR THE INTEGRATED ASSESSMENT OF SUSTAINABLE TRANSPORT POLICIES

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ISIS

INTRODUCTION

The GRACE urban transport externalities accounts framework presented in this paper is an outcome of the European research project GRACE – Generalisation of Research on Accounts and Cost Estimation (www.grace-eu.org). The GRACE project aims to support policy makers in developing sustainable transport systems by developing an innovative framework of transport accounts as monitoring instrument for the implementation of urban sustainable transport policies. Transport accounts are first of all understood as monitoring tool providing information on the state and the development of transport. This monitoring function refers to different policy relevant areas:

- Strategic monitoring: Information on the level and structure of social transport costs for each transport mode as well as on the level and structure of charges and taxes;
- Progress towards sustainable transport: Information on total environmental costs and accident costs, disaggregated into the most relevant components such as air pollution, noise, climate change etc. and – as far as possible – allocated to types of networks and vehicle categories;
- Financial viability: Information on the total costs per mode, where necessary broken down by vehicle types or network categories, relevant for all modes which are not self-financing.

So-called "pilot accounts" were designed to show the social costs and the revenues for each mode of transport on a national level within a previous European Research venture - the UNITE project (www.its.leeds.ac.uk/projects/unite/). The same arguments for establishing transport accounts on a national level are also relevant on a regional level, and the project GRACE aimed therefore to define an **Urban Transport Accounts (UTA)** methodological framework and to provide a first pilot accounts for the Rome metropolitan area.

DESCRIPTION OF THE URBAN TRANSPORT ACCOUNTS FRAMEWORK

The Urban Transport Accounts (UTA) methodology provides a global perspective of transport activities and impacts for a given urban region. The boundaries of the urban region are obviously to be defined on a case by case basis. However, at a more conceptual level, any urban region – however defined – will allow to distinguish four categories of mobility flows:

- *Local mobility*: trips whose origin and destination is within the urban region.
- *Egress mobility*: trips with origin within the urban region and destination outside, to the rest of the world.
- *Access mobility*: trips with origin in the rest of the world and destination within the urban region.
- *Transit mobility*: trips crossing the territory, with origin and destination in the rest of the world.

As it concerns the spatial detail, the Origins and Destinations are firstly to be identified with the municipalities within the urban region. The municipalities of the urban region are then aggregated in three main categories:

- *Urban municipalities*, including all the municipalities which are the main destinations of commuting and with a minimal size of 15.000 inhabitants (urban poles).
- *Peri-urban municipalities*, including all the surrounding municipalities of the urban poles (the main origins of the commuter flows directed to the urban poles).
- *Rural municipalities*, including the remaining municipalities of the urban region.

In practice, urban, peri-urban and rural municipalities are identified with the help of the surveys of commuter flows, which are undertaken at national level in occasion of the general population census survey (in Italy and in other EU countries). Local traffic flows are to be computed for the three aggregates of municipalities, while access and egress traffic flows from/to the rest of the world and transit flows are computed for the whole urban region. Local traffic flows are computed in three forms:

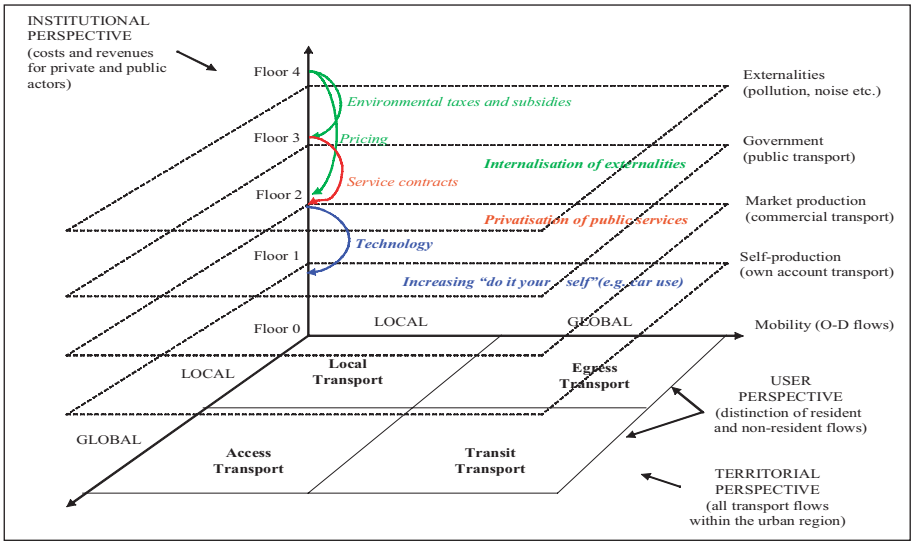
- as **number of trips** by transport mode.
- as **passenger.kilometres** by transport mode, which are estimated multiplying the number of trips by mode by average journey lengths.
- as **vehicle.kilometres** by transport mode, which are estimated dividing the number of passenger.kms by the average vehicle occupation rates.

For practical reasons, *access, egress and transit flows* are quantified only in terms of number of passengers or number of vehicle.kms, depending on which type of data is more eas-

ily available from the standard sources (e.g. railway operators, airports, highway operators, etc.).

In this way, the urban transport accounts are built upon a comprehensive picture of mobility flows which "happen" in the whole urban region, including both short distance trips within the region, and the access, egress and transit legs of long-distance (interurban) journeys. Indeed, the picture of mobility flows represents the first "floor" of data. The costs and revenues of transport within the urban region are then to be accounted for by building four other "floors" of data related to the different private and public actors who "own" the costs and revenues, as illustrated in the figure below:

Grace - Scheme of Urban Transport Accounts



At the base – groundfloor – of this scheme there is the already mentioned layer of **O-D mobility flows**, which encompasses both residents trips within the urban region or exiting from the region and non-residents trips entering or transiting in the urban region, according to a simultaneous territorial and user perspectives.
At the first floor there is the layer of **private costs for own account transport** (self-production). This layer can be divided in two sub-layers: *households*, which includes all purchase and operating costs of private cars, mopeds, bicycles, and *business*, which includes the costs of passenger and especially freight transport undertaken directly by the companies with their own vehicles (mainly road transport).

At the second floor there is the layer of **commercial transport services costs and revenues** (market production). This layer can be divided in various sub-layers according to the different transport market segments: urban transport (bus, metro, tram), regional transport (coaches, local rail), interurban road , rail, air and sea port services for passenger and freight transport entering, exiting or transiting through the urban region.
At the third floor there is the layer of **government services**, which includes capital and current expenditures (e.g. for road construction and maintenance, traffic planning and control services, subsidies paid, etc.) and revenues (taxes and subsidies received) of government. This layer can be divided in three sub-layers: *national government*, including the national taxes levied on transport within the urban region (e.g. fuel taxes) on the revenue side, while on the expenditures side national road or other infrastructure investment and maintenance costs as well as any national subsidy to the lower levels of government earmarked for transport purposes; *regional government*, including any regional tax levied on transport within the urban region (e.g. vehicle taxes) and subsidies received from the national government on the revenue side, while on the expenditures side the regional road or other infrastructure investment and maintenance costs as well as any regional subsidy to lower levels of government for transport purposes; finally, *local government*, which includes municipal taxes and charges (e.g. parking fees, road pricing) and subsidies received from the national and/or regional government on the revenue side, and the local road or other infrastructure investment and maintenance costs or other expenses on the expenditure side. It is important that subsidies between the different levels of government are correctly imputed both on the expenditure side for the paying government layer (e.g. the national or regional government) and on the revenue side for the receiving government layer (e.g. the local government), in order to facilitate the consolidation of government expenditures by netting out the subsidies as needed to avoid double counting.
Finally, at the fourth floor there is the layer of **transport external costs**. This layer can be divided in three sub-layers: *accident costs*, to be further subdivided in sub-layers for the different transport modes (road will take however the lion share); *environmental costs*, to be further subdivided in sub-layers for the different environmental impacts (air pollution, noise, climate change); *congestion costs*, which include time and additional fuel costs.

Pilot application for the Rome metropolitan area

The implementation of the Urban Transport Accounts for a real city area is clearly an ambitious task. Considering the prevailing sectoral organisation of data collection and ownership, it could seem even impossible to coordinate the potential sources of data needed to fill in and complete the UTAs, letting the data from different owners to become accessible and shared for overall and strategic monitoring of transport policies in the urban region of concern.

However, the pressure of environmental problems – especially now climate change and the need to reduce the emissions of greenhouse gases – and the increasing awareness that the burden caused by unsustainable transport trends shall be tackled seriously *and* cannot be handled by a single national, regional or local administration acting alone. It is increasingly clear that different policies shall be combined to be effective, different actors shall work together to coordinate their policies, and a system of shared transport data and indicators is increasingly needed to support coordinated strategic planning and monitoring of policy impacts.
Moreover, the implementation of the system can be greatly facilitated by its modularity. Indeed, it is important to make the first step, building the basis of the urban transport accounts for a given region – i.e. the groundfloor O-D mobility data for the region of concern. Then, the other "floors" of the systems can be built with a step-by-step approach, and following an order in accordance with the policy needs: for instance, it is possible to estimate first the external costs of transport, and then move to the collection of government, business and households budget data (the other floors of the system) when there is the need to simulate the impact of internalisation measures – e.g. new environmental transport taxes and/or subsidies, road pricing etc. – respectively on the revenues of the public administrations, business units and households in the region of concern.

In order to demonstrate the feasibility of the system, a first prototype application has been envisaged for the Rome metropolitan area, which for the purpose of the study has been identified with the whole **Rome province** area. Within this province, on the basis of the 2001 Census Survey data related to the resident population and daily commuting flows for work and education purposes, the Italian National Statistical Institute (ISTAT) has identified 5 daily commuting areas. These are sub-provincial areas are featured by the presence of a central municipality where business and service activities are concentrated and which attract employees and students from the surrounding municipalities. When the resident population in the central municipality is over 15.000 inhabitants, the municipality is classified as an "urban" pole, otherwise is a "rural" pole.[1] Based on the daily commuting systems to which they belong and their role as a "pole" or a "surrounding" municipality, the 120 municipalities of the Rome province are aggregated as follows:

- urban municipalities with a resident population (2001 Census Survey) of 2.657.000 inhabitants (the municipalities are Rome – by far the larger city – and 3 other minor cities: Civitavecchia, Velletri and Palestrina);

[1] The threshold of 15.000 inhabitants is suggested in the ESPON programme to define the "functional urban areas" (FUAs) in Europe.

- 103 peri-urban municipalities which belong to the four urban commuting areas, with a resident population of 870.000 inhabitants;
- 13 rural municipalities which belong to the only system classified as rural because its central pole – Fiano Romano – has a resident population smaller than 15.000 inhabitants (as a whole this rural system includes 42.000 residents).

The first step has been to compute Origin-Destination mobility flows in the Rome area – the "groundfloor" of the accounting system – which have been aggregated for the different categories of destinations: urban, peri-urban and rural municipalities. Mobility flows have been computed based on the 2001 Census Survey data on commuter flows. The strengths of these data are mainly that they come from an official statistical source, and they are available also for other areas in Italy, so they would allow comparative analysis across different metropolitan areas in the country. However, the drawbacks and limitations of these data are also evident: they do not cover the trips for purposes other than work or education – i.e. those for shopping, leisure etc. activities whose share is increasingly important – and they are therefore concerned only with peak-hour mobility. In addition, the prototype application does not include other mobility flows – for instance access and egress flows of tourists, business visitors through the railway stations, ports and airport of the Rome region, and transit flows on the highway corridors crossing the region – because these data are owned by private operators and not easily accessible.

The system of Rome urban transport accounts was still under development at the time to write this contribution. The computation of the other "floors" of the accounts is on going based on the data available from various sources. Although the latter are partial, they seem enough consistent to provide results that may be of stimulus for the future improvement of mobility data collection and sharing at regional level.

INTEGRATED WATER CYCLES IN METROPOLITAN AREAS: QUANTITATIVE AND QUALITATIVE ASPECTS

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Water resources in metropolitan areas are subject to quantitative and qualitative pressures from their multiple uses (drinking, civil, industrial and recreational) and by the contribution of high concentrations of polluting cargo in civil sewers which water purifiers are unable to sustain, as well as emissions and polluting products from handicraft, industrial activities, of services and traffic.
Over the last 15 years a national legislation has been developed (Laws no. 183/89, and 36/94 and Legislative Decree no, 152/99) to regulate the quantitative and qualitative aspects of water resources. The concept of catchment basin has been introduced as a basic territorial unit with the aim of creating an equilibrium between natural availability and required uses in terms of water resoures. The Optimal Territorial Ambit(OTA) is a territorially based unit aimed at the reorganisation of the Integrated Water Service. Moreover the new Legislative Decree152/06 replaces the concept of catchment basin in a catchment district as a territorial unit at national level.
This report will focus on the following issues:
– Integrated Water Service management in the metropolitan areas under examination;
– a study of purifying systems in large city areas and an evaluation of their conformity (except for the city of Venice studied alone);
– the bathing situation with an analysis of the chemical-physical and bacteriological quality of marine-coastal waters found in areas bordering the cities.

INTEGRATED WATER SERVICE MANAGEMENT

Over the last ten years, water services have undergone a process of radical reorganization. Law 36/94 established a new governmental body, the OTA, giving it authority on planning, programming, governing and monitoring water services. Activities carried out by OTA will be updated with current regulations, especially in terms of water service supply standards and ways to reduce the impact of drainage water on receiving water bodies as well as in correlation with the Waters Protection Plan.

Generally speaking, OTA's activities focus on the water cycle (supply, channelling and returning purified water to the environment). More specifically, OTA calculates quantitative consumption, plans repairs for leaks, diffuses methods and equipment for domestic industrial, and agricultural water conservation and is responsible for the construction of networks and systems for re-using drainage waters. The Committee for Vigilance on the use of Water Resources (CO.VI.RI.) is the supervisory body of the Integrated Water Service. It is an independent Public Administration body, whose aim is to describe the state of the Integrated Water Service to Parliament on an annual basis.

THE TERRITORIAL ORGANIZATION OF OPTIMAL TERRITORIAL AMBITS

The Integrated Water Service is always managed by OTA, with the exception of OTA for the city of Trieste. At a national level, the recognition and approval of the Plan of Ambit has taken place in approximately 84 cases (88% of the national population) out of a total of 87 cases. Every plan of Ambit contains information (demographic quantity, of surface, etc) on the territory in question. Territories within OTA are diversified and represented in diagram 1.

Total OTA	93
Authority of Ambit installed	87
Infrastructural assesment carried out	84
Integrated Water Service reliance management	55

Source: Yearly Parliamentary Report on the State of the Water Services Year 2004, Committee for Vigilance on the Use of Water Resources (Rome, December 2005)

Diagram 1- OTA Map– The subdivision of Italian territories into Optimal Territorial Ambits

Source: Committee for Vigilance on the Use of the Water Resources, Year 2003 published by ISTAT - System Surveys on water (2004)

INTEGRATED WATER SERVICE OTA INDICATORS FOR METROPOLITAN CITIES

Article 149 of the new Legislative Decree 152/06, summarising the contents of Law 36/94, contains the provision that the Authority of Ambit must draft and modernise the Plan of Ambit which must be constituted by the following: infrastructure identification, participation program, a managerial model and an economic financial plan. The vast majori-

ty of data contained in the plans of Ambit have been published by CO.VI.RI. The data has been combined to cover OTA territories and calculated in accordance with the Plans of Ambit (March 2004) and the annual report by the Committee for vigilance on the use of water resources, presented to Parliament in December 2005.

Integrated Water Service coverage, distribution volumes and network leaks

The amount of cover supplied by the aqueduct, sewerage and purification services is an important indicator because it is a sufficiently synthetic instrument by which we can carry out comparative analyses and assess the general state of the Integrated Water Service system. Nearly all the Plans of Ambit make note of this parameter. On national level, aqueduct service coverage seems to be acceptable in almost all places, as no region was found with less than 92%. Tuscany and Veneto had the lowest values and a weighted average value between all OTA answers (equal to 95% of the national resident population) equal to 96%. Sewerage and purification services have slightly lower coverage levels. The former is equal to 84% (94% of the resident population at a national level) while the latter equalled 74.8% with a response rate of 93%. These results are inline with overall OTA results. The OTA Plan of Ambit must contain an estimate of the "future drinking water question", which for the most part is concerned with drinkable water volumes which will have to be supplied by OTA during the planning period. The evaluation of such volumes is carried with respect to demographic flows, the distribution of resident and fluctuating populations and average pro-capita needs. This assessment is particularly important as it effects annual rates and timings as well as influencing the economic-financial situation of investments provided in the Plan of Ambit.
Data on pro-capita water distribution volumes, distributed volumes, and OTA losses in percentages has been extrapolated from (table 1) the "System of Surveys on Waters" data by ISTAT for 1999.
In terms of exploited water resources and water supplied pro-capita, it is generally very difficult to establish exact water volumes consumed by consumers. The fact that minimum consumption and supplies are not taken into account complicate data extraction and often, when data on distributed water volumes is lacking, invoiced volumes are taken into account. Moreover, tourist areas with a high distribution of second homes skew water volume calculations since volumes effectively distributed generally are lower than those invoiced. Moreover, situations where the presence of users is not taken into account such us public uses and illicit uses further skew these calculations. A legitimate doubt therefore arises in terms of pro-capita supplies and effectively distributed volumes of water.
Network losses are often used as one of the parameters with which to estimate the state of infrastructure maintenance. Apparent losses, represented by volumes distributed but

Table 1 Water service coverage percentages (weighted average of the resident population: OTA served livings / resident livings), supplied pro capita volumes, total volume/year and network losses.

City	Optimal Territorial Ambits	Resident population	Acqueduct coverage[%]	Sewage coverage [%]	Depuration coverage [%]	Supplied pro capita volumes (l/l//d) ISTAT	OTA volumes supplied [Mmc/y] (1999)	Losses of network (1999) [%] ISTAT *****
Turin	ATO 3 - Torinese	2,226,084	95	90	85	295.0	237,171	26.30
Milan	ATO CdM - Milano*	1,271,396	99.9	98	100	463.1	219,901	12.23
Brescia	ATO BS – Brescia*	1,108,776	94	94	77	289.0	115,639	25.7
Verona	ATO V – Veronese**	822,431	n.d.	79	78	279.7	81,718	25.15
Venice	ATO LV – Lag. Venezia**	636,859	96	74	n.d.	299.3	67,783	31.8
Padua	ATO B – Bacchiglione**	1,048,628	n.d.	84	n.d.	255.8	101,057	24.42
Trieste	ATO ORTS - Or. Triestino****	242,235	—	—	—	512.6	46,345	25.8
Genoa	ATO GE – Genova**	878,082	n.d.	n.d.	n.d.	341.4	113,079	15.93
Parma***	ATO 2 – Parma*	174,471	95	90	90	285.1	41,318	22.19
Modena	ATO 4 – Modena**	644,289	n.d.	n.d.	n.d.	233.5	53,323	27.75
Bologna	ATO 5 – Bologna**	915,225	99	n.d.	n.d.	237.8	79,598	22.02
Florence / Prato	ATO 3 - M. Valdarno**	1,205,198	96	83	51	232.2	102,748	31.13
Livorno	ATO 5 -Toscana Costa	371,691	92	77	58	277.2	37,308	16.71
Rome	ATO 2 - Laz. Centrale Roma	3,696,093	94	93	78	317.2	429,282	32.42
Naples	ATO 2 - Napoli Volturno**	2,751,930	95	88	81	230.7	236,438	30.36
Foggia	ATO Unico - Puglia**							
Bari		4,090,068	96	83	n.d.	157.4	234,672	49.51
Taranto								
R. Calabria	ATO 5 - Reggio Calabria	570,065	99	92	70	261.1	54,556	22.79
Palermo	ATO 1 - Palermo	1,198,644	100	85	51	186.6	84,328	41.12
Messina	ATO 3 - Messina	643,543	97	86	78	260.3	64,322	23.89
Catania	ATO 2 - Catania	1,040,547	98	54	29	255.2	102,491	39.69
Cagliari	ATO UNICO - Sardegna	1,654,649	n.d.	75	68	248.9	150,069	40.23

*Source: Second report on the Plans of Ambit by the Committee for vigilance on the use of water resources (March 2004), Blue Book Edition 2006 Utilitatis-ANEA and ISTAT (2006) *data supplied directly by OTA ** data from blue book - Edition 2006 - the Utilitatis- AneA *** data by the City of Parma **** Authority of Ambit not installed ***** difference between introduced and distributed water.*

not invoiced are also taken into account. This parameter must be employed to define water budgets, but cannot be taken as a sufficiently meaningful indicator of the state of the network. Average values for this parameter are equal to 42% of the distributed volume.

The aqueduct service

The availability and type of water resources supplied by the Integrated Water Services are dually significant. Firstly because of the sanitary hygienic aspect of the quality of drinking water supplied to consumers, and secondly because of sustained economic losses due to illicit uses. This service introduces a fragmentariness of intake works as a result of either managements, or a particular hydrographical and hydrogeological feature of the national territory. Intake works are primarily constitute of pools and source, while superficial water use is instead more restricted as it must be subjected to numerous disinfecting treatments. In accordance with Legislative Decree 152/06, surface water must be classified under the following categories in order to be used or employed in drinkable water production in accordance with its physical, microbiological and chemical characteristics: A1, A2 and A3. Water basements and sources are generally only disinfected. Water basements are more exploited and more valuable both in terms of their organoleptic and bacteriological characteristics, and from an economic point of view, because they have fewer disinfection costs to render them fit for human consumption. This involves an excessive exploitation of resources which will be carried by future generations and problems such as sweet waters basements, along the marine coasts. Table 2 shows that the cities of Turin, Venice, Livorno, Catania and those relative to OTA One Puglia for the most part employ basement waters, while the cities of Florence and Palermo use superficial waters, respectively from the rivers Arno, Imera, Eleuterio and Jato. OTA Rome primarily uses source waters, from the Peschiera, the Capore, the Water March from sources of the High of the Aniene Valley.

Table 2 Type of the water resource

City	Optimal Territorial Ambit	Pools (%)	Sources (%)	Sup.waters (%)	c.d. (%)*
Turin	ATO 3 – Torinese	68	19	13	-
Padua	ATO B – Bacchiglione	57	30	13	-
Venice	ATO LV – Lag. Venezia	85	0	15	100
Florence	ATO 3 – M. Valdarno	29	7	64	99
Prato					
Livorno	ATO 5 – Toscana Costa	93	6	1	100
Rome	ATO 2 – Roma	12	87	1	75
Naples	ATO 2 – Napoli	43	57	0	100
Foggia	ATO UNICO Puglia				
Bari		100	0	0	65
Taranto					
R. Calabria	ATO 5 R. Calabria	75	25	0	48
Palermo	ATO 1 - Palermo	22	36	42	89
Messina	ATO 3 Messina	47	49	4	76
Catania	ATO 2 Catania	82	18	-	86

*Source: from the inspections report as at 31/12/2002, by the Committee for vigilance on the use of water resources (maggio2003). *completeness data: ratio of the number of the fields compiled and field totals*

The sewage service

Water produced by the city and by industrial agglomerates is picked up by the sewage network and conveyed to the depuration system, where it undergoes a polluting power reduction process. This process, according to current regulations, must be more or less forced depending on the objective of quality of the receiving water body. The same uncertainties with regards to information exist for this service in terms of extension and degree of coverage, the state of conservation, and the functioning of the sewage network. In accordance with Legislative Decree 152/99 these would either have to emerge in terms of the dimension of agglomerate to city waste water treatment and collection is extend, or assess determined areas, isolate areas or groups of habitations have a single sewage network. In fact, waste water collection systems are frequently found to be irregular, with unauthorised cesspools or scattering on the ground or in water. Moreover with the spread of unauthorised construction work within homes, especially in big cities, drains and san-

itary services are often connected to white water columns or drain-pipes. The following table contains percentages of each network with respect to their total length.

Table 3 Type of network (Percentage of the black white and mixed networks, compared to total length). Percentage length of the black, white and mixed networks with respect to total length of the sewage system collection.

City	OTA	Separate network [%] **	White network[%]	Mixed network[%]	Black network[%]	c.d.*
Turin	ATO 3 - Torinese		15	58	26	99
Verona	ATO Veronese	48**		52**		—
Venice	ATO LV Laguna Venezia		12	48	40	84
Padua	ATO B Bacchiglione		—	—	—	—
Florence	ATO 3 –Medio Valdarno		4	88	8	99
Prato						
Livorno	ATO % Toscana Costa		36	10	54	83
Rome	ATO 2 - Roma		—	—	—	—
Naplesi	ATO 2 - Napoli		1	98	1	100
Foggia	ATO UNICO Puglia					
Bari			9	0	91	81
Taranto						
R. Calabria	ATO 5 Reggio Calabria		7	61	32	44
Palermo	ATO 1 - Palermo		8	80	12	99
Messina	ATO 3 Messina		2	91	7	94
Catania	ATO 2 Catania		26	48	26	97

Source: from the inspection report available as at 31/12/2002, by the Committee for vigilance on the use of water resources (May 2003); completeness data: ratio of the number of the fields compiled and the field totals; ** from "Focus on 40 plans of Ambit"*

WASTE WATER TREATMENT SYSTEMS IN URBAN AREAS

The aim of this report is to find an explanation to a number of aspects related to the waste water treatment plants situated in agglomerations corresponding to urban areas.
The pollution of water resources due to civil and industrial activities is the main cause of water resource pollution in urban areas.
The development of sewers and waste water treatment plants must be taken into account as some of the most important measures used to counter this type of pollution.

In order to estimate infrastructural compliance to legal requirements, "compliance indicators" has been adopted.
The indicators "urban waste water treatment plant compliance" and "collecting system compliance" show conformity percentages to the Urban Waste Water Treatment Directive for urban waste water treatment plants and collecting system for the agglomerations under examination.
The definition of an agglomeration is found in article 2.4 of the Urban Waste Water Treatment Directive (91/271/CEE): *Agglomeration means an area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point.*
The total waste water load generated by an agglomeration is the organic biodegradable load of the agglomeration, expressed in a population equivalent (p.e.), which consists of urban waste water, which must be collected according to Article 3 of the Directive.
What must be stressed is that each urban area can correspond to one or more agglomerations. For example, the urban area of Genoa is comprised of eight agglomerations.
In order to assess "urban waste water treatment plant compliance" by an agglomerate/urban area according to the regulations, the information employed analyses the existence/absence of secondary treatment (or more advanced treatment for discharges in sensitive areas), and the emission values of plants, in terms of pollutants concentration and percentage reduction.
In particular, to be in conformity with the Directive's requirements, when its waste water treatment plant is provided with secondary treatment (or more advanced if in a sensitive area), with emission value within the limits established by law.
In order to summarise all of the information gathered on compliance of infrastructure to legal requirements, an integrated index has been adopted, with the compliance of each urban area to waste water treatment plants expressed in percentage terms. The following table shows the value of the index for each urban area.

Table 4- Degree of compliance of wastewater treatment for each urban area.

Urban area	Degree of compliance of wastewater treatment
Turin	100%
Milan	75%
Brescia	50%
Verona	100%
Venice	100%
Padua	100%
Trieste	33%
Genoa	72%
Parma	100%
Modena	100%
Bologna	100%
Florence	100%
Prato	100%
Livorno	100%
Rome	100%
Naples	67%
Foggia	100%
Bari	100%
Taranto	100%
Reggio Calabria	50%
Palermo	100%
Messina	33%
Catania	100%
Cagliari	100%

Source: Prepared by APAT based on ARPA/APPA and Regional Data.

In order to assess the conformity of the collecting system with the Directive's requirements, the information used looks at the existence/absence of a collecting system and its degree of coverage. In particular, an agglomerate/urban area is considered in conformity with the Directive's requirements, when its collecting system is capable of covering 90% of it or more.

In order to summarise all the information regarding the compliance of the infrastructure to legal requirements, an integrated index has been adopted, expressing the compliance of the collecting system in each urban area in percentage terms. The following table shows the value of the index for each urban area.

Table 5- Degree of collecting system compliance for each urban area.

