Sketches of Environmental History
A Collection of Essays on Italy
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Ricerche di Storia dell’ambiente. 2
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Introduction

Environmental History: a new frontier or a marginal historiography?

In Italy, the environmental history – understood as the «study of the interactions of people with nature through time»¹ – has found its first academic systematization in an essay by Alberto Caracciolo of 1988, *L'ambiente come storia* (The Environment as History)². Caracciolo highlighted the reluctance of historians in paying attention to «environmental phenomena»³ and underlined the non-anthropocentric character of environmental historiography which, «if it must exist, it is born not only outside, but in contrast with general and economic history, etc.»⁴. According to him, in order to build an «environmental history» it was not enough to devote books and essays «to facts pertaining to the environment», but it was necessary to generate a «historiography of prediction» capable of telling and analyzing the intervention of man «upon the environment at the end of successive generations»⁵.

In 1999 – after a decade during which environmental history remained largely ignored⁶ – a book edited by Angelo Varni (*Storia dell'ambiente in Italia tra Ottocento e Novecento; Environmental History in Italy in the Nineteenth and Twentieth Centuries*) was published, whose objective was to «place environmental history within the phases of development of Italian society between 1800 and 1900, or to understand the reciprocal conditioning factors emerged among the fundamental phases of transition of political, economic, social and cultural life in the Country and the […] necessary environmental adaptation»⁷.

In 2001 a second collective volume appeared (Andrea Filippo Saba and Edgar H. Meyer, *Storia ambientale. Una nuova frontiera storografica; Environmental History. A New Frontier In Historiography*) which contained an important contribution to methodology where Giorgio Nebbia put forward fifteen historical-environmental research sectors and, on the bases of studies published till then, he defined *environmental history* as such as «a sort of history of geography and landscape interwined with the history of agriculture, forestry and land use». According to Nebbia, the privileged object of environmental history – of which he stressed the multidisciplinary vocation deriving from the contact among the disciplines of natural sciences, history, sociology, geography, city planning – was represented by the complex interactions between anthropic activities, environment, nature and artificial ecosystems (cities and industrial districts)⁹. In 2004, Marco Armiero and Stefania Barca published the first Italian handbook on environmental history presented by the authors «as a project aimed at questioning the entire epistemological statute of historical science, with a challenge: to put back nature into history, and to re-write books looking at the way in which groups, societies, nations, individuals and cultures have interacted with their own environments and have been influenced by the same»¹⁰.

Armiero and Barca singled out the peculiarities of Italian environmental historiography in close relationship with agricultural history and economic history¹¹; in the resulting approach «strongly historicized, the result of the combined action of socio-economic and natural factors»¹²; in the restricted development of the fields of research (in essence restricted to the history of the use of resources¹³, to the history of environmental damages¹⁴ and to the history of environmentalism)¹⁵; in the scarce attention paid to «major themes» such as that of urban areas and industries, instead thoroughly covered by other environmental historiographies¹⁶.

This gap was filled beginning from a 2005 publication of an important collection of essays by Simone Neri Serneri (*Incorporare la natura. Storie ambientali del Novecento*)¹⁷ which shifted the balance of contemporary Italian environmental history towards urban and industrial development, regarded as the *engines* of the epochal transformation of «age-long trims which were based on relationship between social systems and ecosystems and, specifically, between town and country, between urban and rural areas»¹⁸.

As Neri Serneri explained

Therefore, environmental history in contemporary times stems largely from urban development, from the methods of construction of the modern city. But it is not just the history of the new forms of pollution that accompany development, since pollution is the epiphenomenon, the symptom of a critical juncture in the use of resources, which is to some extent contingent and it can be absorbed by a more ‘efficient’ mode of exploitation of technical and social resources.

Environmental history in contemporary age is, in the first place, the history of the new ways in which – by virtue of urban industrial development – the acquisition of ‘natural’ resources interacts with the mechanisms of reproduction of ecosystems. This means that it must begin from a reinterpretation of cultural, technical and political paradigms which have guided the development of the city between 1800
and 1900: the paradigm of hygienic sanitation and, later, that of functional planning further transformed in the second half of the last century in the paradigm of territorial government. If the first two were essentially mechanistic and organist and sought to separate city and nature to affirm the autonomy of the first from the second, the third sanctioned the pervasiveness of the multifaceted urban fabric, as the final result of that epochal transformation. The history of transformations and environmental policies is to be found in those paradigms.

Between 2007 and 2009, the publication of two collective volumes dedicated to the city and industrial areas – edited by Simone Neri Serneri with Gabriella Corona and Salvatore Adorno – has deepened and broadened the reflection on the relationship between urban-industrial development and the environmental-historical approach. The researching contained in the first volume – dedicated to the relationship between city and territory, namely the construction of urban and territorial structures – helped to highlight how the history of the environment in contemporary age engages firmly in the radical innovations in the process of «incorporation of parts of nature in the social processes of production and reproduction». So, the history of the environment became «the history of the new mode of acquisition of natural resources and of the interaction with the mechanisms of reproduction of ecosystems».

Corona and Neri Serneri explained

This is the most original result of studies related to the environmental history: the awareness that not only there is a twofold historicity – that of nature and that of human society – but the transformation dynamics of the one and the other are strongly intertwined, since they share - in human time, as well as in geological time – portions of their reproductive processes. This is the deep meaning of the concept of incorporation: human societies are developed by incorporating parts of nature without severing ties (physical, biological, ecosystem) with the remaining complexity of the natural system, which therefore affect more or less markedly reproductive processes. Hence comes the eminently historical relations between nature and society. This historiographical approach [...] has set aside the ambitions of a radical epistemological re-foundation, but remains a formidable challenge bearer of knowledge and discipline, because it requires the historians [...] to communicate not only with other social sciences, but also with many so-called technical-scientific disciplines.

The essays collected in the second volume broaden the view over environmental history of industries, intended not only as a «history of emissions», but as «history of the economic actors in competition for resources, and of the political actors called to regulate such impact». A history – declare the two editors – «that demands to be understood by marrying the history of technology and social history, business history and history of territory, history of resources and of public policies, but whose environmental specificity stands in the ambition of re-running [...] the interaction between human processes and ecosystem processes».

A new generation of environmental historians (very small, to tell the truth) has started exploring new fields of investigation. Saverio Luzzi has published what may be regarded as a first history of the environment in twentieth century Italy, from an innovative perspective: the damages to health caused by pollution and by environmental alterations. This is a social history of change in the relationships between man and nature observed through the evolution of the historical scenario of public health in Italy: the author approaches to his study with the analysis of ‘old rooted diseases’ (pellagra, tuberculosis, malaria ...) and then he faces the relationship between pollution and the onset of new pathologies. In Luzzi’s book there is much more: political history (Fanfani’s ecologism ‘by chance’; the discovery of the environmental issue by the Italian Communist Party; the birth of Legambiente and of the ‘Italian Greens’); social history (cholera in Naples; the oil shock and ‘sundays on foot’; the anti-nuclear energy movement; civil committees and the debate on Nimbyism); industrial history (Seveso, Manfredonia); the history (in the broader sense) of science (Ogms, relationships between pollution and pathogenesis).

A second field of research which is (slowly) developing in Italy consists of studies on the relationship between transport and environment (environmental mobility studies) whose aim is to bring closer together environmental history, transport history and social sciences in order to analyze with an environmental approach the various aspects of mobility.

Despite of the scientific results achieved, environmental history in Italy continues to be a marginal discipline. Proof of this is the small number of environmental-historical sessions, featuring in the programs of Cantieri di storia Sisso (Italian Society for the Study of Contemporary History; Società italiana per lo studio della storia contemporanea), the main event regarding Italian contemporary history: out of 197 panels presented in the eight editions organized to date only 4 (2.03% of the total) concern the environmental history. The picture is not brighter if we consider the annual conference which, since 2006, Sisso devotes to PhD researches (the Seminario nazionale dottorandi called Storie in corso): out of 137 papers
presented, only 2 (1.46% of the total) tackle study subjects which lead to suppose a connection with environmental history.

Expanding the subject to the Associazione italiana di storia urbana (Aisu, Italian Association of Urban History) we note how the broadest opening to themes of environmental history occurred on the occasion of the 4th conference (La città e le reti, Milan, 19–21 February 2009) which enjoyed the presence of a mega-session centered on «environmental networks».

Two years after, the 5th conference (Fuori dall’ordinario. La città di fronte a catastrofi ed eventi eccezionali, Rome, 8–10 September 2011) has devoted a mega-session to «natural disasters».

The 6th conference (Visibile e invisibile, percepire la città tra descrizioni e omissioni, Catania, 12–14 September 2013) has only hosted a single historical environmental panel centered on quantitative sources.

Needs to say that the marginality of the discipline does not depend solely on the lack of consideration that this has within the Academy and to the inability of the environmental movement to take roots within the social fabric (thus also in university departments): in Italy scientific structures that continuously promote research in environmental history are very rare (the most important are the Istituto di studi sulle società del Mediterraneo of the CNR of Naples and the Fondazione Luigi Micheletti of Brescia) and the narrow environmental-historical community appears not so inclined to open up to study issues that are not those most consolidated within historiography. In Italy, also, a significant part of the research on environmental history is carried out by scholars who are only occasionally concerned with the history of the environment, and this contributes to hampering the emergence of long standing synergies bent on generating work teams capable of conferring visibility to Italian environmental historical research inside and outside national borders.

The environmental history suffers from an evident problem which concerns the epistemology of the discipline. At an international level, environmental history appears to be the monopoly of a technical–scientific approach. Furthermore, the strict connection between the environmental history and the environmental movement has lent a militant image to the discipline and this has conferred a markedly eco-centric character to the subject. With the passing of the years, the bridges between the environmental history and anthropocentric histories – such as political history, social history, cultural history – seem to have mellowed down. Attending international conferences one has the feeling that man has been excluded from environmental history: in recent years we have witnessed the exponential multiplication of analysis which – just to give an example – tell of the negative effects of a dam on a river ecosystem or point out the negative consequences produced by the replacement of a native tree species with an allogeneic one. And yet, detailed descriptions of sewage systems and complicated numerical series that attempt to measure the urban metabolisms or cause and effect relationships between consumption and oil extractions. In all this, the political, social and cultural processes inevitably end up in the background, giving the feeling that in order to explain the complex relationship between man and nature it is sufficient to apply the laws of thermodynamics or unorthodox calculations of gross domestic product in a perspective of historical ecology. In short, it seems that environmental history has fallen into the trap of determinism, a risk about which Marco Armiero and Stefania Barca gave a warning.

Concepts such as sustainability, entropy, ecosystem, energy and material flows, carrying capacity are now present in many environmental history researches. But, more generally, the greatest debt contracted by environmental history with the natural sciences is an inclination to see things from an holistic point of view. Using biology, genetics, phytogeography, climatology and zoology to tell the story of men – and maybe comparing the performance of different civilizations – is a very dangerous exercise. Determinism is still there when the environment becomes history.

Environmental-historical determinism should not surprise since the environmental history is not a humanistic discipline in the traditional sense of the term, being widely practiced by scholars who come from the natural sciences, from exact sciences and technical and scientific disciplines. It should not therefore surprise, if this knowledge has introduced a deterministic outlook into the discipline.

In an article published in 2002 in «Contemporanea», Donald Worster has underlined the epistemological difficulties encountered by environmental history in declaring its status of new discipline deriving from the hybridization between technical-scientific and social-historical knowledge.

[...] The new history has failed to create a method radically different from traditional history. Its themes may be new, but its methods are familiar and continue along well-established lines in political, economic, social and cultural history. Much of the American environmental history – though not all – continues to be located within the borders of the nation state and to follow familiar patterns of periodization and time scales. What did not happen – and what some of us have long waited to happen – is a vigorous hybridization between environmental history and natural sciences, especially ecology.
Although some scientists have begun to look at the past through the lens of human bio-geography, ecology or epidemiology [...] historians have rarely joined in that effort. If environmental history should have helped to break the division between the 'two cultures' – which widens between the natural and the human or social sciences – this actually has not happened yet. Environmental historians read more studies of natural sciences, but generally those readings have not led to new questions and to new research techniques or new geographic or temporal scales. Undoubtedly the fact is due to the separation that persists in American university. Students graduated in history have little opportunity or are insufficiently encouraged to become better educated in science, nor the scientists frequently encounter history in the course of their training. Consequently, environmental history has become not just a new species in a forest, but a new branch on an old tree.

In substance, Worster's opinion can be shared: scrolling through the programs of international conferences there is a feeling that the social sciences, the humanities and technical and scientific knowledge embark on the environmental history through the oxymoron of parallel convergences: are all represented, but find it difficult to hybridize and studies that use technical-scientific and naturalistic approach seem to prevail over those whose starting assumptions are rooted in the socio-political approach. At the Seventh Conference of the European Society for Environmental History (August 2013), sessions with a socio-political approach have been 13 out of 112, at the Second World Congress of Environmental History (July 2014) 20 out of 134 and the 2015 Annual Conference of the American Society for Environmental History (March 2015) 19 out of 101.

The gap (analytical, methodological, and of content) between the technical-scientific approach and the socio-political is evident and is perceived by the same scholars who place their studies in the environmental history.

On one hand, on the occasion of the Ninth International Conference on Urban History (Lyon, 27-30 August 2008), Genevieve Massard-Guilbaud (EHESS Paris) e Richard Rodger (Edinburgh University) organized a session entitled Environmental and Social Inequalities in the City since 1800 whose objective was, as we read in the introduction to the volume which came out of it, «to help create bridges between perspectives that should never have been separated: the social and environmental dimensions of inequalities». Evidently, some environmental historians perceive the partiality and incompleteness of the perspectives become conventional (mainstream) in the environmental history. On the other, one of the sessions presented at the ASEH 2014 Conference – Back to Humans, in the end? The challenges of the Environmental Humanities, organized by Marco Armiero (ISSM-CNR Environmental Humanities Lab, Royal Institute of Technology, Stockholm, Sweden) – it has expressed concern for a possible distortion of environmental history due to an excessively anthropocentric approach which would end up with frustrading the original objective, i.e. that of shifting the focus of historical discipline from man to nature placing the latter at the centre of historical analysis. The session has put forward a contribution to overcoming the dichotomy between the anthropocentric and the eccentric approach through a new perspective named 'environmental humanities'.

I would say that we have had several kinds of environmental history, each of them with different approaches, priorities, and narratives, and, therefore, with a different degree of «anthropocentrism». There is no doubt that historically environmental historians have pursued the ambitious project to overcome the great divide which separates hard sciences, humanists, geologists, foresters, biologists, ecologists were their first interlocutors. The other side of the coin has been a rather difficult relationship with history and in general with the humanities. However, instead of thinking in a dichotomous way of nature and humans, there has also been a different approach which speaks of socioeconomic and looks at hybrid constructions of culture and the environment. In the last few years several universities around the world have started new initiatives dedicated to the environmental humanities. In this round table we want to engage a discussion among some of them. Our aim is to address both the theoretical challenges connected to the environmental humanities project and the concrete possibilities offered by the raising of this field of studies in terms of training, research and outreach activities. In particular we want to address the following issues: 1) what are the environmental humanities today? 2) which are – or might be – the relationships between environmental humanities and environmental history? 3) where is the environment and where is the human in the environmental humanities? 4) which are the plans that those centers are pursuing?

In short, the debate within environmental history is open and there is a feeling that the much hoped for hybridization is far from being realized even (and especially?) for the evident epistemological difficulties that separate technical-scientific knowledge from the humanities, as well as the eccentric perspective from the anthropocentric.

In this international context studying environmental history in Italy is objectively difficult and it is so because working on mainstream issues as indicated by international historiography one will be marginalized within the Italian academy which – evidently – does not recognize the themes as object for research within the historical disciplines; at the same time, an Italian
historian who attempts to work on environmental issues with an anthropocentric perspective higher than the average tolerated by the international historiography, will be marginalized at extra-Italian level because – equally clearly – his approach is not considered as belonging to environmental-historical epistemology.

This situation is contributing in a decisive way to the marginalization of environmental history in Italy: after a decade of growth (2001-2010) the environmental-historical approach is declining. The marginalization of the discipline – and also the epistemological cul-de-sac in which it finds itself – has induced some precursors and other researchers who had approached the subject during the 2001-2010 decade to return to more traditional research inspired by an essentially political-historical approach.

In the initial decade of the 21st century, environmental history in Italy has been able to distance itself from its most frequented sectors – the analysis of the ecosystems (which Gorgio Nebbia has called a «sort of history of geography and landscape, crossing with the history of agriculture, of forestry and land use») and the environmental movement (and in particular the vicissitudes of Italian conservationism and national parks) – embracing the history of urban areas, of transport, of health. Now this fervor – limited to a small number of scholars – appears to be dozing off. Yet, study subjects are not lacking: as Nebbia reminded us environmental histories waiting to be written are still many and concern the history of environmentalist associations, the history of the debate on the 'limits of the Earth', the history of the workers struggles for health and the work environment, ecological economics history and of environmental right, the history of environmental technologies, the history of environmental education and information, the political character of protest movements, the history of the 'ecology of masters', the history of the relationships between the Church and the environment, the history of environmental negationism, the history of heterodox environmentalism. Many of these histories have a decidedly anthropocentric character since influenced by social, political and economic dynamics: one may therefore rightly ask, whether to this marginalization of environmental history is also contributing the militant ecocentric approach, which contributes to distancing those scholars interested in studying environmental issues, but not equally keen to contributing to a historiography which identifies itself with a sort of academic rib of political environmentalism whose path – beginning from the 1990s of the 20th century – has taken an increasingly more antagonistic minority stand.

Antagonistic environmentalism places ecological problems into an essentially dichotomous interpretative framework which simplifies questions by opposing to a number of evils (industrial production, neo liberism, western consumption patterns…) some axioms identified as resolutive (the degrowth, the a priori protection of some landscape patterns, the ‘slow food’, the opposition from the bottom to infrastructure deemed excessively impacting …).

Some environmental historians have endorsed this pattern that fits well with the ecocentric perspective. However, environmental issues seldom follow a dichotomous dynamic, but they tend to be far more complex. The onset of an ecological problem and its eventual resolution does not follow a course of cause-effect because – very often – we deal with the result of processes mediated by quite complex social and cultural dynamics.

From this it follows that an inflexible ecocentric approach or – on the contrary – strictly anthropocentric, be limited to producing partial or deterministic explanations of phenomena and contribute to the polarization of the discipline between promoters of the ecocentric approach and supporters of the anthropocentric. In turn this polarization contributes – at least in Italy, but not only – to the marginalization of the discipline.

Notes
3 A. Caracciolo, L’ambiente come storia…, 7-8.
4 A. Caracciolo, L’ambiente come storia…, 24-25.
6 If I am not mistaken, *Tra natura e storia* (Between nature and history) has not received any review or mention on specialized historical journals. Those who have found the themes and reflections worthy of interest were instead agronomists, urban planners, geographers. I believe they were the only interlocutors – except, of course, the few friends lovers of the environmental history – with whom I have had the opportunity to dialogue to the heart of the matter. And this is partly understandable, given the nature of the topics covered. And yet I think [...] that all this points to further evidence of how much more thematically poor, unilaterally closed in humanistic knowledge [...] is still contemporary history in Italy», in Piero Bevilacqua, *Tra natura e storia. Ambiente, economie, risorse in Italia*, Donzelli, Roma 2000 (1st edition 1996), 7.

7 Angelo Varni, *Storia dell’ambiente in Italia tra Ottocento e Novecento*, il Mulino, Bologna 1999. The quotation is taken from the back cover.

8 Giorgio Nebbia, *Per una definizione di storia dell’ambiente*, in Andrea Filippo Saba, Edgar H. Meyer, *Storia ambientale. Una nuova frontiera storiografica*, Teti Editore, Milano 2001, 11-35. The book collects the proceedings of the conference «Storia ambientale. Una nuova frontiera storiografica» – held in Milan in April 1997 at Fondazione Giangiacomo Feltrinelli – organized by Edgar Meyer on behalf of *Istituto lombardo per la storia della Resistenza e dell’età contemporanea* and *Sito- Associazione per la storia e gli studi sull’ambiente*. The research fields suggested by Nebbia are: history of ecology; history of nature conservation; history of the environment; history of ecological protests; history of environmental organizations; history of the debate on the environmental limits of the Earth; history of workers’ struggles for health and the working environment; history of environmental economics and environmental law; history of ecological techniques; history of environmental education and information; history of the political peculiarities of environmental protests; history of the «ecology of the capitalist masters»; history of the relationships between the Churches and the environment; history of the relationships between the governments and the environment; history of the relationships among the governments, lobby groups and the environment in Italy.


11 *In Italy, as in Spain, the relationship between the history of agriculture and environmental history was decisive as explained recently by Piero Bevilacqua who has linked our historiography on agriculture and landscape with new environmental interests. It is not simply a thematic-spatial contingency, so that from the fields we easily passed on to woods, and from here to the large hydrogeological and environmental changes caused by men. [...] historians of agriculture have shown how society and economy have molded the environment, or, at least, have had much to do with it*, M. Armiero, S. Barca, *Storia dell’ambiente..., 50. Cf. Marco Armiero, *Storie e storia dell’ambiente e Piero Bevilacqua, Storia e ambiente in Italia*, in Marco Armiero (ed.), *Alla ricerca della storia ambientale. «Contemporanea»*, V, 1, January 2002, 131-135, 160-163. As to economic history, the two authors indicate in Carlo Maria Cipolla (*Uomini, tecniche, economie*, Feltrinelli, Milano 1966) the economic historian who best combined economic and ecological issues. See also Paolo Malanima, *Uomini, risorse, tecniche nell’economia europea dal X al XIX secolo*, Bruno Mondadori, Milano 2009.

12 As the two authors explain: *In other words Italian environmental history has not started from the principle that nature works without man and for this reason it has not wasted time in a research of real natural spaces (or without man) or on the naturality of spaces (or before man appeared) accepting – on the whole in its totality – the challenge of keeping together economy and nature, society and ecosystems*, M. Armiero, S. Barca, *Storia dell’ambiente..., 51.


14 On earthquakes cf.: Emanuela Guidoboni (ed.), *I terremoti prima del Mille in Italia e nell’area mediterranea*, SGA, Bologna 1989; Enzo Boschi et. al., *Catalogo dei forti terremoti in Italia dal 461 a...*
The data are drawn from the website of Sissco (www.sissco.it). The four environmental panels are:

- S. Adorno, S. Neri Serneri, Gabriella Corona, Simone Neri Serneri, G. Corona, Simone Neri Serneri, This aspect was already highlighted by Neri Serneri: “What is striking is, in contemporary published volume that combines political history, urban history and environmental history (with particular Milano 2000; Luigi Piccioni, Bibliografica, Milano 1996; Luigi Piccioni, Primo di cordata. Renzo Videosi dal sesto grado alla protezione della natura, Editrice Temi, Trento 2010; Gianluigi Della Valentina, Storia dell’ambientalismo in Italia. Lo sviluppo insostenibile, Milano, Bruno Mondadori 2011; Giorgio Nebbia, Scritti di storia dell’ambiente e dell’ambientalismo 1970-2013 (a cura di Luigi Piccioni), Fondazione Luigi Micheletti (I quaderni di Altronovecento, 4), Brescia 2014. Two volumes of significant importance (written by two sociologists) are: Mario Diani, Isole nell’arcipelago: il movimento ecologista in Italia, il Mulino, Bologna 1988; Donatella Della Porta, Mario Diani, Movimenti senza protesta? L’ambientalismo in Italia, il Mulino, Bologna 2004.

This aspect was already highlighted by Neri Serneri: «What is striking is, in contemporary historiography, precisely the delay of studies on the urban and industrial environment. Signs of a more widespread interest in environmental issues are found among historians of agricultural and forest, while the environmental implications of the processes of industrialization and urbanization appear the least considered», cf. Simone Neri Serneri, Industria e ambiente. Per uno studio del caso italiano 1880-1940, in A. Varni, Storia dell’ambiente..., 27-28.


S. Neri Serneri, Incorporare la natura..., 37-38.

S. Neri Serneri, Incorporare la natura...


G. Corona, S. Neri Serneri, Storia e ambiente..., 12.


The data are drawn from the web site of Sissco (www.sissco.it). The four environmental panels are: Ambiente e risorse nell’Italia contemporanea; i luoghi, le periodizzazioni, i problemi (Coordinators: Marco Armiero, Patrizio Armiero and Stefano Labriola; Panelists: Marco Armiero, Patrizio Armiero; Simone Neri Serneri, Gabriella Corona; Cantieri I 2001); Industrie, ambiente e territori nell’Italia del Secondo Novecento (Coordinator: Simone Neri Serneri; Panelists: Simone Neri Serneri, Roberto Tolaini, Federico Paolini, Salvatore Adorno; Cantieri IV 2007); Ambientalismo, ambientalismo: aspetti di storia del movimento ecologista in Italia 1970-2010 (Coordinator: Federico Paolini; Panelists: Catia Papa, Luigi
The most important international conferences are organized by the American Society for Environmental History (ASEH) and by the European Society for Environmental History (ESEH). The American Society has organized its first conference in 1982 (UC Irvine) and now conferences occur annually. The European delay consists of almost twenty years: the ESEH has organized its first conference in 2001 in St. Andrews (Scotland), followed by those of Prague (September 2003), Florence (February 2005), Amsterdam (June 2007), Turku (June-July 2011), Munich (August 2013), Versailles (July 2015). The 2009 conference did not take place because of coinciding with the 1st World Congress of Environmental History (Copenhagen and Malmö, August 2009); the second World Congress of Environmental History took place at Guimarães, Portugal, from 8 July 2014 to 12 July 2014. In 2006 the Sociedad Latinoamericana (Copenhagen and Malmö, August 2009); the second World Congress of Environmental History took place at Guimarães, Portugal, from 8 July 2014 to 12 July 2014. In 2006 the Sociedad Latinoamericana y Norteamericana (Coordinators, Laura Grazia); Le città a motore. La mobilità come fattore di trasformazione ambientale nell’Italia del secondo dopoguerra (Coordinator, Federico Paolini); Reti ambientali e sviluppo urbano: il caso di Napoli (Coordinator, Gabriella Corona); Questions ambientali, uso dei suoi ed aree produttive dismesse nell’Italia del Novecento (Coordinator, Augusto Ciuffetti); Territori, spazi aperti, paesaggi (Coordinator, Rosa Tamborrino); Risorse ambientali e reti degli insediamenti tra Otto e Novecento (Coordinators, Simone Neri Serneri, Rosa Tamborrino).

The session I disastri di origine naturale has been organized by Marco Folin, Emanuela Guidoboni, Melania Nucifora. The panel closer to environmental history was Città, territori e società urbane di fronte ai disastri naturali del XX secolo, organized by Giacomo Parrinello, Ines Tolic and Stefano Ventura.

Quelli fonti quantitative per la storia ambientale urbana? (Coordinator, Federico Paolini); Antonio Parmeggiani, L’evoluzione ambientale tra Otto e Novecento, l’esempio di Velletri; Giacomo Parrinello, Conoscere per governare: la produzione tecnico-scientifica sulla natura urbana tra Otto e Novecento; Mariagrazia d’Emilio, Misurare la “mal’aria”: l’evoluzione della ricerca scientifica e delle metodologie di campionamento nello studio dell’inquinamento atmosferico; Gianni Silei, Uso delle fonti, stampe e costruzione sociale dei rischi e dei disastri naturali nelle aree urbane.

For example, the volume Nature and History in Modern Italy (Ohio University Press, Athens 2010) – edited by Marco Armiero and Marcus Hall – does not take into consideration the most recent studies on public health and on transport and it restricts itself to re-launch the research carried forward by what may be called the core group of environmental history in Italy. As to the objects of study, what is surprising is the scarce interest in the environmental history of consumption.


Cf. Marco Armiero, Stefania Barca, Storia dell’ambiente…, 26: «The history of the environment also appears to be characterized by a strong ethical policy: in a crisis of ideology, it is proposing a radical criticism of the present system of production, distribution and consumption, rejecting the axiom that it is the best possible».

The most important international conferences are organized by the American Society for Environmental History (ASEH) and by the European Society for Environmental History (ESEH). The American Society has organized its first conference in 1982 (UC Irvine) and now conferences occur annually. The European delay consists of almost twenty years: the ESEH has organized its first conference in 2001 in St. Andrews (Scotland), followed by those of Prague (September 2003), Florence (February 2005), Amsterdam (June 2007), Turku (June-July 2011), Munich (August 2013), Versailles (July 2015). The 2009 conference did not take place because of coinciding with the 1st World Congress of Environmental History (Copenhagen and Malmö, August 2009); the second World Congress of Environmental History took place at Guimarães, Portugal, from 8 July 2014 to 12 July 2014. In 2006 the Sociedad Latinoamericana y Caribena de Historia Ambiental was instituted, which organizes a biennal symposium now arrived at its sixth edition (Santiago, Chile, July 2003; La Habana, October 2004; Carmona-Spain, April 2006; Belo Horizonte, May 2008; La Paz, Baja California Sur, June 2010; Villa de Leyva-Colombia, June 2012, Quilmes Gran Buenos Aires, October 2014). An Association for East Asian Environmental History has been instituted, which calls a biennal international conference (Taiwan: October 2011 and October 2013; Takamatsu, Kagawa, Japan: October 2015).

M. Armiero, S. Barca, Storia dell’ambiente…, 34.


Anti-nuclear protest in the 1970s and 1980s in a transnational perspective: Europe and beyond, eye witness perspectives (Organizer: Astrid Mignon Kirchhof, Humboldt University Berlin; Jan-Henrik Meyer, Aarhus University); Anti-nuclear-protest in the 1970s and 1980s in a transnational perspective: Europe and beyond. The Nuclear Rhine as the Cradle of transnational anti-nuclear movements (Organizer: Astrid Mignon Kirchhof, Humboldt University Berlin; Jan-Henrik Meyer, Aarhus University); Anti-nuclear protest in the 1970s and 1980s in a transnational perspective: Europe and beyond – Part II – Global connections (Organizer: Jan-Henrik Meyer, Aarhus University; Astrid Kirchhoff, Humboldt University Berlin); Circulating political models and scientific expertise: Fascism
Conservation, Mobility, and the State: Histories of Preservation in the Global South (Chair and Commentator: Meredith McKittrick, Georgetown University); Mending Wall: Farmers, Conservation, and Stewardship (Chair: David Glassberg, University of Massachusetts-Amherst); The State and Nature: Diplomacy and the Environment in Western Europe, the North Atlantic, and Eastern Russia (Chair: Joshua Howe, Reed College); Picking Cherries: Theory for Environmental Historians (Chair: Uwe Luebken, LMU Munich, Amerikainstitut); It’s the End of the World as We Know It: Environmental Histories in/of the Anthropocene (Moderator: Joseph Taylor, Simon Fraser University); Environmental Justice in the United States (Chair: Michael J. Dockry, USDA Forest Service); A Total Energy Solution: The Energy Debates of the 1970s, Public Opinion, and Policy (Chair: Brian Black, Pennsylvania State University-Altoona); Protest & Politics in Energy Transitions: From Wood to Coal and Back (Chair: Brian Donahue, Brandeis University); Tracing The Roots Of American Environmental Movements (Moderator: Keith Woodhouse, Northwestern University); Environmental Histories of Capitalism (Moderator: Christine Rosen, University of California-Berkeley); Social Responses to Environmental Problems (Chair: Cindy Ott, St. Louis University); Environmental Protest and the Public Interest in Metropolitan America (Chair and Commentator: Ellen Stroud, Bryn Mawr College); Environmentalism’s Intersections with Contemporary Social Movements (Chair: Stacy N. Roberts, University of California-Davis); Water, Politics, and Society in Mexico (Chair: Sterling Evans, University of Oklahoma); Exploring Apocalyptic, Alarms and Alarmism in Environmental History (Chair: Thomas Michael Lekan, University of South Carolina); Red against Green: The Confrontation between Environmentalists and Conservatives in the 1970s and 1980s (Chair: Sarah Elkind, San Diego State University); Listening to Nature: The Sounds of Conservation (Chair: Jeremy Vetter, University of Arizona); Policy in Canada, Denmark and the United States Since the 1970s (Chair: Jay Hakes, former Director, Carter Presidential Library); History of Sustainability above and beyond the Brandtland Report (Chair and Commentator: Teresa Sabol Spezio, Huntington Library).

Conservation, Mobility, and the State: Histories of Preservation in the Global South (Chair and Commentator: Meredith McKittrick, Georgetown University); Mending Wall: Farmers, Conservation, and Stewardship (Chair: David Glassberg, University of Massachusetts-Amherst); The State and Nature: Diplomacy and the Environment in Western Europe, the North Atlantic, and Eastern Russia (Chair: Joshua Howe, Reed College); Picking Cherries: Theory for Environmental Historians (Chair: Uwe Luebken, LMU Munich, Amerikainstitut); It’s the End of the World as We Know It: Environmental Histories in/of the Anthropocene (Moderator: Joseph Taylor, Simon Fraser University); Environmental Justice in the United States (Chair: Michael J. Dockry, USDA Forest Service); A Total Energy Solution: The Energy Debates of the 1970s, Public Opinion, and Policy (Chair: Brian Black, Pennsylvania State University-Altoona); Protest & Politics in Energy Transitions: From Wood to Coal and Back (Chair: Brian Donahue, Brandeis University); Tracing The Roots Of American Environmental Movements (Moderator: Keith Woodhouse, Northwestern University); Environmental Histories of Capitalism (Moderator: Christine Rosen, University of California-Berkeley); Social Responses to Environmental Problems (Chair: Cindy Ott, St. Louis University); Environmental Protest and the Public Interest in Metropolitan America (Chair and Commentator: Ellen Stroud, Bryn Mawr College); Environmentalism’s Intersections with Contemporary Social Movements (Chair: Stacy N. Roberts, University of California-Davis); Water, Politics, and Society in Mexico (Chair: Sterling Evans, University of Oklahoma); Exploring Apocalyptic, Alarms and Alarmism in Environmental History (Chair: Thomas Michael Lekan, University of South Carolina); Red against Green: The Confrontation between Environmentalists and Conservatives in the 1970s and 1980s (Chair: Sarah Elkind, San Diego State University); Listening to Nature: The Sounds of Conservation (Chair: Jeremy Vetter, University of Arizona); Policy in Canada, Denmark and the United States Since the 1970s (Chair: Jay Hakes, former Director, Carter Presidential Library); History of Sustainability above and beyond the Brandtland Report (Chair and Commentator: Teresa Sabol Spezio, Huntington Library).
smoke is our prosperity: Managing and contesting industrial pollution in Middlesbrough 1880-1940; Ewa Kokoszycka, The return to nature: striving for environmental and social justice of the vegetarian social and health reformers in Berlin 1880-1914; Simo Laakonen, Environmental justice in historical perspective: experiences of cross-section analysis; Richard Oram, Social Inequality in the Supply and Use of fuels in Scottish Towns; Leonard Schwartz, Jeremy Boulton, The Early Epidemic Streets; Marie-Claire Vitoux, Ségrégation socio-spatiale et inégalités environnementales à Mulhouse (XIX-XXI siècles); Geoffray Buckley, To promote the material and moral welfare of the community: Neighborhood Improvement Associations in Baltimore, Maryland, 1900-1945. Cf. http://eauh.ish-lyon.cnrs.fr/param/eauh.ish-lyon.cnrfr/files/Prog-EAUH.pdf.


42 Giorgio Nebbia, Per una definizione di storia dell’ambiente, in Andrea Filippo Saba, Edgar H. Meyer, Storia ambientale..., 16.
43 Giorgio Nebbia, Per una definizione di storiella dell’ambiente, 11-35.
44 A second problem that contributes to hampering the development of environmental history is that of sources. Giorgio Nebbia always highlighted the «need for a historical record» noting how «the writing of one or more stories of the various movements and ecological events [presupposed] access to very different materials, partly published in books accessible in public libraries, in part now almost impossible to find, and partly contained in documents, reports, articles buried in archives or dispersed in countless newspapers and magazines, in part now lost». For these reasons Nebbia hoped that the meeting of 1997 «offered an opportunity for a strong request for the establishment of a national historical archive of ecology and the environment». Since then little has been done, for the lack of interest shown by institutions and by the same environmental organizations. Cf. Giorgio Nebbia, Per una definizione di storia dell’ambiente, 33-35. On historical sources cf. also Federico Paolini (ed.), Le fonti per la storia dell’ambiente. Alcune proposte di lavoro, Fruska, Soci (Arezzo) 2013.
Part I

Natural resources and their uses
Chapter I

Economic and environmental impacts of biomass, solar and small wind power plants (World, Italy, Tuscany).

Energy scenarios and future projections

World

In initial years of the Twenty-first century, the production and consumption of energy are still firmly characterized by a predominant use of fossil energy sources.

According to assessments made by the World Resources Institute, in 2001 the global consumption of energy was thus distributed: 79.5% fossil fuels, 10.4% solid biomass, 6.9% nuclear, 2.2% hydroelectric and 0.7% other renewables. In Europe, energy consumption was characterized by a higher use of fossil fuels (84.2%) and of nuclear (10.5%) which confine the percentage of renewables to a mere 4.7% (2.4% hydroelectric, 2.0% solid biomasses, 0.3% other renewables). In 2004, only 0.51% of produced world energy derived from solar or wind systems.

In 2005, renewable sources (including nuclear) represented 10.20% of global energy consumption according to OPEC, and 7.68% according to the Energy Information Administration of the U.S. Department of Energy.

As to the forthcoming decades, the reference scenario (policies and regulations adopted by mid-2008) of the World Energy Outlook 2008 of the International Energy Agency envisages the future of energy still dominated by fossil fuels:

In our Reference Scenario, world primary energy demand increases by an average of 1.6% per annum during the period between 2006 and 2030, increasing from 11,730 million tons of oil equivalent (toe) up to just over 17,010 million toe, with a growth of 45%. [...] In 2030, fossil fuels account for 80% of global primary energy mix, which is slightly lower than the current level. The oil continues to remain the predominant fuel, despite the demand for coal increases more than that of any other fuel in absolute terms. The percentage of world energy consumed in urban centers, estimated at 7,900 million toe in 2006, increased by two-thirds to almost three quarters in 2030.

According to the International Energy Agency, however, renewable technologies are destined to become «the second most important source for the generation of electric power after coal»:

Excluding biomass, non-hydroelectric renewable sources such as wind, solar, geothermal and tidal grow overall than any other source worldwide, at an average rate of 7.2% per annum for the period in question. Most of the increase occurs in the electricity sector. The percentage of non-hydroelectric renewables to total electricity production increases from 1% in 2006 to 4% in 2030. The production of hydroelectric power is growing, even though its share of electricity production fell by two percentage points to 14%. In OECD countries, the increase of renewable sources for generating electricity exceeds that of fossil fuels and nuclear power combined.

Even the International Energy Outlook 2008 of the Energy Information Administration confirms the sustained growth of renewables (2.1% per year between 2005 and 2030) and, for 2030, imagines a scenario that provides a world energy consumption still very dependent on fossil fuels (Fig. 1).

As to the installed power, hydropower and other renewables would switch from 923 megawatts in 2005 to 1,373 in 2030 with an average annual growth of 1.6% (+ 48.75%).

In Europe, the installed capacity would rise from 212 to 293 megawatts (+ 1.3% per annum, + 37.73%).
Italy and Tuscany

In Italy, between 1995 and 2005, the availability of energy sources has gone from 171,716 million tons oil equivalent (toe) in 1995 to 197,776 in 2005. The period in question has been characterized by a progressive decrease of oil consumption and by a constant increase of natural gas consumption. In addition, energy policies have been characterized by an attempt to stimulate the development of renewable sources and to encourage energy saving measures.

In 2005 the final consumption of energy amounted to 146,591 million toe, as follows: 69,219 oil (47.22%), 45,050 natural gas (30.94%), 25,866 electricity (17.64%), 4,629 solid fuels (3.15%), 1,827 renewables (1.05%).

For what concerns electricity, of the 303,672 million kilowatt hour produced, 83.33% were of thermolectric origin, 14.13% hydroelectric, 1.75% geothermal electricity, 0.77% wind and 0.02% solar. The gross production of electric power from renewable sources was distributed as follows: 72.28% hydroelectric, 12.34% biomass and waste, 10.67% geothermal, 4.69% wind, 0.02% solar.

As to Tuscany, after a significant reduction of consumption recorded during the final years of the 20th Century, the demand for energy – led by industry and transport sectors – has returned increase beginning from 2001 with a mean annual rate more than double that of the 1990s. In 2004, Tuscany’s final consumption amounted to 6.74% of the national, of which it largely matched the composition, with a clear prevalence of fossil fuels, and in particular of oil and natural gas (Fig. 2).

As to future forecasts, the Libro bianco per la valorizzazione energetica delle fonti rinnovabili (April 1999) gave as a target for the period 2008-2012 an increase in the use of energy from renewable sources up to about 20.3 Mtoe, as compared to 11.7 Mtoe recorded in 1997. In 2008-2012 electricity production from renewables (16,744 Mtoe) was assessed as follows: 10,362 hydroelectric, 3,916 biomass and waste, 1,294 geothermal, 1,100 wind, 0,073 solar (Fig.3).
The Unione Petrolifera speculates that between 2006 and 2020, there will be a considerable decrease of demand for oil on the total energy demand (from 44.1% in 2006 to 35.2% in 2020) in favour of natural gas and of renewables (respectively 41% and 10.8% in 2020). As to the latter, the Unione Petrolifera foresees for 2020 a production of 92,000 GWh as follows (Fig. 4): 50,000 hydroelectric (+38.35% compared to 2006), 22,500 biomass (including urban waste, +235.82%), 12,500 wind-solar (+288.80%) and 7,000 geothermal (+26.65%)\(^{10}\).

Wind and mini wind

Between the mid-1990s and 2007, wind energy has experienced a significant development gaining important sections of the market in Germany, Denmark, Spain, Portugal and Ireland\(^{11}\). These five countries (Fig. 5) boasted the greatest wind capacity within the European Union, above the average of the Union (both of EU-15 and of the EU-27). Germany, Spain and Denmark – the three first-movers in the sector of wind power – continued to attract the highest investments, followed by France and Portugal.
Wind power contributes to cover 21.22% of electricity production in Denmark, 11.76% in Spain, 9.26% in Portugal, 8.42% in Ireland, and 7% in Germany.

At the end of 2007, the wind power capacity installed in the EU-27 was 56,535 MW; Italy occupied the fourth place, but dropped to the 11th place considering the relationship between installed power and number of inhabitants. Italy appeared to be far behind on offshore wind farms, with a capacity of 0.08 MW as compared to 590.80 MW of United Kingdom and 426.35 of Denmark. A fact of primary importance if we consider that the European Wind Energy Association speculates that in 2015, off shore wind farms will achieve a total power production almost equal to 31,000 MW.

The success of wind energy, despite running costs being generally superior to the technologies employed in fossil fuels – (the cost per KWh varies from 1.033 euro inland to 1.550 offshore) – has been established by the low variable costs due to the low operating costs and to the fact that the wind spares the producers to undertake large outlays due to oil prices. In addition, according to the task force for renewable energies of the G8, the wind is the energy source with fewer externalities (the consequences of an industrial activity which affects other parties without this being reflected in market prices; for examples manufacturing activities that cause air pollution impose health and clean-up costs on the whole society).
Precisely the above mentioned factors have encouraged the spread of wind farms of large dimensions, such as for example the Middelgrunder farms (20 off-shore turbines) and Syltholm in Denmark (35 inshore turbines of 750 KW). Beginning from 1995, wind farms have also spread in Italy where in 2000 there existed 58 active plants generating installed power for about 430 MW. In 2007 there were 157 Italian municipalities with wind plants generating a total of 2,819 MW. The main plants are situated in the territories of Toia (167.9 MW), Agrigento (104.55 MW), Bisaccia (101.88 MW), Sant’Agata di Puglia (97.2 MW) and Ulassai (84 MW).

Despite of wind power being regarded – along with biomass – the principal alternative to fossil fuels and an essential instrument for meeting the European goals of 2020 (20% of total energy obtained from renewables), wind farms have become one of the chief targets of NIMBY protests.

The acronym NIMBY (Not in My Back Yard, is usually named to mean citizen’s protests – generally they refer to citizen’s committees – against the building of infrastructure of public interest. NIMBY committees have started spreading from the 1960’s reaching their peak in the 1990s and the early years of the 21st Century. We often refer to these grass roots movements talking of NIMBY syndrome because their dissent does recognize the social benefits of the opposed structures, only demanding an alternative site (thus the definition Not in My Back Yard). Furthermore increasingly more often protests also regard structures otherwise generally held as indispensable for sustainable development, such as water treatment plants, solar energy plants, sites for the treatment of urban waste and wind farms. Among the most notorious cases are for example those of the building of two wind farms at Nantucket Sound in Massachusetts and in St. Lucie’s County in Florida.

Over the last few years, cases of local opposition to the building of infrastructure have involved many European countries, growing to considerable proportions, especially in Italy where the causes for protests (172 recent episodes, 53% concentrated in Lombardy, Veneto, Emilia Romagna and Tuscany) must be assigned to a fear of obnoxious consequences for health and the environment, to a preoccupation for wrong assessment of costs and benefits (the costs should bear upon the finances of local communities), to distrust in political parties and in the unrepresentative political system. Demonstrations of dissent have concerned the wind farms of Idice and Sillaro river valleys in Emilia Romagna (16 turbines of 800 KW), that of Borbera-Curone in Piedmont (30 turbines of 1500 KW) and that of Poggi Alti near Scansano in Tuscany (10 turbines of 10 MW power). The opposition to the Poggi Alti wind farm has been promoted by local wine producers and by Italia Nostra, whereas Legambiente and WWF have expressed a substantially favourable opinion. Recently the case of Poggi Alti has been the focus of an article by columnist Mario Piri (a journalist of the daily «la Repubblica») in which he called the occurrence «a script of Don Quixote gone crazy with monstrous windmills seizing Dulcinea’s castle» (i.e. that of Montepò, near Scansano). Earlier, still in Tuscany, some protests had involved the small plant in the locality of Secchieta in the municipality of Montemignaio, province of Arezzo (3 turbines of 0.6 MW).

The greatest worries concerning wind farms regard the occupation of land, noise, electromagnetic waves, visual impact on the landscape, and interferences with birds (the best known case is that of Altamon Pass, California) and, in the case of off shore plants, with marine fauna.

Studies carried out to date, however, appear to partly resize the preoccupations expressed by a section of the environmentalist movement. In Denmark, for example, studies have been made on on-shore installations of Tunø Knob and the off-shore one of Vindeby: in the first case «no difference has been noted in the behaviour of birds while the rotors were in action» and in the
second «the result has been the realization of an increase in fish catches, after the building of the plant, due to the fact that the foundations of the windmills (the gravity ones) are seen by the fauna as an artificial reefs»

As to Italy we may mention the case study concerning the Serra Lunga plant at Cinisi (Palermo). In the synthetic assessment of the consequences of the plant, it is said:

Despite of the area of the plant being in the «SIC/ZPS Montagna Longa e Pizzo Montanello», in the light of the data illustrated in the paragraphs regarding the affects of the ongoing installation works on the local species of flora, vegetation and habitat or altogether environmental effects, we can say that the impact of the emplacement of the turbines will be more evident in quantitative than in qualitative terms and only in the short term, since the species and habitats of higher value are connected with floral communities for centuries adapted to heavy human interference. For what concerns flora, vegetation and fauna, the overall impact of the plant appears negligible.

A research carried out by the Centro ornitologico toscano for the Regione Toscana, has found that the most relevant environmental impacts caused by wind farms concern large birds (the hazard of collisions with the turbines has been described as «a limiting factor for the conservation of bird populations») along with the «disturbance caused by ordinary and extraordinary maintenance», tends to induce the birds of prey and sparrows to abandon the sites where the wind plants are erected. For this reason the research recommends not to place the turbines in areas where «particularly rare and delicate and rare species exist», near wetlands, reservoirs and «along the ridges of hills, (watershed and areas immediately adjacent to it) and the same for mountains, in particular at a high altitude» since winds «are stronger and capable of diverting the flight of the birds»

In Italy, concerns about the impact of wind farms have ended up with making wind power from an indispensable resource for reducing weather corrupting emissions into an environmental problem.

For what concerns Tuscany, as states the Piano di indirizzo energetico regionale (PIER) where declares that «wind power has suffered from the climate of prejudice and hostility which has spread against large wind plants generators chiefly for the worries of an excessive impact on the landscape»

The broad dissent towards the installation of wind turbines represents not a simple problem if we consider that the Regione Toscana regarded wind power a strategic resource.

Over the last ten years has begun to take off, with the consent of environmental associations, what is called «mini wind» (small wind turbines, not taller than 30 m). These plants are fairly well distributed in Great Britain, where to begin from the early 90s have been supported by the British Wind Energy Association. In Italy, the first experimental mini wind plant has started working in Trento in 2007 (three turbines with a power of 1 KW, 11 KW and 20 KW).

Compared to wind farms of large dimensions, the mini wind is more easily integrated into the landscape, and in future may make it possible to create a self-productive network, and a «network of agro-energetic businesses, small business districts both productive and sustainable, which in part directly utilize the energy produced and partly exchange in a network with investments giving a return in a matter of few years»
Biomass

As we have seen, biomass is the most used renewable source for the production of energy. This is because in many developing countries, firewood is still the cheapest fuel and the easiest to obtain (Fig. 8).

Fig. 8. Percentage of biomass in total final energy consumption. Year 2001 (World Resources Institute)

In developed countries, the waste of the wood industry constitutes over 50% of biomass employed in the production of energy: in the United States 10,000 megawatt of power derive from the combustion of forestry waste and a Minnesota city (St Paul) has a tele-heating plant which utilizes 250,000 tons of wood industry waste per annum in place of coal, with a drop in carbon dioxide emissions of 76,000 tons per year. In Europe, Finland and Sweden are the leading countries in the employment of wood industry waste, whereas France, Germany and Austria are the leading countries in the productions of energy by incineration of urban waste (Figs. 9-10).

Fig. 9 Energy production by biomass. EU-25 (KToe). Years 2005, 2006 (European Biomass Industry Association)
Since the combustion of biomasses does not produce Carbon dioxide emissions because CO$_2$ production during combustion is equivalent to that absorbed during the growth of the same biomasses\textsuperscript{31}, the European Union foresees – within 2010 – a substantial increment of this energy source according to a scenario that, at least hypothetically, excludes negative effects on food production, on the loss of biodiversity and on the use of soils and water resources (Fig. 11). In addition, the EU holds that an increased use of biomass could insure an increase in employment in rural areas (250,000-300,000 new jobs) beyond contributing to reduce energy imports (between 42 and 48 per cent less) and greenhouse gases (-209 million tons equivalent of CO$_2$/year). According to the estimates of the Commission, the increased power of biomass energy systems would cost 9 billion Euro/year, 6 of which absorbed by biofuels and 3 by solid biomasses.

Despite of the optimism expressed by the European Commission (shared by some important research centres\textsuperscript{33}), the use of edible vegetables for the production of biofuels could upset food markets as has happened for maize whose jump in price – certainly also induced by financial speculation – has caused an increase in the price of many products (from tortillas in Mexico to pasta in Italy). At present the demand for maize for foods and feeds grows annually at the rate of 1%, whereas the demand for bio-ethanol grows by 20%. About biofuels, some recent studies have shown how the conversion of forests and grazing areas into fields for the production of biofuels may generate from 17 to 420 times the annual emissions of CO$_2$ which it was believed could be spared by replacing fossil fuels\textsuperscript{34}. 
Furthermore, the use of biomass, although presenting decidedly positive externalities compared to fossil fuels, has a higher impact than solar and wind energies, because of emissions caused during cultivation, harvest, transport and combustion which, if in a lesser quantity, produce nitrogen oxides.

A study of Enea recommends the realization of biomass power plants «only in contexts of high production of forestry refuse, at distances of supply around 100 Km from the plant». Wherever such conditions do not exist Enea suggests that wood residue should be employed for the «production of local heat and steam for local use». In addition, still according the study by Enea «the forced production of biomass on a large scale (short rotation forestry) creates chiefly environmental problems which at the moment are still to be assessed» 35. In 2004, in Italy, biomasses provided around 32% of all energy produced with renewable sources (Fig. 12).

The report Comuni rinnovabili 2008 by Legambiente concerns 306 municipalities which have a biomass plant in their territory, for a total power of 770 MW. In addition, 267 municipalities possess tele-heating plants (for the production of heating and hot water) that serve 460,000 users, generating 5,000 GWh/year and heating more than 1,217 cubic metres of water 36.

About perspectives for development, according to the Ministry of the Environment, the availability of residual biomasses amount to around 66 million tons of dry matter, equal to 27 Mtoe: this means that «with an adequate programme of reforestation and management of forests we may achieve an availability of 2 Mtoe/year». In addition, still according to the Ministry of the Environment, «we might obtain new conventional woodlands by the reforestation of part of the over 2,000,000 hectares not destined to agriculture because not very productive, and deciduous forests may be planted along with grasses for energy production, reclaiming part of the 250 thousand hectares now left fallow» 37.

As for wind energy, energy produced by biomass is opposed by NIMBY protests: on 172 recent episodes, 50 (29%) have regarded waste to energy plants and 5 (2,9%) biomass plants. The diffidence towards this energy source is chiefly due to preoccupations concerning effects to health, because citizens do not comprehend the mathematical models that are used for assessing concentrations of pollutants, and believe that administrative controls are not adequate for preventing «the introduction of matters other than wood chips» 38.

Talking about Tuscany, in 2003 biomasses contributed to the production of electric energy for 0.13% against 0.02% of wind energy and 0.01% of solar photovoltaic. Biomass, whose annual availability is estimated in 2,500,000 tons, are employed in plants for the heating of greenhouses, for domestic heating and for recycling industrial waste. The Piano di indirizzo energetico regionale (PIER) assumed an installed capacity of 180 MW for a production capacity of 1,025 GWh 39. An objective that finds its basis in the fact that Tuscany is the Italian region with the greatest forestry extension and annually produces 295,912 m³ of wood for energy use (15% of the nation total) employed in low yield systems (ie, chiefly in stoves and fireplaces) 40.
Solar (photovoltaic systems)

Solar energy is—together with wind energy—the source with fewer externalities (cf. Fig. 7, p. 5). During their life cycle (25 years on average) solar panels do not present risks to the natural environment or to human health. Their only negative aspect may be the occupation of soil and the possible interference with urban landscapes (solar panels are installed on roofs, or on walls). The most relevant environmental impact occurs during the production of panels in which toxic substances are employed, such as silane, phosphine, diborane, hydrogen selenide and cadmium. Panels also represent a special waste, whose disposal envisages the separation and recovery of toxic metals contained in them.41

Till the end of the 1990s, solar energy was chiefly utilized for the production of hot water through thermo-accumulators. In China, in 2008 were in operation 124 million square metres of solar accumulators (with an output comparable to 54 coal plants) providig hot water even in villages without electricity supplies.42 In Europe, the principal users of solar panels were Austria (15% of Austrian homes were provided with solar panels for the heating of water) and Germany. Within 2020 it is estimated that about 1,080 million square metres of solar thermal collectors will be in operation: 500 in Europe, 300 in China, 200 in the United States and 80 in Japan.43

The sunlight is also used to produce electricity by means of the energy released by heated fluids at high temperatures (400 °C). The concentrating solar power technology has been developed mostly in California, where between the 1980s and 90s concentrated solar power plants have become operational for a capacity of more than 350 MW. In 2007 a 64MW concentrated solar power plant has been realized in Nevada, whereas in Spain and in Florida two more such plants have been studied and designed.44

However, the solar source who has known a real «boom» was the photovoltaic, or the conversion of sunlight into electricity through so-called «solar cells». The overall capacity of photovoltaic systems has increased from 1,200 MW in 2000 to 9,200 MW in 2007, with a percentage increase of 667%.45 In 2007, 85% of photovoltaic systems were installed in Europe, North America and the Pacific. In particular, 73% of the market was concentrated in Europe, where the photovoltaic sector was driven by investments in Germany and Spain (Figs. 13-15).

Fig. 13 Installed photovoltaic systems. Years 2007, 2030 (%)46
As can be seen from Figures 14 and 15, the European Photovoltaic Industry Association suggests two growth scenarios under which, in 2030, the photovoltaic market will be dominated by Asia, Africa and Central and South America, which together hold a share estimated at around 64%.

According to the EPIA, the developing countries will be able to become the reference market as regards the photovoltaic technology. In particular, China will assume the role of leading country with investments almost double those of Europe.

The European Photovoltaic Industry Association estimates that, in 2030, the installed capacity will reach 912 GW with a production of 1,291 TWh, equivalent to 6.73% of the total consumption of electricity (13.79% in the advanced scenario). The success of photovoltaic systems also would create a significant number of new jobs (between 3 and 9 million) and contribute significantly to the abatement of greenhouse gas emissions (Fig. 16).

These scenarios were envisaged assuming a continued reduction in the cost of energy that, in 2007, ranged between 0.44 and 0.22 euro per KWh. In 2030 produce a kWh should cost between 60 and 70 percent less than in 2007 (Fig. 17).
According to Lester Brown, for those who live in areas not connected to a power supply, «is often cheaper to install photovoltaic panels on the roof rather than building a centralized system and a network to reach potential consumers»:

For the inhabitants of the villages in the Andes, who have always used tallow candles for lighting, the monthly cost to install a solar panel system with 30 months installment is less than the monthly cost of the candles. Indian villagers who are not reached by the electricity grid and depend on kerosene lamps, face similar charges. Install a home solar system in India costs about $400. These systems feed two, three or four small appliances or lighting points and are widely used in homes and shops instead of kerosene lamps, polluting and increasingly expensive. In one year, a lamp burns about 75 liters of kerosene, which at 80 cents per liter means $60 a lamp. A system of solar cells, which replaces two lamps, pays for itself within four years. 
In China, the city of Rizhao in Shandong (about 3 million inhabitants) is one of the first examples of «solar city». At Rizhao, in fact, solar panels provide hot water to 99% of the families who live in the central districts and 30% of those living in the suburbs. In addition, 6,000 families use solar energy in the kitchen and 60,000 greenhouses are heated by means of photovoltaic systems. Overall, Rizhao has installed 500,000 square meters of solar collectors.49

In Spain, following the example of the municipality of Barcelona, over seventy cities have adopted building rules requiring compulsory installation of photovoltaic systems in completely renovated and new buildings.

In California, the city of Sacramento have distributed monetary incentives to residents who installed photovoltaic panels with the goal of achieving a share of electricity from renewable sources accounting for 23% of total consumption.

In Daegu, South Korea, the Center for Solar City Daegu has promoted, in collaboration with the local administration, the installation of photovoltaic systems in school buildings, on campus and in water treatment plants. Also, the cost of installing solar panels on house roofs was funded 80% by the local government in collaboration with the national one.

In Mexico City, the World Bank and some nonprofit organizations have launched a project to install 50,000 solar central heating systems.

Finally, in Cape Town in South Africa, the Clean Development Mechanism of the Kyoto Protocol has promoted a pilot project for distribution of solar systems for water heating to residents.50

A study sponsored by the International Energy Agency shows that the cost of installation of a photovoltaic system can be covered in an average time of between 1.6 (Perth) and 3.3 years (Edinburgh) for those installed on roofs and between 2.7 (Perth) and 4.7 years (Brussels) for those fitted on walls.51

With regard to the systems installed on roofs, the annual energy production can vary between 1,587 KWh/KW year of Perth and 754 in Edinburgh with a saving of CO_2 emissions between 40 tons/KW (Perth) and 0.1 tons/KW (Oslo). Instead, for the systems fitted on walls the annual energy production can fluctuate between 932 kWh/kW of Perth and 539 in Brussels with a saving of CO_2 emissions between 23.5 tons/KW (Perth) and 0 tons/KW (Oslo) (see Figs. 18-19).
Coming to Italy, despite of the high potential of its territory – the global horizontal irradiation is 1,552 kWh/m² in Rome and 1,251 kWh/m² in Milan (compare to the 1,045 in Amsterdam and 972 in Cologne) – it is apparent the delay as compared to the more developed countries of the European Union\textsuperscript{52}.

Fig. 20 Solar photovoltaic in some European countries.
EurObserver 2006 (power in Wp/inhabitant)\textsuperscript{53}
In 2004 – in Italy – solar thermal plants (460,000 m² of total area) contributed to the generation of heat by 0.60%, while the share of electricity produced by solar photovoltaic was equal to 0.06% of the total (the installed capacity was 30,815 kWp)\(^{55}\).