Urban Area	Degree of compliance of wastewater treatment
Turin	100%
Milan	100%
Brescia	75%
Verona	75%
Venice	75%
Padua	100%
Trieste	75%
Genoa	100%
Parma	100%
Modena	100%
Bologna	100%
Florence	100%
Prato	75%
Livorno	100%
Rome	75%
Naples	100%
Foggia	100%
Bari	100%
Taranto	75%
Reggio Calabria	n.d.
Palermo	75%
Messina	75%
Catania	75%
Cagliari	100%

Source: Prepared by APAT based on ARPA/APPA and Regional Data.

Finally, the document presents an overview of the current situation with respect to urban waste water treatment plants and the collection system for the agglomeration of Venice.
In this case, Regional Agencies for Environmental Protection and Regional and Provincial Administrative governments carry out scientific and technical activities to protect the environment, water resources and the soil.

QUALITY OF THE MARINE ENVIRONMENT WITH RESPECT TO ITALIAN METROPOLITAN COASTAL AREAS – 2006

Fourteen out of twenty-four of the biggest Italian cities have a relationship with the sea.

This article investigates the quality of the marine coastal environment and the impact of these metropolises.
The physical and chemical quality of the marine coastal environment is being investigated by various bodies (*Ministero dell'Ambiente e della Tutela del Territorio e del Mare, Ministero della Salute* and *Agenzie Regionali per la Protezione dell'Ambiente*) who describe the situation with the aid of one or more "indicators" – which can summarize various data and considerations into one value - to describe a number of important features reflecting the complex marine coastal environment.
The *Ministero della Salute* publishes a yearly report on the percentage of the coast where bathing is permitted, and notes the sections of coast which must be examined. It is important to keep in mind that no monitoring is carried out where bathing is not allowed for reasons other than pollution. A summary table is found below:

Length of the coast where bathing is permitted with respect to the coast to be monitored
Ministero della Salute, 2006 - data December 2005 - modified

Cities	**Venice**	**Trieste**	**Genoa**	**Livorno**	**Rome**	**Naples**	**Foggia**
Coastal length (km)	103,1	48,1	109,2	337,6	141,5	221,5	222,9
Coast where bathing is not allowed for other reasons than pollution	12,1	24,9	28,4	68,4	48,1	18,6	8,6
Coast to control (km)	91,0	24,6	82,2	269,2	93,4	202,9	214,4
Percentage of controlled coast	100,0	100,0	100,0	73,3	100,0	100,0	99,5
Percentage of coast where bathing is permitted	94,0	100,0	94,2	73,1	83,9	81,2	98,7

Cities	**Bari**	**Taranto**	**Reggio C.**	**Palermo**	**Messina**	**Catania**	**Cagliari**
Coastal length (km)	147,4	118,0	202,9	185,6	379,7	62,8	526,2
Coast where bathing is not allowed for other reasons than pollution	23,7	9,0	23,5	62,731,5	15,2	113,9	
Coast to control (km)	123,7	109,0	179,4	124,1	348,2	50,6	412,3
Percentage of controlled coast	93,1	78,4	99,6	82,0	93,6	92,9	65,9
Percentage of coast where bathing is permitted	87,3	78,4	94,5	80,2	93,1	87,7	65,9

The same Ministry examines the bacteriological quality of sea water and classifies the results (example below, Livorno) on a scale of one to five: from very polluted to unpolluted:

Municipalities	Class IQB			
	1999	2000	2001	2002
Bibbona	1	1	2	2
Campo Nell'Elba	2	1	1	2
Capoliveri	1	1	1	1
Capraia Isola	1	1	1	1
Castagneto Carducci	2	2	1	1
Cecina	2	2	2	2
Livorno	2	2	2	2
Marciana	2	1	2	2
Marciana Marina	2	2	3	2
Piombino	2	2	2	2
Porto Azzurro	1	1	1	1
Portoferraio	1	2	2	2
Rio Marina	1	1	1	1
Rio Nell'Elba	1	1	1	1
Rosignano Marittimo	2	1	1	1
San Vincenzo	2	3	2	2

Legend
1 unpolluted
2 slightly pollutted
3 average
4 polluted
5 very polluted

Bacteriological quality (class) in the province of Livorno (1999-2002)
Data: Ministero della Salute and APAT (2005)

The *Ministero dell'Ambiente e della Tutela del Territorio e del Mare* (MATT) is carrying out a marine coastal environment monitoring programme in some of the "critical areas" to compare them with "control areas" that have not suffered an impact from pollution. Every fifteen days, three water samples are collected from three different depths (and distances from the coast) in each area, and the results of the analysis are published on the Ministry's web site. Looking at the data collection, a trend in changes can be evinced (MATT, 2006). An easier interpretation is given in the article using traffic light

	year 2005											
	II-3	I-4	II-4	I-5	II-5	I-6	II-6	I-7	II-7	I-8	II-8	I-9
Depth 6m. Distance 200m.												
Depth 36m. Distance 1000m.												
Depth 50m. Distance 1480m.												

	year 2005							year 2006				
	II-9	I-10	II-10	I-11	II-11	I-12	II-12	I-1	II-1	I-2	II-2	I-3
Depth 6m. Distance 200m.												
Depth 36m. Distance 1000m.												
Depth 50m. Distance 1480m.												

Quality	low	average	high

Marine environment quality: Naples - piazza Vittoria
Data: Servizio Difesa Mare del Ministero dell'Ambiente e della Tutela del Territorio e del Mare, 2006.

colours, as in the example below on the situation recorded in Naples:
The same Ministry is also in charge of evaluating the TRIX index. This is a unique index regulated by law (Legislative Decree 152/99, Annex 1). It focuses on nourishing concentrations in marine waters and classifies them under four different categories according to concentration rates.
In addition, other information from local sources has been taken into account. Each *Agenzie Regionali per la Protezione dell'Ambiente* operates at local level (district). For example, in the Liguiran coast in the province of Genoa, no bathing zones are monitored in a

Zone	allowed bathing	Motivation
Dopolavoro FF.SS.	suitable	-
Vesima	suitable	-
Campeggio Tortuga	suitable	-
Capo Marina Villa Azzurra	suitable	-
Mulino di Crevari	NOT suitable	Art. 7.1/ case A
Bagni Comunali	NOT suitable	Art. 7.1/ case A
Bagni Sirenella	suitable	-
Bagni S.Nazaro	suitable	-
Bagni Capo Marina	suitable	-
Presidio Militare	suitable	-
Bagni Mangini San Giuliano	suitable	-
Lido di Albaro	suitable	-
Boccadasse (Motonautica)	suitable	-
Rio Vernazza	NOT suitable	Art. 7.1/ case B
Spiaggia Vernazzola	NOT suitable	Art. 7.1/ case B
Sturla Ovest	NOT suitable	Art. 7.1/ case B
Sturla Est	NOT suitable	Art. 7.1/ case A
Bagni Liggia	suitable	-
Bagni Cinque Maggio	suitable	-
Bagni Monumento	suitable	-
Spiaggia Priaruggia	NOT suitable	Art. 7.1/ case B
Bagni Europa e Doria	suitable	-
Bagni Tre Pini e S.Patrizio	suitable	-
Bagni Sette Nasi	suitable	-
Bagni Lega Navale Quinto	suitable	-
Bagni Sport Club e P.S.	suitable	-
Bagni La Rotonda	suitable	-

segue

Zone	allowed bathing	Motivation
Bagni Est Giardini Quinto	suitable	-
Spiaggia Via Gianelli	suitable	-
Spiaggia Via Murcarolo	suitable	-
Scogliera Via Oberdan	suitable	-
Scogliera Miramare	suitable	-
Bagni Medusa	suitable	-
Bagni Marinella	suitable	-
Bagni Traverso	suitable	-
Bagni Scogliera	suitable	-
Spiaggia Capolungo	suitable	-
Cerusa	suitable	-
Leira	NOT suitable	Art. 7.1/ case B

great detail as can be seen below.

The situation in Italy can be described as quite good – and still improving This general trend unfortunately is not inline with some local negative conditions. For example, Rome Fiumicino and Bari are affected by chronic pollution, although the amount of coast where bathing is permitted is very high along the Peninsula, with some excellent cases. A summary table is found below:

Cities	**Coast where bathing is permitted respect to the coast to control** (provincial level) MATT, 2006-reporting year 2005	**Bacteriological quality Index** (local scale) reporting year 2002	Average of **TRIX** values in the period 2002 - 2003			**Marine environment quality index** most frequently recorded in the period 1/1 - 15/3/2006		
			inshore station	**half way station**	**offshore station**	**inshore station**	**half way station**	**offshore station**
Venice	94%	unpolluted	good	good	good	high	high	high
Trieste	100%	slightly pollutted	very good	very good	very good	high	high	high
Genoa	94%	polluted	good	very good	very good	low	average	average
Livorno	73%	slightly pollutted	very good	very good	very good	high	average	average
Rome	84%	slightly pollutted	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
Ladispoli	province of Rome	unpolluted	very good	very good	very good	low	low	medium
Fiumicino	province of Rome	slightly pollutted	good	mean	good	low	low	low
Naples	81%	average	good	good	good	high	average	average
Foggia	99%	no coast at local level	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
Tremiti islands	province of Foggia	unpolluted	very good	very good	very good	average	average	average
Manfredonia	province of Foggia	slightly pollutted	good	good	good	low	low	low
Bari	87%	polluted	good	good	good	low	low	low
Taranto	78%	average	very good	very good	very good	average	high	high
Reggio C.	94%	average	very good	very good	very good	high	high	high
Palermo	80%	slightly pollutted	n.a.	n.a.	n.a.	high	high	n.c.
Messina	93%	slightly pollutted	n.a.	n.a.	n.a.	high	high	n.c.
Catania	88%	average	n.a.	n.a.	n.a.	average	average	n.c.
Cagliari	66%	unpolluted	very good	very good	very good	average	average	average

LEGEND: n.a. = not available n.c. = not collected

CONCLUSIONS

Water resource management in metropolitan areas is primarily monitored from the drinkable aspect (supply), suitable sewer trunk lines (sewage) and depuration conformity, as well as safeguarding aspects (hygienic-sanitary) and the health of the population in general terms. The *aqueducts* provide almost complete cover for the population guaranteeing distribution with figures (litres/living/day) differing sharply between North and South (ISTAT' 99). Network losses are estimated with an elevated degree of uncertainty at an average of around 40% indicating a need for improved monitoring of water use. Uncertainty is a low quality estimate of data because it is calculated on invoiced amount and numerous illicit users, as well as public users which are not taken into account. Water intake for distribution for human consumption, either at a national level or in metropolitan areas, illustrates the critical situation in the sustainable management of water resources. Mostly, water intakes are made from stratums basements because of their quality which leads to savings in the disinfecting process. In important river basins, this process always concerns a greater imbalance in recharge levels, especially for stratums suffering from the phenomenon of uncontrolled illicit intakes and those employed for agricultural use.
The *sewage service* has been found to be less adequate, especially in terms of *depuration* in large agglomerates. Moreover the information available on the effective performance of depurators in terms of ability and efficiency is insufficient. In fact, although urban waste water depuration has always traditionally been conceived to pull down biodegradable organic cargo, the last few decades have seen the rise of non degradable substances, caused by industrialization. Another problem faced by the national depuration system, especially in metropolitan areas, is the insufficient use of depurated waters which could be used as water resources for industrial activities or in agriculture. Furthermore, the problem of the final destination of depuration mud remains, especially in terms of polluted mud. The prevailing answer so far has been to get rid of it in garbage dump.
The drive to fall within the scope of the European strategy described above, in terms of city sustainability and more generally in terms of the use of resources, has lead to changes in communitarian and consequently national regulations imposing a radical transformation on the planning, the protection and the management of the resources.
Therefore, the objective is now an integrated management of quality and quantity in a geographically meaningful ambit (the district) focusing on all water types and the use they are put to. These policies require greater government interest. The pressures and impacts must be assessed in order to monitor the effectiveness of action program employing new monitoring and control methodologies. The management of river basin level resources does not just affect the water equilibrium therefore, but an integrated planning of resources.

As far as coastal zones are concerned the situation of the availability of data in general terms has improved over the last monitoring period. The Ministry of the Health has increased the length of good shorelines open for bathing and the waters of the Italian Navy are - on average - good quality with a tendency towards future improvements. Some sites marked by chronic pollution remain the exception to this overall picture (Fiumicino, Bari). The percentage of suitable coast for bathing has increased everywhere, and in some cases of remaining at a constant level of excellence over the years. Generally speaking, the trophic state (TRIX) index has found good conditions in general which, when cross-referenced with bathing quality and trophic levels, identifies the essential element indicating microbiological pollution and can be used to improve coastal waters in metropolitan areas. However, need to improve the monitoring programs remains valid. These must be extended to include the priority polluting of substances as well as also accounting for sediments as required by new legislation on the protection of waters.
The water protection plans which are currently being prepared by the regions in accordance with the criteria and the aforementioned trends as well as Legislative Decrees 152/99 and 152/06 will lead to a deeper and more meaningful awareness of the state of water resources since these include detailed monitoring programs as an instrument to manage resources and assess the effectiveness of measures as well as the protection and reorganisation programs which are currently underway.

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INSTRUMENTS FOR EVALUATING THE IMPACT CAUSED BY FIRST FLUSH WATERS IN CITY AREAS

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LEGISLATIVE FRAMEWORK FOR FIRST FLUSH WATERS (FFW)

The Environmental Legislation that establishes policies for the protection and sustainable management of the water systems has as its strategic objective the achievement of improved environmental conditions for all water reserves by 2016. This objective must be included in plans for the management of the river basins as well as protection of waters, whilst also taking into consideration the prevention and reduction of the polluting effects on water reserves in the presence of vast metropolitan areas. Legislative Decree 152/99 deals with the problem of impact connected to the **FFW** for the first time and delegates regulatory powers to the Regions in cases in which first flush waters and the waters used to wash external areas in industrial areas are collected and depurated. In reference to these activities, there could be risk of pollution from dangerous substances or from substances that can in some way threaten the achievement of good levels of quality for water reserves. At present, the Regions that have created regulations for **FFW** are Lombardy and Emilia Romagna. They have defined "First Flush Waters" as the first 2.5-5 millimetres of rainwater that fall in city areas and/or areas situated in industrial areas, such as car repair work shops, petrol stations, car washes, etc, which are considered the most polluted. In the legislation for the protection of water bodies, two important aspects must be considered when estimating the effects of first flush waters on the receiving water reserves. The first one deals with the contribution of the polluting load that has a detrimental effect on the environment and is defined in accordance with the capability of the water bodies to maintain the natural processes of self-purification and to support a diverse community of animals and vegetation. The second looks at adherence to Standards of Environmental Quality (SQA) for the water bodies as provided for by Ministerial Decree 367/03, for dangerous polluting agents.

ENVIRONMENTAL FRAMEWORK FOR FFW

Polluting agents that are in the air and are caused by anthropic activity in high density areas in particular produce, through the falling and transportation of rain waters, an impact on the ground which through seepage and first flush effect, is transmitted to the superficial and underground water reserves.

Excessive urbanization and the consequent lack of filtration of the waters, cause the ground to lose one of its main functions that consists in an exchange between the lower stratum of the atmosphere and the ground. It partly protects the stratums but favours the washing away and transportation of contaminated agents, above all, into superficial waters. During the course of a prolonged rainy period, especially after a period of drought, the first quantity of water falls on ground which is more or less impermeable, and this generates refluent water with a higher concentration of polluting agents, than any subsequent rainfall. So it is common practice to ascertain the various rain types and to focus attention on the so-called "first rain waters" that have assumed the characteristics of a typical phenomenon in densely populated man-made environments. This is different to rainwater that hit the roofs and upper storeys of buildings and is less polluted and which should be collected in white nets in order to be drained off on the ground or in superficial waters. Moreover, there is a difference between urban surface water which is washed away and waters used for washing areas which are annexed to industrial activities (car repair work shops, petrol station, car washes, etc) and which are more polluted and therefore subjected to drainage regulations and dependent on depuration before being drained off into the sewerage system.

As well as the problem of the run-off of surface contaminants in urban and industrial areas, there is another problem caused by contaminants from the collection of rainwater in mixed net works which causes the flood ways and overspills to overflow near to the sewage plant. Separation of the nets has been indicated to combat this problem, in alternative it is possible to create a system of off-line storage (first flush tanks) for sewerage collection, where a part of the rainwater temporarily accumulates during intense rain pour. It will subsequently, when flow is low, be poured into the sewage plant again.

The phenomenon of FFW assumes different aspects depending on the nature (structure, slope, permeability and type of surface) and on the uses (civil, industrial, service related, green areas) of the ground. Pollution caused by **FFW** will be more or less serious depending on the presence of significant water reserves (rivers, lakes, coastal areas) that can sustain the polluting impact, because they are closely linked to urban soil. A diagnosis of the quality of first flush waters is not very diffused in urban areas but there are many studies in Italy and abroad that can give us a good idea of the presence of polluting agents in these waters. Some studies have highlighted the fact that both the waters

from the white net works and the mixed net works cause strong contamination of the receiving water reserves. In Great Britain it has been estimated that the annual polluting load entering the receiving waters from the flood arresters contributes to 35% of the total polluting load introduced, while in the United States the EPA (Environment Protection Agency) has estimated a contribution of 20% approximately to the total of the fluvial pollution. Such phenomenon is mostly caused by the presence in waters of dissolved solid substances and in suspension of organic substances and nitrogen, phosphorus, metals and hydrocarbons. The presence of such substances can become important during the "first flush"; that is the outflow of water that takes place at the beginning of an intense rain event, especially after a long period of drought. We now quote a study carried out in 2004 from Rome University "La Sapienza".

Table 1 Quality of waters that reach sewerage systems in dry periods and periods of rain.

Parameters	Dry Time (mg/l)	Rain Time (mg/l)
SST[1]	87	263,5
COD[2]	169.6	265.4
BOD_5[3]	87.4	79.5

Source: Rome University "La Sapienza" for First flush waters from productive takeovers (Grillo and Signorotti, 2004).

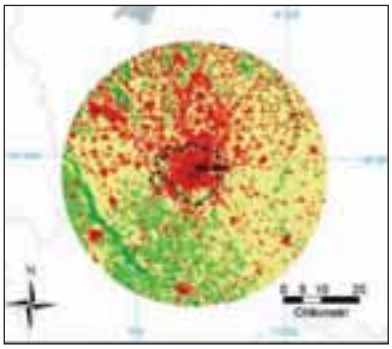
The studies highlight the complexity of the phenomenon but first flush helps us to identify some typical substances to consider when estimating the polluting impact of waters.

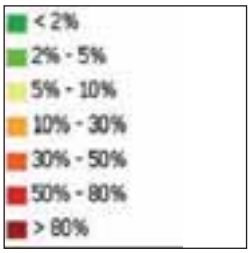
EVALUATION OF WATERPROOFING OF 14 ITALIAN METROPOLITAN AREAS

14 metropolitan areas were considered and studied (Turin, Milan, Venice, Trieste, Genoa, Bologna, Florence, Rome, Naples, Bari, Messina, Catania, Palermo and Cagliari) and the town centre with the town hall was identified. Around the centre some concentric circular areas of increasing dimensions were defined in order to circumscribe the entire communal territories and to analyse approximately half of the total provincial territories. Therefore the defined superficial circulars were used as areas of control to estimate the degree of waterproofing of the city and of the metropolitan areas.
Picture 2 shows the provincial territories in a sandy colour and the concentric areas of control in red.

[1] Total Suspended Solids
[2] Chemical Oxygen Demand
[3] Biological Oxygen Demand on 5 days

Pictures: 2, 3, 4. Areas of control for the evaluation of the degree of waterproofing, chart for the degree of waterproofing of the ground areas of the Municipality of Milan and the type of ground waterproofing.



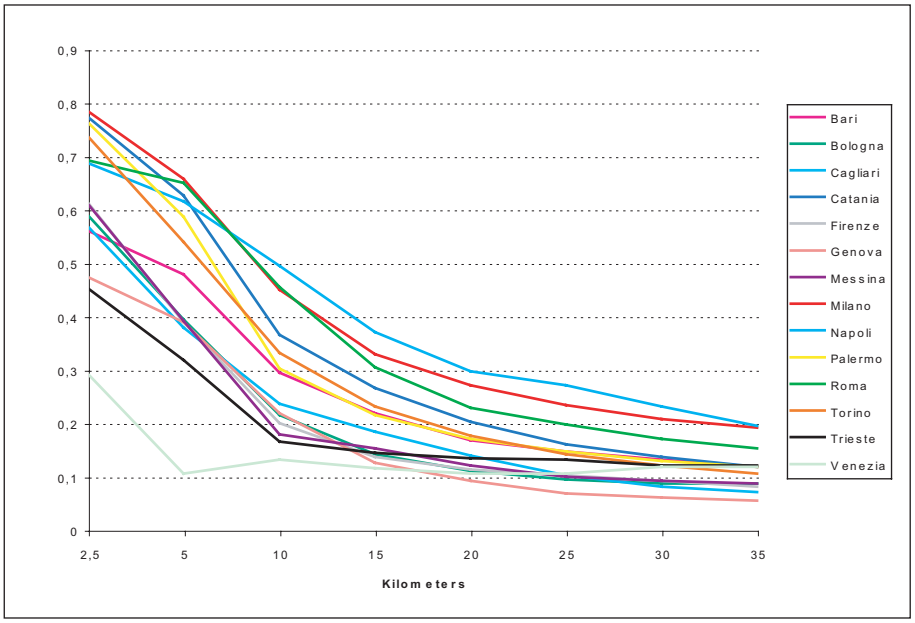


Source: Elaboration APAT on SINAnet data

For each area the percentages of ground cover has been calculated by using the digital Corine Land Cover 2000 database. Several of the ground cover types have been subsequently translated into degrees of waterproofing taking into consideration existing data (Roman, 2005). In this study only the artificial waterproofing has been estimated, depending on anthropic activities. For example, in picture (3) the chart of the degree of waterproofing of the ground in Milan is shown. The degree of waterproofing, varying from 0 to 100% is represented by seven classes as shown in the figure on the right (4). Once estimated, from the waterproofing inside the first circle and inside each circular crown it is possible to combine the values and to represent the variation of average waterproofing according to the distance from the city centre. As a first result, the described methodology has resulted in waterproofing papers for the 14 metropolitan areas being drawn up. These waterproofing papers allow representation of the space distribution of the superficial waterproofing and show also the remarkable geographic differences between the cities. In picture(5) the waterproofing percentage of the ground, according to the distance from the centre of the city, is represented. All the curves show a similar course but, in absolute terms, it should be appreciated that there are considerable differences.

For survey areas wider than 5 km, Naples, Milan and Rome occupy the first three places on the list and can be considered metropolitan areas of greater intensity.

Picture: 5 - Percentage of waterproofed surface according to the distance from the city centre.



In conclusion, the introduced methodology allows a simple estimate of the degree of waterproofing in metropolitan areas. The incoming data is available throughout the entire national territory so that reliable comparisons can be made.
(Turin, Milan, Brescia, Verona, Venice, Padua, Trieste, Genoa, Parma, Modena, Bologna, Florence, Prato, Livorno, Rome, Naples, Foggia, Bari, Taranto, R. Calabria, Messina, Catania, Palermo and Cagliari).

EVALUATION OF THE SPATIAL COURSE OF THE FLOW COEFFICIENT WITHIN THE 24 METROPOLITAN AREAS

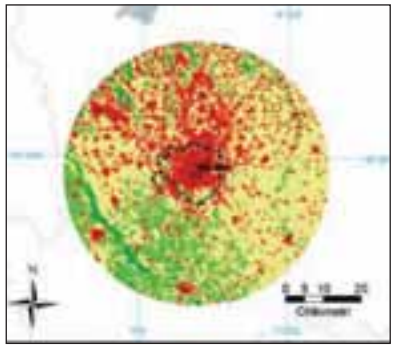
The transformation of rain in superficial outflows represents one of the most important aspects of the problem (Run-Off) and does not depend just on waterproofing, but also on other ground characteristics such as geomorphologic features. It has therefore been decided to estimate the state of the 24 Italian city areas by determining the coefficient flow over the same areas, defined as the relationship between the water that generates su-

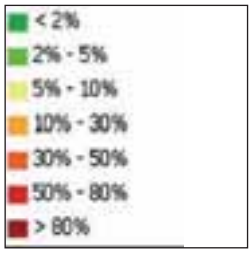
perficial sliding and total rain water, through a procedure that also considers their geologic and morphologic nature. In all 24 cities a series of circumferences of increasing radius were considered. One main area was defined first and then a series of circular crowns with gradually increasing external dimensions. Three various digital bases were considered for analysis:

1. Ground cover "Corine Land Cover (CLC) 2000".
2. The geologic paper in 1:500.000 scale.
3. A map on land slope (slope) obtained from the DEM (Digital Elevation Model) with resolution to 20 meters.

Overlapping three digital bases by using GIS methods and using the results of a study done

Pictures: 6, 7, 8 evaluate the spatial course of the flow coefficient inside the 24 metropolitan areas and flow coefficient (calculated with and without the corrective value depending on the land slope) for the city area of Milan.





Source: Elaboration APAT on SINAnet data

by the Lazio Authority for the regional river basins, it has been possible to gain insight into the values of the flow coefficient of the areas described, beginning with information on the type of ground cover, on its geologic characterization and its gradient.

For example, in pictures 7 and 8 maps are shown of the extension of the communal territory of Milan, and with the spatial course of the flow coefficient, calculated with and without the corrective value, depending on the land slope. The digital cartographies that have been elaborated for the present study allow us to have a synthetic picture which is immediately usable for the spatial trend of the flow coefficient values for the areas considered, and at the same time, allows for the possibility of more detailed and wider analysis to be carried out. The extended versions of the 2nd and 3rd APAT Report deal with the study of precipitations such as short and intense events, waterproofing, ground flow coefficient, pollutant properties, impact, the quality of the FFW collected in the sewerage and the superficial waters, evaluation of the polluting load of the productive takeovers and a first approach for the definition of a synthetic index of the polluting load associated with first rain waters.

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SURVEY ON LOCAL PLANNING TOOLS AND MONITORING OF LOCAL A21 PROCESSES IN THE MAIN ITALIAN CITIES

A) SURVEY IN THE CITIES OF VENICE AND BARI AND THE ROME AND GENOA PROVINCES

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INTRODUCTION

The process of local planning and in particular Agenda 21, "the agenda of things to do for the XXI century" or those local action plans with global responsibilities, began at the European Conference on Sustainable Cities (1994), where the representatives of 400 local administrations underwrote the "Aalborg Chart on Sustainable Cities", joining, therefore, the European Campaign of Sustainable Cities and marking the beginning of a new Governance: everyone working together for the development of sustainable territory. With the continuously expressed requests of Rio (1992), Aalborg (1994), Lisbona (1996) and Johannesburg (2002), it was Aalborg again (2004) that hosted the IV European Conference of Sustainable Cities. "*Aalborg+10 Inspiring futures*" was the slogan that 110 Municipalities belonging to 46 different countries, shared, whilst also subscribing to the "Commitments Aalborg +10", common commitments for future sustainable cities. The adoption of the "Aalborg Commitments" represents a selection of city intervention priorities and the passage from the programmatic phase to a pragmatic one in order to achieve real sustainable objectives.

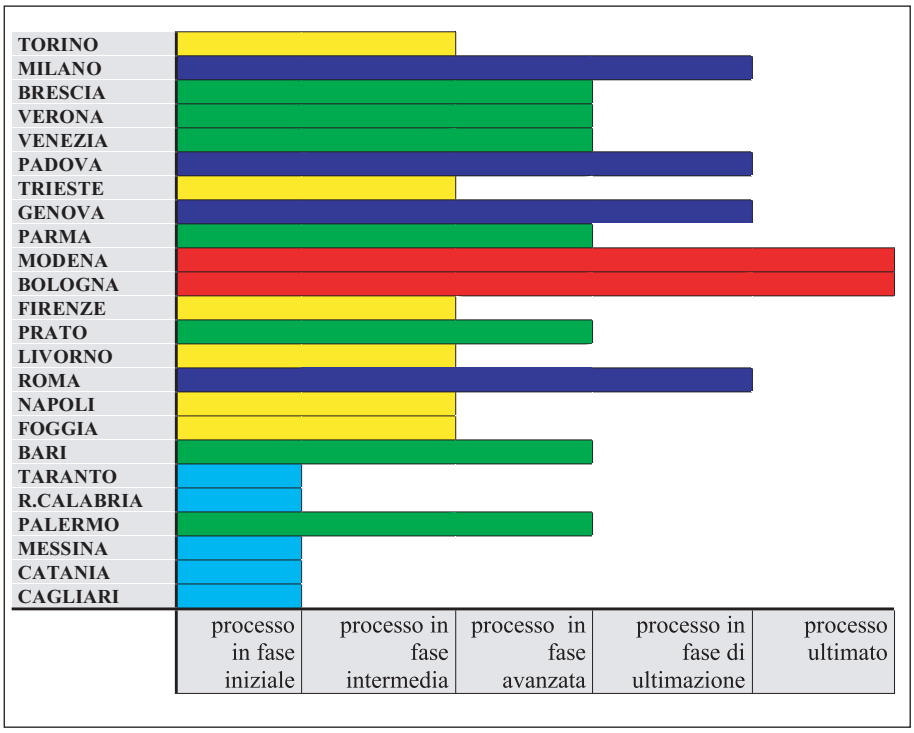
The Tools of Local Planning in the Cities Analyzed

The survey described in III APAT Report concerns the cities of Bari and Venice and the Genoa and Rome provinces and reports the outcome of local administration experiences related to the evaluation and analysis of use of tools in local planning, in order to construct an exhaustive picture concerning criteria, strategies and citizen related programs.
The second part of the paper is dedicated to monitoring results on the use of local sustainable tools in *pilot cases*, carried out by the APAT Work group through direct participation in reunions and group meetings. Local pilot cases were formed from the local Agenda 21 and Area Omogenea Fiorentina works and the Rome Province, which is still ongoing.

The Survey Instrument

The field analysis has been carried out through the *APAT Questionnaire of survey*, articulated in 3 fundamental sections focusing on the local Agenda 21 processes, in order to evaluate the level of Governance and the application of participation processes**.**

LOCAL AGENDA 21 PERFORMANCE PROCESSES IN ITALIAN CITIES ≤ 150.000 INHABITANTS



2. RESULTS OF SURVEY IN THE CITY OF VENICE

2.1 City and Territory

Year 421 is the hypothetical date of birth of Venice, but its institutions have roots back to the Middle Ages and the Doge, elected by an assembly of citizens, represents the continuity with the Eastern Roman Empire. The transfer in 1094 of the remains of the Evangelist

Mark of Alexandria of Egypt to the Basilica of the same name, tied Venice forever, to the apostle. The city, frontier of the Byzantine Empire, was one of the greatest European powers ever, centre of culture and capital of Serenissima Repubblica Veneta, an aristocratic republic which lasted 11 centuries: moreover, in the 18th century, Venice was the most cultured city in Europe. Napoleon's invasion of the city marked its end and in 1866, after the War of Italian Independence, it was annexed to The Kingdom of Italy. New impetus in the late '800's personalized the city with increased maritime traffic and industrial activity and international tourism discovered the beauty of its artistic patrimony and devotedly adopted it as a destination of choice. Murano, the island renowned for glass making since ancient times, Burano, far from the mainland and famous for Burano lace and full of literary memories of Torcello, are the main islands of the Lagoon. The Canal Grande which cuts the city in two and was originally a port-channel and a water route for the commercial centre (Rialto and Fondachi...) and the religious and civil centre (S.Marco), is crossed from the Rialto, Scalzi and Accademia Bridges and connects the ancient and new Venetian poles - symbols include illustrious residences. The industrial expansion of the first '900, sees the construction of Porto Marghera and the expropriation of some of Mestre's territory to become a new area of dry land.
In the last 50 years, very high living costs, transport difficulties and lack of job opportunities have resulted in a fifty per cent reduction of the Venetian population,(c.60,000 in the historical centre). Added to that are the well known and unsolved environmental problems with the degradation of the largest lagoon in Italy and the historical city that is inexorably sinking, jeopardized by more than fifty years of industrial activity in Porto Marghera.

2.2 Local Agenda 21 Achievements of Venice Municipality

The Municipality of Venice began the local Agenda 21 process in 1996, underwriting the Aalborg Chart in the same year. From then on, the process has continued, following an evolutionary method that is ever more aware of the development potential as well as its limits which are linked to the city's problems. Activities linked to the international role of the city and participation are an integral part of the local Agenda 21 Venetian program. Since the year 2000, the International and Communitarian's Relationship Direction and the Municipal Administration have worked on national and international projects for sustainable development, such as: ***PROSIAVE***, concerning a prototype of territorial informative systems on Porto Marghera; ***PRESUD*** an appraisal system of local sustainability levels of Public Administrations in the EC; ***CAMBIERESTI?*** for a more tolerable life style. Since 2002 there has been an increase in the Venetian local Agenda 21's activities, with the overcoming of Forum criticisms linked to a lot of discrepancies among the participants

taking part, the city's registration to the Coordination of the Italian Agendas 21L's network and the activation of some tool aids and Forum topics.

3. RESULTS OF SURVEY IN THE CITY OF BARI

3.1 City and Territories

The legend says it was founded by Japige, Labyrinth's son. The first settlements are attributed to the fourth millennium B.C. and in the third century B.C the City was already a flourishing port. After the Greek phase, Bari was "Roman Municipium", Bizantine, Longobard and Saracen dominions. Its port was one of the main boarding points for the Crusades. Feud of the Angioini, Sforza and Aragon had some very prosperous times in the Bourbon period, The city area was enlarged, the port restored, the walls, the Piccinni theatre and the church of S.Ferdinando were built, piracy was resisted and important commercial trades initiated . The population increased from 18,000 to 35,000 inhabitants.
To the Italian unification there followed instead difficult years: the phenomenon of brigandage, calamity, misery of the popular ranks and the emigration. To the beginnings of `900 Bari counts 94 thousand inhabitants, and an intense and immense work of agrarian transformation follows. In the second half of the century it expands into an enormous and confused city, with a great industrial agglomerate. The suburbs expanded as well as the industrial area with intensification of the harbour activity for passengers and goods. The city suddenly faced commuter issues and de-urbanization phenomena, together with crime problems.
From 2000 the ancient centre of Bari, which was also in a state of obvious degradation has been interested in a restoration programme for the Municipal Administration.
The city of Bari, main town of Apulia and second town of the South of Italy, university pole, centre of the anniversary "Fiera del Levante", extend for 203.9 kmq with a metropolitan area equal to 1.2 million inhabitants.

3.2 Bari and Local Agenda 21 Development: Program for Sustainable Territorial Development

In 2002 The Bari Municipality started its own local A21agenda after having underwritten the Aalborg Chartand carried out *Enviromental Training*, *Civic Forum*, the *Environmen-*

tal State Report and the Local Action Plan, equipping itself with an Environmental Administration System to manage programs and activities with wide ranging commitment plans and initiatives. Among these is the ***VELA Project (*** 2005) which has worked on the reporting, sensitization and communication aspects, together with the help of the *Cartographic Atlas*, a geographic contextualization of the different environmental aspects; the Civic Forum jobs and the convocation of the *Forum 21 Bari Energy*, the revision of the Environmental State Report.
Energy is the Bari local AG21's topic that opened the Bari 21Energia Forum, with work groups on global heating and greenhouse effects and it is now implementing new Building Regulations linked to the eco-compatible city development for the best performance of the Kyoto Protocol, the most important supranational tool in defining sustainable politics and actions.

4 RESULTS OF THE PROVINCE OF GENOA SURVEY

4.1 The Provincial Territories

This territory, with a population of approximately 1,000,000 inhabitants of which 660,000 in the capital of the Province and 67 Municipal Administrations displays long strips of coastline and an articulated valley system circling the mountain towns. The Genoa Provincial Administration started its own Agenda 21 in 2003 and in 2004 the program "*100 Actions for Sustainable Provincial Territories"* dictated strategic objectives and guidelines. The provincial Forum, which was started in May 2004, has led to a positive budget due to the presence in the Forum of stakeholders and the elaboration of topics discussed in the Plenary Forum.
In 2004 the second phase of the Genoa Province local AG21 process began, committed to improving the Action Plan's rough draught and initiating the monitoring process and verification of the Action Plan, in order to update it. The action plans have addressed 4 topical areas: Climatic Change; Nature and Biodiversity; Environment, Health and Quality of Life**;** Natural Resources and Refuge.

4.3 The Ecological Print of the Genoa Province

The Provincial Administration, in starting off with the "Report on the Ecological Print of the Genoa Province", wants to offer valid support for the development of an indicator system to accompany Agenda 21's process. Genoa Province's ecological print is equivalent to 3.88 a., and therefore higher than the average national of 3.26 a.; which gives it an intermediary position among the industrialized countries**.**

4.4. Province of Genoa Local A21, A Positive Budget

That the experience has been a valid one appears obvious and is widely demonstrated by the citizens' participation. Other good success factors are the Plenary Forum that has carried out its workload in full and put in a system and validated the jobs of the other Forums. At the same time, they have produced important tools like "*The Environmental Estate Report*", "*The best provincial practices, experimentation of social capital, calculation of the ecological print and the ICE (European Common Indicators)*". The first local Action Plan "100 actions for sustainability" is a proper strategic plan of the characterization of priorities and interpretation in a local key position on topics of sustainability.

5. RESULTS OF THE ROME PROVINCE SURVEY

5.1. The Provincial Territories

The Province of Rome was formally established in 1870, soon after the new unitary Italian State was created. The territory, apart from the historical and urban distinctiveness of the city of Rome, has a surface area of c.5.300 kmq, 121 municipalities and more than 3.7 million inhabitants, has amazing riches, given the nature of artistic and historical testimonies and naturalistic elements that exist. It borders in the North with the Province of Viterbo and the Province of Rieti, to the East with the Province of L'Aquila and the Province of Frosinone, to the South with the Province of Latina. An environmental context referable to 6 macro areas where, as often happens, the physical aspects are closely connected to the history of the places. The Province of Rome is the second largest in the country after the Province of Turin, due to its territorial size and is the second most densely populated province after the Province of Milan for number of inhabitants, with an equal inhabited density of 691 inhab/Km sq. It is strongly characterized by the presence of small municipalities, 65 of them have less than 5,000 inhabitants and 31 have a population of between 5,000 and 15,000 inhabitants.

5.2 Local Agenda 21 Development of the Rome Province: First Results

In the light of requirements and territorial problems, the Provincial Administration has planned the path of the local Agenda21 as a tool of governance offering an integrated strategic approach and the possibility of real participative involvement. The Province of Rome joined the Chart of Aalborg in 2001,and this was underwritten in the 2004 Aalborg Commitments, and in the same year the A21L process was started. It was committed to

promoting this process in the 121 Municipalities and its territories, through the Ban 21 Agenda Processes 2004/2005, that provided for a loan of 430,000 euros. The Province of Rome, is today, one of the few Italian provinces that are committed to the investment of its own economic resources in order to support local A21 plans. The Sustainable Development Department has operated in the last years with a series of actions linked to A21L and Sustainable Development such as the *Formative Days* for the sensitization of internal staff, the *Public Ban*, for the concession of loans to carry out AG21L and destined for the Municipalities, *Action for Communication and Diffusion*, the *Civic Forum*, the start of themed based *Working Groups*.
The coordination work between the several departments of the Administration, has been successful and is shared by many territorial stakeholders in order to achieve an ambitious initiative for the integration of environmental policies with urban and territorial development.

B) MONITORING OF LOCAL A21 PROCESSES

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The experiences of Local Agenda 21 which have been adopted in Italy, confirm the validity of the plan of action created to strengthen the "sustainable societies", regarding environmental, economical and social aspects. The processes have started to appear coherent, with a consolidated structure, capable of involving the main themes characterizing the territories and developing strategies for the different sustainable issues. The existing problems are also evident, especially those experienced by the larger communities and cities, and it is one of the features that distinguishes the Local A21 processes, the ductility, which causes, in the presence of extreme program diversity , a fragmentation and a division of projects, with a loss of active efficacy.
Most LA21 processes in Italy were started in 2000-2002, with a substantial decrease in the latter period, which emphasizes the current period of maturity, where 75% of processes have already established a Forum and have started the participation phase and among this percentage, 54% have defined the Action Plan, 31% have implemented it and 14% have started the monitoring of the results achieved[1].
The development of the processes needs the results monitoring activities and related

[1] 2006 Survey on the implementation of Local Agenda 21 processes in Italy, National Association Coordinamento Agende 21 Locali Italiane, www.a21italy.it

methodologies to be shared, and the ability of identifying main characteristics and peculiarities expressed. The monitoring activity of Local A21 processes in Italy is undertaken by LA21 Thematic Working Group APAT which started up because of these needs and continued through to the participation with the Forum and Thematic Sessions and through meetings with the processes and local authority managers involved. Analysis of the LA21 experiences, achieved jointly with the proponents and main actors, is necessary to generate shared strategies, identify the role and the identity of the processes conducted and characterized by different aspects related to ethic dimension, sustainable development values, territorial characteristics, by the community and stakeholders involved, and is also related to the forms of consultation and public participation in decision-making procedures adopted. Fundamental requirements for the achievement of the aims are the identification of adequate indicators which is able to improve an assessment of the results and the dialogues established between LA21 processes and territorial and urban planning, in order to ensure a progressive integration of environmental and planning issues.

The monitoring reported is related to LA21 District of Rome and LA21 Area Fiorentina, established by the City of Florence and nine Municipalities[2]; both experiences are on large scale and they are supported by local administrations. The experiences are in different phases of the process: the LA21 District of Rome started the Forum in December 2006 and, at present, the Working Group are concentrating on selected subjects belonging to different topics - economics, social and environmental and sustainable development - while LA21 Area Fiorentina started the Forum in September 2005 and has introduced the Action Plan, concerning specific environmental topics like waste, emissions and mobility and The Report on State of Environment in May 2006. Currently the Association of Municipalities of LA21 Area Fiorentina are preparing the implementation phase for the actions and processes, trying to involve public participation in LA21 for the various programmes and plans with environmental themes.

The involvement of communities in both LA21 processes monitored is wide, with different professional categories represented. From LA21 of the District of Rome arises a specific interest towards territorial and urban planning themes, particularly towards nature reserves, an important connotation of the territory of the district, with 20.9% of area occupied. The problems are referable to the great dimension and the complexity of the project, characterized by a large and differentiated territory and by many municipalities and communities involved.

The structure of the process of LA21 Area Fiorentina, characterized by an association of

[2] The municipalities of LA21 Area Fiorentina are: Firenze, Bagno a Ripoli, Calenzano, Campi Bisenzio, Fiesole, Firenze, Lastra a Signa, Sesto Fiorentino, Scandicci e Signa.

municipalities, assumes a feature of a metropolitan area, a reality built and pursued through the sharing of environmental topics. The process has activated constructive communication with the other programmes and planning tasks, inspired by the need to achieve more integrated and shared information about the processing of environmental themes for policies adopted.
The need for information arises at all levels, from individual level, by community of the Forum, to decision makers at the national levels. The collection and the assessment of data, the standardization and the accessibility of information had to be improved, in order to allow informed decisions concerning environmental and sustainable development.

THE GELSO DATABASE AS SUPPORT FOR COLLECTING AND MONITORING GOOD PRACTICES IN SUSTAINABILITY, APPLIED IN FOURTEEN METROPOLITAN AREAS AND IN LEADING ITALIAN CITIES

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The term "good practice" must be interpreted as an action, applicable in many situations, permitting a Municipality, Community or local administration, to move towards a variety of sustainable management options at a local level.
A sustainable practice is seen as good when it has an essential factor, that is when it is: *"**development which meets the needs for the present without compromising the capacity of the future generations to answer to theirs own**"* (Report Brundtland – UNCED 1987)

GELSO (GEstione Locale per la SOstenibilità) **PROJECT**

The GELSO PROJECT (Local Management for Sustainability), through its own website and its database containing good practices for local sustainability (www.gelso.apat.it), is an instrument whose aim is to spread and diffuse detailed information to all the Administrations which have applied these to the sustainability processes. Te project is also a tool used by Administrations interested in obtaining information on any innovations in the field of sustainable development intended as a balance between environmental protection and economic development. The database contains the following projects on sustainable polices and their main intervention areas: *Agenda 21, Agriculture, Building and Town planning, Energy, Industry, Mobility, Refuses, Territory and Landscape, Tourism.*

PROJECT ACTIVITY "URBAN ENVIRONMENT QUALITY"

The good practice survey

Good practices for environmental sustainability were published in Report I 2004 and Report II 2005 on the following 14 metropolitan areas: **Turin, Milan, Venice, Trieste, Genoa, Bologna, Florence, Rome, Naples, Bari, Catania, Messina, Palermo, and Cagliari.** The above-mentioned good practices were measured by means of direct query to municipal and provincial Administrations. This year, the cities of **Brescia, Modena, Parma, Padua, Verona, Leghorn, Prato, Reggio Calabria, Foggia, and Taranto** were included in Report III 2006. The good practice survey focused primarily on these new cities. In the 14 metropolitan areas listed above, a survey was instead carried out to gather information on new activities. Most importantly however, the application of good practices reported in previous Reports has started to be *monitored*.

The survey on local sustainability was carried out in two distinct ways:

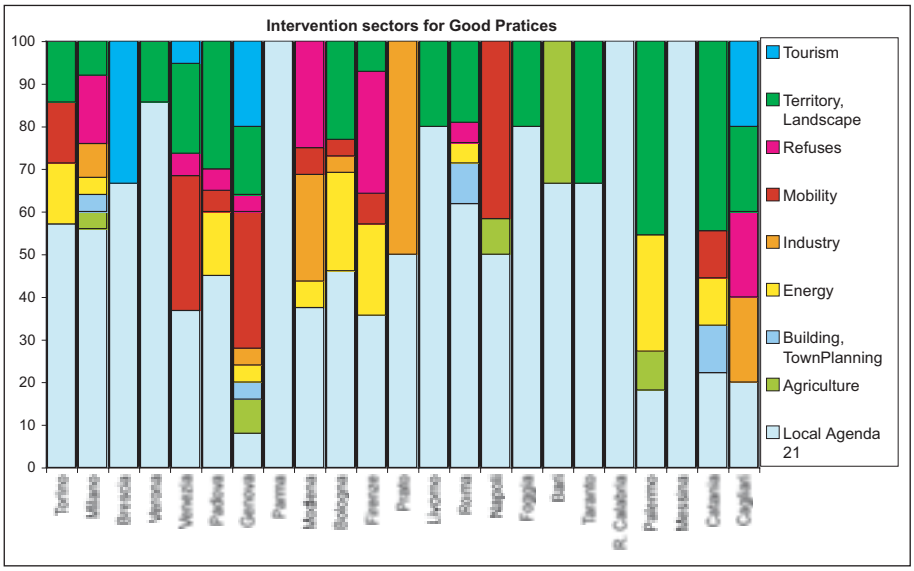
- research was carried out on relevant websites in order to acquire general information;
- direct queries were made to Administrations to survey good practices using a standard form.

Information collected from an analysis of websites belonging to the Municipalities and Provinces, particularly on environmental issues, and from projects in the GELSO database on information collected through direct queries to Administrations depict not just the engagements and activities they promoted and have put into place, but also the amount of visibility given by the administration to such activities. The quality and nature of the environmental information on offer depends, in fact, on their contents and on spreading this information using tools accessible to citizens. Therefore, this depends on how easy it is to find such information.

The following information has been found online:

- data and reports on the state of the environment;
- the performance of environmental legislation and its relative effects on the adoption of measures and provisions;
- collaborations between public bodies or between public bodies and private bodies;
- the promotion of initiatives and events;
- participation in national and international projects.

The results obtained with the direct survey using the standard form found that most good practices are included among interventions in Local Agenda 21(46%), followed by Territory and Landscape (17%), Mobility (10%), Energy (9%), Waste (7%), Industry (4%), Tourism (3%), Building and Town planning (2%), and Agriculture (2%), as illustrated in the following graph.



All good practices can be consulted online at www.gelso.apat.it

MONITORING

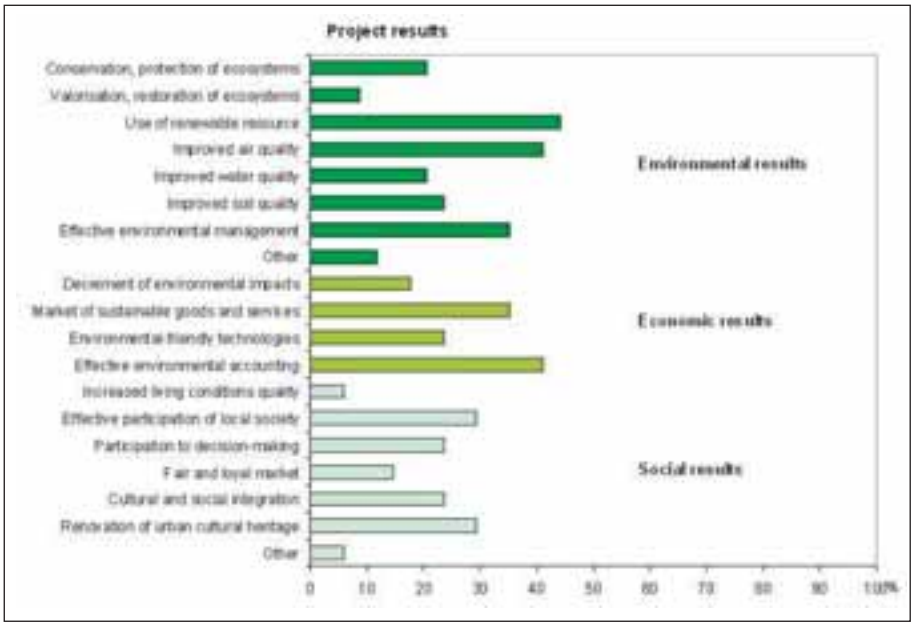
A new feature of this edition was that the good practices proposed over the past years have started to be monitored. This activity ensures that Administrations get feedback on the performance of sustainability policies and especially on outcomes and critical states.

With this in mind, a monitoring form – proposing analysis of project performance meth-

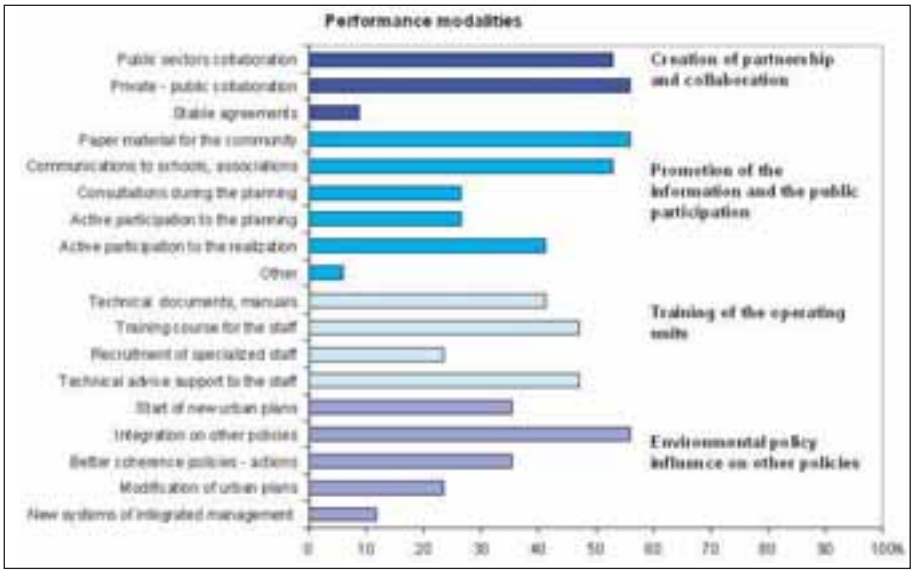
ods by means of an articulated series of questions – was prepared and handed to the individuals responsible for the published projects.
The form gathers information on the following:

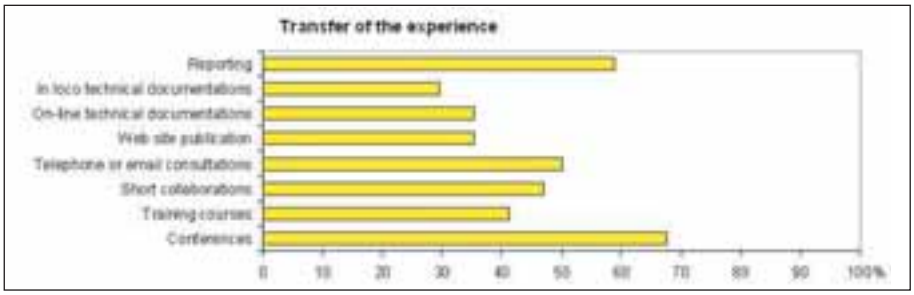
- the attainment of targets in environmental, economic and social areas;
- methods used such as creating collaborations, any training activities required, influences on other policies, and integration levels between managerial plans;
- participation levels in the local community, methods used to spread information on the project and consensus obtained;
- method employed to ensure the transferability of experience to other subjects;
- critical points which came to light while the project was being carried out with the aim of helping other Administrations in their search for new solutions.

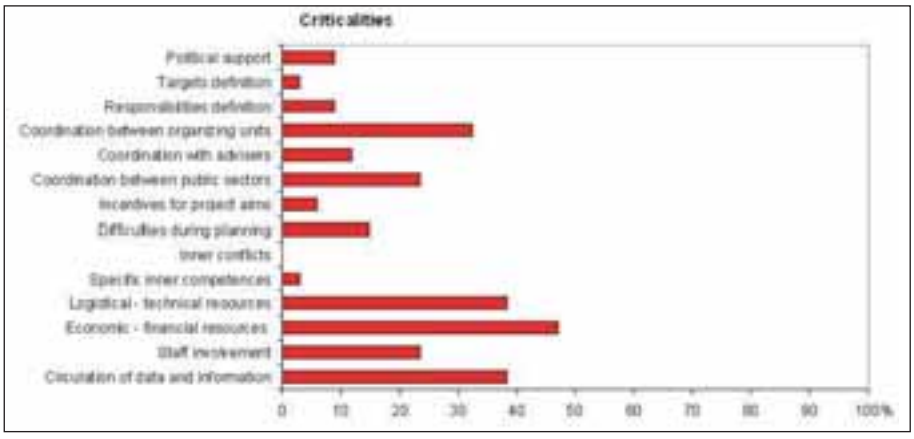
For a quick reading of the outcome, diagrams containing the results of the project, performance methods, critical points, and the transfer of experiences, have been included.



The complete monitoring form and all answers received to the survey can be consulted online at www.gelso.apat.it







The complete monitoring form and all answers received to the survey can be consulted online at www.gelso.apat.it

EXPERIMENTAL IMPLEMENTATION OF THE ENVIRONMENTAL BALANCE SHEET CARRIED OUT BY APAT

A. Capriolo, A. Cataldo, P. Catalfo, I. Leoni, C. Matraia, A. Mazzillo, P. Testaì

APAT – Italian Agency for Environmental Protection and Technical Services

Local governments have an increased awareness of the importance of improving environmental quality inside urban areas (and consequently quality of life). This leads them to action.

At the same time Local Governments have fewer financial resources available for the ordinary and special administrative activities, and have to manage the budget in such a way as to increase the environment protection schemes according to the different institutional duties.

Another priority is to reach a balance between economic growth and sustainable development. In this particular moment it becomes useful to measure the speed of the administration in achieving such balance between city life and environmental matters. Environmental Balance represents a good tool to measure how each particular administration is reaching towards its goals in its location while providing more transparency and information to the public.

Experiments presented by APAT and carried out in important Italian Municipalities such as Venice and Catania are part of a program carried out to support local administrations in managing this new way of measuring environmental policies and the overall revenue for citizens. Through discussions and debates with stakeholders, interested in developing this new tool, it has been possible to fine tune the environmental balance sheet model thus achieving two important results. The first one regards merging together all experiences and lessons learnt from implementing environmental balance sheets in National and International contests, (i.e. the Venice experience) to deliver a useful instrument to all the administrations involved. On the other side, there are critical aspects that occur while using this tool. Consequently, it is necessary to find a better model able to overcome some limits of the Environmental Balance led us to developing a new approach. The goal is always to search for new, alternative ways through which to assess administrative action with secial regards to analysing the returns on the environment examining all balance sheet items that incorporate capital value (this is very similar to the Catania experience).