Solar systems were widespread mainly in Lombardy and Trentino-Alto Adige: the total area of solar thermal was a quarter of the European average, while the installed photovoltaic capacity was 6.5 times lower than the European average (Figs. 20-21)\(^{56}\). Water heaters were present in 390 municipalities and photovoltaic panels in 2,799 (of which 1,339 with a population of less than 5,000 inhabitants). There were 18 municipalities with an installed capacity of more than 100 kW per 1,000 inhabitants\(^{57}\).

As regards Tuscany, in 2004 there were installed 22,500 m² of solar water heaters, while the power of photovoltaic plants was 4 MW (6.1 MW in 2008 according to Legambiente).

About photovoltaic, the Piano di indirizzo energetico of the Regione Toscana expected to achieve, by 2012, of an output of 45 MW for a production capacity of 99 GWh, which corresponds to about 2% of the total production of electricity by renewables (The Regione Toscana envisioned a system based mainly on geothermal energy and biomass, whose share would be about 63%)\(^{58}\).

**Fig. 22. Renewable energies in Tuscany and Italy. Year 2008 (MW)**\(^{59}\)
Notes

9 ENEA, Libro Bianco per la valorizzazione delle fonti rinnovabili, Roma 1999, Section 1.3, Section 3.2.
14 A. Mercanti, R. Granatella, A. La Manna, Energia eolica… 22-26.
21 A. Mercanti, R. Granatella, A. La Manna, Energia eolica..., 105-106.
22 Tommaso La Mantia, Giuseppe Barbera, Rocco Lo Duca, Bruno Massa, Salvatore Pasta, Gli impatti degli impianti eolici sulla componente biotica e le misure di mitigazione, in Gianni Silvestrini, Mario Gambarelle, Eolico: paesaggio e ambiente, Franco Muzzio Editore, Roma 2004, 95-140. The article presents an extensive bibliography on the environmental impact of wind farms.
25 Regione Toscana, Piano di indirizzo...., p. 68.
28 Legambiente, Proposte per lo sviluppo del minieolico in Italia, Roma 2008.
31 P. Menna, L’energia pulita, 41.
Commission of the European Communities, *Comunication from the Commission: Biomass action plan*, 7 December 2005, 20. For 2003, the figure in red includes firewood that forestry and agricultural waste. For 2010 and 2030 have been reported data from the most prudent hypothesis.

For 2010 and 2030 have been reported data from the most prudent hypothesis.


M. Conti (ed.), *L’impatto ambientale..., 34-35.


Ibidem.

Ibidem.


Hours of full sunlight: Berlin 900; Paris 1,000; Madrid 1,400; Mumbai 1,400; Los Angeles 1,800.


For the quoted examples see Janet L. Sawin, Kristen Hughes, *Dare energia alle città, in Worldwatch Institute, State of the World 2007..., 228-235.


R. Bassoli, C. Messana, R. Vigotti, *Energia dal sole...

R. Bassoli, C. Messana, R. Vigotti, *Energia dal sole...


The 18 municipalities were: Prato allo Stelvio (353.9 KW/1000 inhabitants), Rio di Pusteria (271.4), Fiavè (255.3), San Bassano (242.7), Guarea (195), Crandola Valsassina (193.1), Assoro (187.5), Mestrino (177.7), Laces (172.1), Sant’Agostino (160.7), Ailoche (157.7), Romallo (146.8), Castelletto d’Erro (129.4), Bagnolo Piemonte (128.3), Campo Tures (126.7), Portico (115.9), San Benedetto (115.9), Roccastrada (108.7), Capriana (103.4). Cf. Legambiente, *Comuni rinnovabili 2008, 12-15, 16-19.


Chapter II

From environmentalism to nimbyism.
A case study: Tuscany 1986-2008

Introduction

Between 1946 and the second half of the 1960s, the environmental problems caused by economic development remained ignored in a general climate of laissez-faire since legislation was entirely inadequate to confront the new issues raised by such a rapid economic growth. The only measures available to protect urban environment and natural resources were the Act no. 2258 of 20 March 1865 (on public works), the Ministerial instructions of 20 June 1896 (local regulations on public health), the Consolidation Act on hydraulic works of 25 July 1904, the Ministerial Decree of 26 February 1927 (update of the list of unhealthy industries published in the Official Journal of 27 February 1912), articles 217 and 227 of the Consolidated Health Act (Royal Decree of 27 July 1934 no. 1265), Act no. 366 of 20 March 1941 (household waste) and article 650 of the Penal Code (breach of orders of the Authority).

Moreover, ecological issues enjoyed very little support among the Italian population which was excited at the prospect of abandoning a state of mere subsistence and the possibility of achieving consumption levels hitherto reserved only for the more affluent classes. Enthusiasm for industrialization was almost universal and any argument questioning economic development was strongly opposed. Therefore, despite a deteriorating urban environment, organized protests were only sporadic. Much more often, cases of deterioration of the environment were reported by citizen to the Provincial Health Officer, the sole authority who dealt with ongoing environmental issues, as the medical officer in charge of protecting public health. Objects of complaint were water and air pollution, and the difficult conditions of life in the new suburbs. As for water bodies, complaints came from angry residents due to bad smells emanating from rivers and streams (many streams, receiving direct sewage and industrial and household effluents, had become open sewers) and from sports associations of fishermen, alarmed by the continuing deterioration of fish fauna. There were also reports from health monitoring officers, who pointed out that river banks had become tips where waste of all kinds (often industrial waste) was dumped.

The presence of factories within densely populated neighbourhoods caused many protests from local residents. During inspections, requested by the Provincial Health Officer, it often happened that the police had to quell squabbles arising between citizens annoyed by fumes, and industrial workers resenting sanitary inspections for fear that these may leads to the closure of plants. Finally, numerous complaints concerned the living conditions of residents (often in cramped and unsanitary dwellings) of the newly built suburbs, which lacked basic sanitary infrastructure (waterworks, sewerage systems…), open spaces and places of socialization.

The discovery of environmental problems and development of environmental organizations (1973-1987)

In Italy, the mainsprings of environmental change were the rapid process of urbanization (the urban population rose from 54.1 per cent in 1950 to 66.8 per cent in 1985) and the disorderly economic development, which gave rise to serious pollution incidents and hydrogeological upheaval (suffices reminding the 1951 flood of Polesine and the flooding of Venice and Florence in 1966).

The first report on the state of the environment (Prima relazione sullo stato dell’ambiente), published in 1973, brought home the fact that 42 per cent of the population lived in «high epidemic-risk areas from air pollution» and emphasized the deterioration of inland waters.
quality, contaminated as it was by industrial effluents and from household sewage (sewage disposal plants served only 21 per cent of connections to sewers)\(^3\). A further problem concerned the lowering of the water table and the resulting phenomena of subsidence that plagued nearly all large metropolitan areas (involving 8.3 per cent of the country where 49.4 per cent of the population resided). A further emergency was represented by a steady increase in the production of household waste (7,844,521 tonnes/year in the four-year period 1976-1979) since a regular collection service and disposal was only available to 56 per cent of the population.

Concerning pollution there are at least four episodes worth remembering. Between 1956 and 1987, the Bormida Valley was the scene of a fierce clash between local communities and the chemical company Acna, which had a plant in Cengio for processing, among others, explosive derivatives such as benzol and naphthalene, carbolic acids, butyl phthalate and aniline. At the heart of the controversy was the pollution of the Bormida river basin: already in 1909, the magistrate of Mondovi had prohibited the pumping of water from wells in some communities of the valley and, in 1922, the Cortemilia aqueduct was closed. In 1969 drinking water supply to the town of Strevi was suspended and, in 1970, the municipal administration of Acqui Terme filed a complaint against unknown persons for the crime of negligent poisoning. However, only in 1987 it was definitely established that the river Bormida was contaminated by chemicals from industrial sources, and its basin was declared «area at high risk of environmental crisis».

In 1976, in Seveso, an accident at a chemical factory (the Icmesa, owned by Givaudan, Group Hoffman-La Roche) released a cloud of dioxin, which fell over an area 18 km\(^2\). The consequences were numerous cases of chloracne among children, a significant increase in abortions and a high pollution of the soil, so that in order to clear all that, the surface layer of the soil had to be removed. After Seveso, the European Community passed a directive (Seveso directive 96/82/EC) relating to the «control of major accident hazards related to dangerous substances».

In the late 1970s, early eutrophic phenomena began to manifest themselves on a stretch of the Adriatic Sea coast involving the Lagoon of Venice and the coast of Emilia-Romagna: eutrophication became evident in the period 1988-1989 when the waters were infested by mucilage (a floating agglomerations of organic matter of high molecular weight).

Finally, by the mid 1980s, the surface water table of the Po river basin was found to contain significant traces of atrazine (between 1984 and 1986 about 112,00 quintals of this substance were employed there)\(^3\).

In this context, environmental organizations began to deviate from their prevailing conservationist attitude extending their interests to matters such as criticism of the ongoing industrial development pattern, the energy and natural resources crisis, the damage caused by the pollution to the environment, and opposed the use of nuclear energy for the production of electricity.

The worsening of pollution phenomena, the fear of a nuclear catastrophe, environmental problems in urban areas where an increasing number of people lived in precarious conditions, and the growing exploitation of natural resources, persuaded an ever growing number of people to support environmental organizations\(^3\); in 1983, the four major associations (WWF, Lega per l’Ambiente, Lipu and Italia Nostra) combined 76,000 members\(^3\).

Moreover, in 1985, the first environmentalists stood as candidates for the local elections obtaining about 2 per cent of the votes nationally. In 1987, the Federation of the Green lists (Federazione delle liste verdi) participated in a general election winning 13 seats in the Chamber of Deputies\(^8\). In Tuscany, this nascent environmental awareness led to a series of mobilizations joined by environmental organizations and by some spontaneous committees of citizens. One of the most important protests concerned a plant for the production of titanium dioxide which Montedison (a major industrial group active mainly in the chemicals sector) had built near Scarlino, a small town on the Tyrrenian coast\(^7\). The population had welcomed the chemical plant which was to give work to about 400 people. However, industrial production was blocked at the start by local authorities and by the ministry of Merchant marine who regarded the discharge into the sea of tailings (approximately 3,000 tons/day of iron sulfate) as extremely harmful to the ecosystem. This situation fuelled a bitter conflict that gave rise to confrontation between the company and the workers in fear of losing their jobs on one side, and the local authorities supported by some environmental groups on the other.

Between 1972 and early 1974, Montedison continued to dump iron sulfate into the sea, thanks to provisional authorizations granted by the Harbour Office of Livorno. In 1973 the situation became very tense: there was an attack on the cargos used by Montedison to dump iron sulfate in the high seas, and violent riots broke out even in Corsica when dumped copperas reached the coasts of France. Moreover, the Regional Council of Tuscany\(^8\) came to deal with this issue, urged by some Christian Democrat councillors, concerned about the «economic collapse» of the area of Scarlino in case Montedison decided to close the plant\(^7\). The problem
ended in April 1974 when the District Court of Livorno condemned the leaders of the Scarlino chemical plant for causing an ecological disaster in the Tyrrhenian Sea.

A second mobilization of an environmental character was the one aimed at the incinerator opened in 1973 in San Donnino near Florence: the area of Florence was one of the first urban districts to decide to incinerate its own waste. The plant emitted dark ashes which immediately worried local residents: the protest grew out of proportion in 1976, after the notorious incident concerning the toxic cloud of dioxin in Seveso. During 1982, following the results of a number of tests which detected traces of dioxin in the ash produced by the plant, a broad popular mobilization took place, which in November 1984 culminated in the occupation of the Provincial Administration offices. Popular protests led to the closure of the plant in 1986. Halting the incinerator (which dealt with 44 per cent of municipal waste produced in Florence) made it de facto impossible any disposal within the province of Florence thus forcing the municipality-owned company to transport urban waste wherever in Italy there was a disposal system willing to accept them.

Other environmental protests concerned the hypothesis of building a nuclear energy plant in the Brasimone valley (an area in the Apennines between Tuscany and Emilia-Romagna, where a reservoir existed), the construction of a dam in the Maremma, and a serious pollution of the Arno caused by dumping of industrial waste from tanneries in the district of Santa Croce sull’Arno, between Florence and Pisa.

Fig 1. The incinerator in San Donnino

From the emergence of environmental groups to NIMBYism (1988-2008)

As for the environmental movement, the last three decades have been characterized by two phenomena: the gradual institutionalization of environmental organizations and the emergence of several protest movements at a local level, which have gradually assumed an increasingly particularistic and local-policy character.

Between the late 1980s and late 1990s of the last century, the members of environmental associations increased significantly: the WWF went from 30,000 members in 1983 to 281,000 in 1999 (+837%); Legambiente from 15,000 in 1983 to 115,000 in 1999 (+667%), Friends of the Earth-Italy from 9,204 in 1988 to 25,680 in 1997 (+179%).

According to a vast literature, the expansion of the environmental movement has coincided, and not only in Italy, with the emergence of «formal, professional and basically centralized» environmental organizations or, in other words, of organizations operated by large bureaucracies with high professional levels. This has resulted in a transformation of the nature of environmental associations: the relationship between ordinary members and the elites has become weaker, and a growing proportion of annual budgets has been destined to marketing activities aimed at convincing members to confirm their membership from year to year. The mass character of the organizations and their relationships with the institutions have tended to emphasize their willingness to compromise and have pushed environmental groups to taking
increasingly more moderate stands. The moderation of the major environmental organizations has become a prerequisite for continuing the reaping of financial institutions and not diverting the majority of members, reluctant to support not only those classified as radical forms of protest (non-violent actions such as hunger strikes), but also those having a demonstrative effect (marches, mass meetings...)

The gradual institutionalization of environmental organizations – their having become non-governmental organizations with a very similar structure to that of traditional political parties – has caused a growing number of people to drift away from organizations that make the environmental movement too formalized and seek alternative forms of protest.

These alternative forms of protest, usually carried out by citizens’ associations have been interpreted as basic experiences of participation, similar to the current of Environmental Justice, or regarded as conservative attitudes – generally qualified by the acronyms LULU (Locally Unwanted Land Uses, neutral in terms of evaluation) and NIMBY (Not in My Back Yard, which is characterized in the negative sense) – suggested by individualistic and selfish reasons.

Acronyms such as LULU and NIMBY usually indicate popular protests against the construction of environmental infrastructure of public interest such as motorways, high speed railways, power plants, dumps, waste-to-energy plants, regasification terminals...

Citizens’ committees – usually backed by radical environmental groups, but viewed with suspicion and distrust by moderate organizations that regard them as mere expressions of local self-interest – have begun to spread from the second half of the 1960s reaching their peak between the 1990s of the twentieth century and the beginning of the twenty-first. Often we refer to these basic movements with the term NIMBY syndrome, since their dissent did not deny the social utility of the plants in dispute, but calls for them to be built elsewhere (hence the definition of Not In My Back Yard). Furthermore – increasingly more often – protests involve structures unanimously deemed essential to sustainable development, such as purification plants, wind farms, photovoltaic power plants, waste plants. Among the best known cases are the construction of two wind farms in Nantucket Sound (Massachusetts) and in St. Lucie County (Florida).

In recent years, phenomena of local opposition to the construction of infrastructure have involved several European countries and they have assumed significant proportions especially in Italy where, according to the Nimby Forum Centre, they are focused on (in order of frequency) the waste-to-energy plants, thermoelectric power plants, transport infrastructure, dumps, waste processing plants, biomass power plants and regasification terminals. In Italy, the main reasons for this explosion of nimbyism (172 recent episodes, 53 per cent concentrated in Lombardy, Veneto, Emilia Romagna and Tuscany) are attributed to the fear of harmful consequences for health and the environment, to concern for the unequal distribution between costs and benefits (the first would be borne primarily by local communities), to inadequate involvement of citizens in decision-making (in France there is an independent commissioner, while in the U.S. public inquiries are used) and to distrust in political parties and the representative system.

According to Alessandro Beulcke (director of the Nimby Forum), nimbyism has become a typically Italian phenomenon because, in an atmosphere of permanent electoral campaign, which has characterized Italy in the early part of twenty-first century, political parties organise NIMBY protests of their own to gain consensus. Conflicts are no longer restricted to a confrontation between groups of citizens and promoters of public works, but are rather focused on local majorities and oppositions, or local authorities and central government thus ending up with fuelling protracted disputes such as is the case of the Turin-Lyon high-speed railway line.

Coming to Tuscany, between the mid 1990s of the last century and the early part of this century, environmental protests have been marked by the birth of numerous citizens’ associations directing their actions against the construction of 8 waste-to-energy plants, 4 waste processing plants, 3 facilities for the production of energy, 3 transport infrastructure and 2 wind farms.

Here we restrict ourselves to investigating three of the twenty protests mentioned above. The first case concerns the construction of the new high speed railway system which, in Tuscany, provides (among other works) a new Bologna to Florence railway line for an extent of 78.5 km of which 73.8 km underground. As soon as the Italian Railways have made public the High Speed Project (1992), in all areas of Tuscany involved (Mugello, the valley of Terzolle and the city of Florence), citizens’ associations opposed the construction of the new railway infrastructure for the following reasons: the high cost of infrastructure, the possible cuts of funds hitherto devoted to commuter trains, the disfigurement of the landscape, a likely damage to the hydrogeological system and threats to the flora and fauna of the areas concerned.

The protest has grown in 3 phases. In the first (1992-1996), the committees have directed their activities against the construction of the entire railway line supported by environmental
organizations and local authorities. Since 1995, however, local elections have led to an alliance between local bodies and the Region in favor of the new high-speed line\(^\text{24}\); in addition, relations between the citizens’ association and environmental organizations have begun to deteriorate since the committees have accused environmental groups of acting too independently. In the second phase (1997-2000), protests were fuelled by actual damage caused by construction sites (especially during the excavation of the Vaglia and Firenzuela tunnels) to the hydrogeological system of the Mugello (drying up and depletion of 81 water courses, 37 springs, 30 wells and 5 waterworks). While the committees have continued in their opposition to the whole project, environmental groups – involved by the regions and local authorities in decision-making – have centred their action on the request for intervention to minimize the impact on the environment. In the third phase, the protests have shifted from the Mugello to Florence, where several citizens’ associations came together to oppose the completion of the terminal stretch of the Bologna-Florence railway line consisting of an urban tunnel and a new station reserved for high speed trains\(^\text{25}\).

![Fig. 2 A protest against the high speed railway in Florence](image)

The second case concerns the construction of two waste-to-energy plants: the first situated in the immediate vicinity of Florence (at Case Passerini in the municipality of Sesto Fiorentino), the second at Testi, in the municipality of Greve in Chianti\(^\text{26}\). The citizens’ association opposed to the two systems were formed in 2000, immediately after approval of the Provincial plan for waste management: many of the members had already attended, 15 years ago, the protests against the incinerator of San Donnino. Their position – supported by WWF, which has posed a staunch opposition to the incineration of waste also at a national level\(^\text{27}\) – has always been unabashedly opposed to the two waste-to-energy plants.

In the case of the first plant (Florence), the committees held a consultative referendum, but failed to involve the local population significantly: only 30 per cent of the electorate turned up at the polls (84 per cent of voters were against the plant). In this context, the involvement of residents and local associations was restricted to cases of maximum conflict, since the decision-making process developed almost exclusively at the institutional/political level: four institutions were in favour of the project (the Tuscany Region, the Province of Florence, the Municipalities of Sesto Fiorentino and of Florence), two were opposed (the Municipalities of Campi Bisenzio and Greve in Chianti).

As for the two opposing municipalities, the town of Campi Bisenzio opposed the plant for electoral reasons (many participants to the committees lived and voted in its territory); the town of Greve in Chianti decided to object in order to obtain permission to incinerate waste not in the new waste-to-energy plant, but in a cement factory which was going into liquidation (the main reason was to safeguard jobs). At the time of writing, the institutions involved in the decision confirmed the construction of the plant in Florence (works have not yet started) and the technological retrofitting of the cement factory of Greve in Chianti.

Finally, the third case concerns the construction of wind farms.
In the early part of twenty-first century, protests have concerned a small plant located in Secchieta in the municipality of Montemignaio, Arezzo (three 0.6 MW aerogenerators) and the site of Poggi Alti in an area adjacent the town of Scansano in the province of Grosseto (10 aerogenerators for a power of 20 MW). Opposition to wind farms conducted by citizens’ associations led by the wine growers of the area (where one of the most famous wines of Tuscany, Morellino, is produced) and Italia Nostra, whereas Legambiente, WWF and Greenpeace have expressed a substantially favourable opinion. The press too had joined the committee of citizens and an important writer for the daily newspaper «la Repubblica» (the main newspaper close to the center-left political coalition) called the story «a lunatic Don Quixote script, with the monstrous windmills assault to the castle of Dulcinea» (i.e. Montepò castle, owned by the family of winemaker Biondi-Santi, located near the wind farm)\textsuperscript{28}. Protests against the two wind farms have been fuelled by concerns about the occupation of the territory, the alteration of prevailing winds, noise generation, the emanation of electromagnetic waves, the visual impact of windmills on the landscape, and interference with avifauna. Such concerns about the environmental impact of wind farms have transformed wind energy from an indispensable resource for reducing greenhouse gases emissions to an environmental problem. As regards Tuscany, this is explicitly argued by the Plan for Regional Energy Policy (PIER) where it declares that «wind farms have been affected by a climate of prejudice and hostility which has turned against the big wind turbines, and in particular a concern about an excessive impact on the landscape». The widespread dissent towards the installation of windmills is not an insignificant problem, considering that the Regione Toscana regards wind power as a strategic resource envisaging a capacity of 330 MW for 2012\textsuperscript{29}.
Conclusion

The study of the Tuscan case is therefore useful since it helps to understand the evolution of the environmental movement in Italy and the proliferation of local opposition to unwanted public works which increasingly include works regarded as necessary to make the development of a territory sustainable: just think of wind farms.

The study of the Tuscan case illustrates that the reasons for the birth of citizens’ associations opposed to infrastructure of public interest are many and complex.

One such reason rests that, generally speaking, the population is not involved in decision-making which at a political institutional level is entirely managed by the central government first and then by the regions together with local authorities. The lack of involvement of the citizens in decision-making negatively affects the perception of the risk associated with a new plant: very often, protests are fuelled by ignorance deriving from a lack of transparency and a lack of adequate information campaigns from the institutions.

A further cause for discontent rests in the unequal distribution of costs and benefits: very often people are opposed to a facility or a plant since they regard the possible benefits considerably inferior to the drawbacks (environmental impacts, health risks, reduced quality of life...).

Lastly, another reason for the proliferation of citizens’ associations is that they are perceived by the population as meeting places where grassroots democracy finds its expression, while environmental organizations (just like the Italian Green Party) are regarded as too bureaucratic, excessively prone to compromise and not quite locally based. In short, citizens’ associations seem to be the product of the ever-widening rift which has developed between environmental organizations (increasingly formal and similar to a political party in their organizational structures) and a new model of environmentalism, very attentive to bottom-up participation and to issues of social justice. Analysing the case of Tuscany, we can say that citizens’ associations seem to be very articulate and complex structures since they possess various souls, distinct among them, and sometimes potentially conflicting.

For this reason, it is impossible to equate all committees by indiscriminately tagging them as NIMBY. Some of them are undoubtedly motivated by NIMBY reasons (such as the committees opposed to the two wind farms). Others are moved both by NIMBY reasons, and by more general reasons such as the proposal of an alternative model (Mechanical Biological Treatment) for the disposal of waste (this is the case of the protests against the waste-to-energy plant in Florence).

Still others are the bearers of positions aspiring to propose an alternative model of development (such as in the case of some of the committees which have opposed the Bologna-Florence railway line because strongly opposed to this type of rail infrastructure, regardless of where they are constructed30).

Notes

1 Pro-natura was created in 1959 and in 1970 it assumed the name of Federazione nazionale Pro natura; Italia nostra – an association for the conservation of historical, artistic and natural heritage – was founded in 1955; the Italian office of the WWF was instituted in 1966.


3 Atrazine is an herbicide widely used in agriculture, and it can persist in soil for 10-17 months.

4 In the 1980s, the following environmental organizations were active: Federazione Nazionale Pro Natura; Italia Nostra; WWF; Lega per l’ambiente (founded in 1980 upon an initiative by the Associazione ricreativa culturale italiana/Italian Recreational and Cultural Association, close to the Italian Communist Party); Lega italiana protezione uccelli/LIPU (founded in 1965, which was - and still is – the chief Italian association for the protection of birds), Amici della Terra (Italian branch of Friends of the Earth, founded in 1977 by some representatives of the Radical Party with a specific aim to contrast the building of nuclear power plant in Italy); Lega per l’abolizione della caccia/LAC (founded in 1977, to promote the abolition of hunting, in defence of the fauna and for the conservation and restoration of the environment); Lega anti vivisezione/LAV (founded in 1977, it fights against vivisection and for animals rights); Archipelago verde (a coalition of groups of ecologists, non-violent and antinuclearist, instituted in 1981); Kronos 1991 (active between 1967 and 1995, it organised a series of campaigns specifically aimed at reforestation, the protection of small birds, the recycling of urban waste and alternative energy sources). Cf. Archipelago verde. La prima guida completa per chi ama la natura, Mondadori, Milano 1983, 23-65.

5 The 76,000 members were thus divided: 30,000 WWF; 17,000 LIPU; 15,000 Lega per l’ambiente; 14,000 Italia Nostra.

In recent years local protests against plants and infrastructure of various kinds has spread even as far as India, China and Latin America where entire communities have been induced to leave their place of inquadrare i conflitti ambientali. In D. Della Porta, M. Diani, Movimenti senza protesta?, 87-94. See also Christopher Rootes (ed.), Environmental Movements: Local, National and Global, Frank Cass, London 1999; Christopher Rootes, The Transformation of Environmental Activism: Activists, Organizations and Policy-Making, «Innovation: The European Journal of Social Sciences», 12, 1999, 153-173; Mark Dowie, Losing Ground: American Environmentalism at the End of the Twentieth Century, MIT Press, Cambridge Mass. 1995.


The Regione is a self-governing body through which the Constitution enforces the decentralization of political power in Italy. The organs of the Regional Government are: the Regional Council (legislative body), the Administrative Board (executive body) and the President of the Administrative Board (directly elected by the citizens).


The Florentine area includes the municipalities of Bagno a Ripoli, Calenzano, Campi Bisenzio, Fiesole, Firenze, Impruneta, Lastra a Signa, Scandicci, Sesto Fiorentino and Signa.


The Maremma is a vast area in Italy bordering the Tyrrhenian Sea, consisting of part of south-western Tuscany and part of northern Lazio.

Donatella della Porta, Mario Diani, Movimenti senza protesta? L'ambientalismo in Italia, il Mulino, Bologna 2004, 81-83. The authors also provide data relative to the Lega anti vivisezione/LAV (Anti-Vivisection League: 13,500 members in 1997) and to Greenpeace-Italia (40,000 members by the end of the 1990s).


At present the most important environmental organizations are: Legambiente, WWF, Greenpeace, Amici della Terra, Lega protezione uccelli-LIPU, Federazione nazionale Pro Natura, Italia Nostra, Fondo
Naples-Salerno north-south corridor. The project is being described thus by the Italian Railway (brochure *Alta velocità/High Speed*, October 2009): «The High Speed/High Capacity system is the biggest engineering work in all respects in post-war Italy. The new high speed lines are a triumph over adversity, on account of the elevation and particular hydro-geological features of the land, and the densely populated urban areas crossed, in which more than 65% of the population live and work. The new lines are also of extremely low impact on the environment».

The Mugello is an internal basin within Tuscany (570 km²), corresponding to the higher section of the Sieve river basin (a tributary of the Arno). The Valley of Terzolle corresponds to the basin of the torrent by the same name, a small stream with its springs at a few dozen km from the city Florence.

The station is thus described by the Italian Railways (brochure *Alta velocità/High Speed*, October 2009): «The new Florence Belfiore station will rise in the area where the old 19th century stockyards once stood. The project will be characterized by a vertical distribution: the inside space is open along the entire height, allowing trains to be seen even from the surface. It will be the main urban and regional interchange node, connected to the Santa Maria Novella station and to the historical downtown area of Florence by a new tram line and surface metro trains».

Legambiente (along with WWF, the most important environmental organization in Florence and, more generally, in Tuscany) has taken stand which all in all is in favour declaring that a waste-to-energy plant is less polluting than a dump.

Chapter III

Environmental impact of urbanization and industrialization in the Greater Florence Area (1945-2001)

The character of the Florence-Prato conurbation has been prompted by two series of reasons.

The first concerns its environmental character: the area consists of hills and plains and it is characterized by an important water system centred upon the river Arno (which crosses its entire territory) and upon seasonal but relevant tributaries. Thanks to its peculiarities, during the second half of the 20th century this portion of territory has preserved, notwithstanding a high rate of population increase, a significant degree of biodiversity which spans from deciduous woodlands to wetlands.

The second concerns the nature of development occurred in the Florence-Prato plain, which has changed from a district of fields, villages and small to medium size towns to a conurbation with a strong industrial vocation placed within a highly urbanized rural context. The area is highly suitable as the subject of a work aimed at examining the processes by which urbanization and industrialization have profoundly altered the use of resources thus giving rise to an environmental question.

Economic development and the environmental crisis (1946-1971)

The urbanization process

The principal driving force of the environmental change must be seen in the tumultuous process of urbanization caused by massive immigration both from the surrounding country and from the southern regions to the municipalities characterized by significant incipient industrial activities.

Under the pressure of an unprecedented migratory movement, the reconstruction of Florence and of the other urban centres in the area was guided by a lobby agreement which brought together the interests of builders, professionals of the building industry, landowners, private speculators and investment banks. Since 1946 the building industry was placed at the centre of the local economic set up: the principal political and economic actors regarded urban development in the plain west of Florence – in the direction of the municipalities of Sesto Fiorentino and Prato – the main opportunity for growth for the entire economy of Florence.