These are two models and techniques that originate from two different assumptions but

aim to achieve the same result, the idea being to deliver a *tool* able to explain not only the financial phenomenon, but also useful in planning and operating environmental policies in the best way.

VENICE ENVIRONMENTAL BALANCE SHEET MODEL

The structure of the Environmental balance sheet adopted in the municipality of Venice is very similar to a modular structure: it is quite flexible and able to obtain different ad sequential objectives, each one of them able to provide much more detailed information to the public.

- The first step regards the reclassification of environmental expenditures according to a model that takes into account the different methodologies employed so far (CLEAR, SERIEE, SEEE-ONU). All these methodologies have been tailored on the particular municipality of Venice, to build a system coherent with the different departments and issues of the municipality. So environmental expenditure (on going invoices and patrimonial ones) for the year 2004 in Venice have been reclassified. Each invoice has been given a particular environmental domain, such as where the money was coming from, the particular kind of action carried out, and how it has been implemented.
- The second step regards evaluating the coherence between environmental policy and how it was delivered, analysing each step in its constituents, for instance: administrative act, service provided to citizens, infrastructure or public goods/operas
- The third step of this methodology involves grouping all expenditure according to environmental aspects, together with strategic aspects and the planning issues. The link between these two elements is done by creating eco-efficiency indicators and eco-effectiveness; indicators that are able to give a synthetic idea of how the administration is spending money, and how it is respecting established environmental policies and political programmes.

RESULTS OF EXPERIMENTATION

It is quite easily understood how on a programming level, issues like sustainable mobility, waste management, protection of parks and green areas inside cities are main priorities for many local administrators. Therefore looking further on the overall invoices is possible to understand which are the great problems linked to implementing environmental balances in public administrations, and its capacity of giving good a reliable information. So compulsory institutional duties and activities, with a high environmental

effect, are often delegated to third parties, usually companies owned by public. The service provided by these companies is often regulated by particular contracts, that in many cases don't take in much consideration environmental issues and have a low environmental performance. Doing so, the interest of stakeholders is guaranteed (high revenues) and also citizens are happy due to the low tariffs. In spite of all, environmental expenditure (the financial effort to realize a specific issue) is very difficult to evaluate especially because in the Private Public Company there is no transparency provision as for Public Administration.

This is the case of the Municipality of Venice, whose activities of prevention and restoration are lead by few Private Public Companies and shares are mainly owned by the municipality itself. The Municipality transfers to these companies a great amount of money for environmental services that at the end are not fulfilled.

In this case, the companies collect directly the money from tax and environmental tariffs, these are financial resources that don't increase the municipal budget and because of this provision, the companies can quite easily generate a low evaluation of environmental costs.

The Municipality of Venice itself absorbs just 13% of the budget and the rest is transferred to the companies that provide environmental services for the city, therefore it is quite clear how low is the managerial-impact of the Municipality in dealing with such matters.

Only analysing the specific contracts that rule the services is possible to give a reliable evaluation on the capacity of the administration in reaching the programmatic goals. However, a possible evolution of the environmental balance sheet of Venice could be the "the group budget" recollecting not only the municipal budget but also recollecting all the useful information from the companies owned by the Municipality, that have environmental tasks.

APPENDIX: ENVIRONMENTAL BALANCE SHEET MODEL OF CATANIA

The Model tested within the municipality of Catania gives to the environmental patrimonial management a key role to understand an evaluate the administrative behaviour, revenues and losses for the entire City. Consequently this model stresses out important elements like control and programming returns. The expenditures evaluation itself is not just done on a financial level, but is part of a more complex evaluating protocol that takes in to account both investment and management strategies.

Along this Patrimonial profile there is the competence and efficient management (business competence is giving to a particular action the right scale in time) that is measured

by the strict correlation between formal efficiency of action (efficiency in realizing the fact) and strategic efficiency that is measurable by appreciating the physical value of long-term resources involved.
The key concept is the level of detail information necessary and the integration with the different factors that are involved in this evaluation procedure, starting from the business and financial indicators to the physical ones and moreover towards the integration between the two of them. This model helps to support a different thesis where expenditures are not measured just with the cost driver, but become part of a wider strategic business evaluation programme involving investment and efficient management.
Beside the investment patrimonial aspect (cost) there is delivering an efficient business scheme (i.e. efficiency in realizing the investment vs. strategic efficiency) that is measured by a physical value. This model of environmental balance allows to make a comparison between quality of intervention and its real cost using the price as a unitary key to explain both elements.
Therefore the model we are talking about has firstly a methodological nature as a strategic tool, is also an instrument able to report financial and business aspects providing a great support to the programming and control process.
At this level the patrimonial profile of investments is linked to management efficiency (the competence is intended to be the exact belonging of a specific business event to the period of time that is being monitored) that can be seen looking at the correlation between the Formal efficiency of the intervention (doing and finishing it) and intervention strategic efficacy that can be evaluated by measuring the physical value of the long term resources on which the action is directed.

THE TECHNICAL BOARD OF THE ITALIAN ENVIRONMENTAL PROTECTION AGENCIES FOR LOCAL ENVIRONMENTAL BUDGETING (TTI-BIL): GOALS AND INITIAL ACHIEVEMENTS

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APAT – Italian Agency for Environmental Protection and Technical Services

The National Environmental Protection Agency (APAT) has promoted a Technical Board for Local Environmental Budgeting (TTI-BIL), where all the 21 Regional and Provincial Environmental Protection Agencies (ARPA/APPA) are invited to get involved on a voluntary basis.

The main aim of this Technical Board is to establish a network within the National System of Environmental Agencies (APAT/ARPA/APPA) to support the development of Environmental Budgets for Local Governments. This network promotes experimental projects of economic and environmental accounting, so that the link between public expenditures and the related environmental policy achievements can be monitored and evaluated.

In its first year at work, the representatives of 17 Local Agencies have joined a work group constituted in the National Agency. TTI-BIL activities have been implemented by 10 of these Local Agencies and coordinated and scientifically supervised by the APAT group, while the other 7 Agencies were expected to actively participate in some periodical meetings aimed at sharing the results of the implementation phase.

The 10 operative Agencies have benefited from a limited financial budget intended to encourage their experimental efforts, and cover some living expenditures. A short description of their work follows:

- ARPA Umbria has carried out a s*urvey* of all the activities dealing with Environmental Accounts and Environmental Budgeting in which the Local Environmental Agencies have played a role. This is intended as a preliminary recognition activity, based on a self-assessment questionnaire that allows the mapping of the alleged skills for each specific representative of the National System of Environmental Agencies with regard to these topics. On the basis of this preliminary survey, careful planning of any future involvement of the Agencies in environmental budgeting projects should become more feasible.
- The Agencies of Emilia Romagna, Umbria, Marche and Toscana have been working on the redaction of a Methodological Guide for processes of Environmental Budgeting. This Guide, which is still in progress, may help local government in undertaking this

process, and should provide some hints for the identification of a common set of eco-efficiency indicators.

- The Lombardia, Basilicata, Veneto, Sicilia, Liguria and Friuli Venezia Giulia Agencies have worked on two interrelated activities. First of all, they chose some municipalities within their regions (on average, 10 cities per region, of different sizes and with a different territorial specificity), and, via some of their civil servants, they submitted a questionnaire called "screening model" to local administration. The objective was to gain a preliminary understanding of which kind of environmental budgeting could be more correctly implemented in each specific administrative context. Then, each Agency chose one City (or, in one case, a Province) for the implementation of an experimental Environmental Budget. The results of these two interrelated activities are going to be carefully evaluated and compared with the experiments held by the work group within the National Agency.

  This Technical Board's first operational year has just finished, and all the results are going to be initially discussed in a workshop and then published in a final report.

TOWNS AND CITIES OFFERING SERVICES: THE ROLE OF TOURISTS IN STRIVING FOR GREATER EFFICIENCY

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SL&A Turismo e Territorio srl

The debate on the impact of tourism in towns continues, partly due to the fact that the relationships involved, and ensuing effects, have yet to be fully defined.
On the one hand, the minor towns (the most recent new entry is San Gimignano) as well as some of Italy's leading tourist attractions like Venice and Florence are being faced with the choice between "destroying" an asset and safeguarding it by means of planned access. On the other hand, both towns and cities believe that tourism is of prime importance, not just as a driving force for economic activities, but also because of the way it integrates and enhances the urban fabric, placing permanent and temporary residents (or tourists) on the same level.
Additionally, new ways of interpreting the phenomenon have appeared on the scene, including the application of the ecological footprint approach [a method used to measure the amount of land and water area that the human population needs for the resources required to support itself and to absorb its wastes] to tourists. Footprinting analysis used for the Province of Siena revealed that tourists spending their holidays there had a lower environmental impact than when at home.
This chapter (which does not claim to be exhaustive) presents the indicators identified to describe the tourist phenomenon in the 24 Italian towns and cities examined in the 2006 report and examines in greater depth various aspects of this varied scenario; when interpreting the data we must take into account the fact that the various towns experience differing levels of tourism according to their different assets.

Flow Volume in Towns Continues to Increase

The tourist attraction capacity of Italian towns continues to grow, especially for those towns and cities drawing visitors from abroad. In 2005 24 million tourists travelled to Italian towns and cities spending nearly 60 million nights there.
Italy's top tourist cities like Venice, Rome and Florence are witnessing considerable growth while a newcomer to the scene, Turin, has experienced a marked acceleration. In fact, the number of nights spent by tourists in Turin in 2005 increased by nearly 500,000 thousand units (24% of the total) compared to the previous year.

Tourists in towns & cities (nights in accomodation, historical data)

Town/city	2003	2004	2005	Var. % 2005/2004
Torino	1,800,207	2,008,771	2,493,669	24.1
Milano (1)	7,023,214	6,977,215	7,219,962	3.5
Brescia	432,617	404,642	391,353	-3.3
Verona	1,334,796	1,356,985	1,409,187	3.8
Venezia	6,270,015	6,930,073	7,121,056	2.8
Padova	811,916	755,896	832,531	10.1
Trieste	500,567	545,766	506,862	-7.1
Genova	1,210,515	1,337,820	1,230,123	-8.1
Parma	395,614	425,116	443,611	4.4
Modena	539,263	495,314	490,842	-0.9
Bologna	1,759,361	1,730,239	1,802,613	4.2
Firenze	6,070,417	6,444,900	6,719,398	4.3
Prato	330,125	349,769	366,047	4.7
Livorno	346,452	364,378	317,937	-12.7
Roma	19,122,461	20,049,906	21,688,937	8.2
Napoli	2,194,835	2,271,842	-	-
Foggia	98,565	117,383	95,986	-18.2
Bari	445,150	495,356	465,389	-6.0
Taranto	145,217	137,441	144,799	5.4
Reggio Calabria	167,014	162,780	152,664	-6.2
Palermo	1,254,250	1,262,354	1,267,429	0.4
Messina	322,990	387,238	374,326	-3.3
Catania	462,618	512,691	557,436	8.7
Cagliari	304,053	302,628	-	-

Sources: Istat, Ufficio statistica della Provincia di Torino, Ufficio statistica dell'Apt di Milano, Provincia di Milano, Assessorato al Turismo della Provincia di Brescia, Provincia di Verona, APT della Provincia di Venezia, Ufficio statistica Turismo Padova Terme Euganee, Servizio analisi statistiche studi e ricerche Regione Liguria, Servizio promozione e internazionalizzazione della Regione Autonoma Friuli Venezia Giulia, Osservatorio turistico regionale dell'Emilia Romagna, Comune di Bologna, Comune di Modena, Ufficio statistica Provincia di Livorno, Ufficio statistica Provincia di Firenze, Servizio Turismo della Provincia di Prato, APT Roma e EBT di Roma, Ept Napoli, APT della Provincia di Bari, Apt della Provincia Foggia, Apt della Provincia Taranto, APT di Reggio Calabria, Azienda Turismo Palermo e Monreale, AAPIT della Provincia di Catania, AAPIT della Provincia di Messina, AAST di Cagliari.

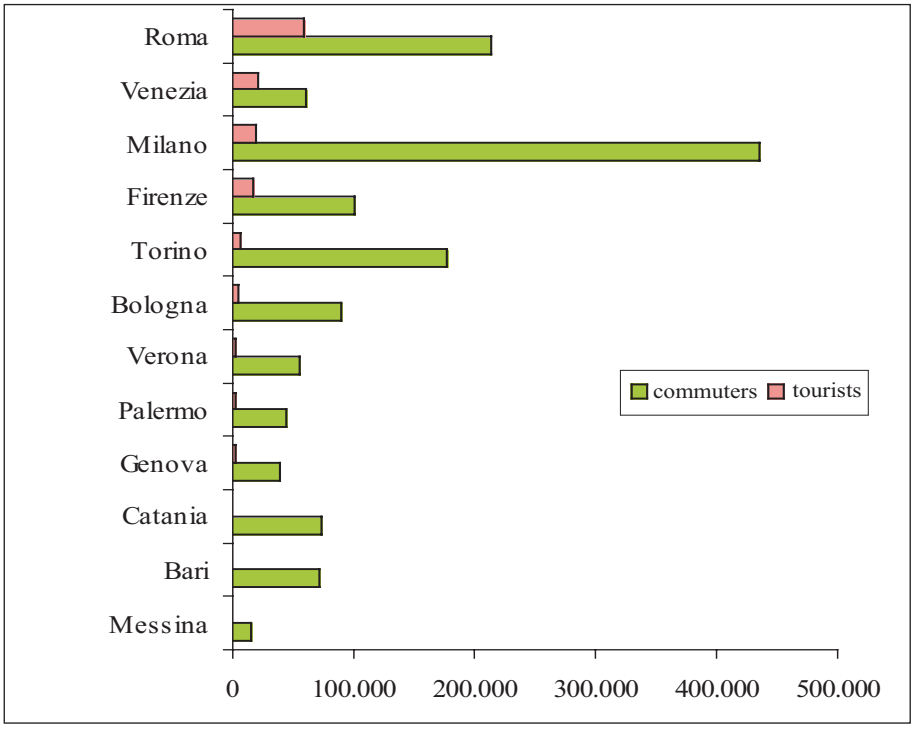
City Demand: Tourists and Commuters

We must remember that tourism only represents part of city demand and that it does not account for the largest share.

The bar chart below (Diagram 1) compares two of the components making up the demand: tourists and commuters travelling to towns and cities to work or study[1].

In the twelve towns/cities examined the daily tourist flow was considerably less than the flow of commuters travelling to urban centres to work or study.

Diagram 1 – City Demand
(commuters studying/working and tourists, daily average)



Source: elaborazione su dati Istat – Censimento della popolazione 2001 e enti turistici locali, 2006

[1] It was impossible to consider day-trippers in this particular case.

Moreover, a number of studies into tourism in towns/cities have supplied interesting information about behavioural patterns. For example, a survey carried out in Rome[2] revealed that only 8 out of 100 tourists reach the city using their own transport, while the others travel by train (20%), aeroplane (66%, foreigners in particular) and only 6% by coach. And during their stay they tend to move around on foot (32%) or use public transport (40%). The number of persons using their own transport is much higher among commuters.

Tourism and City Services

As highlighted in the previous reports on the quality of the urban environment, cities and towns have to cope with the impact of tourism mainly for special occasions throughout the year (fairs, shows, festivals, etc) rather than being spread throughout the year.
Venice and Florence, and, to a considerably lesser extent, Rome and Milan, have real difficulties in responding to service requirements (from transport to energy and waste disposal) resulting in a burden on the environment. The first two cities experience an increase in demand (12.5% in the case of Venice, 8% in Florence) on several occasions throughout the year while values in Rome and Milan remain below 4%.
In these cities the tourist/resident ratio is on the increase as is the hotel occupancy rate. In many towns and cities where tourism plays an important role, hotel capacity is often under-utilised and often these are the very places most affected by overcrowding caused by special events like fairs, cultural and musical events (towns like Bologna, Modena, Turin and Verona) and where the "peak" days require greater attention.
Finally, there are cities like Foggia and Reggio Calabria where there are hardly any hotel beds and where the impact of tourism is virtually zero. For these towns the development of tourism could represent an added value for the economy.

[2] I turisti danno i voti a Roma, 2005 – Survey promoted by EBT and the Municipality of Rome and submitted to 2,000 tourists

Town/city	No. tourists per 100,000 inhabitants (daily average) *(1)*		Total no. beds per 100,000 inhabitants *(2)*	Hotel beds per 100,000 inhabitants *(3)*	No. hotel beds per sq. km *(4)*	Gross hotel occupation rate *(5)*		% hotel beds with respect to total beds *(6)*	Average stay in days *(7)*
	2005	**05 /04**				**2005**	**05 /04**		
TORINO	757	▲	1,584	1,148	80	47.3	▲	72.5	2.9
MILANO	1,522	▼	-	3,320	237	46.0	▲	-	2.1
BRESCIA	558	▲	1,553	1,177	25	37.6	▲	75.7	2.7
VERONA	1.,90	▲	2,697	2,223	28	48.1	▲	82.4	2.6
VENEZIA	7.,47	▲	12,469	8,709	57	69.1	▲	69.8	2.4
PADOVA	1,082	▲	2.,14	1,992	45	47.8	▼	79.2	2.3
TRIESTE	671	▼	2.,84	1,291	32	37.1	▼	54.2	2.5
GENOVA	557	▼	1,351	1,114	28	32.9	▼	82.4	2.1
PARMA	697	▼	1,868	1,540	10	40.0	▲	82.4	2.0
MODENA	747	▼	2,234	1,843	18	35.9	▼	82.5	2.1
BOLOGNA	1,319	▲	2,942	2,497	66	46.0	▲	84.9	2.3
FIRENZE	5.,02	▲	10,188	8,051	289	50.7	▲	79.0	2.5
PRATO	555	▲	1,218	860	16	46.4	▼	70.6	2.2
LIVORNO	558	▼	2,452	1,594	24	27.0	▼	65.0	2.8
ROMA	2,327	▲	3,946	3,128	62	56.9	▲	79.3	2.6
NAPOLI	-	-	1,137	1,037	88	-	-	91.2	-
FOGGIA	170	▼	813	752	2	21.7	▼	92.5	2.1
BARI	388	▼	1,383	1,315	37	29.5	▲	95.1	2.0
TARANTO	199	▲	1,235	1,089	10	17.8	-	88.2	2.3
R.CALABRIA	229	▼	711	633	5	35.3	▲	89.1	2.2
PALERMO	514	▲	1,496	1,286	55	37.1	▼	86.0	2.1
MESSINA	414	▼	1,050	546	6	47.0	▼	52.0	4.0
CATANIA	499	▲	1,981	977	17	38.1	▼	49.3	2.3
CAGLIARI	-	-	1,510	1,258	24	–	–	83.3	–

(1) Tourists: 2005 – Resident population: 2005; (2) Total no. beds: 2005; (3) (4) Hotel beds: 2005; (5) Gross hotel occupancy rate is the ratio between tourists in a given period (year) and the number of beds theoretically available during the same period; (6) Total no. beds and hotel beds: 2005; (7) Tourist arrivals and attendances: 2005

Sources: Istat, Ufficio statistica della Provincia di Torino, Ufficio statistica dell'Apt di Milano, Provincia di Milano, Assessorato al Turismo della Provincia di Brescia, Provincia di Verona, APT della Provincia di Venezia, Ufficio statistica Turismo Padova Terme Euganee, Servizio analisi statistiche studi e ricerche Regione Liguria, Servizio promozione e internazionalizzazione della Regione Autonoma Friuli Venezia Giulia, Osservatorio turistico regionale dell'Emilia Romagna, Comune di Bologna, Comune di Modena, Ufficio statistica Provincia di Livorno, Ufficio statistica Provincia di Firenze, Servizio Turismo della Provincia di Prato, APT Roma e EBT di Roma, Ept Napoli, APT della Provincia di Bari, Apt della Provincia Foggia, Apt della Provincia Taranto, APT di Reggio Calabria, Azienda Turismo Palermo e Monreale, AAPIT della Provincia di Catania, AAPIT della Provincia di Messina, AAST di Cagliari.

NATURE IN THE CITY: GREEN AREAS AND BIODIVERSITY

M. MIRABILE
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Analysis of the urban environment can cause considerable problems due to various harmful elements such as air pollution, noise, traffic and waste. Moreover, cities are a major factor affecting the environment and land use as a whole, especially when considering the uncontrolled urban sprawl of the last few years, which has led to increasing fragmentation and loss of valuable amenities.

Despite this negative picture, cities usually have natural spaces, both inside urban built-up areas (such as parks, gardens, tree-lined avenues, rivers) and peri-urban areas (woods, agricultural fields, wetlands). People's perception of their quality of life is enhanced by green spaces and furthermore these spaces perform many important functions, such as:

- Improvement of the urban climate (balancing of humidity and temperature, wind attenuation).
- Air circulation and the capture of dust and gaseous pollutants.
- Reduction of noise level (especially when plantings are combined with other barriers).
- Stabilization of the soil and reduction of soil erosion.
- Control over excessive light (sunlight, streetlight, headlights).
- Recycling of organic waste.
- Improvement of water absorption and retention.
- Contributing to physical exercise of citizens (walking, jogging, cycling, allotment gardening).
- Helping nature conservation (habitats for wildlife and allowing migration of species across urban areas).
- Contributing to environmental education and research.
- Giving an aesthetic value to urban environment (desirable views, colours, seasonal change), contributing to relaxation and increased levels of concentration.

Therefore, green areas have several roles within urban environment and they represent an important aspect of the analysis.

In the III Report on Urban Environment Quality, aspects of the inquiry relating to green

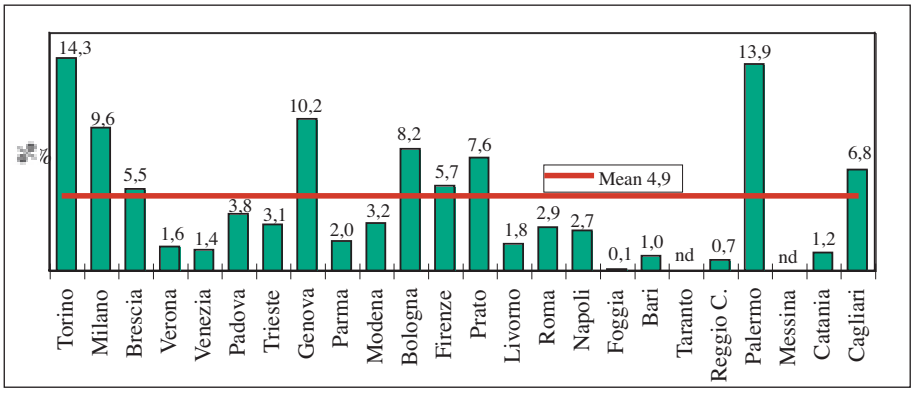
spaces are: analysis of green areas (managed by communal administration), Nature2000 Network in urban areas, works of different kinds on urban biodiversity, analysis of "problematic" animal species in cities (such as the tiger mosquito and introduced species), protected areas and Good Practices. Here is a summary report of these concerns.

GREEN AREAS

For classified green areas we refer to legislative protection and to the different ways green areas can be used by citizens. It is therefore possible to identify five types: equipped green areas (play, sports areas, and multipurpose areas…), urban parks (protected areas as per Title 2 of Legislative Decree 490/1999 because of their beauty and landscape value), historic green (protected areas as per Title 1 of Legislative Decree 490/1999 due to their artistic and historic value), decorative green (parking, traffic islands, traffic circles…) and special areas (such as school fields, botanic gardens, zoos, urban cemeteries).
For the 24 cities, 3 indicators for green areas have been analysed (from 1999 to 2003, source ISTAT data processed by APAT):

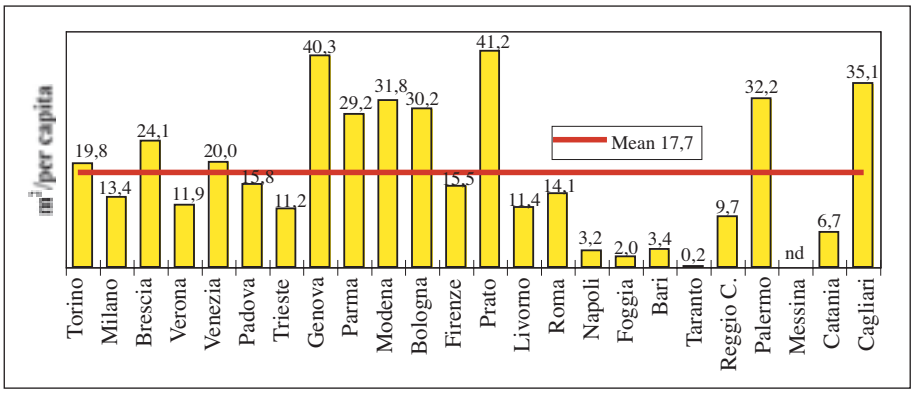
- Percentage of green areas (managed by communal administration) on communal surface. From 1999 to 2003, the value for this indicator has increased, in 75% of cities, by an average of 1.4%. This increase was determined by attainment of new green areas and in some cases by the reclaiming of existing green spaces. In the other 25% of cities figures did not change. Data of 2003 (Fig. 1) show that 41% of cities have an upper mean value of 4.9%. Considering only the green areas managed by communal administration, values for this indicator could be underestimating urban green areas as a whole;

Figure 1: Percentage of green areas (managed by communal administration) on communal surface (mean value in red: 4.9%) (Year 2003; source ISTAT data processed by APAT)



- Availability per capita of green areas (m^2/per capita). General trends show that this indicator has grown in 88% of cities, with an average increase of 4.5 m^2/per capita between 1999 and 2003. 43% of cities exceed the mean value for 2003 of 17.7 m^2/per capita (Fig. 2). Moreover, the availability per inhabitant of green areas, varies a lot between cities, from 0.2 m^2/per capita for Taranto to 41.2 m^2/per capita for Prato;

Figure 2: Availability per capita of green areas (m^2/per capita) (mean value in red: 17.7 m^2/per capita) (Year 2003; source ISTAT data processed by APAT)



- Availability per capita of green areas divided per type (m^2/per capita). Between 1999 and 2003 equipped green has increased in 65% of cities, urban parks in 61%, historic green in 25%, decorative green in 71% and special areas in 67%. Referring to 2003 (not considering Taranto e Messina for which there are no data), the predominant green typology is urban parks in 46% of cities, equipped green 27%, special areas 14% and decorative green 9%.

NATURA 2000 NETWORK

Natura 2000 Network is made up of two types of sites: Special areas of conservation (SAC) and Areas of special protection for birds (ASPB). SAC are designated by Member States in accordance with the 92/43/CEE "Habitats" Directive. Beforehand, however, the Commission, in agreement with each Member State, must classify the sites proposed as being sites of Community importance (SCI). The ASPB are designated by Member States under the "Bird" Directive 79/409/CEE.
At present, in Italy, designation of these sites is being assigned and assessed and so data on Natura 2000 Network is being continually updated. In December 2006, 2280 SCIs and 590 ASPBs were designated sites. Many of these sites are in urban areas, proving

that important habitats and wild flora and fauna are present in our cities. We do not yet have data at provincial and communal level, so in table 1 the status of the 24 cities is shown at a regional level.

Table 1: Total extension (in ha) and percentage on total regional surface of all Natura 2000 sites in the Regions of the 24 cities

Region	Natura 2000 sites (SCI and ASPB)	
	Surface (ha)	%
Piemonte	334,284	13.2
Lombardia	344,926	14.5
Veneto	403,705	21.9
Friuli Venezia Giulia	137,084	17.5
Liguria	147,228	27.2
Emilia Romagna	256,847	11.6
Toscana	293,106	12.8
Lazio	430,708	25.0
Campania	395,520	29.1
Puglia	474,282	24.5
Calabria	314,347	20.8
Sicilia	545,544	21.2
Sardegna	427,183	17.7

(December 2006; source MATTM data processed by APAT)

BIODIVERSITY

Atlas and other works on urban biodiversity

Urban areas give hospitality to many species, both animals and vegetation, thanks to the heterogeneity of the landscape and availability of habitats. Moreover, cities give food, shelter and protection to many species as well. There are lots of studies on urban biodiversity; in Italian cities most of them are on birds and on amphibians and reptilians.
Number and spatial distribution of nesting birds can be ascertained by consulting the ornithological atlas, which is available in 38% of the Provinces and 29% of cities. For two Provinces, a wintering bird atlas is available, too. Herpetological atlases are available in 17% of the Provinces as well as the city of Rome.
Studies on urban wildlife are increasing: with reference to the 24 cities, 12% of works were published after 2003.