Urban growth was thus characterized by an overstatement of any forecast concerning settlement expansion, by the lack of public services, by the conversion of environmentally privileged areas to high quality private building development rather than to public green, and by a system of transport infrastructures favouring roads (planned without a clear notion of functional priorities) to the detriment of collective forms of transport. The future of urban structure of Florence was fatally established beginning from 1958 when a plan was approved allowing intensive urban development in the plain (with a density from 7 m$^3$/m$^2$ up to 20 m$^3$/m$^2$). The plan allowed development in the hills leaving, at the same time, the historical centre without adequate conservation measures.

The municipal administration tried to mend the disarray by passing a measure known as the Detti Plan of 1962 – the urban plan promoted by Edoardo Detti, university professor of architecture and councillor for urban development – which established as a priority the conservation on the historical centre, reduced the density of buildings, allowed more space for urban facilities and green areas and redirected urban expansion in a northwesterly direction. Following the crisis which in 1964 led to the dissolution of the centre-left Town Council, the Detti Plan was shelved without any opposition from the public opinion of Florence: the numerous amendments to the plan, passed during the 60s and 70s, favoured – despite a modest rate of population growth – a very high rate of building expansion which almost doubled the extent of the city.

A lack of public green contributed to aggravate the problem: in 1972 population density allowed 3.62 m$^2$ of space per inhabitant, a very small rate and also unevenly distributed. This situation was mirrored by the other municipalities of the province with a strong industrial vocation: Prato, Campi Bisenzio, Scandicci, Sesto Fiorentino, Calenzano, Lastra a Signa and Signa which expanded geometrically, thus generating a single conurbation where industrial
settlements were mixed up with residential areas, the latter mostly inhabited by the workers employed by manufacturing industries.

During the mid Sixties, the only commune provided with a development plan was Impruneta. Furthermore, although since 1951 authorization to elaborate a comprehensive joint development plan (PIF) had been requested to all municipalities, any attempt to put such planning under way was made ineffective by continual quarreling among the local governments of the hinterland – they were only interested in privileging new industrial plants and workers housing on their own territory – and of Florence Town Council which regarded instead as a priority the development of tertiary activities and of residential housing. To be fair, there was a political reason behind this: from 1951 to 1957 the municipality of Florence had been the only one to be administered by centre and centre-left councils led by Christian Democrat Party (Democrazia Cristiana).

Notwithstanding hydrogeological and forestry obligations, urban development caused major negative consequences for the entire Arno basin (seriously affected, as it was, by the spread of industrial and residential housing) and for the hills. The most blatant cases concerned the Monte Morello area, which was deeply scarred by quarrying, as well as an alluvial plain measuring 270 hectares (an area called «i Renai») lying between the Arno and the Bisenzio, north west of Florence. Until the 1950s this area had been rendered highly fertile by the silt deposited by the regular floods of the Bisenzio and was intensely cultivated. In the course of the 1960s and 70s a portion of 210 hectares, rich in gravel of high quality under its soil, was subject to unchecked quarrying which caused a high degree of environmental damage. Quarrying – halted in 1978 by an order from the Mayor of Signa – had caused vast depressions which originated numerous ponds (today these have turned into valuable wetland populated by herons and wading birds).

Fig. 1 The Isolotto area – in front of the historical park of the Cascine, created by Cosimo I de’ Medici – before the urban development, 1935.
The industrialization process

The Florence-Prato area began to acquire the aspect of an important industrial district – with settlement characteristics not unlike those of industrial areas of northern Italy – at the end of the 19th century.

In 1892 an enquiry carried out by the ministry of Agriculture, industry and commerce, recorded 557 factories in the Florentine district, employing 13,194 workers. Industrial plants were chiefly located in the municipal territory of Florence (which hosted 49.55% of all factories and 72.92% of all the industrial workforce), Fiesole and Sesto Fiorentino.

About twenty years later, the industrial census of 1911 listed 3,839 factories employing 36,110 workers: the chief sectors belonged to the processing of agricultural products (1,715 factories), textiles (722) and metalwork (692). In 1927, the sole manufacturing sector boasted 8,112 factories and 44,758 employees. Florentine manufacturers operated chiefly in the clothing industry (3,016), mechanical (1,427), food (665), processing of non-metallic metals (438), textiles (239) and leather (175).

The quoted data show how industrialization in the area had acquired, by the first decade of the 1900s, a well defined shape characterized by a manufacturing vocation and small size plants (in 1927 the average was 6 employees). As regards the Prato area, in 1888, the German combination Kossler and Mayer set up in Prato the so called Fabbricone (big factory), a vast textiles plant which with its 1,000 workers gave a decisive boost to the vocation already existing in the area. In 1927 the textiles sector employed 12,500 workers, 1,500 of which in the Fabbricone and over 1,000 at Forti (the largest firm based on local capitals).

After the Second World War, the entire area was subject to an intense process of industrialization causing an extraordinary growth throughout the municipalities of the Florentine belt (meanwhile the municipal territory of Florence itself shifted to service industry) and the consolidation of small enterprises (the mean rate was of 6.9 employees per local unit in 1951, of 8.3 in 1961 and 7.0 in 1971).

In the Prato district, war damages suffered by major plants favoured a fragmentation of industrial activity: damaged looms were bought up by former workers who after repairing them started their own small businesses.

Chronologically this process may be divided into two phases. Between 1951 and 1961, new plants tended to grow up along the Florence to Prato route, and particularly in the municipal areas of Sesto Fiorentino and Calenzano. During this decade the number of employees rose from 58,815 to 90,235, of which 73,678 (81.65%) employed in manufacturing plants. The number of workers in the Prato textile industry rose from 21,160 to 35,735.

Between 1961 and 1971, the lack of a plan for urban development led industrial expansion to spread haphazardly over the entire territory, and particularly along a second line joining Peretola-Osmannoro-Campi Bisenzio and along a third southern line connecting Scandicci-Signa-Lastra a Signa. Furthermore, in 1964, the demands put forward by the textile industry for its development induced the municipal administration of Prato to the approval of a plan which allowed industry to spread right up to the limits of the alluvial plain (this is the area between the rivers Bisenzio and Arno) as to occupy the entire territory where water was obtainable through the capture of groundwater. In this way the entire area became one single manufacturing district, characterized by the widespread presence of small to medium factories on the territory.
In the course of this second phase the workforce rose from 90,235 to 101,539: manufacturing industry went on increasing its weight (84.64%), whereas industries connected with agriculture and quarrying were shrinking.
Conversely, the building industry progressively increased its magnitude: between 1951 and 1981 the number of dwellings in the province of Florence rose from 210,980 to 410,299 (+98.26%) and the number of rooms from 971,849 to 1,873,536 (+92.78%).

![Fig. 3 A rubber factory surrounded by dwellings, 1958](image)

![Fig. 4 A chimney of a dyeworks just opposite to a terrace of a house, 1969](image)

**Environmental emergencies**

The environmental impacts of urbanization and industrialization processes have been so considerable as to speak of a true ecological crisis from the second half of the 1950s onwards.

The most pressing emergency concerned the water cycle. Around the mid 1950s, health inspectors began issuing alarming reports on the state of the tributaries of the Arno requested by the Province’s Health Official. In particular, the alarm concerned the discharges of textile industry plants as well as domestic effluents which in the absence of adequate sewerage infrastructure they were spilled directly into water bodies. The situation appeared difficult to tackle right from the outset, since industrial plants and craftsmen’s laboratories were scattered over a vast area, often inside residential areas. This made the organization of an efficient sewerage system very difficult (the sewers of Florence were still those built between the 1860s and 1870s) and yet more difficult was to find a site where to set up a purification plant: Florence did not possess adequate council property where to build such plant. Besides, entrepreneurs – although aware of the need to treat waste water– were not prepared to bear the cost of purification.
Citizens and the environmental crisis

Between 1946 and the early 1970s, ecological issues enjoyed limited consensus among the people, attracted as they were by the idea of coming out of a condition of mere survival and by the possibility of reaching levels of consumption hitherto enjoyed only by the most affluent. Consensus towards a swift shift to industrialization was almost total, and any position which may be raised questioning economic development was strongly opposed.

For this reason, notwithstanding the incipient deterioration of the urban environment, no organized opposition emerged. There were only reports to the Provincial Health Office (the only full-time authority in charge of monitoring the environment, under the National Health Service) regarding blatant episodes of pollution, made by individuals or small groups of citizens annoyed by the fumes or by the effluents issued by industrial plants situated next to their homes. The
objects of these complaints were episodes of water and air pollution and also the difficult life conditions in the new suburbs. As far as for the water bodies, complaints came from citizens exasperated by the smells issuing from numerous small streams crossing the Florence-Prato area (many of these, directly receiving domestic sewerage and industrial waste water, had become true open sewers) and from sport fishing associations alarmed by the shrinking fish population. There were also reports from health inspectors who highlighted the fact that river banks had become dumps where any kind of waste (often including industrial waste) was abandoned.

The presence of factories within densely populated urban districts fuelled numerous protests from those who lived in the vicinity. In the course of inspections requested by Provincial Health Officer, it often happened that the municipal police had to intervene to sedate quarrels between citizens annoyed by industrial fumes and workers who did not welcome health inspections in fear of a possible closure (however temporary) of their workplace.

Finally, numerous complaints concerned the living conditions of residents in unhealthy and cramped dwellings located in new suburbs, lacking even the most basic sanitations, public green and places of socialization.

By the beginning of the 1970s an environmental emergency continued to manifest itself mainly in water supply crisis: the most apparent problem was surface water pollution, highlighted by a whitish froth floating on the Arno, and by the extravagant colours acquired by the water in the streams where the textile plants discharged their effluents. In an attempt to halt such pollution, the Town Council of Florence passed an ordinance banning the use of non biodegradable detergents to be enforced from the 20th of January 1971. The measure – as Mayor Luciano Bausi explained at a meeting called to illustrate the initiative – had become necessary in an attempt to halt water contamination with anionic surfactant chemicals whose level had reached figures much higher then those set by the World Health Organization (500 gamma/litre): in December 1970, tests carried out by the District Hygiene and Prophylaxis Office had shown values ranging between 1,900 and 3,800 gamma/litre. Although its significance was little more than symbolic – since it ignored the waste water dumped into the Arno by factories and containing chemicals (chromium, cyanides) even more toxic than detergents – the Florentine measure prompted a debate which acquired a national dimension since it caused the passing of a bill concerning the «biodergradability of synthetic detergents», presented by the Health Minister, Mr. Mariotti.

In 1972 the Regional Council passed a resolution in which it invited the communes to unify quality standards for «domestic and industrial liquid effluents» along with those suggested by the Regione Toscana.
Two years later the first Water Pollution Map was published and a regional law (27th May 1974, N. 22) was passed which provided funds for a programme of «works for the search and utilization of water resources and for the disposal and purification of waste water». There were measures essentially aimed at solving the shortage of drinkable water – regarded as a priority since the Florence’s aqueduct was fed mostly by the Arno – which could not cope with the crisis of the entire Florentine water system, afflicted as it was by two more problems now turned endemic: a scarcity of water resources and a serious hydrogeological upheaval, revealed in all its gravity by the flood of November 1966. Notwithstanding the flood, during the first half of the 1970s, the political debate still languished around the proposals put forward by the Interministerial commission for the study of water and soil management (Commissione interministeriale per lo studio della sistemazione idraulica e della difesa del suolo), jointly instituted in 1967 by the ministries of Public Works and Agriculture. In order to protect Florence from new disastrous floods, the Commission had proposed a system of 23 reservoirs whose role would be to cut the flood wave before it reached the city centre. In 1970 this project was heavily criticised during a meeting called A plan for the Arno because, according to its critics, it confronted the problem of defense against floods in «a most traditional and narrow-minded manner, in the way of a true war to water» without contemplating an assessment of future needs for drinking, irrigation and industrial water requirements, or a balanced distribution of available resources

The situation came to an impasse difficult to overcome. First of for a latent conflict between the regional administration – which, since its creation, appeared prepared to face the environmental question – and the communes, much more lukewarm towards ecological problems. The administrations of the industrialized communes of the area were staunchly opposed to any measure aimed at restricting the expansion of residential and industrial estates: the haphazard urban and industrial development was tolerated since administrations believed it would alleviate social tensions generated by unemployment and lack of housing.

In the second instance, pressures exercised by industrialists who – notwithstanding their apparent support in principle for projects aimed at controlling the Arno basin – showed firm opposition to any revision of urban planning and were scarcely inclined to foot the bill for environmental cleaning up programmes

Finally, a Scheme for a pilot project for the control of the Arno basin (Schema di progetto pilota per la sistemazione del bacino dell’Arno) was passed: the document envisaged protection of the city of Florence from floods and the monitoring of the Arno river according to a «coordinated programme for the use of water and the control of its quality»

Five years later, in 1978, the final text for the Pilot Project was presented and this envisaged the «building reservoirs for mixed use (to regulate and contain floods) or for the sole purpose of regulating the water flow», the «realization of defences against floods» and the construction of treatment plans aimed at reducing by 90% the pollution caused by waste water.

The document highlighted the chronic lack of drinking water resources and stated that the building of new waterworks was «a matter of utmost urgency» and «prejudicial to any development programme». As to industrial uses of water, it established two priorities: insuring supply for factories – those of the Prato textile industry in particular – and making the process of industrialization compatible with available water resources

Notwithstanding such disconcerting picture, actions – even those regarded as priorities – remained at the stage of projects: among these were a basin for the prevention of floods, two more reservoirs destined to feed the waterworks, an outlet canal for the Arno, four purification plants for the Florence-Prato area.

In 1980, in observance of measures established by laws N. 319/1976 and N. 650/1979, the Regione Toscana approved the first biennial programme (1980-1982) of the Regional Plan for the Purification of Waters (Piano regionale di risanamento delle acque). This document too was little more than a declaration of intent which reiterated intervention lines already included in the Pilot Project. Concerning the Florence-Prato area, the document spoke of «intervention schemes at a considerable level of definition and depth» listing a series of actions all in the early stage of hypothesis

In conclusion, twelve years of discussions had produced a significant amount of documents which never came to fruition in so far as the water system was concerned.

The realization that a serious environmental question existed, only led to the approval of a number of sectoral policies aimed at insuring the availability of resources in order not to hamper economic development and to alleviate the negative effects produced by the more urgent problems (water and air quality, chaotic urban development).

As far as to air quality, the main initiative undertaken by local authorities to reduce air pollution was the setting up of a consortium for the distribution of methane gas, whose objective was to encourage the shift from oil to gas for central heating systems. By the end of the 1970s, the area south of Florence still did not have methane gas supply and methane gas pipelines did not reach any of the other communes.

Lastly, choices in matters of public and residential housing, remained based upon a policy of
alterations to the town plan with no strategy. The result was the failure of a concerted strategy involving all communes – comprehensive florentine urban area plans of 1973 and 1978 were nullified by the attitude of local authorities who continued to ignore the guidelines contained in the territorial documents – and the doubling of the urban perimeter of Florence which resulted from the development of vast public housing areas on the far outskirts of the city, as well as from the sale by apportionment of the hills, which were built up with a high concentration of volumes.

The early steps of environmental movement

During the second half of the 1970s the environmental movement began to take its first latering steps. The main organizations (the most firmly rooted in the Florentine-Prato area were Italia Nostra, WWF and Pro-natura) still privileged the conservationist approach: at the core of their action was the conservation of the landscape (woodland and mountains in particular), the protection of fauna, and the awareness of public opinion towards the establishment of protected areas. As to the urban environment, environmental groups focused their attention essentially on water resources (pollution, problems caused by an irrational use of water) and upon some urban planning questions (building without planning permission, conservation of historical centres).

We cannot yet speak of an environmental movement capable of influencing political choices since the various organizations were not capable of mobilizing a significant number of people prepared to take action in «defense of the environment». The interest of the people was still very poorly addressed to environmental issues because they appeared not so relevant as compared to problems of an economic nature (these were the years of reshaping of the systems of production which involved divestments of industrial assets and dismissal of workers) and of public order (the 1970s are identified with the age of terrorism).

Interventions for restoration (1982-2001)

Persisting problems

In a book published in 1987, the commune of Florence described environmental problems of the area as «evident» and «of a considerable gravity».

The most pressing emergency continued to concern water resources. Every year, only in the commune of Florence water consumption amounted to 70 million m³ (10 pumped out of underground wells; 5-6 used by factories). The chief problem remained that of water quality since almost all untreated liquid waste was discharged into surface waters: purification interested less than 10% of all discharges (industrial waste water represented around 4-5% of the whole). In Summer, mainly in August, the flow of Florentine sewer system was almost equal to that of the Arno (4m³/sec), enough to induce the intake of the Mantignano waterworks (west of the city) to frequent halts. A very worrying situation was that of the water table, which resulted polluted with numerous chemicals (organic chlorines in particular).

The second problem was represented by air quality. The main responsibility lied on road traffic which every year discharged into the atmosphere as much as 15,000 tonnes of carbon dioxide, 1,500 unburnt hydrocarbons and 3,500 of nitrogen oxides. Domestic central heating, largely fuelled by methane gas (80%), produced around 300 tonnes of sulphur dioxide. Industrial activities emitted sulfur dioxide, heavy metals (led, zinc, cadmium, chromium, mercury and copper), acids, phenols, aldeids, carbon compounds, sulphur and nitrogen. Air was also affected by acid rains composed of nitric, sulphuric, chloridric acids, and heavy metals (led, zinc, cadmium, mercury and copper). The most serious consequences were visible in the historic centre of Florence – where the surface of marble monuments turned into chalk – and in the forest of Vallombrosa.

Unsolved remained also urban planning problems. The document assessed the municipal territory of Florence as having «reached saturation» and the outskirts of the city expanded «beyond measure» with housing. In view of this it hoped into a transformation of the city from monocentric into bipolar, in order to lighten up «greatly the urban pressure on the historic center».

There was finally a further problem which concerned urban solid waste. Already in 1978 the production of solid waste (160,000 ton./year) surpassed the capacity of disposal of the incinerator situated in San Donnino (130,000 ton./year). The closure of this plant, decided by the Provincial Administration in 1986, resurrected the problem of waste disposal, forcing the town council to send urban waste wherever in Italy there was a plant prepared to treat it.
The picture presented by the town council enables us to highlight the twofold nature of the environmental question. On one hand, this was the direct result of the model of development which had seen its driving forces in the building and manufacturing industries, both voracious consumers of resources (soil, water, energy). On the other, it largely depended on the rising of living standards and the consequent high acceleration of consumption, so as to speak of a pollution «caused by life styles and consumption habits». The most prominent fact, but not the only one, is the deterioration of air quality due to traffic. Between the end of the 1960s and the first half of the 1970s, washing machines – which has swiftly supplanted hand washing based on homemade soaps and lye – were to blame for the pollution of water with industrial soaps. The waste emergency was a further such example. The problem became urgent in the first years of the 1980s when mass distribution, encountering a wide consensus from the consumers, contributed to the establishment of the use and dispose theory: the consequence of which was the rapid growth in waste to be disposed, composed for 31% of paper and plastic, the chief materials of the new style in consumption.

The hard way to create an environmental infrastructure network

During the first half of the 1980s, environmental policies were characterized by a significant activism of the Region – the foremost actions concerned the cleansing of the Arno, territorial planning and energy – which was opposed by the braking action of trade corporations, trades unions and communes causing, de facto, a continual postponement of the enforcement of regional directives. The result of this was that the updating of the civil and industrial purification plans (according to the terms established by the Merli Law of 1976) was further delayed to the 13 June 1989. The communes only adopted a minimum portion of the regulations for urban planning, the energy deficit (Tuscany used more energy than it produced) remained high (18.7%) and consumption continued to rely on the dual source of oil and methane gas.

This new impasse had been caused by the pressures exercised by small-medium industries in particular and by trade unions upon local authorities. The first demanded significant contributions as a condition for adopting anti-pollution technologies. The second, while denouncing environmental impact problems, placed the energy deficit and the safeguard of jobs at the core of their worries. In a period in which serious restructuring of companies was in progress, the councils of industrialized communes of the Florentine and Prato areas referred postpone the adoption of concrete environmental measures which great numbers of citizens perceived as an obstacle to economic development.

In the early 1990s, when the need to improve the quality of the urban environment became urgent, local authorities approved some measures aimed at insuring an acceptable quality level for air and water, by means of new infrastructure: ten new cleansing plants for the purification and treatment of civil and industrial effluents became available (the capacity of such plants, however, could not suffice for more than 88,000 inhabitants); a new monitoring network checking on air quality was set up; a Provincial Plan for the disposal of urban and industrial waste was also set up; in the Prato area a special waterworks for carrying recycled water was built; the construction of a dam at Bilancino (Mugello) went under way to resolve the perennial shortage of water which afflicted the Florence area in Summer (the reservoir, completed in 1995 was put into operation only by 2002).

In this way the most blatant effects of water pollution were dealt with, and the levels of atmospheric pollution were put under control thanks to the introduction of methane gas, lead free petrol and catalytic converters.
Fig. 6. Urban section of the Mugnone stream (viale Redi, 2008)

Fig. 7. In the background: the north western suburbs and the new court (2015)
This article summarizes a research work lasted six years, the results of which are published in Federico Paolini, Firenze 1946-2005. Una storia urbana e ambientale, FrancoAngeli, Milano 2014.

The Florentine area includes the municipalities of Bagno a Ripoli, Calenzano, Campi Bisenzio, Fiesole, Firenze, Impruneta, Lastra a Signa, Scandicci, Sesto Fiorentino and Signa. Part of the Prato area are the municipalities of Cantagallo, Carmignano, Montemurlo, Poggio a Caiano, Prato, Vaiano and Verno.


In 1951, Firenze, Fiesole, Bagno a Ripoli, Impruneta, Scandicci, Lastra a Signa, Signa, Campi Bisenzio, Sesto Fiorentino, Pontassieve, Prato, Vaglia and Vaiano, were part of the Piano Intercomunale Fiorentino (PIF). In 1956 Montemurlo, Cantagallo and Verno were also included in the PIF; in 1971 Poggio a Caiano, Camignano, Barberino di Mugello, Greve and San Casciano Val di Pesa were also added.


These are increases in percentage of local units in the Florentine area in the period 1951-1971: Calenzano +460.56%, Scandicci +211.38%, Campi Bisenzio +176.45%, Sesto Fiorentino +121.07%, Signa +94.47%, Impruneta +67.89%, Lastra a Signa +55.23%, Firenze +38.02%, Bagno a Ripoli +36.93%, Fiesole +25.47%.


Manufacturing industries operated chiefly in the following sectors: mechanics and metals (Firenze, Scandicci, Sesto Fiorentino, Calenzano), fashion and clothing (Firenze, Campi Bisenzio, Sesto Fiorentino, Calenzano, Signa, Lastra a Signa), chemistry (Firenze, Calenzano, Sesto Fiorentino, Scandicci), textiles (the whole Prato area, Campi Bisenzio, Calenzano, Signa, Lastra a Signa), wood and furniture (Firenze, Scandicci, Sesto Fiorentino, Bagno a Ripoli, Lastra a Signa), printing–publishing (Firenze, Scandicci, Sesto Fiorentino), non metallic minerals (Sesto Fiorentino, Firenze, Lastra a Signa, Campi Bisenzio, Impruneta), leather (Firenze, Scandicci, Signa, Lastra a Signa), food–tobacco (Firenze, Scandicci, Sesto Fiorentino, Calenzano, Campi Bisenzio, Lastra a Signa, Fiesole).

The most polluted tributaries of the Arno were the Bisenzio, very highly polluting since it received the waste water of the textile industries located in Prato, Calenzano, Sesto Fiorentino, Campi Bisenzio and Signa; the Vingone, whose waters contained high concentrations of cleansing agents, sulphur, ammonia, phosphates, sulphates, chlorines e cyanides; the Elsa, contaminated with phosphates, cleansing agents, chlorures, chromium e cyanides.

The cost of 1 m³ of self produced water by means of wells amounted to 10 or 20 italian lire; that of 1 m³ bought from the municipal utilities varied from 45 to 90 italian lire.


Law 3 March 1971, n. 125. The measure prohibited the production and trade, import and employment of 80% non biodegradable detergents.


Ibidem.

The plant produced 300-500 kg per day of chloridric acid; 2-4 kg of heavy metals (led, zinc, mercury and cadmio) and 20-40 grams of organic chlorine derivatives of which 5 grams of dioxine. Comune di Firenze, Firenzezeologia..., 93.

Integrata la disciplina urbanistica per una migliore pianificazione territoriale, «Toscana Consiglio Regionale», 14, 1984, 521.


Cgil Regionale Toscana, Seminario sui problemi energetici, Impruneta, 9-10 September 1986.

The function of the reservoir was to stabilize the flow of the Arno in a way that it granted the functioning of purification plants and the capture of water for purification plants.
Chapter IV

Florence and its waters: water management policies
in a city of Central Italy (1944-1980)

This essay synthetically illustrates a research work\(^1\) which has represented an attempt at writing an environmental history of the relationship between a city (Florence) and its water resources. The purpose of this article – which offers the first results of a much larger research dedicated to the environmental impact of urbanization and industrialization in the greater Florence area from 1946 to 2005\(^2\) – is to offer some thoughts useful to include this case study within the international historiography devoted to the history of water and, in particular, to problems relating to urban development and water management policies\(^3\).

Between reconstruction and development (1944-1965)

Water management policies

The city of Florence has since time immemorial shared its space with the rivers which cross it. The largest is the Arno – the eighth river in Italy in importance (241 km) – which divides it in two, crossing it from east to west. From the surrounding hills the torrents Mugnone, Terzolle, Mensola and Affrico (latterly covered in its lower reaches) descend into the Arno. There also are a number of lesser streams (Santa Cristina, S. Gervasio, Piagentina, Anconella, Ricorboli) which have been channelled as a consequence of urban development. The western part of the city is also crossed by the stream Fosso Macinante whose original function (already mentioned in the first half of the 14\(^{th}\) C.) was to collect the waters of the Arno in case of flooding and divert them towards the open countryside, whereas in the mid 16\(^{th}\) Century was to power a series of mills. In the course of time, Florence – situated as it is in the middle of a basin surrounded by mountains – has suffered from numerous floods, often with disastrous consequences. The most serious ones, before the 1966 flood, took place in 1269, in 1333, in 1547 and in 1844.

The frequent inundations have always been favoured by a profusion of destabilizing geological events, which characterize the Arno basin, and which are due to the nature of the soil: impermeable and prone to erosion. Beginning from the first half of the 20\(^{th}\) Century to these natural causes of disruption, others have been added by a pattern of growth based on urban expansion and industrialization, which has deeply altered the uses of resources\(^4\). Florence and the communes of its province, are a typical example of how a territory can be deeply altered by such factors, technological and social (i.e. Fordism, industrialization, urban expansion, large use of oil and electricity, expansion of private transport) which J. R. McNeill identified as the cluster of the motorized city\(^5\).

The consequence of the acceleration of urbanization and industrialization, which has taken place after 1950, has been a radical transformation and a serious deterioration of the environment.

The most significant effect has been a rapid geological disarray caused by the neglect of upland and hill agriculture, which led to the collapse of the capillary drainage system of cultivated fields; by the dredging of river beds for obtaining building materials; by a significant increase in earthworks (i.e. excavations, trenches, ditches), indispensable for creating the infrastructures, which set off a chain of processes of degeneration of the soils; by the progressive occupation of river beds – of those portions of river beds which in case of flood filled up avoiding the overflowing of the river – which were destined both to residential and industrial buildings.
Between 1944 and 1965, six municipal administrations and two prefectorial commissioners\textsuperscript{8} governed the city, neither was able to work out coherent policies for the government of the territory and the environment. Firstly the dramatic budget deficit made impossible the enforcement of the necessary measures for confronting the numerous problems of the municipality\textsuperscript{9}. In the second instance the building industry was placed at the centre of economy of the area: In fact, the principal political and economic actors regarded urban development in the portion of territory north-west of Florence, towards the municipalities of Sesto Fiorentino and Prato, as the greatest opportunity for the growth of the entire Florentine area economy (cf. Fig.1). This made city planning disliked by vast sectors of Florentine society, which regarded the problem of territorial organization secondary, with respect to lack of housing and high unemployment rate\textsuperscript{10}. During the mandate of the third La Pira administration, the town plan promoted by Socialist councillor for urban planning Edoardo Detti\textsuperscript{11} had been opposed by La Pira himself\textsuperscript{12}, by the building workers' unions (worried at the thought of possible repercussions on the levels of employment)\textsuperscript{13} and by industrialists\textsuperscript{14}. In 1965, in the aftermath of the crisis which brought to the fall of the La Pira administration, the town plan was practically dropped.

In this situation, the good management of water resources and land came second to the needs of urban areas expansion. The main actions were the study of a plan for rivers management contemplated by a law of 1952, which never came into being, and a study of the geological situation of the Arno basin, promoted by councillors for agriculture in the provinces of Tuscany (May 1965). It was not even considered that the existing system of flood warning consisting of antiquated hydrometers and pluviometers totally disconnected and without co-ordination, might be improved to monitor the entire Arno basin.

So far as concerns the commune of Florence, its water management policy was chiefly directed towards sewerage and water supply systems. Until the 1950s, the drainage system of Florence was still the same created in the 1860s and 1870s, consisting of three outlets (central, northern and southern), of the manifold drain called «Goricina» which flowed into the Fosso Macinante (itself become a manifold drain) and of still more ancient drains (i.e. the so called «great drains of Ripoli and Gusciana»)\textsuperscript{15}.

The need to modernize the entire sewerage system in answer to the requirements of an ever expanding city, was discussed in a meeting of the City Council on November 6, 1950 when, for the first time, the proposal was made to put into operation a combined sewerage system which had been already approved by a special Health Authority Commission in the 1940s. It was envisaged that the scheme, which had no budget, would be completed within 10 to 15 years.

The problem of drainage system became again an issue only in 1957, when the City Council concerned itself with the building of a new residential quarter with 6,000 flats in an area southeast of the city called Sòrgane. It was in fact necessary to provide the area with suitable sewerage system capable of collecting the sewage of the new settlement. However, between the end...
of the 1950s and the first half of the 1960s, successive administrations renounced to the elaboration of a project of general restoration and restricted themselves to the adjustment of the old drains wherever they saw it necessary. In March 1964, the City Council approved a deliberation which denounced the faults of the city’s sewerage system. In the following years – during which the city was governed by Prefectorial commissioner as a result of a complex political crisis which parties were unable to resolve – this denunciation fell into oblivion until the great flood of 1966 which brought home the structural faults of the entire drainage system.

The municipal waterworks, was not in better conditions. From the time of its foundation to the first decade of the 20th C. the chief water supply of Florence had been underground water. Almost every house had it’s own private well (Florence had more than 10,000 wells). The city’s waterworks was itself relying on the water table until 1912 when it was decided that the waters of the Arno should be exploited by means of a plant which was to be built in a place called «Anconella», in the southern part of the city. In 1928, during the Fascist era, the Podestà authorized the building of the municipal water pipeline of S. Maria a Mantignano.

By 1946, soon after the end of the Second World War, the problems concerning municipal waterworks were essentially three: a) the inadequate capacity of the water pipeline (carrying about 60,000 m³ per day) which did not satisfy the city needs of 85,000 m³; b) recurrent water crises, in the summer months, due to the seasonal character of the Arno, which caused insufficient water flows (below 3 m³ per second), forcing an under utilization of the Anconella plant; c) the precarious hygienic situation determined by the water pipelines which almost entirely ran inside the drains.

Only in 1953, the municipal administration named a Commission with the task of finding solutions for increasing the production of drinking water. The final report, consigned in 1954, advised the Florentine administration to agree with the electricity company Selt-Valdarno the exploitation of the reservoirs of Levane and La Penna, a plan for the exploitation of the torrents Carza, Carzola and Terzollina (situated in the basin of the river Bisenzio), and the creation of a reservoir by damming the Bisenzio itself (a river which crosses the city of Prato descending from the Tuscan Aemilian Apennines) to be utilized both for domestic use and for the production of electricity. The hypothesis of building a dam along the course of the Bisenzio, however, caused a conflict between Florence and Prato whose municipal administration voted in April 1956 a bill stating the «absolute binding necessity, for the city of Prato and for its territory, to use all the water of the Bisenzio». Dissent burst out again in 1957: to help fuelling the clash came also the proposal presented by a study group guided by engineer Giulio Supino, to harness the waters of the Bisenzio in order to reserve the water table to industry and sell part of the excess water to Florence. The proposal caused protests among the industrialists and the Christian Democrat Party of Prato which in a meeting reiterated the right for Prato to exercise the exclusive right on the waters of the Bisenzio, «the only river in the Prato administrative area».

Consequently, in November 1958, the City Council of Florence approved a decision in which – in order to increase the production of 2,000 litres per second, in an effort to confront the perennial scarcity of water – it was envisaged that two new waterworks should be built: a reservoir supplied by the torrents Carza and Carzola, and the damming of the torrent Pesa, respectively with a capacity of 7 and 17 million m³.

Still in 1958, a project was presented signed by civil engineer Cambi for the creation of a reservoir on the river Sieve, which should supply the waterworks of both Florence and Prato. The plan proposed by Cambi, however, had the only effect of stopping the building of the other two plants causing a long delay which lasted nearly three decades. In 1961, meanwhile, a Commission was created (known as «the Seven») with the allotted task of presenting to the municipal Council the best possible alternative to a new waterworks. The choice fell upon the Sieve and, secondarily, upon a further project which contemplated the exploitation of the torrent Ema. The job of working out the executive project for the Sieve reservoir (Lago di Bilancino) was given to the man who proposed it (civil engineer Guadagni), only in June 1963. Two more years passed before the administration of Florence approved the resolution (December 1965) necessary for beginning the study of the new city water supply system, which now included the Sieve reservoir and waterworks.

On the eve of the flood of November 1966 the hydraulic problems of Florence kept unsolved: the city’s network of sewers and water mains remained the one put into operation between the 19th Century and the 1930s.

Pollution

From the beginning of the 1960s, to the infrastructural deficiency the problems of pollution added. The water quality of rivers and torrents became a concern, not only in Florence but in the entire metropolitan area.
So far as concerned the Arno, the water quality was beginning to deteriorate on the eastern outskirts of Florence where the river received the waste waters of the suburbs of Compiobbi (the raw sewage contained residues deriving from galvanic processing plants and synthetic rubber factories) and Bagno a Ripoli (the raw sewage contained residues deriving from paper mills and chemical plants). At the extreme western outskirts the quality of water deteriorated further as a consequence of the tributaries of the Arno, the Mugnone and Terzolle which were highly polluted by raw sewage, industrial drain waters of the industrial plants of Rifredi, and the waste water of Careggi hospital. Near Signa – after having received the waters of the Greve, Vingone and Bisenzio – the water quality of the Arno was highly critical. On coming out of Florence the river carried significant quantities of ammonia, nitrates, nitrates, surface-active agents, phosphates, chlorides and traces of chromium and cyanides.

The water quality of the tributaries, was actually worse that of the Arno itself, with the exceptions of the Sieve and the Pesa, which were the least polluted thanks to the scarcity of industrial plants and urban conglomerates along their courses. The Greve appeared highly polluted by sewage and surface-active agents which reached «enormous values» so as to be responsible for the pollution of a high number of wells. The torrent Vingone collected and discharged into the Arno the sewage of two of the most densely industrialized areas of the province (Scandicci and Lastra a Signa) where there were foundries, galvanic processing plants, silver processing plants, rubber factories, metalworks, candle factories, soap works and salami factories.

The Bisenzio carried a high load of pollutants since it received the sewage of Vernio, Vaiano and Prato, the waste waters of the numerous industries of the Calenzano, Sesto Fiorentino, Campi Bisenzio and Signa areas, and finally the urban and industrial effluents of the area to the north west of Florence. The waters of the river contained a high percentage of ammonia, nitrates, surface-active agents, sulphates, chlorides and phosphates. Furthermore, the fragments of wool fibres dumped by textile plants (about 4,800 kg per day) caused a serious lack of oxygen (every mg of fibre destroys 1.19 mg of oxygen).

The biennium of the flood (1966-1967)

On the 4th of November 1966, the front page of the daily paper «La Nazione» carried an alarming headline: Dramatic situation at 6 am. The Arno floods Florence (cf. Fig. 2).
Actually, that morning few Florentines would read the newspaper. At 7.20 a.m. some area of the city had been flooded and at 9.35 a.m. the level of the water had risen above two metres in the centre of the city, flooding even Piazza del Duomo. At 7.30 p.m., the RAI (Italian broadcasting corporation) headquarters announced that the level of the water was decreasing after having reached 4 metres above street level in many quarters of the city (in some areas of the centre it had reached 5 meters).

The flood caused serious damages to dwellings (13,493 families had to leave their homes), to industrial plants (more than 12,000 jobs were lost and 3,997 workers in the crafts and trade industries were suspended or sacked) to accommodation facilities (47% of hotels were damaged), to artistic heritage (over 1,400 works of art, and almost two million books in libraries in the city). During the months which followed the flood, there was a succession of floodings caused by breaks of sewer pipes, while the flood water – saturated with petrol and salts (nitrates of potassium and sodium) – continued to cause damages to monuments and dwellings.

During the entire course of 1967 there were discussions on who to blame for the flood. The first to had the finger pointed at were the successive local governments of the second post-war period, who had failed to build an efficient sewerage and water supply system, and a system of flood control for the Arno and its tributaries. There is no doubt that the inadequacy of the sewerage system contributed to the seriousness of the calamity: the flood wave – which rushed through the city at a speed of 60 km per hour, carrying 4,200 m$^3$ of water per second – literally caused the explosion of the drains.

Then there was the question of the lack of warning which involved the Chief of Police and the Prefect: in a conversation which took place in the early hours of November 4th, the two authorities decided not to warn the entire city since the danger «did not seem to justify alarm» and for fear of disorder caused by traffic jams since people might rush to reach the motorway and the hills.

Furthermore, the debate went on to the role of the dams of La Penna and Levane (built in the 1950s by the Electricity Company Selt-Valdarno, for the production of hydro-electric energy), and situated in the province of Arezzo, at about 50 km from Florence. According to a wide literature, the flood wave which reached Florence originated from the sum of the flood wave of the Sieve, and that of the two dams (about 2,000 m$^3$ per second from 3 to 6 a.m. of November 4th, 1966). The argument became animated when the magistrates discovered, in February 1967, that the Selt-Valdarno had built the plant of Levane without the necessary authorizations. However, an inquiry ordered by the Public prosecutor’s office highlighted the bad conditions in which versed, at the time of the flood, all river banks, thus discharging the dams of Levane and La Penna which experts’ report said only caused the level of the Arno to raise by a few centimetres.
During the fiery but sterile debate, one of the few useful comments came from Professor Livio Zoli, who held the chair of Forestry and Water Studies at the Faculty of Agricultural Sciences of the University of Florence. He proposed an articulate plan for the safeguard of the banks of the Arno based upon the elimination of the two weirs built across the Arno within Florence (this however would have meant the «re-foundation of all bridges as well as the rising of all parapets and walls of the Lungarni»), on the construction of at least ten reservoirs, «with the exclusive role of defence» placed along the course of the river, and the excavation of an underground canal capable of carrying at least 1,000 m³ per second across the urban area.

On their part, institutions entered the debate with a disorderly array of initiatives, among them was a long succession of round tables and a singular proposal: the application of Florence as the seat of the Olympic Games of 1976 (put forward by the daily paper «La Nazione» for the purpose of accelerating the restoration of the city), which fortunately was later discarded.

In November 1966, the Regional Union of the Provinces of Tuscany issued a Statement where the «inefficiency of the civil defence» was pointed out and where the «creation of an adequate system of flood prevention and warning» was proposed, and hoped in an early «initiation of an effective policy of protection against land degradation». According to the Regional Union of the Provinces of Tuscany, the causes of the hydrogeological hazard must be found in «the indiscriminate excavations of the Arno river bed» and in the «meteoric disruption of the soil and subsoil» caused by a «lack of effective drainage works both in forested and agricultural areas».

In March 1967, the Regional Union of the Provinces of Tuscany promoted a round table aimed at discussing the plan for the realization of a «system for the rational management of water resources and river basins». In September the mayors of Fiesole, Pontassieve, Rufina and Pelago invited the municipal administration of Florence to call in assembly all the communes affected by the flood with the purpose of «avoiding municipal solutions». In October 1967, representatives of the affected communes of the Province of Florence met and decided to rapidly proceed to the reconnaissance of damages suffered by water defences all over the province, to a census of the repair works already planned and financed, and to the monitoring of works in progress.

At the close of 1967, the lack of ability in decision making displayed by the City Council of Florence and Provinces of Tuscany – engaged in calling meetings and conferences which never produced a single plan for the control of river basins – had turned the flood of 1966 into yet another missed opportunity for understanding the causes of soils and rivers degradation and for starting a global and definitive programme of hydro-geological restoration, placed within the context of a wider territorial development plan.

This is not all: various enquiries point at 1967 as the year in which the foundations were laid for a new age of urban expansion in areas subject to the risk of flooding. This was due to the passage of a planning Law (number 765 of 1967) which – under the declared scope or helping the economy – allowed the expansion of buildings in all areas of the municipal territory. The result was urban saturation of the Arno basin.

The uncertain beginnings of restoration (1968-1980)

In the years following the flood, the crisis of water resources became the most evident (and debated) issue concerning the environmental emergency which concerned Florence.

The most apparent sign was the pollution of surface waters, made prominent by an abundance of froth floating on the Arno. In an attempt to halt this degradation, the City Council of Florence approved an order which forbade the use of non biodegradable detergents, beginning from the 20th of January 1971. The measure – since it ignored the sewage and industrial waste discharged into the river, which contained materials (chrome, cyanide…) far more toxic than any synthetic detergents – had become necessary in order to contain the contamination of water by surface-active agents whose level had reached values far superior (from 1,900 to 3,800 γ/litre) to those established by the World Health Organization (500 γ/litre).

In 1972, the Regional Council approved a resolution with which it invited local administrations to agree on common quality standards concerning «urban and industrial effluents» as established by the Regional Government. Two years later the first Map of water pollution was published and a law was approved (27th May 1974, number 22) which provided finances for a programme of «works for the detection and utilization of water resources and for the depuration and disposal of liquid waste».

In 1974, the Consortium of Water Resources Scheme 23 – which brought together the communes of Florence, Bagno a Ripoli, Barberino del Mugello, Calenzano, Campi Bisenzio, Firenze, Fiesole, Impruneta, Lastra a Signa, Montemurlo, Prato, Scandicci, Sesto Fiorentino and Vaiano – was created. The constitution of such Consortium of communes ended up with block-
ing action aimed chiefly at the purification of waters, as promoted by the commune of Florence between 1974 and 1975: the construction of a digester (an hamlet called S. Mauro a Signa astride the communes of Campi Bisenzio and Signa) and two purification plants (in Settignano, a suburb north-east of Florence, and in an area north-west of Florence known as San Donnino). In 1976, «Scheme 23» started to consider the setting up of a purification plant capable of satisfying a population of 700,000 inhabitants, but it took almost ten years before an agreement was found on where to place such plant in an area (S. Colombano) astride the communes of Lastra a Signa and Scandicci.

In 1980, in observance of Act n. 319/1976, the Regione Toscana approved the first biennial programme (1980-1982) of the Regional Plan for the cleaning up of waters. For Florence and the Florentine area, the document envisaged «intervention schemes at a high level of definition and depth», and listed a series of interventions nearly all in their first planning stage. These were measures intended to tackle the issue of water quality – regarded as a priority since the Florentine waterworks was chiefly fed by the waters of the Arno – which, however, were not apt for coping with the crisis of the entire Florentine water supply system, afflicted as it was by two critical factors which by now had become endemic: the serious hydro-geological degradation – as it had been underlined by the 1966 flood – and the scarcity of water resources.

In 1976, as to hydro-geological deterioration, Ministers of Public Works and Agricultural Policies had instituted an Interdepartmental Committee for the study of water management and soil defence. The Committee worked out a plan (known as Piano Supino, from the name of its rapporteur Prof. Giulio Supino) for the reorganization of the Arno basin prompted by the eventuality of another catastrophic event like the one occurred in 1966 (Interministerial Commission 1968). In accordance with the Committee appointed by the College of Engineers of Florence, the Interdepartmental Committee recommended the construction of a series of reservoirs of a medium capacity (from 10 to 50 million m$^3$) and smaller (from 1 to 10 million m$^3$) capacity. The lower section of the reservoirs was to be destined to accumulate water to be employed for the production of electrical power, and also for domestic and irrigation uses.

The higher sections of these reservoirs, should have instead been destined to the lamination of floods. According to the Piano Supino in order to protect Florence from a new flood 17 such reservoirs and a drainage channel would be necessary in the tract of river upstream from Florence, in order to allow the river bed to carry no more than 2,200 m$^3$ of water per second (here we need reminding that the Florence flood of 1966 carried 4,200 m$^3$ per second). Due to the high costs (over 65 billion lire – in the current value of 1968 – only for the five years from 1970 to 1975), the project of the Interdepartmental Committee remained shelved, never becoming operational.

Ten years later, in 1978, the Final Report was approved of the Progetto pilota per la sistemazione del bacino dell'Arno (Pilot Project for the restoration of the Arno Basin). As compared to the Piano Supino, the Project envisaged the building of 11 reservoirs (2 along the course of the Arno and 9 along its tributaries) for a total capacity of 378.8 millions of cubic metres. Once again, however, due to high costs (about 111 billion lire at the current value of 1971) and to the lack of adequate finances, the planned interventions remained suspended.

Regarding the availability of water resources, from 1959 to 1969 mean daily water consumption had more than doubled: in 1969 the mean per capita needs amounted to 372 litres. In 1970 the Florentine water treatment plants produced 172,000 m$^3$ per day of water: the plant of Anconella – by now technologically inadequate, scarcely safe and very costly – provided 135,000 m$^3$. The plant of Le Cascine (fed by 25 wells constantly threatened by pollution by sewage) provided 25,000 m$^3$ per day. The Mantignano plant provided 12,000 m$^3$ since the constant lowering of the ground-water level had caused a reduction in supply amounting to more than 8,000 m$^3$ per day. The problem of the lowering of the water table was particularly serious since it prevented any increased exploitation of underground wells which provided for about 20% of the need. What prevented any increased exploitation of wells was also the deterioration of water quality: a significant number of wells was polluted by ammonia and organic chlorinates.

This meant that in Florence only one source of water remained certain, and that was the Arno$^6$. In order to confront the scarcity of water afflicting the city, the municipal administration of Florence presented in October 1970, an intervention plan centred upon the improvement of the Anconella water treatment plant (within a span of ten years a doubling of the production up to 3,000 litres per second was foreseen) and on the fast construction of the Bilancino reservoir with the Sieve waterworks, which would have insured a sufficient supply of drinking water at least until 2000. Meanwhile works to separate the water mains from the sewerage system went under way. Notwithstanding the ever increasing problems caused by water scarcity, in the early Eighties the City Council of Florence still continued to argue – after twenty years of arguments and without having reached a final decision – on the opportunity of building the Bilancino reservoir and a new Sieve aqueduct.
Conclusion

In conclusion, thirteen years of discussions on water management policies had produced a significant pile of documents which had never reached the stage of turning into works capable of starting a concrete process of restoration of the water system: in the second half of the 1990s, Florence still continued to wait for an efficient water supply system, a purification plant (works for the plant of S. Colombano were started on June 18th, 1994) and an efficient flood control system (the reservoir of Bilancino was completed in 1995 and became operational in 2002).

The continual deferment of water management policies was due to a complex series of factors: in the first place it was the peculiarity of the process of urban and economic development of Florence (as in other important Italian cities) which, to use an expression of Melosi, had caused «the age of miasmas» partly to coincide with the «urban crisis in the age of the ecology»49. It needs reminding at this stage that Italy has gone from the status of socially backward country, with an almost entirely agricultural economy, to that of a modern industrial country, (or a country with an advanced and complex social and political organization, similar to that of other industrialized countries) in little more than twenty years: from 1950 to the first half of the 1970s. This means that the modernization process had been very fast and extremely chaotic40.

After the second world war, for example, Florence was affected by a migration wave without precedent, chiefly made up of young adults – coming from the surrounding countryside, from the provinces of Tuscany not yet industrialized, and from the southern regions – in search of jobs in the factories scattered around the municipality. To alleviate the consequent social tension, municipal administrations of Florence began to build working class neighborhoods in areas unaffected by building speculation. The new settlements grew up lacking the most elementary sanitary and other infrastructure, such as sewers and waterworks: this caused Florence to be affected by a succession of typhoid fever epidemics lasting up to the early 1970s.

In this context the absolute priority, for the local administrations of Florence and the adjacent municipalities, was to alleviate social tensions fuelled by poverty and lack of housing. Furthermore, if we take into account the scarcity of finances due to considerable debt and to the scarcity of State contribution, we understand why Florence’s municipal administrations were unable to enforce prompt and effective water management policies. The inconclusiveness shown by Florence’s administrations in matters of water management policies was also encouraged by inadequate national legislation: up to the early 1970s, the main national laws concerning water management policies were the law of March 20th 1865 n. 2258 (on public works), ministerial instructions of June 20th 1896 (local rulings on soil and dwelling hygiene) the law on hydraulic works of July 25th 1904 n. 523 and articles 217 and 227 of health law (Royal Decree July 27th 1934, n. 1265).

Only in the second half of the 1970s, a law was passed (319/1976, cf. note 13) whose implementing regulation, due on June 13th 1979, suffered a series of procrastinations and was eventually modified by law N° 650 of December 24th 197941.

There are at least three more causes for the delay in the enforcement of water management policies.

The first was a conflict between the municipal administrations and the Regional Administration of Tuscany (Regione Toscana). As we have seen in the paragraph The uncertain beginnings of restoration, the earliest water management policies began to be discussed and approved under the pressures of the political action of the Regione Toscana which, as did other regions under ordinary statute, began to function in 1970. Water management policies promoted by the Regione Toscana, however, met the opposition of municipal administrations who regarded them as an impediment for a further expansion of residential and industrial settlements.

The second is the conflict which opposed the communes of the Florentine area (confronting a serious shortage of drinking water resulted from a considerable population increase) to the commune of Florence itself which continued to postpone the creation of a consortium for a collective handling of the water management policies, since it was not prepared to foot the bill for all cost, as expected by the other communes.

The third was the fiery confrontation between the Florentine division of the Confederation of Italian Industry and municipal administrations. The dissatisfaction of entrepreneurial organizations was encouraged by a scarce availability of water resources due both to insufficient quantity and to incipient decline in quality: More and more often groundwater turned out unfit for industrial use due to high pollution and excessive hardness.

Furthermore the serious subsidence of the water table prevented an increase in pumping from underground wells, which represented the primary source of water for industrial plants, who – although unwillingly due to high costs – were forced to resort to surface water hitherto used by city-owned water enterprises for feeding municipal waterworks. From this the pressing demand to reserve a growing quantity of Arno and Bisenzio water for industrial needs, the highest in the
entire region amounting to 3.11 m$^3$ per day per worker (this is an approximate but realistic figure meaning a daily requirements of about 419,000 m$^3$).

Such conflicts as we have tried to illustrate caused a continuing postponement of the enforcement of water management policies which – notwithstanding having been discussed since the 1950s – began to be actually put into effect only as late as the second half of the 1990s and the beginning of the XXI Century.

Notes

1 This article is based on secondary sources – the books containing reports on studies and researches published by the Commune of Florence (Comune di Firenze), by the Regional Administration of Tuscany (Regione Toscana) and by the Arno River Basin Authority (Autorità di bacino del fiume Arno) – and primary sources such as the Official Records of Florence City Council Proceedings (quoted in the text as Accf), the Edoardo Detti Records in the State Archive of Florence (quoted in the text as Asf-Edr) and the Archives of the Region of Tuscany (quoted in the text as Art). The archive documents have been translated into English in order to make them accessible to an international audience.


7 The image is taken from Margherita Azzari (ed.), Atlante geoambientale della Toscana, Regione Toscana e Istituto Geografico DeAgostini, Novara 2006, 90.

8 Fabiani Administration from 29 November 1946 to 5 July 1951 (Left); La Pira Administration from 6 July 1951 to 9 August 1956 (Christian Democrat Party); La Pira Administration from 3 August 1956 to 16 June 1957 (Christian Democrat Party); Prefectorial commissioner Lorenzo Salazar from 27 June 1957 to 7 March 1961; La Pira Administration from March 1961 to 9 August 1965 (Centre-Left); Lagorio Administration from 3 August 1965 to 19 November 1965 (Centre-Left); Prefectorial commissioner Adriano Monarca from 16 November 1965 to 29 July 1966.

9 Accf, Statement by Mayor Fabiani, 12 July 1948: «When the Administration is unable to inscribe in the budget an optional sum of one hundred lire, which would not even be considered in a budget of 1935, you mustn’t believe that much can be done!».

10 Accf, Statement by Councillor Pucci, 12 July 1948: «It is the problem of unemployment the one that more urgently presents itself in the political and economic context. If you took the trouble [addressing Christian Democrat Franchini] to come one day to see the room where we work in Palazzo Vecchio, you would see how daily 40, 50, 60 people come to us...one has his wife ill, another has his parents to care for and, every day, these put pressure on us for the possibility of earning a loaf of bread ».

11 Edoardo Detti has been one of the most important urban planners in Italy, director of the City planning Institute of the University of Florence and chairman of the Town planning National Institute (INU, Istituto Nazionale di Urbanistica).

12 Asf-Edr, Envelope 9, Document 1133, Letter by Detti to the Socialist Senator Luigi Mariotti, 17th February 1961: «[...] Prof. La Pira, has, as always, made various detours at this time on that question, and now he says that the Commune cannot confront it. The question concerns instead municipal city planning policies. Demagogic weaknesses would not afterwards be accepted, neither I would condone them, or enter into arguments»; Asf-Edr, Envelope 9, Document 1934, Letter by Detti to La Pira, «Enríques Agnoletti, Giulio Mayer, 3 January 1962.

13 Asf-Edr, Envelope 14, Document 1657, Letter from Domizio Caderni to Detti, undated but datable to 1961-1962: «[...] I would pray to give permits and to examinezonings since in this case allotments prices
would reach footing levels […] since with such block speculation increases every day (and I by going around offices hear that all faults are made to fall upon Architect Detti).”

14 Asf-Edr, Envelope 19, Document 2094, Observations concerning the City Plan by the Association of Industrialists of the Province of Florence.


16 Davis Ottati, L’acquedotto di Firenze dal 1860 ad oggi, Vallecchi, Firenze 1983.

17 The present paragraph is based on the documents contained in: Art. Office of Provincial Health Officer of Florence, classified under the entries Waters and Sanitary measures.


19 Regione Toscana, Mappa degli inquinamenti idrici… 62.

20 Regione Toscana, Mappa degli inquinamenti idrici… 84.

21 Piero Innocenti, L’industria nell’area fiorentina, Associazione degli industriali della provincia di Firenze, Firenze 1979, 702.

22 Regione Toscana, Mappa degli inquinamenti idrici… 102-105.

23 Figures 2 and 3 are taken from Provincia di Firenze. Carta dell’alluvione del 1966 nella provincia di Firenze. Pianta dell’abitato fiorentino alluvionato e aree inverse dalle acque, Edizioni Multigraphic, Firenze 2006.


25 This was the opinion of two city planners of the University of Florence: «The level of the Arno increases therefore at a disturbing rate and, between three and four o’clock of the morning of the 4th, from the dams of Levane and La Penna began a flow – with sluice gates which, if not completely open, released at any rate all the water that they received – well in access of 2000 m³ per second, a flow described as catastrophic by the very construction projects of the dams» (Principe and Sica 1967, p. 194). On June 3rd 1966 the Councillor for agriculture of the Provincial Administration of Florence, Riccardo Degl’Innocenti, wrote a letter to the Enel (National Electricity Board) District of Florence regarding the dams of Levane and La Penna: «This Councillorship Office […] has been repeatedly and forcefully recalled to actively take note of the damages and sudden floods of the Arno, caused by the opening of the hydroelectric power stations of Levane and La Penna to the fish fauna of the river […] We do not intend to raise here a grave problem, which does exist and does cause serious situations, of the threat which such floods represent for the safety of the citizens. […]» (Provincia di Firenze 1966, pp. 7, 21). Cf. also Reuss (2004, p. 539).

26 F. Nencini, Firenze, i giorni…, 39-42; Giacomo De Angelis, Le acque dell’Arno, Lanciano 1969.

27 F. Nencini, Firenze, i giorni…, 36-37.


29 In the biennium of the flood two administrations have been in office: the Bargellini Administration from July 29th 1966 to November 3rd 1967 (Centre-Left); the Bausi Administration (Centre-Left) from November 3rd 1967 to August 26th 1968.

30 Cf. the report on hydraulic hazard published by the Arno River Basin Authority: «[…] the urban development in areas pertaining to the riverbed, also occupying the overflow areas, has aggravated further the risk of river inundations. Such urban development in areas subject to the risk of flood has occurred mainly after 1967, such as shown by aerial photographs covering the territory, and it had abundantly established itself by 1974; and it is still under way» (Autorità di bacino del fiume Arno 1996, p. 27).

31 From 1968 to 1980 the following administrations were in office: Bausi Administration from August 26th 1968 to April 28th 1969 (Centre-Left); Prefectural commissioner Guido Padalino from April 28th 1969 to September 22nd 1970; Bausi Administration from September 16th 1970 to September 7th 1973 to September 16th 1974 (Centre-Left); Zoli Administration from September 4th 1974 to October 30th 1974 (Christian Democrat Party); Prefectural commissioner Antonio Lattarulo from October 28th 1974 to July 26th 1975; Gabbugiani Administration from July 25th 1975 to September 3rd 1980 (Left).


33 This law – centred on sanitary rather than environmental regulatory aspects – focuses on water waste and discharge regulation and it represents a breaking point with respect to the traditional policy where water was considered essentially as a resource to be exploited.


38 Accf, Statement by Councillor Conti, 5th June 1981; Accf, Statement by Councillor Cariglia, 5th June 1981: «The first safe data seems to me that the Bilancino Reservoir, if falling within the scheme of optimization of regime of the Arno, it certainly will not by itself resolve the problems of the safety of the river. This is said by the experts, it is also said in the most advanced proposals and, therefore this work does not serve, it does not contribute, should it remain the only work, to insure safety from floods, thus the true reason for being of the Bilancino reservoir should be to protect Florence from thirst».


41 The measure postponed the deadline for the submission of plans for the cleaning up of waters to the 31st of March 1981.
Chapter V

Industries, tourism and the environment.
A case study: Tuscany’s Central-Southern Coast.

Introduction

The coasts of Tuscany extend for about 400 km (not including the islands of the Tuscan archipelago). From a morphological point of view the coasts of Tuscany presents three different basic typologies: 1) coasts characterized by low and sandy shores, with a low gradient and shallow waters even at a considerable distance from the coastline; these are low energy coasts, with scarce possibilities of mixing water and dispersing pollutants; 2) high coasts with sudden considerable depths; these are high energy coasts, with a remarkable capacity of mixing and dispersing pollutants; 3) Tuscan archipelago coasts, with absolute predominance of high energy rocky coasts. The watersheds along the coast are crucial zones for the understanding of environmental phenomena and problems which interest the shores of Tuscany. The six principal rivers discharge a significant pollution load into the sea: an organic load that is equivalent to 10,075,528 inhabitants (population equivalent), 60,418 tons of nitrogen and 25,504 tons of phosphorus (Fig. 1).

Fig. 1 Chief rivers of Tuscany: pollution load (Year 2000)

<table>
<thead>
<tr>
<th>Basin</th>
<th>Organic Load Population Equivalent</th>
<th>Nitrogen Load Ton/Year</th>
<th>Phosphorus Load Ton/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serchio</td>
<td>941,152</td>
<td>3,569</td>
<td>1,164</td>
</tr>
<tr>
<td>Arno</td>
<td>7,477,779</td>
<td>34,950</td>
<td>13,496</td>
</tr>
<tr>
<td>Cecina</td>
<td>114,169</td>
<td>1,874</td>
<td>959</td>
</tr>
<tr>
<td>Cornia</td>
<td>78,110</td>
<td>1,014</td>
<td>478</td>
</tr>
<tr>
<td>Bruna</td>
<td>86,791</td>
<td>1,168</td>
<td>547</td>
</tr>
<tr>
<td>Ombrone</td>
<td>1,157,308</td>
<td>14,909</td>
<td>7,382</td>
</tr>
<tr>
<td>Albegna</td>
<td>220,219</td>
<td>2,934</td>
<td>1,478</td>
</tr>
</tbody>
</table>

Source: Regione Toscana, La qualità delle acque marine costiere in Toscana, 2010

As to population density (Fig. 2), the maximum concentration is found in the northern sector: in the stretch from Carrara to Cecina – which represents only 22 per cent of the total length of the Tuscany coast – we find over 70 per cent of the inhabitants of the total coastal area with a medium density of over 720 inhabitants per km² and peaks of over 1,500 in the cities of Viareggio and Livorno. In the remaining part of the coast, average densities amount to a little over 120 inhabitants per km².