"Pest species"

Human-wildlife interaction in urbanizing environments can also be of a negative nature and often creates inevitable conflict between humans and wildlife in suburban and urban areas. Anthropic species that cause a lot of aggravation (environmental, economi-

cal, social, and sanitary) are generally called "pest species". For example, some birds cause problems, especially as far as hygiene is concerned, such as urban pigeons and European starlings as well as some mammals such as rats and mice. In Italy, another problematic insect is the mosquito, especially with the arrival of the Asian tiger mosquito (*Aedes albopictus*) in recent years. In our country this insect was observed for the first time in Genoa in 1990 and then it spread across most of the Italian peninsula. Although this species is particularly annoying because of its bite, it does not represent a real health risk. The tiger mosquito is now present in 92% of cities (Source: Istituto Superiore di Sanità, 2006), apart from Catania and Cagliari (Table 2). In Venice, Trieste, Livorno and Foggia it is found only in provincial areas and in Naples it is an isolated hotbed around the hinterland and harbour. In general, its appearance has been more recent in southern cities, with some exceptions (such as Livorno).

Table 2: Presence of tiger mosquito and date of appearance in the 24 cities

Cities	**Presence tiger mosquito**	**Year**
Torino	YES	2000
Milano	YES	2000
Brescia	YES	2000
Verona	YES	2000
Venezia	Only Province	1998-00
Padova	YES	2000
Trieste	Only Province	2003
Genova	YES	1990
Parma	YES	no date
Modena	YES	no date
Bologna	YES	2000
Firenze	YES	2001
Prato	YES	2002
Livorno	Only Province	2005
Roma	YES	1997
Napoli	YES (isolated hotbed in hinterland and harbour)	1998
Foggia	Only Province	2000
Bari	YES	2005
Taranto	YES	2005
Reggio Calabria	YES	2004
Palermo	YES	2004
Messina	YES	2005
Catania	NO	
Cagliari	NO	

(Source: Istituto Superiore di Sanità, 2006)

Introduced species

An introduced species (also known as naturalized species or exotic species) is an organism that is not indigenous to a given place or area and instead has been accidentally or deliberately transported to this new location by human activity. These species can often damage the ecosystem they are introduced to.

Introduced species are becoming a regular presence in many Italian cities, where they can be dangerous for the original wildlife (for example the American grey squirrel in Turin and the ring parakeet and nutria in Rome). Moreover introduced species can have a negative impact on the economy. For example: damage to agriculture or fishing and the costs of controlling or eradicating these invasive species.

SAFEGUARDING BIODIVERSITY AND THE ECOLOGICAL AND FUNCTIONAL ADAPTATION OF SPACES AND OBJECTS WITHIN THE URBAN ENVIRONMENT

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INTRODUCTION

In a recent Communication from the Commission to the Council and European Parliament regarding a thematic strategy on the urban environment – Brussels, 11.01.2006 COM (2005)718 definitive - specific reference was made to the problem of uncontrolled development in the cities as one of the main causes leading to the loss of natural habitats and biodiversity.
As such, within the scope of sustainable urban development, the drive towards putting into place integrated urban plans is presented as a priority. The spread of a culture of "integrated territorial government" is encouraged by means of measures primarily aimed at local authorities.
Cities must offer a healthy, safe and stimulating environment to their citizens without excessively exploiting natural resources and their ecosystem.
Problems such as pollution, high energy consumption, the increase of rainproof surfaces and the reduction of green areas in cities are difficult to solve with a single method of intervention. Attention must be focused on the ecosystem of the entire territory of a city. It is a combination of different ecosystem types (ecological mosaics) in a city's territories and the relative local environmental components connected to natural features which characterize urban agglomerates, as such rendering them the target of specific intervention strategies. Only over the last few years have a number of spatial planning choices - motivated by the social, economic and productive transformation which has taken place on a global scale - been able to find an expression using "shapes" and "rules" which are more respectful towards the ecological-environmental features of the areas (for example the introduction of the Ecological Network Plans within the General land Management plan belonging to the larger metropolitan areas).

Nature, biodiversity and sustainable urban planning

The new European strategy stressed the importance of favouring the adoption of sustain-

able urban planning as a contribution towards reducing the loss of natural habitats and biodiversity.
Sustainable spatial planning provides that the models and types of territory used by certain urban areas must take environmental aspects into account.
Specific actions must therefore be introduced into different urban tools aimed at improving the respect and quality of phenomena directly or indirectly connected to nature and biodiversity such as urban proliferation, waterproofing and the presence of biological diversity within the urban landscape.

Preventing urban proliferation
Excessive urbanisation, correlated to the "dispersion" and expansion of new urban areas in the territory, is connected to the consumption of agricultural and/or natural land. What must therefore be underlined is the need to build high-density mixed use, compact urban areas. Furthermore abandoned or contaminated (*brownfield*) areas must also be used to develop new urban settlements.

Reducing waterproofing
A number of specific ecosystem and biodiversity problems are directly correlated to the indiscriminate consumption of the territory and waterproofing. In fact, the land, as underlined in Communication COM (2002) 179 by the European Commission – Towards a themed strategy for land conservation - plays a role of primary importance in supporting life and ecosystems, preserving gene pools, as well as being an essential feature of the landscape.

Promoting urban biodiversity
Actively maintaining and/or restoring functional ecological relations between cities, their hinterlands and the wider regions can guarantee respect between new urban developments and the natural environment. The integration of biodiversity within the urban landscape is based on the presence of species and/or protected habitats and the "need" of citizens to come into contact with wild plants and animals.
Urban dwellers, with their behaviour, can determine the success of any plan or local action. Education can strengthen a culture of respectful coexistence with the animal and plant world present in the city.

Biodiversity and the sustainability of buildings
Improvements of functional ecology in an urban system can be put in place by working on "structures" (i.e. buildings, infrastructure, etc). For example, the ratio of buildings to fauna, with the exception of a few cases capable of offering favourable opportunities to

species (i.e. nesting sites or sanctuaries) remains, for the most part, fraught with difficulty.
A number of planning and technical solutions may be adopted in order to improve buildings with the aim of preserving biodiversity. These include:
– Outlines or anti-collision strips for birds to reduce impact mortality rates;
– Artificial nests to favour bird and mammal reproduction in species that nest in cavities (i.e. peregrines, barn owls, owls, swifts, swallows, house martins, jackdaws, bats, etc).
– Constructing green roofs to favour animal and plant species.

Biodiversity and sustainable urban transport

The growth of urban transport creates pressures on habitats and biodiversity by directly consuming land, a general change of bio-geochemical flows, and light and acoustic emissions as well as air pollution. The development of ecological networks side by side with infrastructure networks (roads, railways, power lines, etc.) and treating the problem from the point of view of the ecosystem, allows any possible impacts on each individual environmental component to be compared in an integrated overview (road ecology).
Measures to adapt and/or reuse infrastructures from an ecological point of view must be put in place to reduce infrastructure interference on wildlife such as for example crossings (tunnels and bridges) or barriers for amphibians, ungulates and medium and large animal species.

Urban greenways

The construction of greenways is another category of planned territorial interventions. This is a linear system of territories connected because safeguarded, managed, and developed in order to obtain recreational, ecological and historical-cultural benefits - with routes specifically dedicated to non-motorised traffic, capable of connecting citizens with the natural and historical-cultural resources of the territory and its environment.
The ecological value of a greenway depends on a variety of factors: the size and shape of the greenway, the quality of the vegetation, the diversity of habitats present, location on the territory and degree of connection (depending on the connection with respect to other possible networked elements), and the number and size of interruptions along the way (fragmentation).
In an urban environment, where disturbances are very strong, the greenway must be as large as possible and vegetation must be extremely compact in order to create a habitat. The size of the corridor determines its richness and biodiversity up until a certain point – which is specific to every environment. Beyond this point, no increases in biodiversity are possible.

ELECTROMAGNETIC POLLUTION IN ITALIAN METROPOLITAN AREAS

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The interest towards electromagnetic fields has become more important because of the contemporary frenetic development of the telecommunications' systems. These installations, located in a capillary way in the urban environment create doubts and worries about their dangerousness. The increase of the electric grid too, caused by a higher demand for electric energy, as well as the urbanization of land until then uninhabited and characterized by long-distance power lines or radio-television broadcasting stations, has contributed to increasing perplexities about possible negative effects on human health due to a prolonged stay close to the installations.
The phenomenon called "electromagnetic pollution" is connected to the generation of artificial electric, magnetic and electromagnetic fields. This type of artificial energy is created by systems built to transmit information through the propagation of electromagnetic waves (for example radio-television broadcasting stations (RTV) or radio base stations (SRB), by systems built to transport and transform electric energy (low distance power lines) and by all the systems powered by electricity (like electric household appliances).
In the fields of radio-frequency (RTV and SRB) and extremely low frequency (ELF) control activity is increasing rapidly due to the ever greater pressure both from local groups and the requests of the population.
Indeed, monitoring electromagnetic pollution is one of the most important emergencies for the relevant corporations. If they appear to exceed exposure limits, attention values or quality targets, the general public will start protests and similar activities.
The future tendency will be to use new technologies which will change both environment and landscape laws mainly in urban contexts, employing "low-impact" technologies and a good compromise between the increasing number of sources and environmental protection.

The following aspects were discussed in this third report:

- **European, National and Regional regulations and Italian technical rules**: the present situation has been analysed to verify if each region has taken into account the

general policy law n. 36/2001 and its implementing decrees DPCM 8/07/2003;

- **Measurement instruments**: in regards to the equipment used for measurements in low and high frequency: about 94% of the analysed cities have instruments for measurements in broad band for high frequency; about 82% have instruments used for measurements in broad band for low frequency and about 72% have instruments used for measurements in narrow band;
- **Control activity: monitoring network monitoring**: this activity concentrated on measuring campaigns employing instrument for continuous monitoring. The places were these instruments were placed were described. The development of the control and monitoring networks represents beyond doubt one of the most important innovations in the area of the methodologies of evaluation through measurement of environmental electromagnetic fields through measurement. A network of monitoring and control is constituted by a certain number of reading stations located on the territory in order to monitor a municipality or a province and a central unit that controls the operativeness of the reading stations. The central unit gathers, processes, shows, divulges and records the figures provided by the reading stations. To date many companies have set up or are going to set up stations for continuous measurement of electromagnetic fields, all equipped with the necessary systems of data acquisition, transfer and processing. The use of a specific instrument, called PMM8055s, has increased; it is employed for monitoring in continuous and in remote mode the narrow band from 5 Hz to 40 GHz. About 82% of the analysed cities has stations for monitoring in continuous in high frequency while 25% has stations for monitoring in continuous in low frequency. Measurement campaigns have covered sensitive areas such as schools, airports, public and private buildings.

  The regional agencies have not only been involved in monitoring environmental protection, but over the years there have also developed a national network which monitors electromagnetic fields, with particular reference to radio-telecommunications systems. The Ministry of Communications, through the Ugo Bordoni Foundation (FUB), has set up a monitoring network with the active participation of system of agencies (ARPA- regional agency for environmental protection; APPA - provincial agency for environmental protection). The ARPA/APPA system chose monitoring locations, gathered and validated recordings and sent them to the national gathering centre at the FUB. The FUB planned the network and the Ministry of Communications financed activities. Every region has a FUB monitoring network. This system of control and vigilance has an efficient website (www.monitoraggio.fub.it) and anyone can access information on the controls carried out in any municipality. The following information is provided by each monitoring station:

– Name of the monitoring place;
– Address;
– Start Date of the measurements;
– End Date of the measurements;
– Measured readings and time (hour) in which the readings were taken;
– Histogram in which the measured readings are assembled in three groups as follows:

- E (Electric field recording) < 6 V/m;
- 6 V/m< E (Electric's field recording) < 20 V/m;
- E (Electric field recording) > 20 V/m.

Example:

DATA OF THE PLACE:

Measure Point : Private school "Casa del Fanciullo"
Municipality: PALERMO (PA)
Address: Via Galletti,78
Localization: Terrace of the building
Types of systems: SRB
Limit fixed by the law: 20 V/m
Start date of the campaign: 21/06/2005
End date of the campaign: 11/07/2005

Fig. 1 Histogram of the readings from the campaign in Palermo.

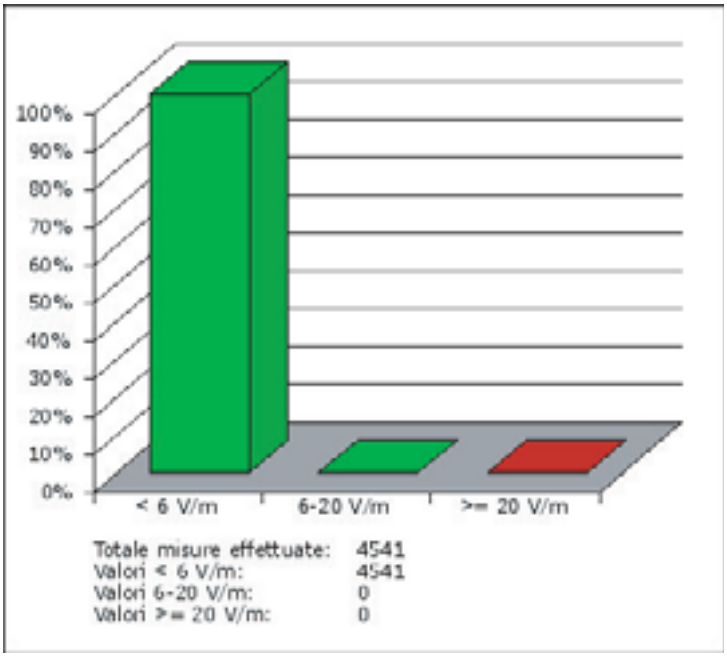
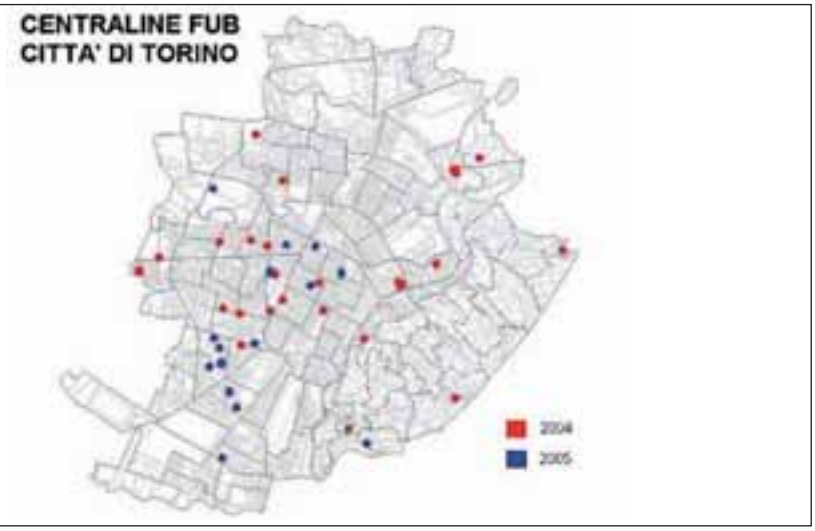
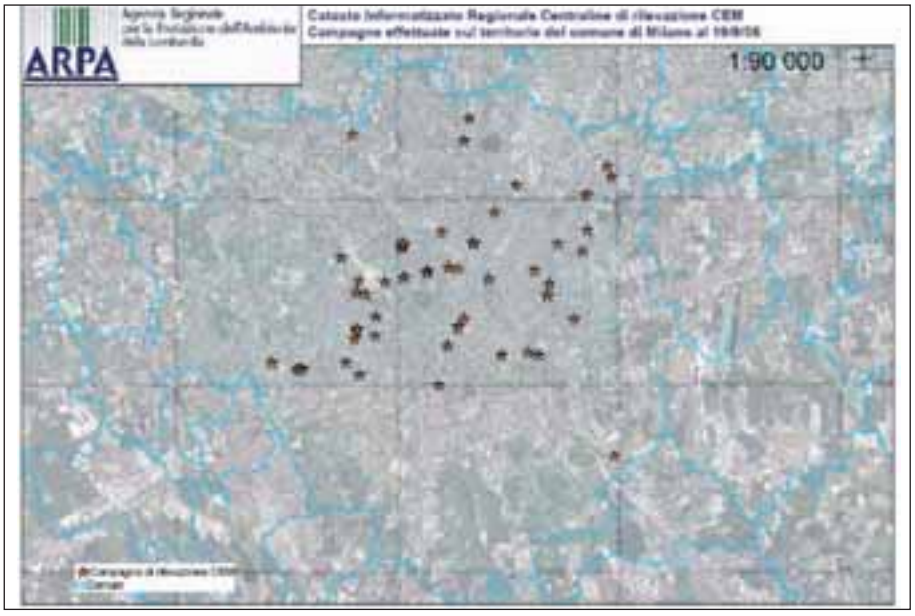


Fig. 2 Map of the location of the FUB instruments monitoring Turin (2004-2005)



(Readings source: ARPA Piemonte- Ivrea's Department)

Fig. 3 Map of the location of the measuring points of the CEM measurement campaign in the city of Milan up to September 19, 2006



(Readings source: ARPA Lombardia)

- **Exceed limits discovered and consequent reclaiming actions:** the localized measurement campaigns have discovered that limits set by law were exceeded. As far as measures in high frequency are concerned, 80% of the analysed cities has discovered exceeded limits and only 70% of these cities has arranged or is arranging for a reclaiming action. As far as measures in low frequency are concerned, no excesses were discovered.
- **Identification of "Hot- Areas"**: in some cities specific areas where the set limits have often been exceeded have been identified. About 74% of the analysed cities has identified these areas.
- **Level of citizen information:** useful information on how the municipalities have informed citizens on electromagnetism, its management and its effects on human health have been gathered. About 90% of the analysed cities set aside space in the municipal website for notes about electromagnetism and the relevant legislative references. About 60% of the analysed cities has carried out campaigns to inform the public through communication systems such as internet, brochures, posters and meetings. These campaigns are launched in order to provide a wide and informed knowledge of this topic and to divulge the results of monitoring. About 70% of the analysed cities set aside a space on their municipal website for the results of controls carried out .

EXPERIMENTAL EVIDENCE AND ENVIRONMENTAL INDOOR POLLUTION
REPORT: STUDY CASES AND PROXY INDICATOR SET

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1. INTRODUCTION

Although various studies have been carried out by primary international research institutions on indoor pollution highlighting an extensive range of experimental evidence, there is still difficulty in finding a set of indicators for the reporting activities. This difficulty is mainly due to the nature of indoor pollution, which is strictly connected to the behaviours and choices of what is introduced into an indoor environment for private use. As a consequence, this subject is still lacking a comparable set of indicators due to the lack of data used to report it.
In this context, this is now the third year that we have presented a set of proxy indicators. These, based on social, economic, functional and structural information, can help to follow the trend of the onset of indoor pollution.
We have also included a table (table 1) with some experimental values referring to the most common indoor pollutants. These are extracted from studies performed in some Italian towns (references have been published in the extended version of the Report).

2. INDICATORS

In this report we analysed 6 proxy indicators for the indoor air quality evaluation:
- Affordability
- Crowding
- Time employed commuting to the job or study place
- Percentage of smokers
- Percentage of families equipped with an air conditioning system
- Legionellosis cases.

Table 1: Concentration values of some indoor pollutants.

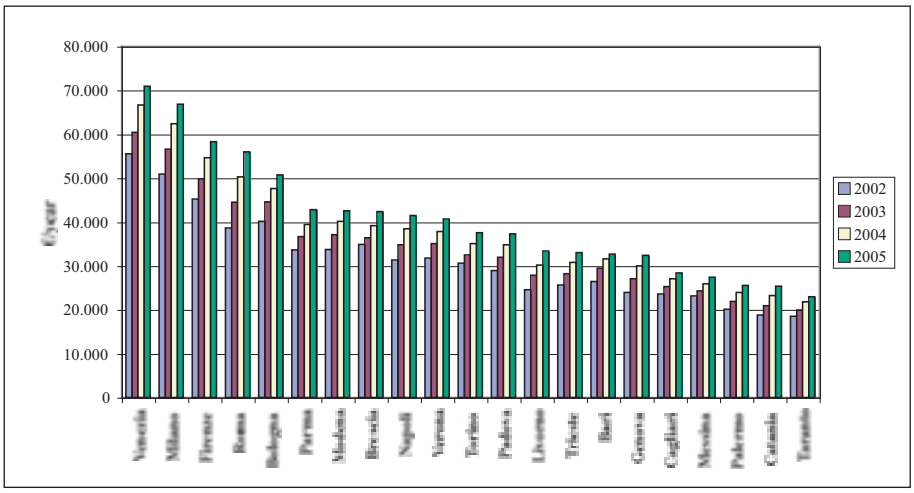
City	Place typology	Testing site	Benzene ($\mu g/m^3$)	Toluene ($\mu g/m^3$)	Xylenes ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	Formaldehyde	TVOC[1)]
			Annual threshold: 5 $\mu g/m^3$ (DM 60/02)				24h threshold: 50 $\mu g/m^3$ (DM 60/02)		
			The concentrations of airborne benzene associated with an excess lifetime risk of1/10.000, 1/100.000 and 1/1.000.000 are, respectively, 1.7 and 0.17 $\mu g/m^3$ (WHO)	0,26 mg/m^3 as weekly threshold mean (WHO)		• 24h threshold: 25 g/m^3; • Annual threshold :10 $\mu g/m^3$ (WHO)	• 24h threshold: 50 $\mu g/m^3$ • Annual threshold: 20µg/m3 (WHO)	0,1 mg/m^3 in 30 minutes (WHO)	
Roma	**Dwelling**	*Indoor summer*	6.7/2.0*	38.9/16.3*	33.7/9.8*				
		Outdoor summer	5.7/2.3*	33.2/13.3*	29.4/10.1*				
		Indoor winter	5.6/4.5*	66.5/50.9*	49.3/30.6*				
		Outdoor winter	4.3/2.2*	58.8/26,5*	52.7/27.6*				
	Office	*Indoor*				21	28		
		Outdoor				27	46		
	School	*Indoor*	3.1	7.7	7.6				
		Outdoor	2.2	8.3	10.4				
Catania	**Renovated office**	*Indoor*						0.122 (ppm)	
	No renovated office	*Indoor*						max < 0,05 (ppm)	
Modena	**Inner library**	*Indoor*	11.0	22.0	38.0			22.9 ($\mu g/m^3$)	566
		Outdoor	11.0	32.5	59.0			22.0 ($\mu g/m^3$)	584
	Suburban library	*Indoor*	8.9	24.5	25.5			10.5 ($\mu g/m^3$)	282
		Outdoor	4.4	16.0	24.0			9.2 ($\mu g/m^3$)	300

* data pertinent to high/low traffic zones

2.1 Affordability

This indicator shows the percentage of population with an income below the level needed to purchase an 60 square meter home of normal quality.
The indicator is based on the assumption that 15% of the income, over a time span of 25 years, should be sufficient for such an investment. The choice of using the cost index for new dwellings is based on the hypothesis that these are made with construction materials and according quality standard; these factors are determinant for the indoor air quality.
The table indicates that from year to year, the necessary income for the purchase of a house of good quality increases in percentage by about 10% approximately, in all of the cities, with a peak in the city of Rome, in which, from 2002 to 2005, there has been an increase of 45%.

Figure 1: Affordability trends in the 24 metropolitan cities. Years 2002-2005.



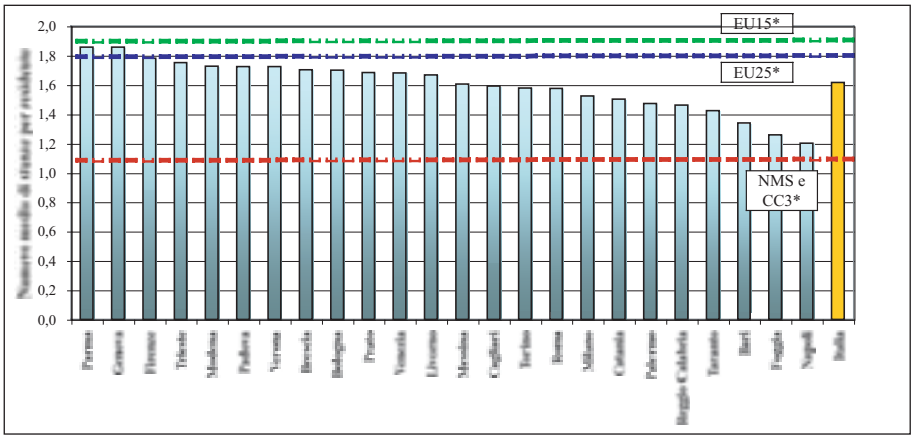
Source: NOMISMA data processed by APAT

2.2 Crowding

Crowded housing conditions can be the driving force of risky situations, allowing the rapid spread of infectious diseases, increasing the probability of accidental injuries within dwellings and influencing the microclimatic conditions. Inadequate space poses a threat to the mental well being of an individual, causes stress and dissatisfaction,

together with other social and health problems for families. As shown in the figure below, in the major Italian provinces every inhabitant has the use of at least one room. Residents of most Northern-Central provinces, with the exception of Milan and Turin, enjoy a higher number of rooms than the national average (1.62 rooms per resident). The resident that has the lowest number of rooms lives in Naples, with 1.20 rooms, while in Genoa and Parma each inhabitant lives in an average space of 1.86 rooms. Comparisons with the European survey taken into consideration (see references in the extended version), show that Italy is within the average number: in EU15 Countries, an individual lives in 1.9 rooms (excluding kitchen, bathrooms, corridors, warehouses and rooms for professional use); in EU25 Countries, the average number of rooms per person is 1.8 and in NMS and CC3 Countries, the average number of rooms falls to 1.1.

Figure 2: Average number of rooms per resident in the twenty-four provinces. Year 2001



Source: ISTAT data processed by APAT
* Source: European Quality of Life Survey 2003

2.3 Time Employed Commuting to Job or Place of Study

Transport constitutes an indoor environment where we spend a large part of the day. Some factors (traffic situations, climatic conditions, proximity to exhaust pipes from diesel motors, environmental tobacco smoke, etc.) can be the cause of an accumulation of pollutants inside the vehicles. The time employed in commuting is important if we consider the exposure that is the concentration integrated for the time; it can be connected to potential risks related to exposure to pollutants. In Italy, 41.3% of people employs more than 15 minutes commuting. In the major metropolitan provinces the time is longer than the

national average: 42.9% Vs 41.3%. In Rome commuters spend more than 15 minutes in 61.5% of cases. Instead, in the provinces where the inhabitants are less than 200,000 (Brescia, Parma, Modena, Livorno, Prato, Foggia, Taranto, Reggio Calabria) the percentage of commuters that employ more than 15 minutes i lower than the national average.

2.4 Percentage of Smokers

Environmental tobacco smoke is among the most common pollutant present in the indoor environment. In Italy an evaluation of passive smokers has been carried out (Table 2). The data shows that 50% of Italian children (under 14) live with a smoker.

Table 2: Non smokers who live in families with smokers. Year 1999.

Age	Absolute value (*1000)	% respect to the total no smokers	% respect to the total population of the same age
0-5	1,557	10,4	49,3
6-14	2,612	17,2	50,9
15-24	2,479	16,4	36,2
25-64	6,974	46,1	21,8
65 and more	1,501	9,9	14,9
Total	15,143	100	26,5

Source: ISTAT

Being the monitoring of the percentage of active smokers an easier task if compared to that of the passive smokers. We have chosen this as an indirect measure of potential exposure to tobacco smoke. In 2003 in Italy, this figure was 23.9% of the population over 14, of these 31% were males and 14.3% females. In the central metropolitan municipalities and in the suburban municipalities, smokers are respectively 25.9% and 26.2%. In Europe, however, smokers in the EU15 Countries are 28.41% while in the EU25 Countries they are 30.72%.