Fig 2. Chief coastal Communes. Population.

<table>
<thead>
<tr>
<th>Communes</th>
<th>Population</th>
<th>Density Inhab./km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livorno</td>
<td>161,152</td>
<td>1,548</td>
</tr>
<tr>
<td>Val di Cornia</td>
<td>Campiglia marittima</td>
<td>12,543</td>
</tr>
<tr>
<td></td>
<td>Piombino</td>
<td>33,917</td>
</tr>
<tr>
<td></td>
<td>San Vincenzo</td>
<td>6,528</td>
</tr>
<tr>
<td>Val di Cecina</td>
<td>Bibbona</td>
<td>3,017</td>
</tr>
<tr>
<td></td>
<td>Castagneto Carducci</td>
<td>8,204</td>
</tr>
<tr>
<td></td>
<td>Cecina</td>
<td>26,355</td>
</tr>
<tr>
<td></td>
<td>Rosignano Marittimo</td>
<td>30,558</td>
</tr>
<tr>
<td>Piana di Scarlino</td>
<td>Scarlino</td>
<td>3,718</td>
</tr>
<tr>
<td></td>
<td>Follonica</td>
<td>22,142</td>
</tr>
</tbody>
</table>


The coastal areas are characterized by two major anthropogenic pressures: industrial activity and tourism.

Livorno, Piombino, Rosignano and Scarlino host industrial settlements that are classified as critical areas with regard to the use of natural resources. The stretch of coastline from Livorno to Piombino contains most of the heavy industry of Tuscany; the presence of big business makes the productive system of this area different from that of the rest of Tuscany which is characterized by light industries districts and scattered industrialization. Much of the iron and
steel, chemical, petrolchemical and metallurgic industries in Tuscany are settled in Livorno, Rosignano and Piombino. In Livorno are located chemical, petrolchemical, mechanical industries and a thermal power plant. In Rosignano is settled the Solvay chemical plant which produces sodium carbonate, caustic soda, polyethylene. Since the nineteenth century, in Piombino a steel plant was established for the production of steel, steel sheets, welded tubes. In the gulf of Follonica there are also two chemical industry plants for the production of titanium dioxide and sulfuric acid.

As for tourism, the municipalities of the centre-south coast boast significant annual attendance with average values ranging between 300,000 and 800,000.

Where major industries has left free stretches of coastline, very intensive Summer tourism has developed which has caused huge changes to the morphology of the coast, generating such intense human presence often superior to the carrying capacity of the area, thus contributing to the exasperation of some serious environmental problems. Such seaside tourism is essentially concentrated both in time and territory, generating congestion on the coast by being characterized by an irrational use of space and resources. The excessive human presence restricted to the Summer months generates repercussions not only on the natural environment, but also upsets the organization of services along the coast, which cannot answer to the needs of such great number of tourists. To this are added the increased consumption of water, the disposal of waste (in the coastal municipalities such demands doubles in Summer with respect to Winter months) and the growing in car traffic. Thus emerges the gravity of the problem of a congested coastline, along with that of an irrational planning of the territory and of its consequent deterioration.

A controversial development model: heavy industry and tourism

Industrial development

The existence of port infrastructure, the proximity of mining sites and the presence of a railway line were conducive to the establishment of industry along the coast. Industrialization process (started in the second half of the nineteenth century) intensified in the early decades of the twentieth century and then accelerated in the Fifties and Seventies of the ‘900 (the period known as the economic miracle).

The process of industrialization prompted a significant repopulation of the coast. In 1861, 10 per cent of the population resided in the coastal municipalities; in 1901, 11.22 per cent; in 1951, 20.33 per cent and 23.29% in 1981.

In Livorno the first factories were built in the second half of the 19th Century: the main businesses were connected with shipbuilding, metallurgy and chemicals (glass). In the Thirties of ‘900, a large mechanical factory (the Moto Fides Company producing torpedoes for the Italian Royal Navy) and the first plant of the Livorno Refinery were created. The Refinery (which was completed in 1939) had a processing capacity of 1.6 million tons/year of crude oil aimed at the production of fuels (including liquid gas), lubricants and paraffine. In 1954, the Refinery reached a production capacity of 3.2 million tons/year of crude oil destined to the production of fuels and lubricants. The increasing commercial demand for oil products promoted the expansion of the refinery, which in 1971 reached a processing capacity of 5.2 million tons/year of crude oil. Currently, the refinery is the main industrial activity in the Livorno area where there also are some chemical industries (among them a plant of Dow Italia, Italian associate of the Dow Chemical Company) and a thermal power plant. In Rosignano, the Solvay plant was established in 1916 when the production of caustic soda started. In 1957, the Solvay Group also decided to start the construction of a plant for the manufacture of polyethylene, which induced Solvay to build a pier enabling the plant to receive liquid ethylene (necessary for the production of Polyethylene) at low temperature. In 1959, Solvay decided to start the production of hydrogen peroxide and sodium perborate; in 1971 began the production of plastics. Currently the Solvay plant of Rosignano is operating in the following production units: soda (production of sodium carbonate, sodium bicarbonate, calcium chloride), electrolysis (the production of chlorine, hydrogen, caustic soda), polyethylene (resins production); peroxidized products (sodium peroxide, sodium perborate), chlorinated products.

In Piombino, iron and steel industry was installed in 1865. After the complex events which are beyond the scope our narrative, the companies present in the area are Lucchini-Severstal (full-cycle steel company, the main Italian centre for the production of long sheets), the Magona d’Italia (an engineering company among the main producers of galvanized and painted metal sheets), Dalmine (galvanized pipes) and the thermal power plants administered by Ise Spa.
(which manages the central services located inside the Lucchini-Severstal plant) and Enel (a power plant fuelled with oil with a capacity of 1,280 MW)4.

Fig. 3 The port and industrial area, Piombino

A very special case is represented by the plain of Scarlino5. For the construction of the industrial area of Scarlino, part of the *padule di Scarlino* (the Scarlino Marshes) were reclaimed. These constituted the last remaining example of such marshes as were typical of the Southern Tuscany coast. In the early Seventies, Montedison (a major industrial group, chiefly active in the chemical sector) completed the construction of a plant for the production of titanium dioxide.

Fig. 4 The Scarlino marshes (*padule di Scarlino*)

The population had welcomed the plant, since it was expected to provide around 400 jobs. However, industrial production was marred at the outset by the local governments and by the ministry of the Merchant Navy, who regarded the plant as extremely harmful to the ecosystem, since it involved the dumping at sea of processing residue (approximately 3,000 tons per day of ferrous sulfate). This situation fuelled a bitter conflict between, on the one hand, the company and the workers who feared unemployment and, on the other, the local authorities supported by environmental committees.

Between 1972 and the beginning of 1974, Montedison continued to dump ferrous sulfate into the sea, by virtue of provisional permissions granted by the Livorno Harbour Authority. By 1973 the situation had become very tense: there was an attack on the ships used by Montedison for the dumping of ferrous sulfate in high seas, and violent disorders erupted even in Corsica, since ferrous sulfate reached the coasts of the French island. Furthermore, the Regional Council of Tuscany took on the matter, prompted by a question put to it by some Christian Democrat Councillors concerned about the «economic impoverishment» of the Scarlino area, in case Montedison decided to close down the plant. The controversy ended on 28 April 1974, when the Court of Livorno condemned the management of the Scarlino plant for the ecological devastation caused in the Tyrrhenian Sea.
Currently the plant for the production of tytanium dioxide is part of Huntsman’s (a chemicals multinational company) and – albeit through a rigid control protocol – it continues to employ sea water in its production processes (3,651,800 m³/year).

Since 1962, in the plain of Scarlino also operates Solmine (today New Solmine), a company producing sulfuric acid (up to 1994 Solmine used mineral pyrite, later replaced by sulfur). The processing of pyrite caused pollution due to arsenic contained in pyrite ash.

Even today, the presence of plants for the production of titanium dioxide and suylfuric acid makes the plain of Scarlino one of the most polluted areas in Tuscany.

The development of tourist industry

Towards the end of the 19th century, the medical science reevaluate the healthy effects of the sea air and sun: in the final glimpse of the century the spread of sand treatment (hot sand baths) opened the way to a closer relationship of man with the beach, which only in the 20th century began to fill up with people. Until the first decade of the 20th Century, beaches were lacking infrastructures and were only regarded as places where to walk. The turning point came in the Twenties and Thirties when the myth of sun tan made the beach a focal point for seaside life. The relationship with water also changed: bathing lost its therapeutical function turning into leisure. The discovery of sunbathing caused a revolution in the geographical map of tourism: the Mediterranean coasts (already for some decades very popular for Winter tourism) began to attract a growing number of holiday-makers during the hottest months. For the first time Mediterranean shores had competed with the cold coasts of the North Sea and, within a changed cultural and aesthetic context, they came out winners.

During the 20th century, the emerging Mediterranean resorts prepared to receive entirely different guests from those of the past, since élite tourism no longer represented the economic hub of such industry. The period between the two world wars not only lauched the trend of sun tan but it witnessed the emergence of middle class tourism: the main tourism flow no longer contemplated big hotels, but preferred less expensive solutions such as boarding houses and small hotels.

In Italy, élite seaside tourism was restricted to the Ligurian Riviera, Sorrento and the Amalfi coast, and places such as the Lido of Venice and Taormina. The growing demand of middle class tourism gave rise to the development of a second group of bathing localities, concentrated along the north central Adriatic coast and the Tyrrhenian coast: these hosted a clientele that generally demanded less expensive accommodation, though with a degree of differences within it.

The seaside resorts of Tuscany became very popular destinations: their customers came from the upper-middle income bracket, even though there were boarding houses for the less prosperous holiday-makers.

Between the 50s and 70s, Italy became the leading country in Europe for seaside tourism, attracting – in addition to Italian holiday-makers – 60 per cent of European tourists who decided to stay in seaside towns. Italy was able to create, first among the Mediterranean countries, a minimum level of facilities which allowed to enter the market with a highly varied accommodation offer, able to satisfy all classes of income which were discovering tourism: the number of hotels, of boarding-houses and lodgings continued to grow decade after decade in perfect harmony with the increase in the number of tourists. In the sector of seaside tourism Italy was a precursor (along with France), anticipating all other Mediterranean countries and conquering a leadership which remained unchallenged till the first half of the 1980s.

The other side of this success was the growth of urbanized areas along the coasts, characterized by a process of urban expansion without regulations which has ended with irreparably upsetting the coastline environment: in Tuscany too, the coastline appears disfigured by unplanned urban development, from the illegal construction of holiday homes, to the erection of great hotels built next to the beach, to the construction of yackting harbours.
The grabbing of land is a constantly growing phenomenon and is likely to further disfigure the coast (in the town of Livorno, impermeable surface increases by 0.25 km² each year and is equal to about 23 per cent of the total area). Land use continues unabated even in the face of the deep transformation which the tourist industry is undergoing: for example, the stretch of coastline here taken into consideration is the stage of blatant development speculation phenomena. The estate of Rimigliano, in the commune of San Vincenzo – an area of great environmental value (640 hectares), next to the coast which the Municipality has not inscribed among the protected natural areas of local interest – is the scene of an intense urban development process which contemplates the building of hotels (about 30,500 m²) and of holiday homes (around 17,000 m²). Still in the municipality of San Vincenzo a new marina has been built, which is causing a rapid erosion of beaches to the north and south of the harbour zone.

Along the coastal area of the municipality of Castagneto Carducci, 60,000 m³ of new buildings are being constructed as holiday homes which will infringe upon the dune system of the area and on the Tombolo di Donoratico (characterized by a pine forest and by a system of sand dunes) for a total surface of little less than 800,000 m².

The legacy of economic development: an affected environmental situation

Over exploitation of water resources and the salinization of the water table

The coastal area is characterized by a considerable consumption of water (generally above 150 litres per person per day): the requirements of Val di Cornia is 83,000 m³/km² and that of the Huntsman Dioxide plant of Scarlino of about 7 million m³/year. The total demand is thus distributed: 14.7% civil; 43.5% industrial; 41.8% agricultural. From the 1970s to the present, the development of heavy industry and tourism (to a lesser degree also of intensive agriculture) along the coast has caused a progressive increase in water consumption: water has not been obtained from surface sources like rivers since these are of a seasonal nature and their capacity varies greatly in the course of a year, with long periods of almost total dryness. Water has been obtained by drilling wells in deep aquifers of the coastal plains (in the Val di Cornia alone, the number of wells has increased from 49 in 1928 to 1,000 at the beginning of the 1990s); the overexploitation of water tables has caused considerable lowering of the piezometric level (in some areas around 10 metres lower from 1961 to 1984). The decreased pressure of freshwater has allowed the gradual infiltration of saltwater into the water table: infiltration started near the coastline has progressively advanced inland, affecting the water table utilized for agriculture and the wells of factories which had to treat the water with lengthy and expensive desalinization processes.

The water extraction from wells has caused an increasing imbalance between extracted water and the natural reserves of underground water. The presence of chemical, petrochemical, mechanical and steel industries underlines a highly critical problem for what concerns the availability of water. The problem becomes even more worrying when we think that the indicator utilized does not take into account water consumptions in irrigation and for tourism, which are considerable.
The high increase in human presence which occurs in the Summer months, causes excessive extraction from the aquifers aggravating the problem of salinization and increase of chlorides levels in water up to 1,200 mg/litre (the maximum tolerated level is 200 mg/litre).

**Water pollution**

The area is experiencing significant groundwater, rivers and sea pollution where effluents of industrial and civil settlements spill.

For what concerns sewers, problems frequently derive from the technical inadequacy of purification plants whose effectiveness is inadequate in consideration of the magnitude of pollution: this problem magnifies during the Summer period when the coasts are invaded by high number of tourists, and purification plants – sized on an amount of people less than what occurs – cannot provide a satisfactory treatment of the waters which flow into them.

As to industrial pollution, the situation is made complicated by the existence of the industrial plants of Livorno, Rosignano, Piombino and Scarlino. The main problem is related to heavy metal contamination (mercury, chromium, nickel), whose presence in the water is due to industrial effluents and residues deriving from ore bodies. Mercury pollution is caused by the ores of Monte Amiata and by geothermal activity; in particular from the geothermal power plants of Piancastagnaio and Bagnore. The other relevant source of mercury contamination is represented by the industrial plants producing soda by means of mercury electrolytic cells.

The most important industrial plant is that of Solvay in Rosignano which utilizes mercury catodic cells for the production of chlorine, hydrogen and caustic soda: the immission of mercury into the sea has been great until 1976, but still occurs today (furthermore water contamination derives from mercury residue settled beneath the deeper marine sediments). In addition, the Solvay plant directly discharges a significant amounts of calcium carbonate and sodium chloride into the sea (the waste flow rate was estimated at about 200,000 tons/year in 2003) which are utilized in the productive processes of the Solvay soda: the result is the white spot that is typical of beach and sea water opposite the Solvay plant.

As for chromium, sources of contamination from human activities are mining, production of metal alloys and production of finished products containing chromium (dyes, paints, chrome plated objects). As for nickel, the main sources of anthropogenic contamination are represented by mining, production of nickel alloys and the use of finished products containing it.

![Fig. 6 The white beaches in Vada.](image)

In the background: the Solvay chemical plant in Rosignano.

**Coastal erosion**

The massive pumping of water from groundwater aquifers, intensifies the effects of subsidence which is in progress in many coastal areas. The considerable subsidence occurring in many areas represents a risk for the land adjacent to the coast whose altitude lies at almost seal level, and it is at times even lower. Besides intensifying subsidence, human activity has
contributed to aggravate erosion along the coast. The building of piers, breakwaters and other structures has generated changes in the processes of deposition of sediments, which are causing serious erosion. To this we must add the fact that many beaches were replenished by the contributions of river estuaries rich in lime. Reclamation processes in many swampy areas and the excavation of streams – with intent to prevent flooding and for utilizing gravel and sand for building – have reduced the accumulation of sediments, causing serious erosion and a retreat of the coastline which in parts of the gulf of Follonica extends up to 200 metres, but such retreat has also reached worrying magnitudes in some stretches of the coast around Vada Marittima and Marina di Cecina.

To accentuate such erosion phenomena contributes the human impact, which in the Summer months becomes very considerable in tourist areas: dune areas are often used for parking cars and campers, the underbrush is devastated or destroyed altogether thereby exposing the soil to rapid erosion. In many areas of the coast, consolidation efforts based largely on artificial beach nourishment are practiced, but the severity of the problem and possible future scenarios (further retreat of the shoreline, flooding of reclaimed land) make one understand that it is necessary to adopt planning policies for the territory which must carefully face a future use of the coastline, envisaging the exclusion or certain areas to development, the safeguard of dune areas and the prohibition of quarrying river beds for inert materials.

More environmental problems

In addition to the above mentioned environmental problems, there are others pressures on the environment, which cause a more or less marked deterioration of it. The industrial areas of Livorno, Rosignano and Piombino are affected by widespread air pollution caused by the emissions of industrial plants (sulphur dioxide, nitrogen oxides, particulate matter). There is also the problem of industrial waste (lead and granular ashes, waste water treatment plants sludges and water decarbonation sludges). The question of waste disposal is especially critical in the plain of Scarlino where the Huntsman Dioxide plant produces significant amounts of red gypsum derived from desulfurization of liquid and gaseous effluents in the production of titanium dioxide. Red gypsum is disposed chiefly in the area of the plant and in a dump in the territory of Follonica.

The continuity, along the whole coastline, between industrial and tourist-residential urban areas means that frequently the pressures exerted by industrial sites affects the tourist bathing areas (the blatant effects of Solvay plant, whose activity has repercussions on the coastline area where beaches are called bianche (white) due to the sewage of the industrial plant into the water; the fall-out of dusts – the so-called spolverino – from the steelworks of Piombino).

It happens also that industrial activity and tourism generate combined effects upon the natural resources thus exacerbating the effects which one or the other could produce in a non-combined way: the most emblematic case is the pressure on groundwater from coastline industrial plants, jointly with agriculture and with water pumping for the municipal waterworks: in Summer, when tourist activity is most fervent, the crisis of water resources is manifested in a heightened pressure as the various factors act synergetically.

Conclusion

The model of economic development characterized by the combination of heavy industry and tourism on the coast, has generated a high density of business, settlements, infrastructure and, consequently, an overbearing human load. The development of modern industry in Livorno, Piombino, Rosignano and Scarlino drew workers from all the surrounding areas and has conveyed a lot of people on the coast from inland; the lure of industry has joined that of beach tourism, providing good gain perspectives and employment, it has accentuated migration to the coast.

Human activity has resulted in consumption of natural resources, shedding of pollutants into water and air, occupation of land and other forms of pressures which have often pushed matters beyond the carrying capacity of the coastal area.

During the Eighties of the 20th century the decline of industry began, and consequently a loss of jobs followed with the need to divert the workforce towards other sectors. Seaside tourism along the coastline – too concentrated in time and space – is not only incapable of providing new jobs, but has generated such a congestion on the coast as to demand an intervention aimed at decreasing the anthropogenic capacity in the Summer months.
The coastal areas demand further interventions to restore the quality of the environment, in the first instance reducing erosion, restricting pressure on groundwater aquifers, along with the recycling of water and the restoration of its quality.

Notes


Part II

Environmental mobility studies: automobility and the environment in Italy
Chapter VI

The environmental impact of the car on Italian cities (1950-1974)

Urban growth and building speculation

The earliest signs of the remarkable urban growth which pervaded Italian cities (particularly in the regions of the centre-north) during the second half of the 20th Century, became visible from the first half of the 1950s. The process of mass immigration from the southern regions to the cities where the leading productive sectors causing rapid economic growth were accumulating, became evident. That was the so called «miracolo economico» (economic miracle) which reached its peak between 1958 and 1964. Not only the great industrial centres of the north-west attracted immigrants, but also the cities of north-eastern central and parts of industrialized southern Italy.

Between 1951 and 1971, the 23 metropolitan areas of the country experienced a population growth of almost 12,000,000 in 1971, while occupying 8.3% of the national territory, and they housed 49.4% of the entire population. The metropolitan areas of the centre-north doubled the number of their residents (from 8,418,296 of 1951 to 16,766,709 of 1971), whereas in the centre-south growth was less dramatic (from 6,345,205 to 9,934,832).

Under the pressure of this unprecedented migration the reconstruction of the cities came under the control of private speculators and in particular of a «builders club» which catered for the interests of builders, building industry professionals, real estate owners, private speculators and investment banks. It has been pointed out that «such a club extended its interests to all economic and social sectors, in line with the well known notion that «if the building industry thrives, all economy thrives»». It has also been calculated that between 1956 and 1965, investment in the building sector represented 12.5% of the GDP and that house prices increased by 250% whereas the general increase in consumers prices was of 140%. During the reconstruction years and the period of miracolo economico the building industry became, together with the car industry, the chief sector of the Italian economy. Clearly this had been the result of a precise political choice designed to enable the building industry to develop unhampered since it created jobs for a considerable number of otherwise unemployed workers (the building industry employed more than two million workers), providing at the same time, accommodation for the homeless.

During the 1950s and 60s therefore, urban growth was heavily influenced by private interests which at the same time delayed and conditioned urban planning. Cities thus ended up by spreading haphazardly while building speculation produced, over the years, a widespread lack of collective amenities which apart from depriving new building estates of the recommended «settlement fitness» specifications as set by planners, also gave way to densely built up urban areas lacking in essential services.

The pace of growth was chaotic. By the end of the 1950s the number of rooms was over 47,000,000 units (with a population of 50,000,000) the majority of which had been built in the regions of the centre-north, where there was practically one room per resident. In the 1960s, during which 16,000,000 rooms were built, the expansion of housing was even more conspicuous, especially in medium size towns. The number of dwellings built, including those illegally built, went on growing inexorably through the 1970s. During this decade, as compared to a modest rate of population growth (of two million), 23,000,000 rooms were built, and owner residents reached 60% of the total.

What happened in Italian cities between 1946 and the end of the 1970s is very effectively summed up by planner Giuseppe Campos Venuti:

The cities of the miracle growth by virtue of a phenomenon called by architects ‘the oil stain’, meaning spreading in all directions, indiscriminately, invading the countryside not leaving aside indispensable space for future gardens or for services; a mighty block after another, interspersed by narrow gaps where streets are but narrow lanes, and with a density which only fulfils the arrogant wishes of building speculators. The communes watch powerlessly: while proprietors “allot” and sell without leaving aside one single square metre for amenities of collective interest, most of the time they demand to be paid for land where the communes will later have to build roads, drains, electrical networks, water and gas pipelines.

Within the above described context, the diffusion of private transport was regarded as indispensable in order not to hamper building expansion. The car, in fact, enabled an ever-growing number of people to reach the new suburbs in comfort and at a reasonable cost.
The car «boom»

The growth of private transport went hand in hand with building expansion. The car in Italy had not had a significant influence upon the organization of public transport and upon personal mobility, at least up to the early 1920s when the Fascist regime started the first motorways, boosting private transport.

It was only after the Second World War that the diffusion of the motorcar gained a new impulse: in 1946 private cars numbered 149,649, these increased to 342,021 in 1950. Still in 1950, production, which in 1945 had dropped to 2,093 units, as opposed to 55,553 of 1939, went over the pre-war level reaching the number of 101,310 cars. Notwithstanding the first symptoms of an economic recovery, the density rate of cars in circulation, i.e. the number of inhabitants per vehicle, continued to be very low in Italy. In 1950 the rate was of one vehicle every 81.9 inhabitants, against a rate of 48.7 for West Germany, of 24.2 for Switzerland, 20.7 for Belgium, 17 for France, 15.2 for Great Britain, 5.8 for Australia, and 3.1 for the United States.

In 1959, in spite of the numerical increase in cars which had taken place between 1950-1958 an annual rate of 15.48%, we still could not speak of mass motorization. Italy continued to be essentially a country on «two wheelers» or, if you like, on «three wheelers», the typical little transit vans which clogged up urban traffic. Until the economic miracle years the expansion of private motorcars was characterised by an extraordinary increase in sales and circulation of scooters.

We can say that Italy joined the club of motorised countries only in 1964, at the end of an extraordinary period of growth already known as the «miracolo economico». In this same year, the number of cars in use went over that of scooters: the «four-wheeler» (4,674,644) overtook the «two-wheeler» (4,656,035) by a mere 18,609 units.

In the economic boom years, between 1959 and 1963, car expansion grew alarmingly with a mean annual increase rate of 20.7%. In 1964, compared to 1950, car density went from 81.9 to 9.9 inhabitants per vehicle and cars on the road numbered more than three times the number of 1958.

From 1964 to 1974 there were 14,303,761 vehicles on the road and the mean density had reached 3.6 inhabitants per vehicle, 3.89 per car. Therefore 1974 marked the peak of the first phase of the mass diffusion of the private motorcar. Beginning from 1975, in fact, commercial trends altered considerably, and the production of such car models as had hitherto characterised the country’s market, were all but taken out of the market, being replaced by new cars designed to compete with an aggressive foreign competition. By the end of what may be rightly called the «motorcar revolution», Italy had become one of the countries with the highest density of vehicles in the world, having reduced to nothing the initial gap. The exceptionality of the Italian case was confirmed by the rate of expansion after 1974. In 1990, for example, Italy had the highest density of cars in Europe and was fifth in the world following the United States, Canada, Australia and New Zealand.

Cities «up to the neck in cars»

Following the sudden explosion of car sales between the end of the 1950s and the beginning of the following decade, in the principal cities of Italy and in many of its towns, road traffic had become a problem. In 1968 an important weekly magazine, «Domenica del Corriere», gave ample space to the chaos which pervaded the roads in all Italian cities with an article entitled «Italy up to the neck in cars».

This situation had been reached because during the first half of the 1960s, local administrations were not able to make the right choices in urban planning following the growing demands for mobility, restricting themselves to vaguely pointing out the problem. The explanations of this deficiency in decision making are essentially two. The first derives from the method. In fact, in Italy, statistical forecast techniques aimed at predicting traffic density growth by means of mathematical models, were practically unknown, or at any rate they were rather obsolete, since they did not consider political and administrative issues in urban planning, although these matters were regarded as priorities by Anglo-Saxon researchers. Furthermore no organised studies of traffic were available; the scanty data available was restricted to quantitative analyses which were mere collections of quantitative data concerning vehicles in circulation. The few enquiries on the origin and destination of vehicles in transit, carried out by the Automobile Club Italia (Aci), bore little value since they did not take into account the reasons for movement and the use of road space.

The second reason concerned the absence of adequate legislation on the matter. In fact the rules concerning land communication networks were still the ones addressed by the 1942 law.
on planning (a law passed at a time when in Italy, as a whole, there were only 73,790 cars) since Parliament was never able to pass a new general planning law. As a result there was a serious lack of areas destined for collective amenities (in the first place those destined for road networks and parking spaces) and the progressive deterioration of urban structures and transport system congestion.

During the course of the first half of the 1970s the traffic congestion in Italian cities remained practically unchanged, and not only that, we also observed the failure of the measures adopted by local administrations, all amounting to interventions in the area of traffic management and upgrading of infrastructures. Such were the measures upon which all administrators could agree. To solve the urban traffic problems, the Associazione nazionale comuni italiani (Anci)\(^{13}\) (National Association of Italian Communes) proposed, in the pages of its news magazine, «the possibility of co-ordinating the infrastructure systems in great metropolitan areas with territorial and regional ones […], the development of systems of urban public transport based upon fast vehicles […] the study of efficient underground network systems, the planning of a network of urban toll and free motorways, the realisation of large car parks near city centress»\(^{14}\).

The remedies put forward by the Lega nazionale dei comuni democratici, regioni, province ed enti minori (National league of democratic communes, regions, provinces, and minor institutions)\(^{15}\) were not very different from those proposed by Anci. The organization of socialist, communist and republican communes proposed the rationalization of taxi ranks and bus stations, the building of underground passages and car parks, the building of inter-city coach stations, the ruling that new roads should not be less than 14 m wide, the institution of municipal offices for monitoring traffic, and to organise road traffic on the basis of speed and type of vehicle and weight\(^{16}\).

Measures for regulating traffic actually enforced by local authorities concerned chiefly the checking of traffic flows (one-way streets, no left turning, installations of automatic traffic lights) and parking (establishment of «green zones» and pedestrian precincts, installation of parking metres). Some local administrations had instituted preference lanes reserved for public transport, with the purpose of easing traffic circulation and to increase the rate of speed of commercial traffic (hampered by cars, buses were restricted to an average speed of 15 km/h) even so, the lack of method and the scarcity of reserved lanes did not bring about the expected benefits. The failure of traffic engineering measures was essentially due to their fragmentary and casual nature. Local councils who adopted these measures not according to a careful plan, but as a result of pressures to intervene, often resulted in emotional reactions, coming from the indignant man in the street, fed up by the situation of urban circulation. Furthermore, the measures adopted by local administrations did not follow commonly shared criteria and often not even scientific criteria. This chaotic situation led experts into demanding the passing of national law dictating guidelines to which local authorities must adhere to. Lacking a firm legislation, many communes, chiefly medium size and small, had adopted no measures to deal with the chaos of vehicle circulation, whereas in the cities, such measures were applied rather irrationally and casually.

In large cities, beyond measures in the field of traffic engineering, other measures of a structural nature were applied. Generally speaking these consisted of by-passes and ring roads, whose final aim was to lighten the traffic of vehicles in historical city centres. In a few years, however, along these new roads, high density settlements dwellings and businesses were built turning by-passes into urban avenues with traffic congestion problems similar or superior to the original ones. Furthermore, often such by-passes and ring roads were planned with inadequate technical features for supporting the amount of traffic of the time and, therefore, were absolutely insufficient for absorbing the ever growing number of cars in circulation. This was because in Italy the budget allocated to road building went almost entirely to motorways, whereas to urban and ordinary roads only went negligible resources; half of what was budgeted for such roads in France and Britain, and one fifth of Germany's.