2.5 Percentage of Families Equipped with an Air Conditioning System

Air conditioning systems may be a potential cause of poor indoor air quality, especially if the system isn't managed or installed properly. All air conditioner elements can be a pollution source. They can be the site both of growth and reproduction of biological pollutants, and the cause of their transportation and dissemination. It isn't possible to find exact information about the management of air conditioning systems, while we can easily procure the percentage of families that have the system. In Italy in 2003, the percent-

age of families owning an air conditioner increased if compared to that of 2002, from 13.5% to 17.2%. Collected data is available at Regional level: in particular, in the Veneto Region, we can observe a remarkable increment percentage, from 31.6% in 2002 to 40.3% in the following year. High percentages are also found in Emilia Romagna, Sardinia and Sicily.

2.6 Legionellosis Cases

Legionellosis is a typical infection related to indoor pollution. Legionella pneumophila is the species most frequently involved and it causes pneumonia-like infections. Water reservoir systems, mineral springs and mud, rivers and pools and also air conditioning systems, constitute the main sources of infection. The high infection rate present in indoor environments is related to the fact that often the bacteria grows and proliferates in the air conditioning systems, from which it is diffused into the surrounding indoor air. In Italy, notification of the cases of infectious diseases is mandatory, including Legionellosis. The total number of cases of Legionellosis recorded is surely underestimated, as often, the disease is not diagnosed and because sometimes cases are not notified. In the 2004, 592 cases of Legionellosis were notified to the Ministry of Health. This shows a falling trend if compared to that of the year before, confirming, however, an increase in the number of cases recorded if compared to those of 2001; in particular Rome and Milan are the cities mainly responsible for a fall in Legionellosis cases but, however, they still remain the two cities with the highest number of notified cases. The incidence of Legionellosis in Italy in 2004 was one case per one hundred thousand inhabitants and is similar to the European average.

WEB ENVIRONMENTAL COMMUNICATION AS A SUPPORT FOR DECISION-MAKING OF LOCAL GOVERNMENTS

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Executive Summary

The international and european policies are progressively evolving towards a new concept of communication as a mean of environmental governance. Communication is becoming more and more necessary when credible and firm decisions must be taken. To obtain consensus, stakeholders must be involved in environmental decision-making.
Legislation has gradually established "the right to access" to environmental information, "the right of being informed", up to the recent "right to participate" in the preparation of public acts.
Internet is the most effective and economical mean to organize public participation and to provide interactive information. Therefore, it represents a strategic requirement for the public administration.
The report analizes the content of the italian metropolitan areas' Web sites, and specifically, the information and communication relevant to the environmental aspects.
In particular, the objective of the research is to appraise the state and the evolution of the environmental communication carried on by Italian metropolitan areas through their Internet sites.
The sample is constituted by the Internet sites of 24 urban areas with more than 150.000 inhabitants, subdivided into Web Sites of Municipalities and Provinces (Turin, Milan, Brescia, Verona, Venice, Padua, Trieste, Genoa, Parma, Modena, Bologna, Florence, Prato, Livorno, Rome, Naples, Foggia, Bari, Taranto, Reggio Calabria, Palermo, Messina, Catania, Cagliari).
The research methodology is based on a qualitative judgement: the contents and the structure of Web sites are examined and evaluated by indicators based on the site usability and on the type of communication (one/two way communication). Finally, the best practice cases are shown.

Main Results

Access to environmental topics: topics are frequently implemented by direct links ("En-

vironment") to small internal sites.
Sites Architecture: even inside the same site, the architecture is very heterogeneous and the easiness of consultation is highly variable.
Contents: the quantity and the quality of contents are highly variable even inside the same site. Less than 50% have links with ARPA (Regional Agency for Environmental Protection).
Information: "dynamic pages" are scarcely utilised for diffusion of data and novelties. "Static means" are frequently available (e.g. forms).
Communication: person-to-person communication (e.g. e-mail) are frequently available. Generally the analysis of user's needs (e.g. inquiry) is not taken into account; therefore the offer of specific services (e.g. Faq, answer to more frequent questions) are not available.

Comments

Generally, the framework that appears is positive, even if with many different faces due to the variabile quality of the contents and of the web sites usability. There are some smart cases in which local government utilizes Internet as a multimedia platform to provide information, consultation and involve the public in the process of preparing plans and programmes (see Best Practice).
In particular, different **information purposes** are assumed by the various administrations. The following four approaches are prevailing:
- Bureaucratic (information concerning administrative jurisdiction and procedure, e.g. forms);
- Information (data on the environmental quality, technical explanation on the environmental factors);
- Educational (cause and effects on the environmental problems, behavioural advice);
- Participation (on-line facilities for user's consultation/involvement)

The **communication purpose** is not yet exploited for all its potential (two way communication). Few administrations utilise Internet as a multimedia base for public information, consultation and involvement in the planning and programme processes.
Main weaknesses: most of the sites reflect the organisation and culture of the system conceiving them, instead of the user's needs.

Best practice

Municipality of Venice. Councils have been implemented, on-line "blogs" for the confrontation and cooperation among organisations, associations and the public.
http://www.feempandora.it

http://www.ambiente.venezia.it/ambientario.asp?p=stilinfo

Municipality of Padua. Workshops for planning shared measures to re-qualify some districts of the town.
http://www.comune.padova.it/lista.jsp?tasstipo=C&tassidpadre=243&tassid=976

Province of Parma. Internet sites providing information concerning hydrological risk: water level of rivers and Web-Gis to show the land degradation in the Province.
http://livellotorrenti.provincia.parma.it/
http://difesaattiva.provincia.parma.it/dissesto/

Municipality of Modena. Shared initiatives to define the municipality budget, with specific attention to women, young people and foreigners.
http://www.comune.modena.it/bilanciopartecipativo/

Province of Modena. Very complete Agenda 21 Web site.
http://www.agenda21.provincia.modena.it/
http://www.provincia.modena.it/page.asp?IDCategoria=7&IDSezione=808&ID=911

Municipality of Bologna. "Citizen Forum" and "Mobility Forum" for the local planning.
http://urp.comune.bologna.it/PSC/PSC.nsf/1d47b9bee7175c51c1256e63005ae6d7/2f8c9272c39b2a39c125700a005d1299?OpenDocument
http://urp.comune.bologna.it/Mobilita/Mobilita.nsf/7b56d201002c688cc1256dc200330cef/625245e55af43953c1257194004889da?OpenDocument

Province of Bologna. "Tandem" UE Life Project for the dissemination of EMAS among local authorities. "Ecozona", weekly environmental information on a radio program. "Dashboard of Sustainability" for the appraisal of the territory.
http://www.provincia.bologna.it/emas/tandem.html
http://www.provincia.bologna.it/ambiente/ecozona.htm
http://www.provincia.bologna.it/ambiente/dashboard.htm

Municipality of Prato. CARMEN Project (Citizens Advanced Relationship ManagemENt): new information technologies improving the relationship between citizens and the municipality (e.g. sms, e-mail, Web site, monitor in public areas, real-time opinion survey).
http://www.comune.prato.it/cooperazioni/?act=i&fid=691&id=20060109100235070

DATA ANALYSIS OF PM10 IN 24 ITALIAN CITIES

L. Bertuccio, F. Parmagnani, M. Quatrale
(Euromobility)

1. INTRODUCTION

This work deals with the data of PM10 concentration during the year 2005 and the first six months of 2006 as monitored by the survey net covering 24 Italian cities having more than 150.000 residents. It also presents a data comparison between the first six months of 2005 and 2006, respectively. Special attention is also given to data dissemination to public and press.

2. DATA SOURCES

In each city (Turin, Milan, Brescia, Venice , Verona, Padua, Trieste, GEnoa, Parma, Modena, Bologna, Florence, Prato, Livorno, Rome, Naples, Foggia, Bari, Taranto, Reggio Calabria, Palermo, Messina, Catania, Cagliari) the reference station was either indicated as representative by the local competent authorities or had the highest number of registrations exceeding the set limits.

3. DATA IN 2005

Concentration data in 2005 were collected in every PM10 monitoring station in the 24 cities considered. It has to be underlined that not always the monitoring stations with the worst records in the first six months of 2005 turned out to be such at the end of the year. This is the case of Trieste, Florence and Messina.
Some of the cities which have not exceeded the 35 day limit allowed in 2005 have not provided a sufficient percentage of reliable data. In particular, this percentage is 41% for Florence, 70% for Reggio Calabria and 79% for Messina. Catania though had 65% of reliable data had exceeded the 35 day limitation.

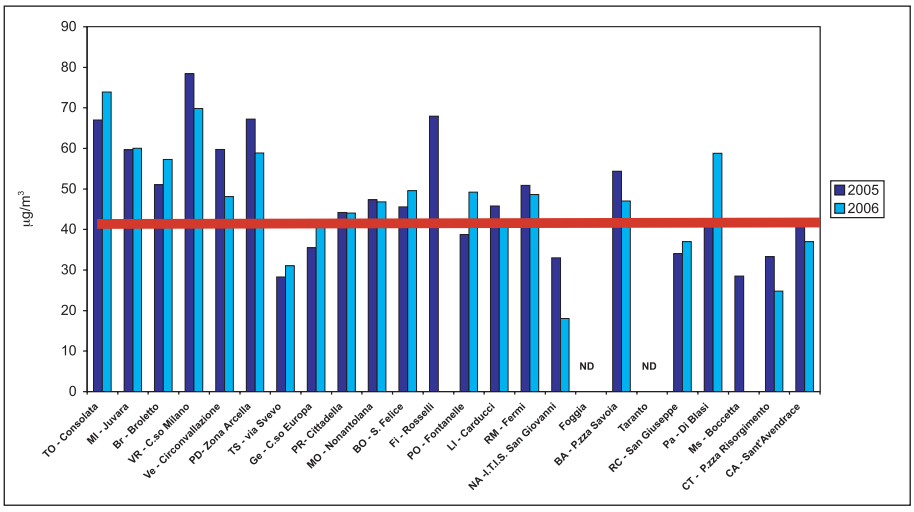
4. DATA IN 2006

Some of the cities which have not exceeded the 35 day limit allowed in 2006 have not provided a sufficient percentage of reliable data. In particular, this percentage is 43% for Florence while for Catania, exceeding the limits in 9 cases, it was 57%.

5. DATA COMPARISON

To allow a comparison between the data of the first six months of the years 2005 and 2006 the monitoring stations showing the worst recorded data were chosen for 2005. Please note that Florence could not be part of the comparison since the station in via Rosselli, the worst in the first six months 2005, has stopped collecting data since April 9th 2005 and also because the via Gramsci station, the worst in 2005, does not supply enough reliable data (39% and 43% in the first six months of 2005 and 2006 respectively); Messina cannot be compared too since the station in via Boccetta, the worst in 2005, did not record data in 2006.
In Trieste, Florence, Rome, Naples, Messina and Catania, the worst monitoring station in the first six months of 2005 have been changed in the same period of the following year. By comparing for the same stations the total number of days when registrations exceeded limits, in the 2005/2006 comparison, a general decrease in the figures is registered

Graph comparing average data in the first six months 2005/2006 The red line shows the annual limit set at 40 µg/mc.



in 2006 in the cities located in Pianura Padana which is the most critical area of the whole country.
In the cities located in the south the trend is actually the opposite even though in many of them it was impossible to make any comparison at all due to lack of available information.
From the trend of the annual average data is quite evident that the highest concentration values are recorded in the northern cities which exceed by far the annual limit set at 40 µg/mc. The highest average in the first six months of 2005 was registered in Verona (78 µg/mc) while in the same period 2006 it was in Turin (74 µg/mc).
By putting together, for each city, all data exceeding limits in 2005 it turns out that those located in Pianura Padana exceed the annual limit already in February. Unexpected is the trend in Bari and Cagliari.

6. COMMUNICATION

The availability of official data on PM10 concentration on the web is dramatically increasing. Most of the data employed in this work was obtained throughout the net for the most part of the cities involved. In the other cases there was no other way than submit formal request to the monitoring network manager. Besides, it was possible to find easily not only data on daily concentration, thanks to bulletins available on many web sites, but also processed data, tables and graphs. The following websites must be mentioned for being user friendly, updated and rich of complex information.

ARPAV - Veneto (www.arpa.veneto.it)
ARPAT - Toscana (www.arpat.toscana.it)
ARPA - Friuli Venezia Giulia (www.arpa.fvg.it)

Thanks go to:
Enrico Daminelli – Provincia di Genova
Eriberto De Munari - ARPA Emilia Romagna Sez. di Parma
Eugenio Donato e Silvia Anselmi – Comune di Rome, X Dipartimento
Michele Macaluso e Ilaria Attanasio – ANEA, Naples
Marco Tateo - Comune di Bari Settore Ambiente
Pasquale Bonocore – Comune di Reggio Calabria
Marcello Voltaggio – AMIA SpA di Palermo
Salvatore Ipsale – Provincia Regionale di Messina

SOIL SEALING AND LAND TAKE IN URBAN AREAS

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* ARPA Piemonte – Regional Agency for environmental protection of Piemonte)

** APAT – Italian Agency for environmental protection and for technical services)

1. INTRODUCTION

In many European and Italian areas severe soil degradation processes are occurring, sometimes in an irreversible way. These processes result from the growing demand arising from various economic sectors and from population growth, climate change impact and land use change (Barberis et al., 2001). The evolution of the most important dynamics of land cover and land use on national territory, in particular during the last decade (1990-2000), highlights a progressive decrease in cropland and an increase in artificial areas, forestland and semi-natural environments.

The direct impact of artificial land take is the destruction or the irreversible alteration of soil deriving from urbanization, infrastructure construction, quarries opening, etc. All these phenomena are contained in the concept of *soil sealing*, indicating the separation by means of partially or totally sealing material between soil and other ecosystem components such as biosphere, atmosphere, hydrosphere, pedosphere and human dimension (EC, 2004).

The present study aims to evaluate soil sealing and land take and their evolution during the decade 1990-2000 in 24 Italian Municipalities and Provinces. Moreover, a study of land consumption for the Provinces of Milan, Brescia and Turin has been carried out in order to estimate the agronomic potential of the lost resource and to give useful information for better land planning (Barberis, 2005). Finally, a legislative framework at European, national and regional level has been developed and an analysis of urban planning instruments on soil sealing has been carried out in 21 municipalities.

2. SOIL SEALING AND LAND TAKE

Soil sealing and land take have been assessed in the 24 urban areas (Figure 1) in terms of percentage on the total area. The calculation has been carried out on the municipal, provincial and buffer areas (30 km from the city centre).

Four indicators have been calculated in those areas (Table 1):

A. Sealed area / total area (%);

B. Sealed area changed between 1990 and 2000 (%);

C. Sealed area per person (m^2/person);
D. Land take by urbanization between 1990 and 2000 (%).

Figure 1. The 24 buffer areas

Table 1. The indicators calculated in the study areas

	A			B		C	D
Year	2000			1990-2000		2000	1990-2000
Reference Area	Municipality	Province	Buffer	Province	Buffer	Province	Province
Torino	46,1%	6,8%	12,0%	4,4%	3,7%	215	9,7%
Milan	48,5%	24,6%	20,9%	1,3%	1,4%	132	0,0%
Brescia	31,1%	7,3%	10,6%	1,8%	2,2%	322	1,7%
Verona	19,3%	9,8%	10,2%	1,7%	1,6%	371	4,1%
Venezia	11,1%	9,9%	11,7%	2,8%	2,7%	301	4,3%
Padua	32,6%	11,5%	11,9%	3,6%	2,7%	292	5,6%
Trieste	24,7%	15,6%	13,7%	2,6%	1,8%	134	7,8%
Genoa	17,6%	5,9%	6,0%	0,0%	0,0%	121	3,6%
Parma	12,8%	5,3%	8,7%	3,2%	3,8%	471	16,0%
Modena	16,1%	8,2%	10,6%	2,8%	4,0%	353	7,8%
Bologna	28,6%	7,7%	8,8%	5,1%	4,9%	313	15,8%
Firenze	34,4%	6,9%	9,1%	3,0%	4,4%	259	10,8%
Prato	22,1%	10,4%	9,2%	6,3%	4,9%	169	9,9%
Livorno	19,7%	8,4%	9,9%	4,1%	2,8%	312	10,7%
Roma	22,1%	11,7%	17,1%	2,1%	2,3%	169	4,6%
Napoli	52,4%	24,9%	23,2%	1,4%	1,7%	95	2,3%
Foggia	9,5%	6,1%	7,1%	0,0%	0,0%	633	0,0%
Bari	38,4%	9,6%	13,0%	0,2%	0,3%	315	0,7%
Taranto	24,0%	9,9%	10,8%	0,5%	0,7%	411	1,9%
R.Calabria	10,4%	6,0%	7,3%	2,8%	1,7%	336	10,6%
Palermo	37,6%	7,5%	12,9%	0,8%	0,7%	302	2,7%
Messina	17,3%	7,0%	9,2%	0,5%	1,1%	344	1,1%
Catania	26,4%	9,3%	13,6%	0,5%	0,3%	314	1,5%
Cagliari	23,8%	5,7%	8,3%	3,6%	5,0%	517	15,6%
Mean (24 urban areas)		8,5%				248	5,4%
Italy		6,7%					

3. ASSESSMENT OF SOIL CONSUMPTION: LAND CAPABILITY AND NATURALISTIC VALUE

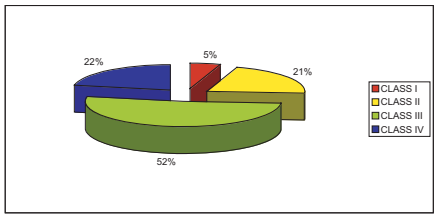
The study aims at the description and the analysis of land use changes induced by urban sprawl in peri-urban and rural areas between 1990 and 2000. The methodology is based on overlapping, using GIS technology, of naturalistic value (in terms of its pedological char-

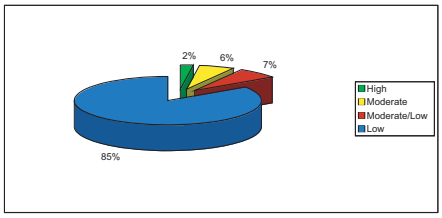
acteristics) and land capability data with categories 1.X.X. of Corine Land Cover change (CLC 1990-2000).
The study concerns the Provinces of Milan, Turin and the plains of the Brescia Province.

Province of Milan

Soil consumption, between 1994 and 2000, occurred mainly in those classes with the lowest restrictions on their use (classes I-IV, figure 2). Concerning naturalistic value, the reported results show the class with a "low" naturalistic value (the most represented typology inside administrative boundaries) as the most frequently consumed (figure 3).

Figure 2. land capability as percentage of artificial land uptake and Figure 3. naturalistic value as percentage of artificial land uptake

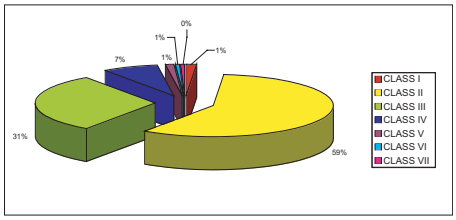


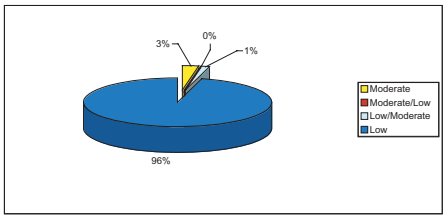


Province of Brescia

As in Milan Province, changes have interested agricultural area converted to discontinuous urban fabric, industrial, commercial and public units and mineral extraction sites. Also in this case, land cover/land use changes are connected, in both cases, with the classes mostly represented on maps of both land capability classification and naturalistic value (figures 4 e 5).

Figure 4. land capability as percentage of artificial land uptake and Figure 5. naturalistic value as percentage of artificial land uptake

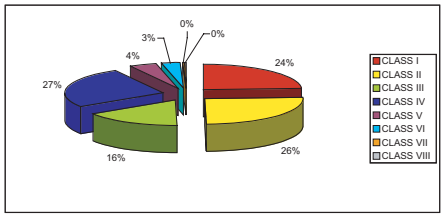




Province of Turin

The results show an important trend toward consumption of productive agricultural areas; figure 6 illustrates how a high percentage (around 80%) of urban land (uptake by industrial and commercial sites) belongs to the first four classes.

Figure 6: land capability as percentage of artificial land uptake



4. LEGISLATIVE FRAMEWORK AND URBAN PLANNING INSTRUMENTS FOR SOIL SEALING RESTRICTION

In Italy, land management falls under the competence of both state and regional laws. State laws lays down a general framework for land and city planning, but disregard environmental aspects linked to soil sealing. Binding choices on soil sealing can be singled out in legislative and planning acts issued by Regions, Provinces and Municipalities.

Some Regional laws on environmental quality at urban level (LR Emilia Romagna 20/2000, LR Toscana 1/2005, LR Umbria 1/2004) put soil sealing restrictions on the list of environmental parameters to be considered in city planning. At a lower scale PTCP (Territorial Plans of Provincial Coordination) outline the integration of territorial policies (including environmental ones). Finally, city planning regulates urban transformation and can actually restrict soil sealing and lead to a balance between urban development and environmental protection.

This research examines whether urban planning in 24 main Italian cities took into account soil sealing issues and how it has been done.

It examines in particular:

– Soil sealing indexes.

– Measures aiming at restricting the extension of sealed areas.

– Measures aiming at controlling land capability and naturalistic value of sealed areas.

– Measures aiming at de-sealing and mitigation.

The plans (PRG) of Rome and Brescia take this issue into account even in their strategic

statement and can be considered good practices.
Sealing indexes are used in 8 plans (Milan, Brescia, Padua, Parma, Modena, Bologna, Florence, Rome), but they are quite varied, both with regard to methodology and definition of "sealed area".
The Brescia plan, for example, fixes some minimum values for the extension of permeable green areas, ranging from 15% in town centres to 35% in residential areas. The index used is linked to definitions of "permeable area" (meteoric water absorption >70%), "semi permeable area" (meteoric water absorption 70%-50%) and "sealed areas" (meteoric water absorption <50%).
Many plans contain measures aiming at restricting the extension of sealed areas referred to specific interventions: construction of roads, parking, public and private green areas. Plans analysed don't contain binding measures related to an explicit evaluation of land capability and naturalistic value of sealed areas.

5. CONCLUSIONS

In the areas analyzed in the present study, the sealed surfaces are on an average equal to 8.5% with respect to the provincial area while the national mean is 6.7%. The highest values have been found in the Provinces of Milan and Naples, where they exceed 20%. In terms of pro capita sealed surface, Naples, Milan, Genoa and Trieste have less than 150 m^2 while Provinces with a lower urban sprawl, but a low population density, exceed 500 m^2.
The urban sprawl during the decade 1990-2000 is on an average about 5% in the major urban areas but exceeds 15% in Bologna, Parma and Cagliari, showing the worrying problems of soil consumption and urban growth.
The land capability classification is one of most important methods of land classification that can be based on broad interpretations of soil qualities. This kind of classification could be seen as a simple planning tool able to assess the quality of land take during a certain period of time - from an agronomic and naturalistic point of view - and to address the urban sprawl/growth toward lower quality soil both in terms of its fertility and naturalistic interest.
It is very important that land planning should be based on systematic soil sealing monitoring in order to define the areas where this problem assumes critical levels.

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URBAN EXPANSION IN THE PROXIMITY OF CAPABLE FAULTS: ANALYSES ON A NATIONAL AND LOCALE SCALE

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Italy has a large number of "capable faults", that are "active faults capable of producing surface faulting (or cracks on the earth's surface) during large earthquakes" in the near future. In fact, when a fault is reactivated, it can lead to a dislocation/deformation of the earth's surface and any structures on it.

The hazard posed by capable faults represents a problem for any type of construction (buildings, infrastructure, etc.). The absence of any territorial planning regulations has lead to significant urban expansion close to capable faults.

Over the past few years seismotectonic and paleoseismic studies in Italy have made notable contributions to our knowledge of the distribution of active faults. The ITHACA (Italian Hazard from Capable Faults) database provides information on capable faults found throughout the country. In terms of land cover, the only homogenous database available in Italy is the CORINE Land Cover database updated in 1990 and 2000. Intersecting these two databases allows us to gain a greater understanding of urban expansion in areas in close proximity to capable faults and how this has increased in intensity, as well as defining what type of urban areas have been most effected by the process.

The CFUI (Capable Fault in Urban areas Index) has been developed in order to identify which areas have been most affected by this phenomenon by comparing two different time periods.

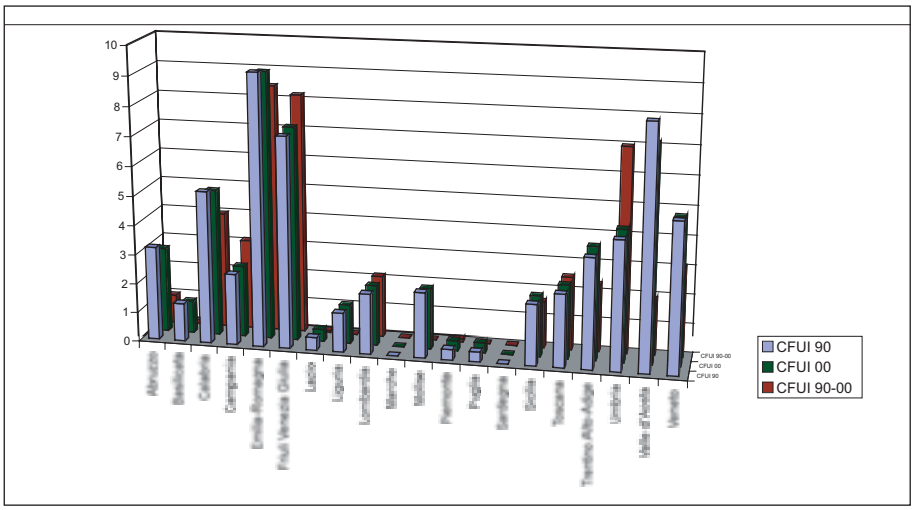
$$CFUI_{200,\ T1\text{-}T2} = \frac{\text{Urban expansion T1 - T2 at a distance of less than 200m from the fault}}{\text{Total urban expansion T1 - T2}}$$

A standard 200 m wide sector was examined on both sides of the fault during this study. The extent of this buffer around the capable fault should have been evaluated, based not just on the results obtained from the data but first and foremost in terms of expected deformation with respect to each fault.

Based on CORINE data, total urban expansion in the 1990-2000 period in Italy was equal to approximately 856 km?. Of these, slightly more than 23 km^2 (equal to approximately 2.7%) fall within 200 m from capable faults.

Figure 1 and Table 1 show $CFUI_{200}$ indicator results in provincial territories around 24 urban areas.

Figure 1 $CFUI_{200}$ indicator results for each of 24 urban areas with reference to 1990, 2000 and the period 1990-2000



A number of sample areas where the phenomenon was found to be most intense were selected and studied based on these figures. This work was primarily carried out with the use of aerial photographs (volo Italia '54) and orthophotographs (Terraitaly 2000) and with respect to a line of setback of 200m. It studies:

1) The urban areas of Bologna and Reggio-Emilia (Figures 2,3 and 4)

Table 1 – Total urban areas, within 200m of and $CFUI_{200}$ indicator results for each of 24 urban areas with reference to 1990, 2000 and the period 1990-2000.