Restricted to larger cities were, eventually, envisaged ambitious plans concerning the building of urban underground or tower car parks, and of metropolitan railways in Milan, Turin, Genoa, Venice and Rome (among these only Milan and Rome got their underground lines). During the course of the 1970s, town councils continued to postpone any policy aimed at applying precise and rigorous rules in matters of urban traffic planning and control policies remained restricted to limited measures aimed at making the best out of what already existed and to rationalising, as far as possible, road traffic in an attempt to prevent the total breakdown of urban circulation.
Urban chaos, circulation crisis and pollution. The cases of Rome, Milan and Florence

Rome, Milan and Florence represent a case in point in illustrating the way local administrations confronted the problem of urban expansion and car traffic increase.

Concerning Rome, planners speak of a true «town-planning massacre», which took place chiefly during the years spanning from the second post-war period to the 1960s. During this period the city was subject to a savage building speculation rush, led with the consent of a centre-right administration, by the vested interests of the aristocracy, of a builders’ bourgeoisie, and by the Vatican owned Società Generale Immobiliare. A comprehensive operative plan was only produced by the city council in 1962 and was only approved in 1965, when the city had already been overbuilt in disregard of any principle of fair administration.

This speculation exercise was accompanied by massive widespread illegal building, fuelled by the demands of a fast growing population (623,100 more inhabitants between 1955 and 1970). In 1962 illegal buildings occupied an area of 3,800 hectares; in 1977-78, during the development of an alteration to the general plan of 1962, illegal buildings amounting to 267,000 rooms were counted over an area of 5,000 hectares.

The dramatic lack of essential amenities of collective interest, the scarcity of green areas (2 m² per inhabitant), and a road traffic which was impossible to govern, created a situation apparent to all. Conducive to this situation was the slow progress of the works for the underground railway, the dismantling of tramway lines (from 182 km in 1953 to 43 km in 1966, with a decrease in the number of passengers from 396,320 to 77,897) the inadequacy of the road system, which had remained practically that of the ancient Roman roads.

An article appeared on «Quattroruote», the main monthly car magazine in Italy, which very effectively described the lack of any planning when speaking of an «almost comical example» concerning the enforcement of regulations established by the general operative town development plan.

An example of this (…) is the ‘bottle-neck of the Via Salaria’. In order to ease the heavy traffic of cars and trucks on this road, the town-development plan contemplated a one way traffic flow to be made possible by the building of an alternative route running behind the mansion of an aristocrat. As it happens, on this site, a builders’ co-operative had erected two luxury villas, with the result that now the authorities of the Capitol seek the key to the solution of a problem which has become insoluble, by means of the most audacious experiments.

In 1966, when in the Province of Rome there were 624,009 cars in circulation (increased to 1,191,547 in 1974), the average speed of urban traffic was of 5 km per hour.

In spite of the institution, in 1962, of a Citizens’ Consultative Committee on Traffic, the city administration, under public opinion pressure, renounced the adoption of a serious policy aimed at redressing the balance of the transport system in favour of public transport, ever more congested. The proposed remedies put forward by the Commission of Enquiry on Traffic, established on November 1963, remained words on paper. The report spoke of «green-wave-routes» (itinerari ad onda verde), some kind of «urban motorways», of a traffic plan aimed at establishing priority for public transport and rigid parking regulations, of a «specialization» of traffic areas including «pedestrian precincts».

The blatant inconsistency of the traffic policy put forward by the Capitoline administration – which, as we read in a report written by the commission, should not have «altered the existing urban equilibrium» or oppose «in any way» the «development of the city as envisaged by the operative plan» – was the fact that it failed to turn into pedestrians only the area included between Piazza del Popolo, Via della Mercede, Via del Corso and Trinità dei Monti, which aborted after only a ten day trial period. In 1968, the administration, notwithstanding the violent reactions of public opinion (43% of all journeys were made on private cars, 40% on public transport), decided to close to traffic a portion of the historical centre and, in 1973, the park of Villa Borghese. Such restrictions remained largely ignored by car drivers. Rome also held the unenviable record of being the city with the highest level of pollution deriving form motor vehicles.

Already in 1960, both in the Via del Corso and in the underground passage by the Quirinale, a concentration of carbon dioxide of 0.3-0.5 per thousand was measured, and it was calculated that the level would stabilise around the 1.5-2 per thousand. In 1967, motor vehicles in circulation, most of them obsolete, released in the air 269,040 tons of carbon dioxide; 31,289 of hydrocarbons; 11,700 of nitrogen oxides; 873 of sulphuric oxide; 383 organic acids; 1,074 of dust particles.
In Milan, the first operative general town planning programme was approved in 1953, when already large sectors of the city showed a very high density of residential units, favoured as in Rome, by the reconstruction plan. The 1953 plan showed all negative traits of the town-planning methods of those days: a high residential density – the plan envisaged the building of 2,500,000 dwelling rooms for a population of 1,280,000 residents which did not grow beyond the 1,750,000 units reached in 1973 – due to blown up growth forecasts which represented a concession to private speculators, the phasing out of industrial settlements and the resulting conversion of the central areas into services areas, the lack of collective amenities and, in particular, of public green (1 m² per inhabitant in 1961). Under the pressure of speculators, the addenda to the general operative plan of 1963 and 1969 failed to give results, and the situation remained unchanged until the publication of the new plan in 1976. The planning measures concerning car traffic led to the development of a dense network of roads which, disregarding any rational consideration, created a chaotic system of circulation and lacking in any adequate parking areas. Furthermore, in Milan too, the enthusiasm for the private car led to the dismantling of tramway lines, which reduced from 302 in 1953 to 128 in 1966. In a belated attempt to find a remedy to this situation, the administration of Milan was one of the first to adopt measures aimed at easing the congestion of road traffic by forbidding the parking of cars between certain hours of the day: from 7:30 to 9:30 and 1:30 pm to 3:30 pm (the so-called «green zones») and by allocating certain areas of the city centre to pedestrians only. Notwithstanding such measures and the building of an underground metropolitan railway system, traffic problems remained practically unsolved. It is true that in 1964 in the province of Milan there were 469,552 cars, which in 1974 had increased to 1,233,285 (this meant 8.63% of all cars in circulation in Italy). Every day (1972) 342,000 cars came into the city bringing in 74% of all commuters, whereas commuting cars numbered to 670,000 daily (only 33% of commuters used public transport). As to the quality of the air, Milan was, after Rome, the city with the highest level of polluting emissions produced by motorcars. In 1955 it was shown that in the air of central streets there were from 0.48 to 2.24 mg of lead per g. of dust, and in the air of peripheral streets from 0.40 to 0.88 mg. In 1967 vehicle exhausts discharged into the air 164,160 tons of carbon dioxide; 31,295 of hydrocarbons; 6,815 of nitrogen oxides; 533 of sulphur dioxide, 234 of organic acids and 655 tons of dust particles.

The head city of Lombardy showed in 1972 a level of sulphur dioxide of 0.0196 kg/m³, against a national average of 0.0019 kg/m³. Due to its poor environmental situation, in 1996, the environmental association Italia Nostra, the Centro studi attività politiche (Centre for the study of political activities) and Ente provinciale per il turismo (Tourist office), organised in the city of Milan the first important public awareness campaign concerning air pollution called Aria per Milano (Air for Milan).
Up to the mid 1950s, Florence, not having an operative development plan yet, expanded in a disorderly fashion\(^2\). Its urban lay-out was, from 1958, further undermined with the approval of an operative plan allowing intensive development in the plain (with a density of 7 m\(^3\)/m\(^2\) to 20 m\(^3\)/m\(^2\)) allowed building on the hills and left the city centre without real protection. Furthermore, planners allowed only small areas for common green and services. An attempt to correct this situation was made by the Detti Plan of 1962 – from the name of the Councillor responsible for urban planning, member of centre-left coalition, who promoted it – which established, as a priority, the protection of the city centre, it reduced building density, increasing the space designated for public green and services, directing the expansion of built up areas towards the north-west.

After the crisis which, in 1964, led to the fall of the centre left coalition in the local government, the Detti plan was de facto shelved, without raising any protest from the part of public opinion. The numerous addenda to the plan, approved in the 1960s and 1970s, encouraged, in spite of a relatively modest growth in population, very substantial development which led to the doubling in size of the urban area by adding 220,000 rooms to it (a 45% growth). In this situation the road network too, along with public green and service areas, suffered to the benefit of building speculation. The decided shift of the city towards services accompanied by an inadequate communication system caused traffic congestion problems well in advance of other medium-size cities. Between 1952 and 1964, in the province of Florence, the rate of increase of private motor vehicles reached 634.33%. In 1964 there were 163,308 vehicles on the road (147,614 of which were cars) one car every seven inhabitants. In 1974 the rate increased to 428,135 vehicles (397,066 of which were cars) one car every 2.77 inhabitants.

One should not, therefore, be surprised if aerial photographs taken in the 1960s show the roads of Florence occupied by a great snake of cars and if squares were only huge car parks, with cars parked right to the steps of the churches of Santa Croce and the Cathedral of Santa Maria del Fiore. When in 1964, the Borough Commissioner, Lorenzo Salazar, tried to rid the city centre from cars with a bill which banned cars from the medieval heart of the city. A protest led by Christian Democrat MP Salvatore Foderaro, president of the parliamentary group «Amici dell’automobile» (Car friends), induced Salazar to withdraw his bill\(^3\). Only in 1971, despite the protests of traders and residents, a limited traffic zone, called «zona blu» (blue zone) was enforced. Over the years the traffic situation, in spite of works on existing structures and new roads, did not improve. The various road trunks appeared, in fact, disjointed and car circulation remained restricted to the system of avenues which crossed the city from the southern outskirts (Rovezzano) to the northern (Peretola), whereas in place of a true ring road, road belts connecting the motorway to the city were built. To aggravate the existing traffic problems were both the lack of an appropriate system of car parks and the dismantling of tramway lines (from 65 km in 1953 to 0 in 1966). So far as the environmental situation is concerned, Florence appeared to be one of the most polluted cities in Italy. A survey carried out by the Istituto di chimica analitica of the University of Florence, found that road traffic and domestic central heating systems were the chief sources of pollution\(^3\). Measurement made in Autumn 1972 and
winter 1973, showed, in the air, high percentages (0.0035 kg/m³) of sulphur dioxide and the presence of calcium, aluminium, silica, magnesium, manganese, iron, vanadium, copper, zinc and nickel, beside high quantities of lead (average of 7μg/m³) and polycyclic aromatic petrol released by vehicle exhausts. The situation which we have illustrated concerning the three cities not only applied to all medium size and large cities in Italy but often to centres of modest size, so much so that in 1973, the first report on the environmental situation of the country produced an alarming picture of the urban environment.32

Fig. 3 Florence, Piazza della Signoria in the second half of the 60s

The discovery of pollution

Italy had officially discovered pollution in March 1971 when the president of the Senate, Amintore Fanfani, promoted the institution of a Comitato d’orientamento sui problemi dell’ecologia (Orientation Committee for Ecology Problems)33. In 1973, the conclusions of the Prima relazione sulla situazione ambientale del paese (First report on the environmental situation of the country) provided the first scientifically relevant data concerning the «state of health» of urban areas.

According to what was reported in the document, Italian cities continued to occupy the last positions in the European scale regarding the relationship between the number of inhabitants and green areas: 2m² for Rome, 1.5 for Turin, 1 for Milan, 0.58 for Naples (where in 1973, 27 residential districts did not have any green areas) in Florence the inhabitants of new residential districts, when they did not have any green areas, they had about 0.70 m² of public green per head34.

The values of noise measured in various Italian cities were decidedly higher to the standards regarded as acceptable (up to 50 dB) and appeared to be produced for the greater part by road traffic. In the streets of Milan (1959) values of 85-90 dB had been recorded, in Rome (1968-1969) levels reached 60-100dB, and in Bologna (1972) 85-100 dB. As far as air pollution was concerned, beyond industrial fumes, the chief sources of pollutants were domestic central heating plants – between 1966 and 1971 the consumption of fuels had practically doubled going from 114,109-10⁹ Kcal to 225,934-10⁹ Kcal – and in motor vehicles. It was estimated that in 1968, 42% of the population lived in «high risk» areas35, and that deaths due to diseases connected with air pollution amounted to 66,799 (those directly caused by this were 10,371), cases of disease amounted to 6,500,500, hospital cases and hospital days amounted respectively to 80,000 and 13 millions, working days lost to 3,600,000. Between 1966 and 1971, motor vehicle emissions had increased altogether by 46.3%. Dust emissions had increased by 6.7%, sulphur dioxide by 6.5%, nitrogen oxides by 7.2%, hydrocarbons by 7.6% and carbon dioxide and lead by 8%.

In 1972 motor vehicles in circulation had produced 5,425,000 tons of carbon dioxide; 746,000 tons of hydrocarbons; 215,000 tons of nitrogen oxides; 20,500 tons of «particle matter». In almost all urban areas with heavy traffic, the level of nitrogen oxide reached 100-150 ppm, when the admitted limit was 20-50 ppm, furthermore, the blood of people «not exposed for occupational causes to lead rich environments» contained high concentrations of lead amounting to 20-80 mcg per day in excess of the danger limit set at 8 mcg/100 ml of blood. Concerning nitrogen oxides and oxidising substances there were no available data36.

In Italy, the car was singled out as one of the main causes for air pollution from the 1950s. The Public’s attention was only sporadically drawn to the problem of traffic noise, but not yet to
air pollution caused by motor vehicles. One of the reasons for this was the widespread opinion that concern for the environment was a mere attempt to preserve the privileged life-style and cultural values of an élite. The protection of the environment was regarded as a luxury only affordable by the few who enjoyed a high standard of wellbeing. For this reason all questions concerning environmental policies were held as being much less urgent than those concerning the improvement of living standards and a minimum of social welfare to larger sectors of the population who still lived in poverty conditions.

In November 1957 the World Health Organization held a Congresso per l’inquinamento atmosferico (Convention on air pollution) in Milan, in which fifty delegates from twenty three European countries took part. From this congress came data which the «Pirelli» magazine described as being «more alarming than anyone could envisage». For the first time, cars were pointed out as «a source of danger» and from the works presented it emerged that in certain areas of Milan the levels of carbon dioxide in the air were similar to those in Los Angles, this meant one part of dioxide each 4,200 parts of air.

From 1960 the subject begun to be discussed in the specialised press which examined the relationships between the inhalation of car exhausts and the occurrence of certain diseases. The journal of the Commissione per l’automobilismo industriale (Commission for industrial motor car transport) of Aci, in its first issue of 1961, underlined the role of motor vehicles as sources of air pollution and listed the damaging effects of smog.

To the sources of pollution, which have become increasingly more concerning over the past decades, another has been added recently, one third, not less serious, constituted by the emission of products issued by internal combustion engines. [...] The effects of smog and of fog may be: 1) truly intoxicating and even cause death, 2) irritating for the respiratory system and for the eyes; 3) disgusting or disturbing to the organism.

The following year, the Aci weekly magazine pointed out the fact that in Italy there was no «law against gases», whereas the monthly magazine of the Istituto sperimentale della Commissione strade (Experimental Institute of the Commission for roads) of Touring Club, published an article with concerned undertones where diseases connected with air pollution were listed.

In 1964, on the September-October issue of the «Annali della sanità pubblica» (Public Health Annals), the minister of Health published a study by Prof. Cominelli, which unequivocally put under accusation road traffic, as one of the principal causes of pollution.

Motor traffic constitutes, as we know, one of the chief sources of urban air pollution. We have tried to establish statistics concerning global pollution, translating these into values which span from modest [...] up to 25% in larger cities [...]. Whatever the volume of pollution deriving from road traffic, we cannot avoid to attribute to motor vehicle exhaust a particularly dangerous quality [...] 40.

The expert of the ministry for Health believed «ill conceived» any optimistic attitude in this respect and, although he believed it to be a «vaguely fictional» hypothesis, regarded the «generalised use of different sources of energy from the present» as the only solution which would radically deal with the problem.

Notwithstanding the ongoing debate in the country, the first law in matters of air pollution was only passed during the second half of the 1960s. As to motor vehicles, legislation consisted of mere generic statements. The first ruled that motor vehicles must not «issue polluting discharges, however caused»; the second ruled that Diesel engine vehicles must not «issue fumes of a density above those established by regulations». The only concrete measure adopted by the text ruled that regular testing of motor vehicles should include checking polluting discharges; as to the installation on the vehicle of devices which reduced the toxic exhaust gases, the ruling established that the ministry of Health should have faculty to make this obligatory, only after having asked for many opinions.

In 1967 the monthly magazine «Strade e traffico» (Roads and traffic), dedicated a soundly based article to the relationships between air pollution and the development of urban traffic, quoting a study carried out by the Chase Manhattan Bank, the monthly highlighted the fact that transport constituted the chief source of pollution (59.8%), followed by industry (18.7%), power stations (12.6%) domestic central heating plants (6.2%), and refuse disposal plants by incineration (2.6%). Furthermore, motor vehicles represented the chief source of carbon monoxide. The magazine highlighted the fact that in Italy the problem inherent with petrol engines had not been studied from a «really practical point of view», and pledged that European countries should adopt rigorous measures, established bearing in mind the urban planning situation, the situation of traffic and of the development of motorised transport, in order to «grant absolute safety for public health». In March 1969 Italia Nostra promoted a meeting in Milan on pollution caused by the motorcar, which had vast resonance throughout Italy.
Notwithstanding the vibrant tones of the internal debate and the growing alarm of the unstoppable depletion of the urban environment caused by the geometric increase in traffic and by air pollution registered in cities, only in 1971, following a European law (n. 70/220/CEE), the Colombo government passed a bill aimed at checking the concentration of polluting discharges by motor vehicles using petrol. The measure dealt with the characteristics required to approve a vehicle those concerning the limiting of polluting gases should be included, and established that such fitness should be tested in the presence of a official from the Ministry of Health or from the Higher Institute on Health. The law contained, however, general rules which were restricted to the acceptance of the European guideline but failing to tailor it to the Italian situation: this made the provision little more than a declaration of intent.

Notwithstanding the progressive deterioration of the situation, during the course of the 1970s and ‘80s adequate legislation on the matter was still lacking, no national survey project was conceived and no urgent measure was adopted, as wished by experts, to lower the levels of obnoxious substances present in vehicle exhaust. We can point to two chief reasons which determined such an underestimation of the environmental impact of the motor vehicle. On one hand was the resistance (and the requirements) of builders who were so powerful as to be able, in spite of the enormous amount of data testifying to the obvious relationship between the substances contained in car exhaust gases and the increase of urban air pollution, to postpone the enforcement of all recommendations put forward by experts. On the other hand, municipal administrations, save some declaration of principles, showed a scarce attention to the problem and did not exercise sufficient pressure upon central government to pass severe anti smog laws.

Notes


2 Cf. Tecneco, Prima relazione sulla situazione ambientale del paese, Roma 1973, vol. II, 284-400. In particular, the area of Milan-Brescia went from 3,803,992 inhabitants to 6,351,017. Turin from 834,375 to 1,714,292; in the centre-south, Rome and Naples registered the highest increase passing, respectively, from 1,734,055 residents to 3,117,232 and from 2,713,015 to 3,652,745.


5 Bernardo Secchi, Il settore edilizio e fondiario in un processo di sviluppo economico, in F. Indovina (ed.), Lo spreco..., 3-46.


7 Ibidem, 15.

8 The data have been worked out by the author. Statistics were provided by Aci, Autoveicoli circolanti, 1950-1975 and by Istat, Annuario statistico italiano, 1950-1975.


11 The Automobile Club Italia was founded on the 23rd of January 1905: the establishment of an association of car drivers was felt necessary after 1898, when the first Automobile Club had been founded in Turin, and this was followed by others in Florence, Milan and Genoa. In 1960 the Automobil Club Italia had 305,500 members. In 1975 Aci was officially acknowledged as a «public institution».

12 The law of 1942 was restricted to prescribing that the general town planning programme should indicate the network of main roads.

13 Anci was created in 1901 as a free league of communes. Up to 1926, when Fascism included it in a Confederation of autarchic institutions, it carried out propaganda activities concerning local autonomy causing an interesting meeting point between catholic, socialist and liberal-democratic administrators. In the post-war period Anci regained its role and its original independence.

14 Mozione degli amministratori di comuni e province presenti alla XXIV Conferenza di Stresa, Notiziario Anci, October-November 1967.

15 Born in 1916, the «Lega dei comuni socialisti» (League of Socialist Communes) was suppressed in 1926 by the Fascist Regime. During the post-war period it changed its name into «Lega dei comuni democratici, delle regioni, delle province e degli enti minori» (League of Democratic Communes, Regions, Provinces and minor Institutions) following the joining of the Republicans (in Umbria) and of
the Communist Party. In 1968, at the 5th Congress of Bologna, it changed its name into «Lega per l’autonomia dei poteri locali» (League for the Autonomy of Local Authorities)


23 L’inquinamento atmosferico e lo sviluppo del traffico automobilistico, «Strade e traffico», November 1968.


26 Il verde in città, «Quattroruote», June 1961; cf. also A. Cederna, La distruzione..., Einaudi, Torino 1975, 324-337.


37 Law 13 July 1966, n. 615. The regulations enforcing the law were only put into practice in 1970 and concerned central heating plants and vehicles with Diesel engines: industrial plants and vehicles with petrol engines (the great majority of vehicles) were excluded.

38 L’inquinamento atmosferico e lo sviluppo del traffico automobilistico, «Strade e traffico», November 1968.


40 Law 3 June 1971, n. 437.
Chapter VII

Transport and the environment in Italy (1944-2006)

The growth of transport

Policies

In Italy, during the second half of the 20th century the development of transport has been characterized by three factors: the achievement of road transport, the construction of great infrastructure (first and foremost motorways), the rapid growth in volume of both passenger and freight transport.

By the end of the Second World War, the Italian road network presented complex structural problems, essentially due to war damages which made half of the state road system, one third of provincial roads and one sixth of local roads unusable. The road network still retraced the pattern of the Roman and medieval road systems, and consisted, for over two thirds, of provincial and local narrow and unpaved carriageways, crossing all towns and villages en route.

The lack of road infrastructure, prompted the Bonomi Government to reorganize the transport sector, which became one of the first to be administratively rationalized with the extinction of the Ministry of Communications, and the creation, in December 1944, of the Ministry of Transport.

Thus a two-headed system was born which had in the Ministry of Public Works its management centre for the coordination of road transport and in the Ministry of Transport the institutional hub of the rail and air sectors. This dual system meant that the different networks developed independently almost as if they didn’t have to interact on the same territory, and also because of the prevalence of the conviction that infrastructure did not significantly influence the economic development, transport policy developed without serious and effective planning.

During the first parliament (1948-1953), the seventh De Gasperi Government introduced a bill (signed by Salvatore Aldisio, the Minister of Public Works) which granted to National Road Board (ANAS) special funds amounting to forty billion lire for the improvement of the road system in the Southern Italy. The Aldisio bill (1951) was the first to determine a turning point in favour of road infrastructure development, a choice also dictated by the influence exercised by the model of economic expansion which was developing in the early Fifties, and which regarded the automobile industry as a strategic sector to be supported and encouraged.

Within this scenario the motorway policy began to emerge, favoured by two crucial premises: the first was the institution, on 16 June 1952, of the Federazione italiana della strada (FIS, Italian Federation of the Road transport) which declared its objective to favour the funding of road infrastructure; the second was the institution of the Gruppo parlamentare Amici dell’automobile, chaired by the Christian Democrat Salvatore Foderaro (Parliamentary Group of car friends). The Amici dell’automobile organized in nine working commissions, grouped nineteen senators and one hundred and twenty members of the Chamber of Deputies (Christian Democrats, Liberals, Democrat Socialists, Monarchists, Neo Fascists, and some member of the Mixed Group, but not Communists and Socialists).

The first motorway plan was presented by Giuseppe Romita, the Minister of Public Works – one of the excellent representatives of the Amici dell’automobile – on 9 November 1954 (Law n. 463, 23 May 1955). The plan provided 120 billion lire, 20 of which designated to ordinary road in the South, and 100 to the realization of the following motorway layouts: Milan-Naples, Serravalle Scrivia-Milan, Savona-Ceva, Turin-Ivrea, Brescia-Padua, the doubling of the Padua-Mestre, Naples-Pompei and Naples-Bari. The Romita plan met practically no opposition. The parties of the left, and the Communist and Socialist in particular did not oppose the law in fear of damaging the interests of the unemployed. Between 1956 and 1958 centre governments specified more exactly their motorway policy. In November 1956 the law n. 1328 was passed, which included in the motorway programme the Bologna-Rimini, the doubling of the Via Aurelia between Rome and Livorno, the doubling of the Florence-Tyrrhenian Sea and the Naples-Reggio Calabria. When the second parliament came to an end, on 30 June 1958, the choice in favour of road transport was definitely in place. In the course of the five years term, governments had financed the building of 10,000 kilometres of roads, they had started the improvement of the national roads network and approved a motorway plan which had no equal in Europe. Three years later, the attitude in favour of road transport took action with the motorway plan proposed by Prime Minister Amintore Fanfani on 12 January 1961.
The main provisions of the measure (Law n. 729/1961) concerned the construction of some highways, the consent of ANAS to take out loans for 180 billion for the construction of the Salerno-Reggio Calabria, and the allocation of 408 billion (a figure which committed the budget of ANAS until the year 1999-2000) for the co-financing of the motorway layouts already approved. In essence, the Fanfani plan brought to fruition a policy of infrastructure centered upon a highway system that was unprecedented in Europe. This caused a waining of interest in public transport: railways entered a phase of crisis caused by the age of the lines and the difficulty of competing with road transport, favoured by a widespread diffusion of the bus and by the flexibility granted by the car. The tramways – both urban and suburban – were gradually replaced by buses; air travel began to play a growing role, albeit all in all, marginal. Such transport policy embedded within a tow-headed development pattern (on the one hand the policies of road and cars interest, on the other rail trasport) ended up with promoting micro-sectorial interventions instead of broader intermodal convergences duplicating those aspects of non-interference and non-communicability among different sectors of the organization, identified as the main problem of the Italian transport system.

The result was a system characterized by a lack of co-ordination between the different forms of transport and by an institutional weakness of public policies, with respect to the pressures exercised by industrial oligoplies: that of the car, led by FIAT and the electro-mechanic, almost entirely State owned within the Institute for Industrial Reconstruction group (IRI). In the transport sector, the network between industry, politics and public administration tended to merge so as to structure stable and lasting policy networks which extended to the building industry (fragmented into many small units) and to petrol-chemical industry, gathered around the ENI (National Hydrocarbon Corporation). This closed and protected market, remained practically unchanged until the early 1990s, generated a mono-modal system characterized by a predominance of road transport.

In the early 21st century, the main problem of the transport system remained the absence of a comprehensive policy that was capable of treating the major chronic woes: the lack of coordination between the different modes of transport and the existing inequalities between regions. Intermodality development was hampered by at least four factors: the predominance of carrier by road over rail; the prevalence of small companies over large ones in road transport; the absence of policies to discourage the use of trucks over long distances; the underestimation of diseconomies produced by road transport (pollution, overuse of non renewable resources...).

The persistence of such problems highlights the difficulties encountered by policy makers in putting into practice the directives approved by the European Union (until 1992, The European Economic Community) which – despite of the many actions aimed at favouring rail, water and sea transport (less detrimental to the environment and less energy-consumptive) and reducing the competitive inequality between the different means of transport on the basis of the notion according to which those who utilize transport systems must also sustain the externalities bearing upon the community (including environmental ones) – were unable to affect the mono-modal nature of the transport system.

The data

The mono-modal nature of the Italian system of transport, also appears evident from the analysis of the data: between 1950 and 2006, the extension of the road network grew by 395.12% whereas that of the railways and tramways decreased respectively by 6.32% and 72.93% (Figs 1 and 2); in 2006, road transport – which in 1970 moved 44.29% of goods – attracted 64.30% of traffics (Fig. 3).
Fig. 1. *Lenght of infrastructure. Km. Italy 1950-2006*³

Fig. 2. *Length of road network. Km. Italy 1950-2006*⁴
Source: Istat, *Annuario statistico italiano* (stated years);
Broadening the subject to include Europe, we must say in fairness that Italy is not the only country to have a transport system decidedly partial in favour of road transport. Over the years, in fact, the monomodality – presented by historiography as a negative peculiarity of the Italian transport system – has become a problem of European magnitude. Between 1970 and 2001, road transport peremptorily established itself in twelve of the fifteen member states. In 1970, 52.1% of all goods travelled by road, 30.2% by rail, 10.9% on inland waterways, and 6.8% in pipelines. In 2001 the extraordinary growth of road transport became apparent; it covered 75.5% of traffic, against 13% of the railways, 6.8% of inland waterways, 4.7% of the oil pipelines (Fig. 4).

In 2001 (Fig. 5) 98% of goods in Greece travelled on the road, in Ireland 93.3%, in Italy 87.9%, in Portugal 87.2%, in Spain 87.6%, in Great Britain 83.4%, in France 77.8%, in Denmark 73.2%, in Finland 72.6%, in Luxembourg 71.2%, in Belgium 71%, in Germany 69.5%; in Sweden 60.5%; in Austria 50.4%, in Holland 46.4%. Only in Sweden, Austria and Finland the railways continued to play a primary role, since the rail transport carried respectively 39.5%, 30.8%, 25.8% of all goods. The volume of traffic handled by the railways ranked above 10% of the total only in another six countries: Luxembourg (17.1%), Germany (14.7%), France (14.3%), Portugal (12.8%), Belgium (12.6%) and Great Britain (10.3%). In the
remaining six it was marginal: 8.6% in Denmark, 8.1% in Italy, 7.5% in Spain, 6.7% in Ireland, 4% in Holland, 2% in Greece. As to waterways, they played a significant role only in the Netherlands (43.4% of all traffic), Belgium (13.5%), Germany (12.8%) and Luxembourg (11.7%).