Provincie	ea urbana totale	a urbana < 200 m	$CFUI_{200}$	ea urbana totale	a urbana < 200 m	$CFUI_{200}$	ea urbana totale	a urbana < 200 m	$CFUI_{90-00}$
Bari	244652580	0	**0**	248615124	0	**0**	1873410	0	**0**
Bologna	164426647	26172587	**15,9**	196842305	31174769	**15,84**	27897869	3179338	**11,4**
Brescia	348034087	14543094	**4,2**	363495510	15253532	**4,2**	14450903	710439	**4,92**
Brindisi	88705632	0	**0**	89691593	0	**0**	987969	0	**0**
Cagliari	236225969	0	**0**	273659906	0	**0**	37810563	0	**0**
Catania	236125299	16913345	**7,16**	240015248	17289349	**7,2**	3602168	376004	**10,44**
Firenze	157461735	4083255	**2,59**	176632050	4802785	**2,72**	17916291	693901	**3,87**
Foggia	134665496	2842348	**2,11**	134665496	2842348	**2,11**	0	0	**0**
Genova	118195601	0	**0**	119169729	0	**0**	0	0	**0**
Livorno	80475621	0	**0**	92190371	0	**0**	9683737	0	**0**
Messina	180561063	274616	**0,15**	185998441	348901	**0,19**	1983370	0	**0**
Milano	653442878	3281946	**0,5**	673132279	3281946	**0,49**	11714473	0	**0**
Modena	143809836	14301651	**9,94**	155108363	15157378	**9,77**	12198858	845593	**6,93**
Napoli	325432248	11081304	**3,41**	335027885	11316204	**3,38**	7830991	323414	**4,13**
Padova	205048052	8601804	**4,2**	221804376	9259939	**4,17**	16371123	658134	**4,02**
Palermo	234760711	20639	**0,01**	241990381	20639	**0,01**	6466966	0	**0**
Parma	90642605	5696803	**6,28**	105640286	7019139	**6,64**	14703667	1322336	**8,99**
Prato	40600388	2969133	**7,31**	45262685	3529993	**7,8**	4390041	290507	**6,62**
Reggio Calabria	99952638	7373819	**7,38**	110385252	7619049	**6,9**	10657784	232340	**2,18**
Roma	591576209	0	**0**	622048883	0	**0**	29617674	0	**0**
Taranto	146808020	0	**0**	149929544	0	**0**	2819923	0	**0**
Torino	391609046	1836827	**0,47**	434900924	1971282	**0,45**	40372261	82419	**0,2**
Trieste	43397065	3962934	**9,13**	45596526	4167492	**9,14**	1587569	83030	**5,23**
Venezia	208667358	1045699	**0,5**	222821136	1063400	**0,48**	14035890	17701	**0,13**
Verona	245948373	11226730	**4,56**	259696111	11282697	**4,34**	11237856	173404	**1,54**
	1990			**2000**			**1990-2000**		

Figure 2 - The urban areas of Bologna and Reggio-Emilia in 1954 (in green) and in 1994 (in blue). The red lines indicate ITHACA capable faults.
Superficial deformations are due to the reactivation of reverse type capable faults generally accompanied by average sized seismic episodes which may lead to locally based upheavals on the topographic surface and, although rarely, modest dislocations.

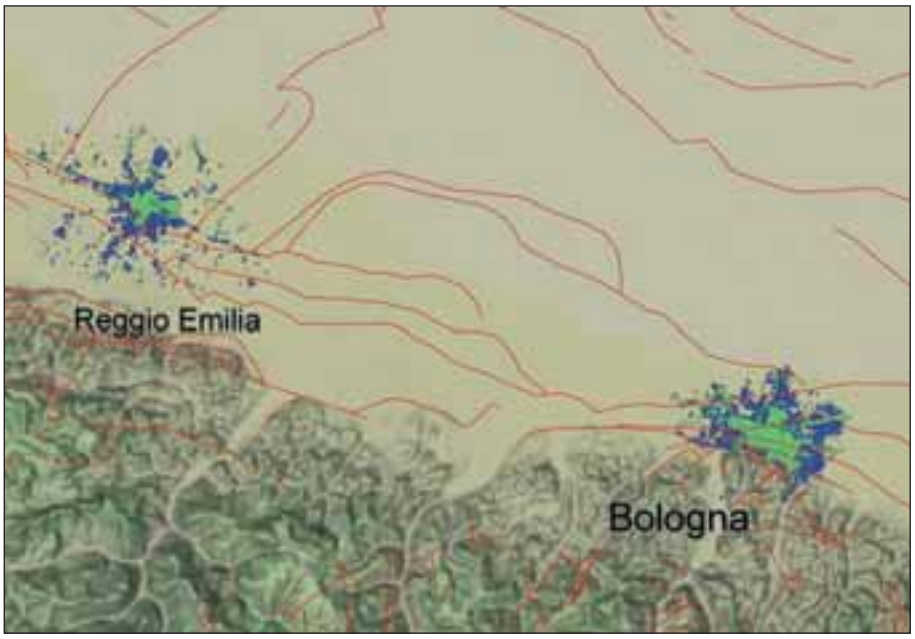


Figure 3 – The $CFUI_{54\_94}$ indicator for the urban area of Bologna shows that urban growth has proportionally Affected both the internal and external line of setback.

BOLOGNA	
Area urbana totale (m)	34375920
Area urbana entro 200 m (m)	3812575
CFUI_54	11,00
Area urbana totale (m)	63130327
Area urbana entro 200 m (m)	6954171
CFUI_94	11,00
Area urbana totale (m)	28754407
Area urbana entro 200 m (m)	3141596
CFUI_54-94	11,00

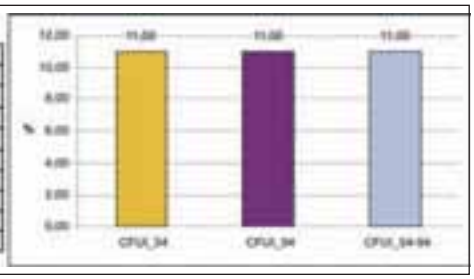
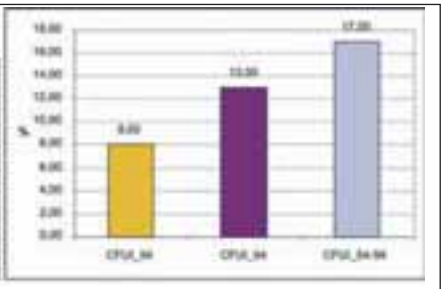


Figure 4 - The $CFUI_{54-94}$ indicator for the urban area of Reggio Emilia show an increase in urbanisation of 17% within the lines of setback.

REGGIO-EMILIA	
Area urbana totale (m)	15872698
Area urbana entro 200 m (m)	1218331
CFUI_54	8,00
Area urbana totale (m)	40062440
Area urbana entro 200 m (m)	5329250
CFUI_94	13,00
Area urbana totale (m)	24189742
Area urbana entro 200 m (m)	4110919
CFUI_54-94	17,00



2) The l'Aquila area and "Antrodoco sheet" (Figure 5, 6 e 7);

Figure 5 – the Pizzoli and Monte Pettino faults bordering the Aquila basin (from BLUMETTI e GUERRIERI, in print).
These areas are for the most part marked by normal capable fault dislocations, as typically happens in central Apennine areas.

Figure 6 – The $CFUI_{54\text{-}00}$ indicator for the Aquila area shows that the total urban area has diminished in the face of massive urban sprawl.

L'AQUILA	
Area urbana totale (m)	2608693
Area urbana entro 200 m (m)	225303
CFUI_54	8,64
Area urbana totale (m)	10503618
Area urbana entro 200 m (m)	558165
CFUI_00	5,31
Area urbana totale (m)	7894927
Area urbana entro 200 m (m)	332862
CFUI_54-00	4,22

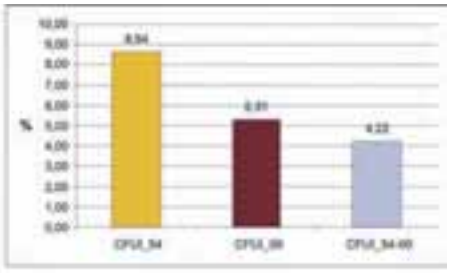
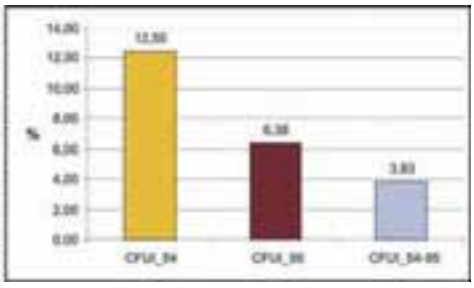


Figure 7 – The $CFUI_{54\text{-}95}$ indicator shows that urban expansion has only marginally affected areas in close proximity to capable faults in the Antrodoco area.

ANTRODOCO	
Area urbana totale (m)	2338832
Area urbana entro 200 m (m)	292328
CFUI_54	12,50
Area urbana totale (m)	7955499
Area urbana entro 200 m (m)	507398
CFUI_95	6,38
Area urbana totale (m)	5616667
Area urbana entro 200 m (m)	215070
CFUI_54-95	3,83



3) Catania area and the western slope of the Etna (Figures 8 and 9).

Figure 8 – Geological Sketch of the western slope of the Etna. Coseismic capable faults (in red); aseismic capable faults (in blue) and coseismic and aseismic capable faults (in green) are highlighted. From **Blumetti** et al. (2006).
Capable faults in this area are affected by the presence of a volcanic-tectonic environment.

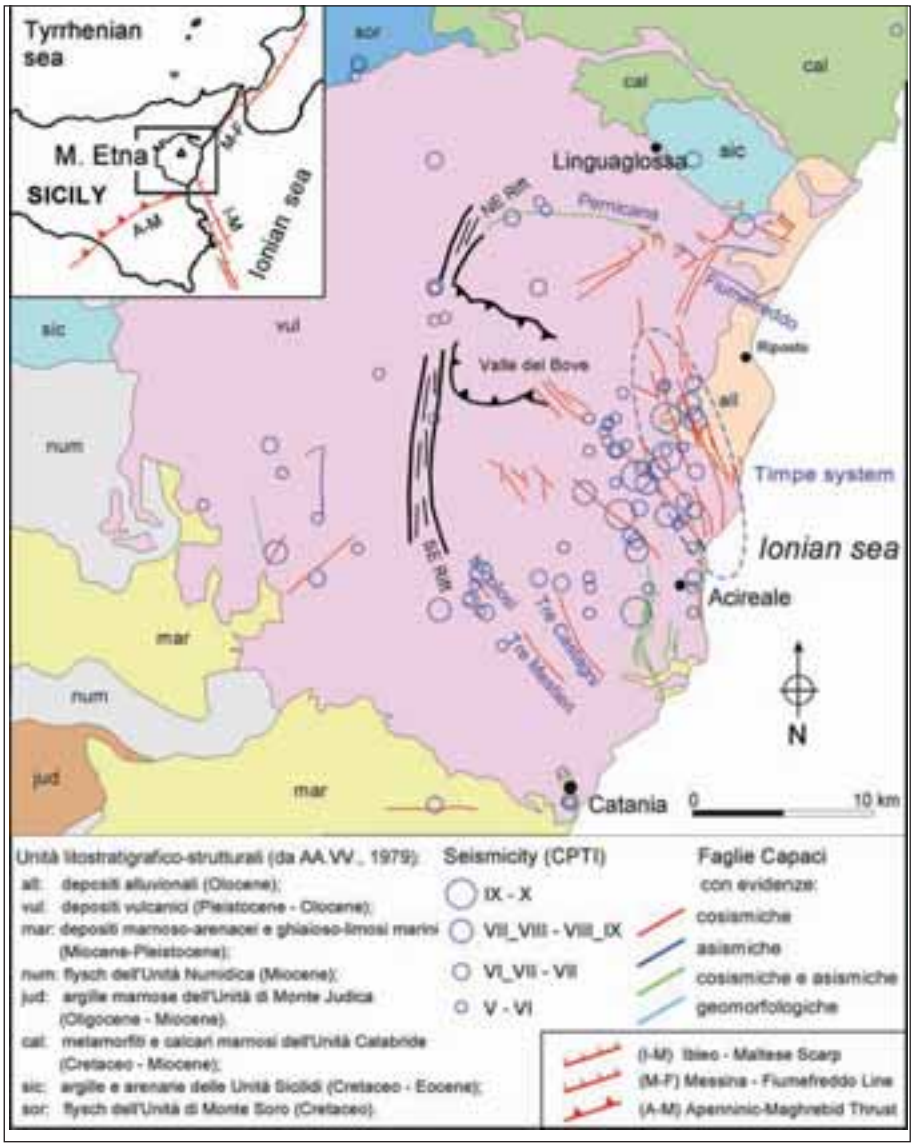
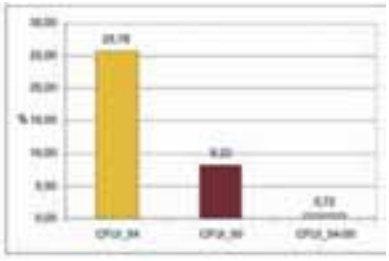


Figure 9 - The $CFUI_{54-00}$ indicator in the Etna area indicates the urban expansion which has taken place in areas outside the lines of setback.

AREA ETNEA	
Area urbana totale (m)	32117446
Area urbana entro 200 m (m)	8279482
CFUI_54	25,78
Area urbana totale (m)	107252817
Area urbana entro 200 m (m)	8821276
CFUI_00	8,22
Area urbana totale (m)	75135371
Area urbana entro 200 m (m)	541794
CFUI_54-00	0,72



The study carried out at a national level has revealed that 2.7% of urban expansion (little more than 23 km^2) has taken place in areas less than 200m from capable faults in the 1990-2000 period.

Studies on sample areas have allowed us to focus our attention on specific sectors obtaining greater detail than that found in the CORINE data.

These analyses have confirmed that the CFUI indicator is capable of identifying where the phenomenon of urban expansion in close proximity to capable faults has been strongest and assess the role played by recent urban expansion in this process.

As such, we believe this indicator is capable of provining a first indication which could allow us to take the problem of the presence of capable faults into account in land management. We hope, in future, that regulations will be introduced for specific urban areas in order to limit expansion near capable faults, as it has been introduced in other countries where the phenomenon of surface faulting is equally diffused.

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR THE PLANNING OF VAST AREAS: EXPERIENCES OF THE PROVINCE OF BOLOGNA

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1. ABSTRACT

The application of 2001/42/EC Directive on Strategic Environmental Assessment (SEA) concerning the assessment of Plans and Programmes on environmental effects constitutes an important step towards supporting EU strategies in the field of sustainable development.
At a regional level only some of the regions have issued regulations for the application of SEA procedures.
The Province of Bologna was one of the first to apply SEA to its provincial plans.
In this study the application of two SEA programmes in the Province of Bologna are examined: the VALSAT (SEA application in the Province of Bologna) territorial Plan for provincial coordination (PTCP) and the VALSAT Plan for Air Quality management (PGQA)[1].
Some scenarios from these applications have been taken into consideration and are regarded as examples of good practices.

2. 2001/42/EC DIRECTIVE

This Directive establishes general principles for the environmental assessment system that must be kicked off together with the drawing up of the Plans and Programmes. This must be carried out alongside the development of the projects in order to enable continuous and constant integration measures to take place. In this way SEA influences the preparation of the Plans and Programmes and enables the possible effects of the various options to be identified and assessed, so that possible alternatives can be considered. The best solution can therefore be selected and sustainable objectives achieved.

[1] For his collaboration in presenting the document, we thank Gabriele Bollini, director of the Environment Protection Service, Environment Sector, and Province of Bologna.

SEA's main features are:
- Producing an environmental report.
- Consulting and informing interested authorities and the public.
- Taking into account environmental reports and consultation in order to make decisions.
- Monitoring significant environmental aspects during the progress of Plans and Programmes.

3. GOOD PRACTICES IN EXAMINED SCENARIOS

The specific activities in the SEA process are considered examples of good practices in the two plans we have assessed and are reported in a schematic way below.

Process Organisation: Integration of SEA into the plans examined took place at the beginning of the planning process. The creation of an interdisciplinary Unit for the preparation of VALSAT was decisive. The best results have been obtained in the PGQA.

Determination of Sustainability Objectives and Coherence Analysis:
General objectives were defined, taking into consideration both documents at different levels of territorial scale, with the possibility of associating them with specific quantifiable and time verifiable targets for suitable indicators.

Coherence Analysis for the Verification of a Sustainable Plan: In the VALSAT report of the Plans that were examined a policies/actions matrix was employed in order to allow all possible points of interaction (positive, negative, unclear) between policies/action plans and sustainable objectives to be highlighted. This enables considerations and suggestions required to eliminate and/or limit interactions and negative effects.

Consultation and Participation Process: This procedure was developed for the whole planning process right up to the final planning agreement. Consumer, Social Economic, Category and Environmental Associations and Cultural Institutions were invited to the negotiations. These Associations and Institutions are, furthermore, part of two different Organisms coordinated by the Province of Bologna: The Pact for Work and Agenda 21 Forum which made a combined contribution to the Planning Conference.
The team involved and the interaction efforts that were developed within the Planning Conference and Agenda 21 Forum through joint meetings, represented the right forum in which to point out and propose relevant solutions to conflict of interests. To guarantee continuity in the update of data the Province of Bologna pursued and developed several

projects to create and utilise territorial integrated automated systems.

Information and Communication: One of the policies/actions of PTCP, states that people are to be informed and involved in the actions, enabling objectives to be achieved in the most effective and efficient way.

Determination and Evaluation of PGQA Plan Scenarios: Framework scenarios constitute the terms of comparison to which the "alternative plans" relate to in order to evaluate effects derived from their implementation.
The quantitative evaluation in PGQA was carried out with the assumption of two reference scenarios regarding the transportation sector: the present scenario, which considers the 2003 vehicle fleet and allows for an estimation of the effectiveness of initiatives carried out in absolute terms, and the future scenario with the 2010 vehicle fleet that allows for an estimation of effectiveness of actions according to present evolutionary trends.
The effectiveness of actions was assessed in terms of emission reduction resulting from the carrying out of synergic and interdependent action lines.
With reference to traffic emission, the assessments have produced two alternatives, one of maximum and the other of minimum effectiveness.

ENVIRONMENTAL POLICIES IN THE NEW URBAN DEVELOPMENT PLAN OF ROME

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THE CITY OF ROME

The city of Rome, with a territorial extension of 128,531 hectares and a population of almost 2,700,000 residents, is the largest city in Italy: its administration consists of a central structure, 19 Municipalities, 19 Departments and 12 Extra-Departmental offices, and counts 25,000 employees. The Municipalities manage social, cultural, sportive and recreational services, the maintenance of communal buildings and schools, roads and facilities.

The Departments for each functional area ensure the coordination and monitoring of the municipality activities and have the task of programming, planning, designing and supplying services to the city. Moreover, in order to manage many public services (water, electric and waste supply), the Rome authorities out sources them whilst also maintaining public participation.

PROGRESS OF THE NEW URBAN DEVELOPMENT PLAN OF ROME

Work started many years ago in 1997 with the "Certitude Plan" and concluded with the institution of many protected areas and natural reserves; at the end of the process almost 83.000 hectares (about 64% of the whole city territory) became "protected" areas.

FEATURES OF THE NEW URBAN DEVELOPMENT PLAN

The New Urban Development Plan of Rome was approved by the City Council on March, 20th 2006 and is made up of three structural ruling components:

1. The Historical-Environmental System.

2. The Mobility Infrastructures System.

3. he Central Metropolitan and Urban System.

These three structural components define:

- Limits for the urban and housing development programme.
- The preservation of Rome's environment and heritage.
- A mobility and urban planning system based on the development of urban railway infrastructures.

The Environmental System is made up of protected areas and agricultural land in the adopted Urban Development Plan and consists of about 87,800 hectares (68% of the whole city territory) with half of this area in 19 city parks.
The "Ecological Network" has the strategic role of guaranteeing the conservation of Biodiversity: it is an environmental planning instrument for preserving the features of the ecological systems together with the evolutive processes in the agricultural territories, protected areas and hydro graphic networks.

THE "ECOLOGICAL NETWORK" OF ROME: ITS OBJECTIVES AND STRUCTURE

The institution of the "Ecological Network" aims to guarantee continuity for the protected areas: the strategic guidelines were drawn up at the Aalborg Conference. The "Ecological Network" has been planned in order to transpose environmental sustainability to strategic environmental planning items which will be carried out through land management.
The "Ecological Network" is explained by the following objectives:

- Preserving and increasing the value of the best areas in terms of protected areas, biotopes, and natural resources.
- Environmental restoration of areas in degradation, which are strategic for the construction of the network, of the "ecological corridors", strengthening of natural elements and rehabilitation interventions for these areas (forests, streams, etc.).

The "Ecological Network" involves three types of components:

- *P**rimary components** (core areas)* represented by the most fragile elements of the environmental system: they concern, in particular, the areas with the strongest natural resources, Bio Italy areas, rivers and hydro graphic networks, agricultural areas with environmental value, protected areas and a public green spaces system: for this component action plans are mostly preservation and improvement.
- *S**econdary components** (buffer zones)* that comprise important elements to guarantee the connectivity of the network and concern areas partly in degradation, partly concerning housing linked to reclaiming and environmental restoration and are the largest part of the intervention,: for this component the action plans are mostly restoration, and natural improvements.
- *L**inking components** (ecological corridors)* with a strong established anthropic use. For this component the action plans concern an environmental re-organization to promote the link between the other components of the network.

THE "ECOLOGICAL NETWORK" IN THE NEW URBAN DEVELOPMENT PLAN OF ROME

This ecological network represents, in the field of urban planning, a system of areas where

urban development is not allowed, and moreover, are points of reference for urban transformation; they constitute the structure of the city and configure a basic "sustainability" of the New Urban Development Plan of Rome.
Therefore, the urban development model is built on a system for these areas, rich in environmental, natural, physical, biological and historical resources. This intends to value these resources and to generate a more complex structure where urban planning and architecture must consider these relationships.

METROPOLITAN DISUSED AREAS: THE CURRENT SITUATION IN SEVERAL ITALIAN TOWNS

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ARPA Sicilia: P. Nania, F. D'urso

The reclaiming of disused areas aims to:

– Contribute to the improvement of the town, by increasing the number of public structures and green public areas, and in this way create new opportunities for social and economic development.
– Improve quality of environmental resources and their availability in urban areas.
– Appropriate management of free land spaces – which are increasingly small, rare and vulnerable in metropolitan areas – oriented towards soil protection.

The use of former industrial areas in cities represents an opportunity to gain economic, social and environmental advantages together with a sustainable development perspective.
A risk that needs avoiding, through a common development strategy between public and private companies, is that of building speculation.

Former activities

Edited reports:
2004:
First research work on former industrial sites in Italian metropolitan areas was an in-depth focus of the Milan situation.

2005:
Research extended to 13 Italian metropolitan areas which were chosen in addition to the Milan one, in order to screen:

- The condition of artistic sites in polluted areas and the regional database.
- The situation in the National Interest Site, according to the environmental law requirements on waste and the renovation of polluted sites.
- The nomination of site scenarios which can be reused and result in significant upgrading of the environmental level of urban quality.

2006:
Third year of data collection on disused sites in metropolitan areas, National Interest Sites, environmentally sustainable and advantageous technique application examples for site reclaiming.

Criticality of this research work

In data collection:

– Difficulties in data comparison, as a consequence of different regional organization in polluted sites and management problems.
– No indicators available for analysis of developing systems, because of non-homogeneous regional database structures.
– Need for database revision according to the most recent Italian environmental law (Legislative Decree 152/06)

Site reclaiming examples

A considerable amount of information is available on so called "good practices" projects, showing case by case application of state-of-the-art bio–environmental technologies, such as district heating, energy saving pumps, renewable power sources, or even just involving the accomplishment of extensive green areas.
Focus on > Piemonte Region > areas involved the implementation of buildings and services for the Winter Olympic Games 2005-2006.

National Interest Sites (see table in the text)

Many advanced site specification plans (146), only a few dozens of preliminary and definitive reclamation projects by now.

 Some results of data collection

Metropolitan Area: Milan

- Nearly complete census (except it lacks info on polluted areas local coordinates).
- First-step investigations into about 1500 areas in total, about 700 of which showing significant pollution.

In Milan – only the city area – more than 600 reclaimed industrial sites have been detected. Half of them have already been decontaminated and in most of the rest the decontamination is on- going.

Metropolitan Area: Brescia

This metropolitan area is evidently different to the Milan scenario:

- 120 polluted sites in total and 32 in the main town.
- Very few sites have already been decontaminated.
- Difficulties in data interpretation and still on- going.

Metropolitan Area: Florence, Prato, Pistoia, Livorno

Data collection and elaboration by ARPAT shows that the databases of the Tuscany Region have been identified as being among the most complete. The total number of polluted sites is 550, mostly in the Florence area, some in Livorno (industrial district and harbour area) and a few in the Prato and Pistoia area.
More than 50% of polluted sites in the Livorno area are located within the main town, as a consequence of oil industry activity which is mainly storage and sales.
The decontamination process has already been carried out and completed, and a decontamination certificate has been issued for nearly all of these sites.
We can broadly define decontamination techniques:

- Bio-remediation
- Soil-removing
- Pump & treat
- SVE
- Ground-water barriers
- Air sparging

"Good practices" examples (Photos in the text)

Metropolitan area: Turin

The "Central Spine" project aims to:
- A new city design, based on the city railway line as a "spinal column".
- Integration of the reconverted areas into the town, as public services sites and open air spaces
- A growing interest in the Dora Riparia river as an attraction

The so called "Spina 3" area, in which several former industrial sites (FIAT, Michelin, Savigliano and Paracchi) are located, lies mostly along the Dora Riparia River; it is about 1.000.000 m^2 wide and most of it will become a public park, through the environmental landscaping of the river banks.

The current landscaping efforts include:

– Extensive lawns facing the river, with "vegetal curtain" protection along the town-facing side, as a place for relaxation and walks.
– Walking routes and tree hedgerows, to improve the look and provide shade for car parking spaces and other asphalted areas.
– Both mown and wild lawns, achieved through different techniques and materials according to the use of different types of vegetation and adorned with a large variety of flowers and plants as befits a wildlife environment.
– Gardening themes in line with citizen tastes and also according to aesthetic criteria when choosing plant species.
– The exposing of the Dora Riparia River's flow, currently still covered, aimed at providing a public riverside with pontoons, walking trails and water surfaces.
– Channels, basins, pits and photovoltaic water-pumping systems for the harvesting of rainwater and useful for irrigating lawns and plant rows;
– Partially solar powered park lighting.

Another important project code is PRUSST 2010, which relates to some very impressive public works called "Green Ring Road" and this also involves municipal entities close to Turin, Settimo Torinese and Borgaro Torinese.
This project involves a lot of recovery and revamping work for a piece of land which is several kilometres wide together with a general reorganization of green areas, productive sites and service structures.
District heating by a tubing network is one of the most interesting planned initiatives: it aims to satisfy the whole town heating needs through waste-to-energy facilities, in terms

of biogas, a million cubic meters of production.

Metropolitan Area: Milan

Project: reuse of former industrial areas in Sesto San Giovanni district.
The whole land space is about 1.3 million square meters, and 1 million of these are marked out for public and private green areas.
There will be various service structures which are to be mostly tower-shaped together with important traffic routes crossing this area.
Public transit will be upgraded through improved local availability and by acquiring state-of-the-art vehicles: this project also refers to the introduction of alternative fuel powered buses.

THE EFFECTS OF ENVIRONMENTAL POLLUTION ON CULTURAL HERITAGE: THE DEFINITIONS OF ENVIRONMENTAL AIR RISK MAPS

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INTRODUCTION

The natural decay, to which works of art are subjected, is greatly accelerated by environmental pollution.
The project developed by Agenzia per la Protezione dell'Ambiente e per i Servizi Tecnici (APAT) and the Istituto Centrale per il Restauro (ICR) aims to define the correlation between damage to the cultural heritage and concentration of airborne pollutants [1], [2].
In particular APAT and ICR are working out a research plan aimed at defining thematic-based environmental-air risk maps for 24 Italian towns, by using Risk Maps for Italian Cultural Heritage information and air quality data provided by APAT.

The Risk Map of Italian Cultural Heritage

The Risk Map of Italian Cultural Heritage is a project promoted by ICR which aims to tackle the conservation of works of art through the rational planning of restoration work and preventive measures [3].
Information concerning environmental factors which may be harmful to the cultural heritage is being gathered by the Geographical Information System (GIS) [4]. The Risk Map tool contains information on the geographical distribution of Italian archaeological and architectural monuments, the state of conservation as well as environmental and geographical features of the territory.
Table 1 shows the number of catalogued monuments in the 24 Italian towns which are being analysed in this Report.

Table1. The number of catalogued monuments in 24 Italian towns

TOWN	MONUMENTS	TOWN	MONUMENTS
TORINO	557	FIRENZE	1440
MILANO	1203	LIVORNO	123
BRESCIA	633	PRATO	116
VERONA	994	ROMA	3695
VENEZIA	2167	NAPOLI	946
PADOVA	535	FOGGIA	54
TRIESTE	326	BARI	408
GENOVA	1954	TARANTO	80
PARMA	330	REGGIO CALABRIA	75
MODENA	251	PALERMO	367
BOLOGNA	909	MESSINA	192
FIRENZE	1440	CATANIA	223
LIVORNO	123	CAGLIARI	209

Environmental- Air Risk Maps in Rome

The GIS project has made it possible to correlate monument vulnerability with territorial dangers in each area via a process which overlaps computerized theme-based maps [5].
Data used in drawing up the maps is organized into three different categories and concerns three different risk factors: static/structural risk (earthquakes, volcanoes, etc); environmental/air risk (air pollution, climate, etc.); human risk (theft, tourist pressure, etc.).
In this paper the steps for the construction of an *environmental/air* map for Rome are shown via the correlation of information on air quality recorded by national monitoring stations with data concerning the distribution of monuments.
Figure 1 shows the cartographic representation of environmental/air risk in Rome. The different shades of colour indicate the different risks in the various areas.
In figure 2 the overlapping between catalogued monuments (green colour) and the risk areas is shown in order to obtain the precise distribution of their position within the territory.

Fig. 1: Cartographic representation of environmental/air risk in Rome

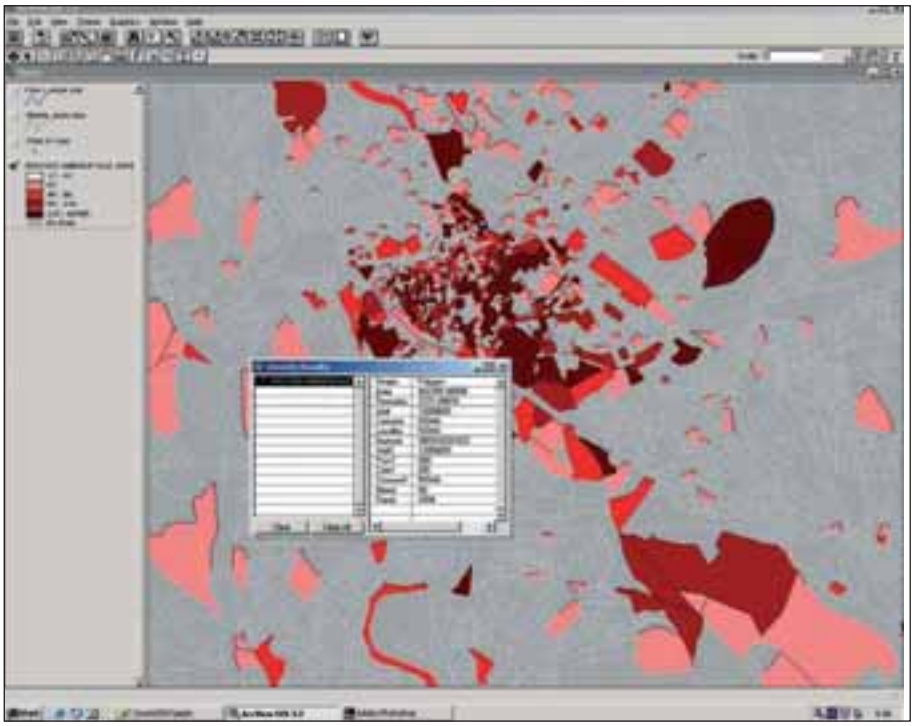


Fig.2: Overlapping of monuments on the environmental/air risk map

The geographical positions of the air quality monitoring stations in Rome were then entered into the risk map system in order to characterize monuments situated near the stations.
In figure 3 the positions of monitoring stations within the "Grande Raccordo Anulare" (Ring Road) in Rome are shown.
Figure 4 describes the position of monitoring station situated in Via Arenula, in the central part of the city, in more detail.

Fig.3: The positions of monitoring stations within the "Grande Raccordo Anulare" in Rome

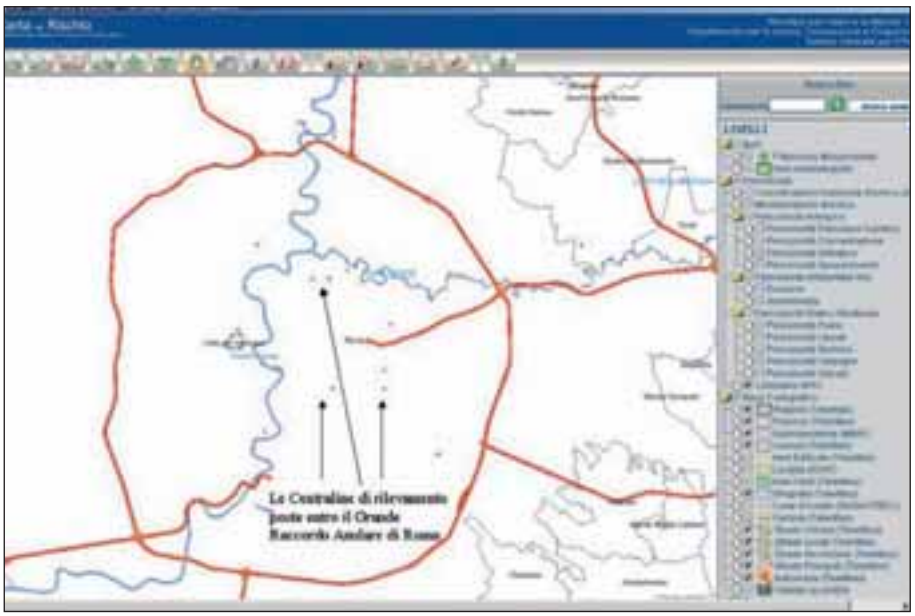
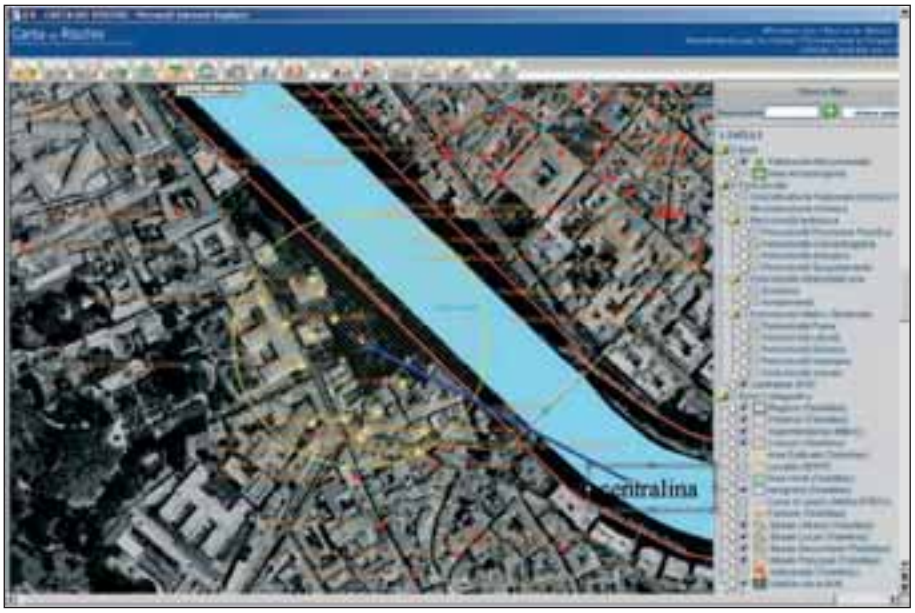


Fig. 4: The positions of monitoring station situated in Via Arenula, in the central part of the city

Moreover, the GIS system allows those monuments situated just a few metres from the station to be selected.
Figure 5 shows those monuments selected which are located about 150 metres from the station in via Arenula.

Fig. 5: Monuments selected around 150 meters from the station in Via Arenula



CONCLUSIONS

The GIS Risk Map represents an important tool in the visualization of cartographic maps and deterioration phenomena concerning Italian Cultural Heritage.
The System allows the selection of those monuments situated near the air quality monitoring stations.
The ability to associate environmental/air risk levels with degradation already affecting monuments allows us to obtain information concerning air quality surrounding the works of art. This could be used as an indicator for the reclamation of air quality.

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SOIL SENSITIVITY TO POLLUTANT DEPOSITIONS: PRELIMINARY STUDIES ON URBAN AREAS

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The Convention of Long Range Transboundary Air Pollution (CLRTAP) establishes a broad framework for co-operative action on air pollution. The Parties undertake, by means of exchanges of information, consultation, research and monitoring, to develop policies and strategies to combat the discharge of air pollutants.

The (CLRTAP), signed in Geneva in 1979, has been representing in the last 25 years one the main tools in controlling and reducing emission of air pollutants in Europe. The Convention has promoted the international cooperation in environmental matters in general and has led to extremely relevant reductions of air pollutants emission (SO2, SOx, ozone precursors, heavy metals, persistent organic pollutants). The Convention has been added to by eight protocols: specific country related goals, based on the results of complex modelling procedures, have been defined.

Italy has signed the eight Protocols to the Convention and actively participates to the CLRTAP initiatives

In Italy APAT, the National Agency for Environmental Protection, supports the Ministry for the Environment to develop national maps of ecosystem sensitivity, and takes part in the implementation of critical loads calculation and mapping procedures. Critical load maps for acidity, eutrophication and heavy metals (lead and cadmium) are today available as the result of a general revision and upgrading of the critical load database. This was performed by adding new data and applying new more advanced methodologies (e.g. dynamic modelling) to determine critical loads.

The critical load concept is applied to evaluate the extent to which the emissions of air pollutants will have to be reduced and represents the scientific base for the discussion of new abatement strategies and measures. Even if urban areas have not considered specific receptors in critical load calculation, nevertheless they represent critical areas, as their surroundings are subjected to high deposition rates of anthropogenic compounds emitted by several human activities. Thanks to the Protocols' implementation relevant reductions in deposition rates could be observed in the last decades especially for acidity and nitrogen. Additional abatement measures are still necessary however to achieve the respect of critical loads.

The Critical load calculation

Critical loads are indicators of soil (ecosystem) sensitivity to pollutant deposition and are defined as the quantity (flux) of one or more pollutants below which adverse effects on specific sensitive part of the ecosystem (receptor) have not been observed, according to current scientific knowledge. They represents the limits to nature's tolerance to human induced deposition of pollutants and can be estimated for every ecosystem type. Critical loads have been generally calculated by the Steady State Mass Balance approach (for references see 2004 CCE Mapping Manual, Bilthoven. The Mass Balance Calculation represents the methodology followed for the critical load calculation).

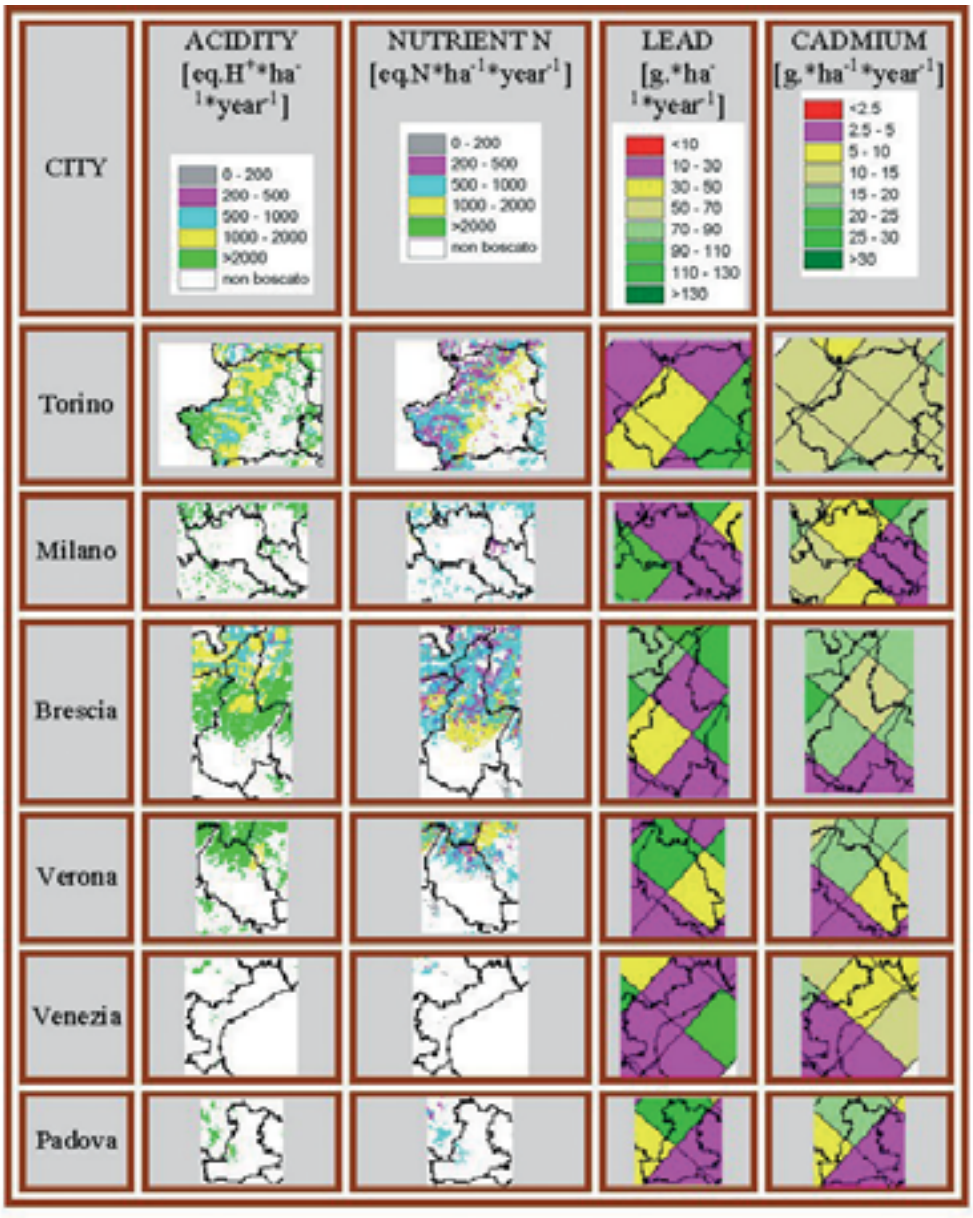
Environmental data

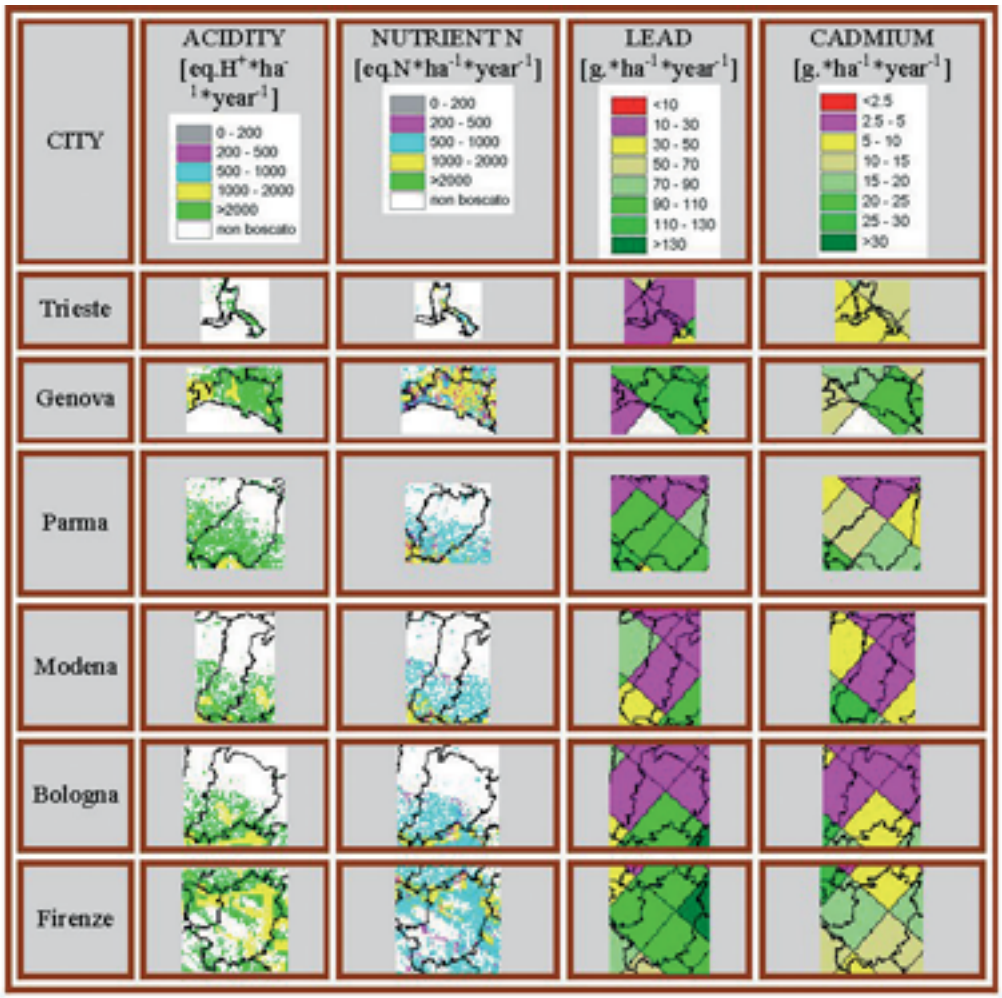
The information about ecosystems distribution was derived combining Image & Corine Land Cover 2000 database (APAT, 2004) with data from the National Vegetation Map (Ministry of the Environment. 1992). Ecosystems were subsequently classified according to the EUNIS habitat nomenclature (16 first levels and 29 second level classes).

Temperature and precipitation data were derived from maps of the Public Work Ministry, and updated to the year 2000, while base cation deposition were provided by ENEL (Italian Electricity Generating Board). Information regarding soil characteristics were extracted from EUSOILS European database (JRC, Ispra).

Pollutant atmospheric depositions were provided by EMEP (Cooperative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe). The spatial resolution of the critical load maps is 50 km x 50 km (the so-called EMEP grid). Italy is fully covered by 253 cells. More detailed maps (1 x 1 km) are however available.

Critical loads of acidity, nutrient nitrogen and heavy metals, in 24 Italian cities

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70 - 90
90 - 110
110 - 130
>130
CADMIUM [g.*ha-1*year-1]
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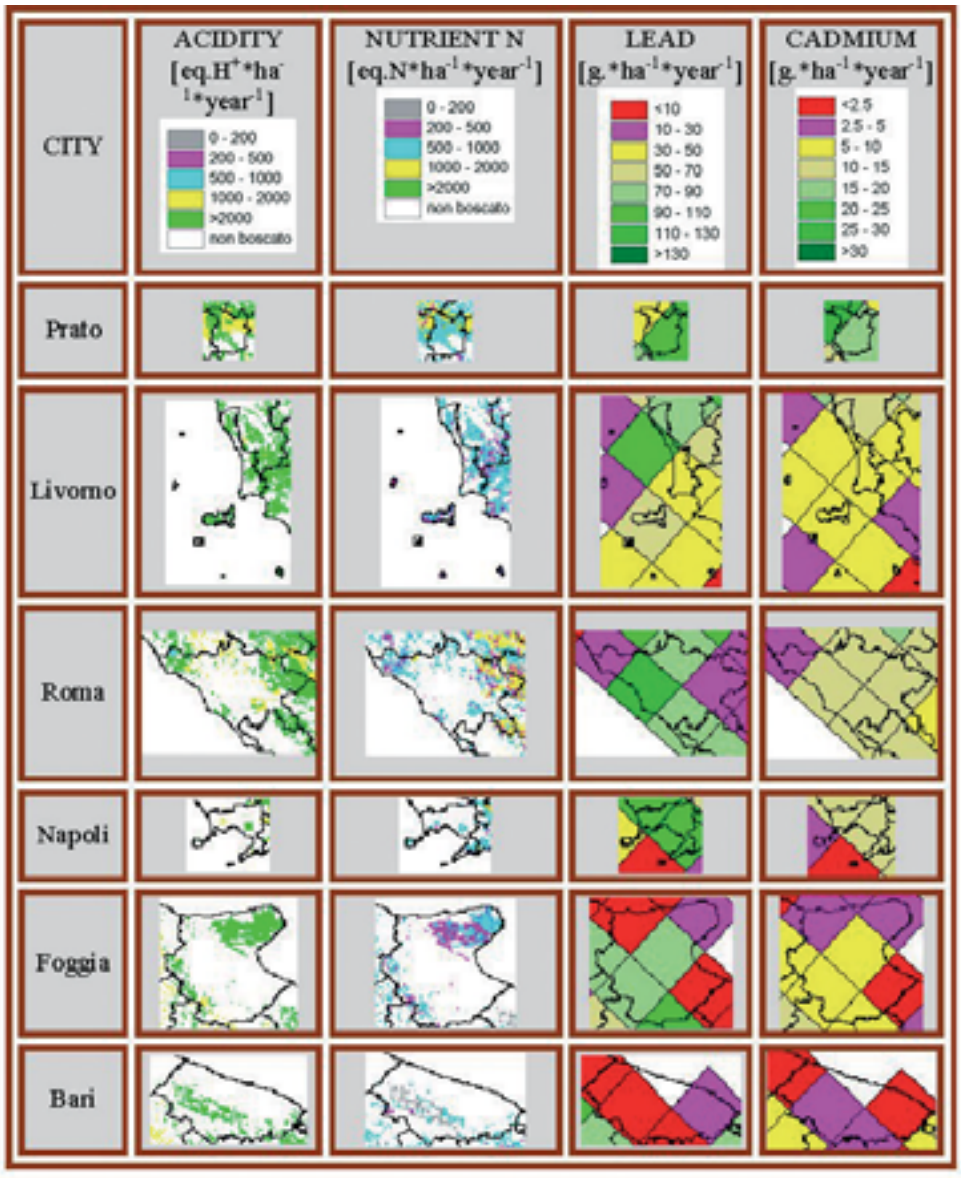
Trieste
Genova
Parma
Modena
Bologna
Firenze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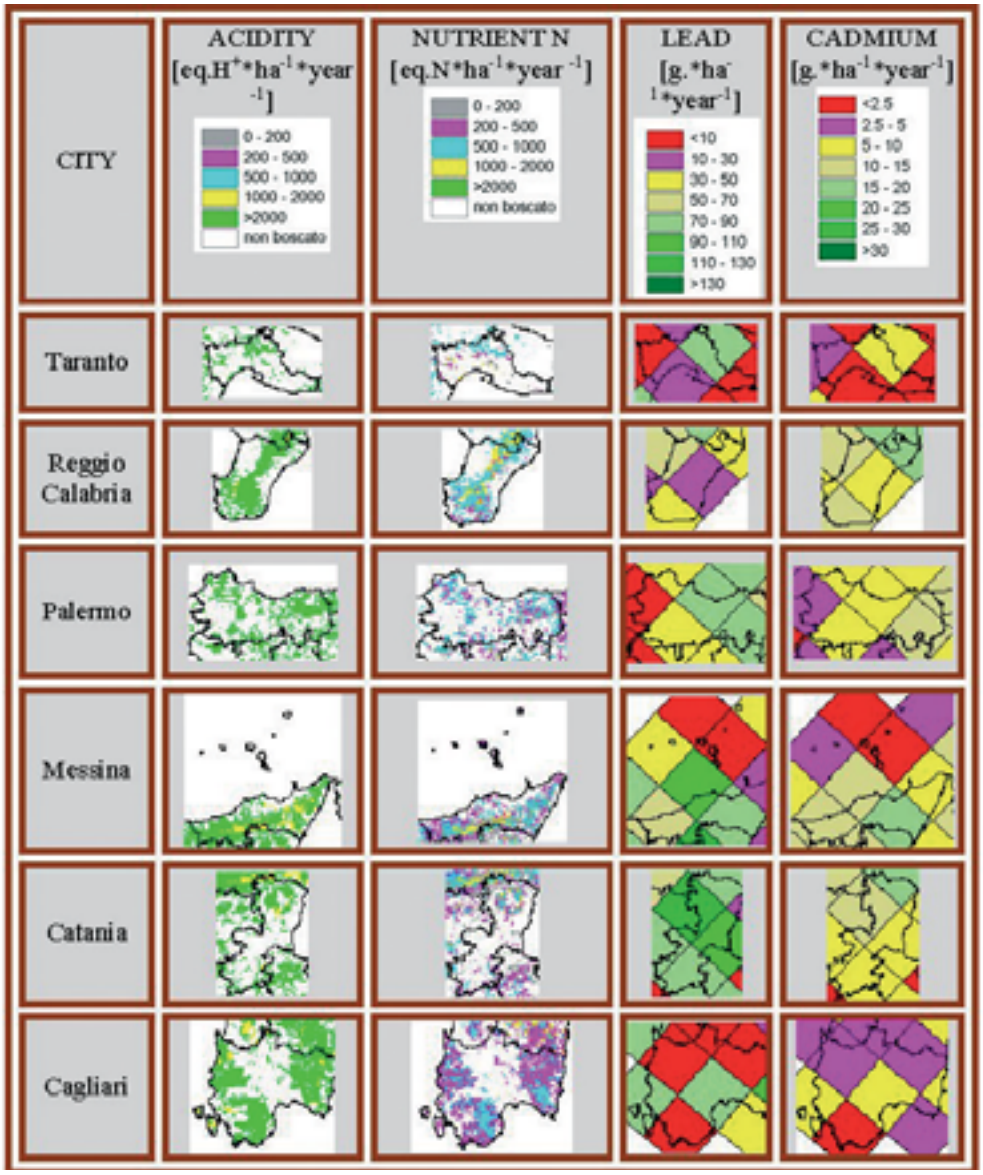
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70 - 90
90 - 110
110 - 130
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CADMIUM [g.*ha-1*year-1]
<2.5
2.5 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
>30
Taranto
Reggio Calabria
Palermo
Messina
Catania
Cagliari

Results

Acidity

Results point out a low to medium sensitivity of the Italian peninsula to acid deposition, with some more sensitive areas located in the Alpine and in the Appennine regions. Several provinces however show large areas of non-sensitive soils.

Nutrient nitrogen

Ecosystem sensitivity to nutrient nitrogen is, for a large extent, comparable to that of acidity. The areas with the highest sensitivity are located in Sardinia and Sicily and their sensitivity is mainly due to low nitrogen uptake rates of forest ecosystems. Some sensitive areas can be observed also in Tuscany although most of the ecosystems in this region are classified as non-sensitive.

Heavy metals

Italian soil show a low sensitivity to heavy metal deposition, in particular to lead and cadmium. Critical areas are limited to some of the north-eastern provinces (from Venice, Trieste to Milan, and Pianura Padana), particularly to lead. Highly sensitive areas can be observed in Central Italy and in the south, both to (Rome, Taranto, Bari e Foggia), lead and cadmium deposition.

Conclusions

Results of the mapping activity point out an overall low sensitivity of Italian soils to acid depositions. On the other hand, large areas with forest ecosystems are sensitive to nitrogen atmospheric deposition, with possible eutrophication risks (nitrogen saturation). Referring to lead and cadmium deposition, critical loads maps highlight a moderate soil sensitivity, which should be studied more in depth as heavy metals may show high mobility rates. During the last years the application of the Dynamic Models has improved and refined critical load calculation. Even if dynamic models need an extended and complex dataset regarding soils and environmental parameters, they allow the development of time-related simulation maps of soil sensitivity. The same results can not be obtained by the SMB methodology. The widely applied dynamic model VSD (Very Simple Dynamic Model), suggested by the CCE, allows time-dependent soil sensitivity studies and forecasts; therefore it appears very useful to evaluate the effectiveness of environmental politics, especially for what concerns air pollution reduction measures.

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