Fig. 5. Freight transport. EU 15. 2001 ( tkm in %)

<table>
<thead>
<tr>
<th></th>
<th>Road</th>
<th>Rail</th>
<th>Inland waterways</th>
<th>Oil pipelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>50.4</td>
<td>30.8</td>
<td>4.5</td>
<td>14.3</td>
</tr>
<tr>
<td>Belgium</td>
<td>71.0</td>
<td>12.6</td>
<td>13.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Denmark</td>
<td>69.5</td>
<td>14.7</td>
<td>12.8</td>
<td>3.1</td>
</tr>
<tr>
<td>Finland</td>
<td>72.6</td>
<td>25.9</td>
<td>1.4</td>
<td>-</td>
</tr>
<tr>
<td>France</td>
<td>77.8</td>
<td>14.3</td>
<td>1.9</td>
<td>6.0</td>
</tr>
<tr>
<td>Germany</td>
<td>69.5</td>
<td>14.7</td>
<td>12.8</td>
<td>3.1</td>
</tr>
<tr>
<td>Greece</td>
<td>98.0</td>
<td>2.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ireland</td>
<td>93.3</td>
<td>6.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Italy</td>
<td>87.9</td>
<td>8.1</td>
<td>0.1</td>
<td>3.9</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>71.2</td>
<td>17.1</td>
<td>11.7</td>
<td>-</td>
</tr>
<tr>
<td>Netherlands</td>
<td>46.6</td>
<td>4.0</td>
<td>43.4</td>
<td>6.0</td>
</tr>
<tr>
<td>Portugal</td>
<td>87.2</td>
<td>12.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>83.4</td>
<td>10.3</td>
<td>0.1</td>
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</tr>
<tr>
<td>Spain</td>
<td>87.6</td>
<td>7.5</td>
<td>-</td>
<td>4.8</td>
</tr>
<tr>
<td>Sweden</td>
<td>60.5</td>
<td>39.5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EU 15</td>
<td>75.5</td>
<td>13.1</td>
<td>6.8</td>
<td>4.7</td>
</tr>
</tbody>
</table>

Fig. 6. Passenger transport. EU 15. 2001 (pkm in %)

<table>
<thead>
<tr>
<th></th>
<th>Car</th>
<th>Bus</th>
<th>Rail</th>
<th>Tram + Metro</th>
<th>Motorbike</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>72.9</td>
<td>13.9</td>
<td>8.6</td>
<td>2.9</td>
<td>1.7</td>
</tr>
<tr>
<td>Belgium</td>
<td>82.5</td>
<td>9.5</td>
<td>6.1</td>
<td>0.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Denmark</td>
<td>79.3</td>
<td>12.2</td>
<td>7.5</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>Finland</td>
<td>82.2</td>
<td>11.1</td>
<td>4.7</td>
<td>0.7</td>
<td>1.3</td>
</tr>
<tr>
<td>France</td>
<td>84.1</td>
<td>5.1</td>
<td>8.3</td>
<td>1.2</td>
<td>1.4</td>
</tr>
<tr>
<td>Germany</td>
<td>80.8</td>
<td>7.9</td>
<td>8.5</td>
<td>1.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Greece</td>
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<td>1.3</td>
<td>1.1</td>
<td>15.3</td>
</tr>
<tr>
<td>Ireland</td>
<td>81.0</td>
<td>14.5</td>
<td>3.5</td>
<td>-</td>
<td>0.9</td>
</tr>
<tr>
<td>Italy</td>
<td>75.5</td>
<td>10.9</td>
<td>5.3</td>
<td>0.6</td>
<td>7.7</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>79.9</td>
<td>13.9</td>
<td>5.3</td>
<td>-</td>
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</tr>
<tr>
<td>Netherlands</td>
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<td>6.9</td>
<td>7.9</td>
<td>0.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Portugal</td>
<td>79.3</td>
<td>10.7</td>
<td>3.3</td>
<td>0.5</td>
<td>6.2</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>86.4</td>
<td>6.4</td>
<td>5.4</td>
<td>1.1</td>
<td>0.7</td>
</tr>
<tr>
<td>Spain</td>
<td>76.9</td>
<td>13.0</td>
<td>5.2</td>
<td>1.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Sweden</td>
<td>80.3</td>
<td>9.7</td>
<td>7.4</td>
<td>1.9</td>
<td>0.7</td>
</tr>
<tr>
<td>EU 15</td>
<td>80.4</td>
<td>8.8</td>
<td>6.5</td>
<td>1.0</td>
<td>3.2</td>
</tr>
</tbody>
</table>

The road monomodality is further highlighted when we observe the situation of passenger transport (Fig. 6). In 2001, private transport on four or two wheels was dominant in all European countries (83.6% of the total as compared to 16.3% of public transport). The close relation between choice of means of transport and income level appeared evident: Inspite of the existence of efficient and widespread public transport networks, the use of the car reached maximum values in countries with a high GDP per capita. Despite commonplaces, the use of public transport was lower than the European average in countries with a high level of infrastructure, such as in France, the Netherlands and the United Kingdom (Finland and Germany, instead, ranked a little above the European average). For what concerns two wheels
vehicles, their use was strictly connected with the average level of GDP per capita and the scarce effectiveness of public transport in metropolitan areas\(^5\).

The situation doesn’t change if we consider the 27 Member States of the European Union: in 2006 the passenger and freight transport on road remained dominant (Fig. 7).

![Modal split of passenger and freight transport. EU 27. 2000 and 2006 (pkm and tkm in %)](image)

**Source:** Eurostat, Tables interface on line (17.11.2011)

The environmental impact of transport: production and infrastructure

In the 20\(^{th}\) century transport has been one of the main agents of environmental change. The interactions between transport and environment are much more complex than would emerge today from the debate between policy makers and social actors, which is chiefly centered on the effects produced by the daily use of means of transport\(^6\).

The impact of transport on the environment manifested itself following the construction of industrial plants. Beginning from the early years of the twentieth century, factories have profoundly altered the territorial texture of the places where they have been established: suffice to think of land consumption (FIAT Mirafiori alone, built in the Thirties, occupied an area of 2 million m\(^2\)); repercussions on the physiognomy of urban development and architecture (built in what at the time seemed peripheral areas, far from residential quarters, industrial plants have been swiftly captured within the urban network, following a process of intense development, fuelled by immigration)\(^7\); social implications (tensions generated by migratory flows... ); problems raised by the restoration of industrial areas as the dynamics of economics required the restructuring of production cycles (just to stay anchored to the present, we may consider the case of the industrial desert of Lambrate where the production area of Innocenti was located, for years the centre of controversy fuelled by assumptions about its future use).

The impact on the territory of the production of means of transport goes well beyond the physical places where the factories are. It is a good thing to consider the construction of the infrastructure needed to make the means of transport functional which has resulted in a huge consumption of space\(^8\): At the beginning of the twenty first century roads occupied nearly 5,914,804 m\(^2\), railways 126,630 m\(^2\), airports 145,940,000 m\(^2\), ports (yards for the handling of goods only) 11,034,012 m\(^2\).

Beyond quantitative data, we must emphasize how, until recent years, infrastructure were designed and built without taking into due consideration the effects on landscape and natural resources\(^9\). As Massimo Moraglio has written, «[everything] was aimed at emphasizing the effectiveness […] of human activity, its power in modifying the land, in crossing rivers, in tunnelling mountains and in crossing valleys to reduce distances and facilitate communication»\(^10\). Thus the values of landscape and natural resources became obscured by the ‘infrastructural epic’ which enjoyed a broad approval (both from the ruling class and among citizens) since it was a tangible demonstration of modern Italy, of a country which had left
behind a past of poverty and misery in order to enter lavishly into the club of the most industrialized countries. The tracks of high-speed lines, airports, the motorways, not only served the movement of the means of transport, but to demonstrate to the countries of the first world that Italy was about to join them entering from the main door (the door of accelerated modernization resting on the pillars of industrialization and mass consumerism).

The long wave of environmental impact caused by the transport sector on the territory does not stop here: transport, in fact, has represented the prime flywheel for the development of two highly polluting industries: the by-products of oil and rubber (Fig. 8). In 1993, on 13 areas declared to be under «high risk of environmental crisis», 5 hosted petrochemical industries and refineries (Napoli, Brindisi, Taranto, Priolo-Agusta, Gela). In 2006, 52.9% of industrial plants «at risk of relevant accidents» belonged to the chemical, petrochemical and petrol refining sectors.

Fig. 8. Industries of by-products of oil and rubber
Production (1,000 t)


<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Car petrol</td>
<td>15,218</td>
<td>14,665</td>
<td>18,011</td>
<td>18,723</td>
<td>20,875</td>
<td>20,759</td>
</tr>
<tr>
<td>Aviation fuel</td>
<td>193</td>
<td>84</td>
<td>48</td>
<td>26</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Jetfuel</td>
<td>1,840</td>
<td>1,364</td>
<td>2,172</td>
<td>2,164</td>
<td>2,753</td>
<td>2,551</td>
</tr>
<tr>
<td>Petrol</td>
<td>2,419</td>
<td>2,190</td>
<td>1,727</td>
<td>--</td>
<td>1,607</td>
<td>1,408</td>
</tr>
<tr>
<td>Diesel oil</td>
<td>25,215</td>
<td>22,712</td>
<td>28,640</td>
<td>31,295</td>
<td>33,891</td>
<td>38,025</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>35,996</td>
<td>20,066</td>
<td>21,952</td>
<td>17,281</td>
<td>14,349</td>
<td>13,278</td>
</tr>
<tr>
<td>Lubricating oils</td>
<td>1,028</td>
<td>974</td>
<td>1,172</td>
<td>1,292</td>
<td>1,167</td>
<td>1,239</td>
</tr>
<tr>
<td>Oil bitumen</td>
<td>2,065</td>
<td>2,064</td>
<td>2,356</td>
<td>2,330</td>
<td>2,686</td>
<td>3,496</td>
</tr>
<tr>
<td>Liquified gas</td>
<td>2,027</td>
<td>1,742</td>
<td>2,154</td>
<td>2,235</td>
<td>2,308</td>
<td>2,398</td>
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<tr>
<td>Virgin nafta</td>
<td>2,637</td>
<td>2,596</td>
<td>1,806</td>
<td>3,466</td>
<td>3,448</td>
<td>3,939</td>
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<tr>
<td>Light distilled fuels</td>
<td>173</td>
<td>152</td>
<td>10</td>
<td>6</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Pneumatic tyres</td>
<td>355</td>
<td>306</td>
<td>324</td>
<td>348</td>
<td>396</td>
<td>279</td>
</tr>
</tbody>
</table>

Further to the above issues, there is the one – highly important – regarding the flows of matter. A country’s economy may be regarded as a kind of large metabolic organism regulated by a flow of materials to and from it: among the latter there are the emissions and refuse generated by production cycles and by the consumption of the produced goods. Industrial activities (like all other human activities) end up with creating a sort of degenerative metabolism by which industries, in their reproductive cycles of wholesome resources (water, energy sources, soil) return them in the form of degraded metabolites (emissions in the atmosphere and in water; waste deposited at dumps…). Part of the exit flows consists of the product of external diseconomies generated by industrial activity. Transport is the cause of unidirectional externalities (for example the exploitation of water resources and the emission of pollutants whose cost is imposed on the community – in the form of damages to health and clean up activities – do not enter into the economic calculation of producing firms); reciprocal (emissions from vehicles exhausts, perceived as a social damage produced by a collective behaviour whose magnitude is regarded as very modest since deriving from the use of the environment by numerous members of the community); intertemporals (the emissions of gas with involving future generations).

The limited and fragmentary data available do not allow one to draw a comprehensive picture of environmental impact caused by the metabolism (flows of matter and externalities) of the production of means of transport. However, it is possible to construct a partial synthesis using some indicators: water unit per capita loading (equivalent population). By analysing the indicator of the equivalent population, it is clear that, with regard to water resources, the transport industry does not have a high pollution load: in 1981 it amounted to 702,649 units (0.53% of the total equivalent population) and in 2000 at 459,775 units. 

Interestingly, in order to assess the externalities of the production of means of transport, to dwell on the sources of water extraction and discharge bodies used. In 1990, the sources for extraction were as follows: 64.3% wells; 18.5% waterworks; 17% other sources; 0.1% sea; 0.1% lakes (Istat, 1993). This highlights two problems that gripped the Italian industrial districts, and to which, evidently, did not escape even the manufacturers of means of transport: the dependence on groundwater pumping, which was causing severe piezometric depressions in industrial areas; the progressive reliance – prompted by the subsidence of the water table which
prevented an increase of levy from wells – on surface water utilized by municipalities for replenishing the municipal waterworks. Industrial usage of water provided by municipal waterworks caused severe conflicts over the use of water resources: the scarcity of water in Summer months ended with generating a true competition for water resources among the municipalities, agricultural consortia and industrialists, all equally convinced of possessing a kind of priority right for the use of water.

As to water drainage, 58.7% flowed into sewers (33.3% private and 25.4% public), 25.2% into streams, 14.8% into other places, 1.2% into the sea and 0.1% into lakes (Istat, 1993). These figures also highlight other problems: the lack of adequate sewage treatment plants. In the early 1990s, compared with an industrial population equivalent of more than 92 million units, sewage treatment plants had a capacity of just over 15 million units.

Still referring to the use of water resources, a further indicator – very effective for an illustration of the pressure exercised by industrial activities on natural resources – is represented by the notion of virtual water, or water incorporated within the production and trading of foods and consumption goods (thus this is water hidden within the goods, and employed for their production and trading). The table here below (Fig. 9) shows the close relationship existing between industrial production and the total volume of water utilized in the production of motor vehicles. Still more effective for understanding the relationship between vehicles and use of natural resources, is the showing of the volume of virtual water which travel on the roads with vehicles in circulation (Fig. 10). Figure 10 enables us to introduce another notion: that of water footprint. Each country possesses an internal water footprint – the amount of water necessary for the production of goods and services produced and consumed in the country – and an external one (the water used in the production of goods in the exporting country). The water footprint of production is made of green waters (the volume of rainwater stored in the soil and subject to evaporation); blue waters (freshwater pumped from water bodies which used and not returned); grey waters (the volume of polluted water issued from production processes). Considering that in 2001 60% cars in circulation was manufactured abroad (they were 1.48% in 1958 and 16.58% in 1970), this means that Italy, beyond importing cars, also imports a portion of water footprint from the exporting countries. In 2001, therefore, 60% of virtual water relative to cars in circulation came from the water reserves of other countries. This provides a measure of the progressive globalization of environmental problems: the purchase and use of a car no longer affects only the natural resources of Italy, but also those of exporting countries. Seeing this in a global perspective, the improvement shown by indicators concerning Italy (due to the decrease in produced volumes) (Fig. 9) has a positive effect on the national territory (less consumption of green and blue waters, and diminished discharges of grey waters) but at the cost of exporting a part of domestic environmental problems towards producer countries. So, the problem of exploitation of natural resources does not diminish, but shifts from consumer countries to producer ones.

Fig. 9. Italian cars and lorries production.

Estimate of virtual water 1954-2006

![Graph showing virtual water usage for cars, lorries, and cars in circulation from 1954 to 2006.](chart.png)
Let us finally reflect on the third indicator: the average amount of waste per worker. In 1986, a worker in the construction and assembly of motor vehicles produced 448 kg of waste similar to urban waste, 829 kg of special waste and 39 kg of toxic and hazardous waste; considering the total number of workers, the industry generated 122,730,944 kg of waste similar to urban, 227,107,037 kg of special waste and 10,684,167 kg of toxic and hazardous waste. Still in 1986, a worker in the construction of means of transport (different from motor vehicles) produced 159 kg of waste similar to urban (22,159,830 kg in total), 2,123 kg of special waste (295,882,510 kg) and 13 kg of toxic and noxious waste (1,811,810 kg).

In 1999 the production of means of transport generated 1,204,515 tons of non dangerous special waste, and 141,224 of hazardous waste.

The magnitude of the waste problem is also extrapolated from data regarding the recovery of some materials (Fig. 11).

Until the mid ‘70s, a remarkable part of the waste of industrial origin was directly dumped into the waters giving rise to serious pollution incidents. The improper disposal of waste products was a major cause of soil contamination: spread a little everywhere, there were hundreds of sites responsible for the storage of sewage and industrial slag.

Since the mid ‘80s – when a resolution was approved on the classification of waste destined to dumping (27 July 1984) – the situation has gradually improved thanks to legislative interventions which, among other provisions, have favoured recovery of certain materials (Table 11), but, still today, waste (deriving from production processes that dissipate large amounts of materials and energy) represent a relevant environmental externality.
The environmental impact of transport: consumption and utilization

Coming now to consumption, in the course of the second part of the 20th century two trends have become clear: the rapid growth of cars and air transport (Figs. 12, 13).

For what concerns cars, Italy had become in 1990 the leading European country in density: there were 483 cars per thousand inhabitants against 480 in Luxembourg, 447 in Germany, 421 in Sweden, 415 in France, 389 in Finland, 388 in Belgium, 387 in Austria, 368 in the Netherlands, 360 in Great Britain, 309 in Denmark and in Spain, 227 in Ireland, 187 in Portugal and 171 in Greece.

The Italian record was determined by a growth that suffered no interruptions: cars in circulation grew from 15,059,689 in 1975 to 27,415,828 in 1990. Sixteen years later, in 2006, on the Italian roads travelled 46,329,144 vehicles, among which were 4,331,747 lorries and 5,288,818 motorcycles returned to being the principal alternative to the car for movements within the city, growing more and more congested with traffic. Italy – with the exception of Luxembourg (280,709 cars per 444,100 inhabitants) – established itself as the European leading country in density: there circulated a car every 1.72 inhabitants against 1.96 in Germany, 2.03 in Austria, 2.04 in France, 2.15 in Belgium, 2.21 in Sweden, 2.30 in Spain, 2.34 in Portugal, 2.39 in Finland, 2.60 in Holland, 2.61 in Great Britain, 2.78 in Denmark, 2.86 in Ireland, and 3.32 in Greece. In 2006, Italy, with 2,323,440 new registrations, was the third market in Europe after Germany (3,467,961) and Great Britain (2,344,864).

As to air transport, in 2001 there were 1,238,239 airplanes (+81% compared to 1992) which transported 90,210,038 passengers (+76%). In 2006 total internal passenger traffic (13,930 mio pkm) had more than doubled as compared to 1998 (6,416 mio pkm).
The rapid growth of private road mobility has therefore represented the principal factor in environmental impact: the car turned out to be a voracious consumer of space and energy and has produced significant effects on land use (and urban form), on energy consumption and the volume of polluting emissions.

As for land use and the consequent transformation of the urban form, between the 50s and the 80s local administrations did not make choices capable of adapting urban planning to the increased demand for urban mobility.

The reasons explaining such a decision-making deficit are essentially two. The first concerned the absence of suitable legislation on urban development. Italian legislation had remained unchanged since 1942: since then the Parliament had been unable to pass a new general urban planning law. The second concerned the approval of a law (291/1971) which established anti economic crisis measures in favour of building trade. The measure helped to deregulate further town planning, aggravating the instability of urban areas: the law exempted municipalities from adhering to minimal planning standards, ending up by invigorating building speculation which, in the absence of an effective legislation, detracted from planning ever increasing portions of public space, preventing their future use for infrastructural adaptation, and for the expansion of collective spaces (public green, collective infrastructure...).

The result has been that the expansion of Italian cities has caused negative traits, typical of the so-called urban sprawl: a horizontal growth pattern which occupies considerable portions of land making it essential to use the car.

The urban sprawl is most prominent in countries and regions with a high population density and by an intensive economic activity (for what concerns Italy, the northern regions and the industrial areas of the central ones). The planning policies at both local and regional level – fuelled by EU cohesion and structural funds to support infrastructure developments – has ended up with accelerating the urban sprawl in response to improved trasportation links and enhanced personal mobility and has caused the emergence of new development patterns visible around the smaller cities situated along trasportation corridors. This tendency is cousing an increase in soil consumption (the amount of space consumed per person in the cities of Europe has more than doubled over the past 50 years; over the past 20 years, the extent of built-up areas in many western and estern European countries has increased by 20% while the population has increased by only 6%).

A close connection exists between urban expansion and environmental effects: the urban sprawl causes an increase in the deamend of private mobility which in its turn generates a further consumption of space (such as the space occupied by cars, cf. Fig. 14) and increases the number of health problems due to pollution. According to the Report on air pollution in Italian cities. compiled by the World Health Organization, only PM10 fine particulate matter is responsible, in eight major Italian cities, for 3,500 deaths, 1,900 hospitalizations for respiratory problems, 2,700 hospitalizations for cardiovascular diseases, and 31,500 acute bronchitis fits.
The growth of private mobility did not have a lesser impact on energy consumption and on the volume of polluting emissions (Figs 15, 16).

Cars have played a dominant role in the production of carbon dioxide (Fig. 17) and, with the sole reference to road transport, are the main source of sulphur oxides, nitrogen oxides, methane, carbon monoxide, carbon dioxide, nitrogen protoxide and ammonia (Fig. 18).

Fig. 14. *Cars in use and estimates of soil occupancy (1950-2006)*

![Fig. 14](chart1.png)

Fig. 15. *Cars in use and estimates of emissions of PM$_{10}$ and energy expenditure (1950-2006)*

![Fig. 15](chart2.png)

Analysing the issue from an European perspective, the relationship between the consumption of transport and the onset of critical environmental issues, we can underline the high energy-intensive characteristics of transport consumption and the close relationship existing between the volume of traffic and of emissions. The problem appears related to the consolidation of a
very specific social model of mobility characterized by a high demand for an ever faster capillary mobility in travelling chiefly with private means and with vehicles for collective transport moved by fossil fuels. In this context, remarkable voracity for energy and the high volume of emissions appear as common traits in all countries of the European Union (Figs. 19, 20): true, there are countries which are more virtuous than others, but the trend of phenomena presents proportions and characteristics which are very similar in all countries of the European Union taken into consideration (in particular those belonging to the EU-15).

Fig. 16 *Consumption of oil products 1967-2006 (tons)*

Source: Anfia, *Automobile in cifre*, Torino 1971;

![Consumption of oil products 1967-2006](image)

Fig. 17 *Carbon dioxide emissions. Transport 1990 and 2001 (1,000 t)*

![Carbon dioxide emissions](image)
### Fig. 18 Emissions from transport. 2005 (tons)


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### Fig. 19. Final energy consumption of transport.


(Mtoe and % of total final energy consumption)


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Fig. 20. CO₂ emissions.

Shares % of total national emissions.


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Conclusion

In the second half of the 20th century, the growth of transport has been one of the hallmarks of industrialized societies (and, by the end of the century, including the developing ones): its development has been characterized by the consolidation of road transport, by the construction of major infrastructure (primarily highways), by the rapid growth in the volume of passenger and freight transport, by the spread of a mode of personal mobility based on the two or four wheels for domestic routes, and air transport for transnational and transoceanic routes.

At the same time, transport has been one of the principal causes of environmental change. The impact of the production of means of transport has had relevant consequences on the processes of urbanization and on the organization of the urban form, and also on the use of resources (water in particular and energy sources) and on the production of waste. Their daily use has caused significant effects on the quality of the air (especially in urban areas where polluting emissions are concentrated), and on the demand for by-products of oil, and on climatic balances. Private mobility on the road in particular, has played a fundamental role in urban expansion (made possible, for the greater part, by the flexibility of use allowed by the two and the four wheels) and it has been a promoting factor of the growth of land consumption (in Italy, between 1950 and 2006, the surface occupied by cars has increased from 2,180,179 to 224,998,994 m² with a percentage growth of 10220%).

The Italian case does not present special peculiarities if compared with other EU countries. The perception of a greater gravity of the problem (not only of an environmental nature) induced by transport which in the last decades has pervaded the social-political debate in Italy, does not have statistical grounding since it is essentially due to planning disorder which characterizes Italian cities and which has repercussions upon the organization and efficiency of public transport.
The chaotic traffic which grips urban centres in Italy; the lack of efficient collective transport (predominantly using buses rather than tramways and metropolitan railways) characterized by exasperating slowness; the irrational organization of urban spaces as the result of unplanned expansion of the cities; the particular preference which the Italians have for individual mobility (Italy is, among countries with a medium-high GDP, the only country with a relevant number of motorcycles) has caused a crisis whose evolution seems to be going in a circle: an increase in the number of private means of transport, a worsening of urban circulation, an increased inefficiency of public transport, worse solutions favoured by municipal administrations (extension of parking areas in central districts, populistic provisions such as the suppression of parking fees...), further increase in the number of private vehicles.

All of this has happened (and still happens) albeit on a lesser scale, in the cities of the other EU countries (with the partial exception of other Mediterranean states with low income: Greece and Portugal) where collective transport is more efficient, and the municipal administrations are less inclined toward populistic attitudes, where collective sensibility is less prone to tolerate attitudes to breaking the rules of conduct (random parking in the wrong spaces, cycles and motorcycles traveling in the opposite direction to the allowed or on pavements...). Despite of all, however, such problems have repercussions on the daily life of citizens (and in consequence, upon their perception of problems), even though they do not impinge upon environmental criticalities.

It is important, finally, to emphasize the existing relationship between technology and consumption growth: The replacement of red petrol with green, the improvement of diesel fuels, the use of catalytic convertors, the technological update of engines to adapt them to admitted maximum emissions by European regulations which caused the decrease in lead, nitrogen oxides and sulfur dioxides concentrations. If the results achieved were not those initially hypothesised – chiefly for what concerns emissions of greenhouse gases (increased, between 1991 and 2006, of 27.7%, cf. Fig. 21) – this is due to the fact that technological progress has been partly neutralized by a constant increase in numbers of circulating vehicles (in Italy, between 1950 and 2006, the number of cars and trucks in circulation has increased by 6,766%) and the overall number of movements.

The data relative to emissions highlight a scarce effectiveness of regulating measures (European directives acquired within the national legislation concerning the quality of fuels, emissions of motor vehicles and maximum levels of principal pollutant) implemented to date. In particular, the analysis of data highlights a scarce effectiveness of regulatory measures in the absence of effective policies aimed at containing road public transport and at encouraging local public transport and rail transport.

Fig. 21. Greenhouse gas emissions from transport EU 27
(Mio tons CO₂ equivalent)

<table>
<thead>
<tr>
<th>Year</th>
<th>Air</th>
<th>Road</th>
<th>Railways</th>
<th>Navigation</th>
<th>Other</th>
<th>Total transport</th>
<th>Total emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>81.7</td>
<td>723.5</td>
<td>13.0</td>
<td>129.2</td>
<td>11.1</td>
<td>958.5</td>
<td>5,644.2</td>
</tr>
<tr>
<td>1996</td>
<td>106.5</td>
<td>805.2</td>
<td>10.7</td>
<td>136.6</td>
<td>10.2</td>
<td>1,069.1</td>
<td>5,523.7</td>
</tr>
<tr>
<td>2001</td>
<td>133.0</td>
<td>877.1</td>
<td>9.1</td>
<td>157.2</td>
<td>9.2</td>
<td>1,185.6</td>
<td>5,368.8</td>
</tr>
<tr>
<td>2006</td>
<td>157.1</td>
<td>924.2</td>
<td>8.5</td>
<td>197.4</td>
<td>10.3</td>
<td>1,297.3</td>
<td>5,447.8</td>
</tr>
<tr>
<td>1991-2006</td>
<td>+92.2%</td>
<td>+27.7%</td>
<td>-36.2%</td>
<td>+52.8%</td>
<td>-7.2%</td>
<td>+35.4%</td>
<td>-3.5%</td>
</tr>
</tbody>
</table>

At the beginning of the 21st century, therefore, Italy appears to be still incapable of adjusting its policies to the challenges demanded by European integration and globalization due to an apparent inability to make its transport system more efficient through overcoming the two-headed development model (on the one hand the policies favouring road and car transport, on the other rail transport) the dismantlement of monopolies and protected markets, and the promotion of effective actions aimed at tackling the problem of mobility in urban areas.
The inhabitant (population) equivalent is a measure used to express the impact of civil and productive activities. It is calculated based on the consumption of various materials, both internal and external, and the emissions associated with these activities. The calculation takes into account the energy content of materials, the distance they are transported, and their environmental impact. The inhabitant equivalent is used to compare the environmental impact of different regions or countries.

External economies (externalities) are the influences exercised by economic activities, outside market transactions, on production or on the wellbeing of a community in a positive (external economies) or negative (external diseconomies) way. They are not considered in the national accounts but are important for understanding the true costs and benefits of economic activities. Externalities can be classified into positive externalities, which improve public welfare, and negative externalities, which impose costs on the public. Positive externalities can be encouraged through policies that promote environmentally sustainable practices, while negative externalities can be reduced through regulations and incentives.

Recently, the construction of the high-speed railway line Bologna - Firenze has fuelled bitter arguments. The project has faced opposition from environmental groups and residents due to the potential impact on local ecosystems and communities. Despite these concerns, the railway line has been a significant contributor to the nation's economy, offering faster travel times and increased connectivity.

For what concerns municipal roads, the data relative to the years 1980 and 1990 only account for suburban roads.

The administrative organization of the road system has been substantially altered after the reformation of Title V of the Constitution (2001) which passed part of the State road system to the Regional management.

In 2001, among the fifteen countries taken into consideration, Portugal and Greece occupied, respectively, the penultimate and the last place in the ranking of GDP per capita. As to Italy, the absence of adequate public transport networks in greater urban areas still makes today motorcycles the means of transport with the highest popularity rating (8.55 against 7.90 for the car, 7.43 for the metropolitan railway and 6.03 for bus and tramway). Cf. Isfort, Ottavo rapporto sulla mobilità urbana in Italia, Roma 2011, 22.

 historians – and not only in Italy – have begun only in recent years to address in detail the environmental problems caused by means of transport. In recent years we have seen an attempt at creating a new interdisciplinary study sector (environmental mobility studies) to bring together all notions on transport, environmental and social history, with the aim of studying, from the environmental point of view, the many topics concerning mobility. For a review on the state of the art cf. Tom McCarthy, A Natural Intersection: a Survey of Historical Work on Mobility and the Environment, in G. Mom, L. Tissot (eds.), Mobility in History. The State of the Art..., 61-81; Federico Paolini, Greening Mobility History in Italy: Toward an Interdisciplinary Way to Environmental Mobility Studies?, in Peter Norton, Gijs Mom, Liz Millward, Mathieu Flonneau (eds.), Mobility in History. Reviews and reflections, Éditions Alphil-Presses universitaires suisses, Neuchâtel 2011, 145-150.

Think of what has represented – from the planning point of view – the construction of the Fiat (Lingotto, Mirafiori) and Lancia (Chivasso) plants to Turin, or the Alfa Romeo (Portello, Arese) and Innocenti plants to Milan, or again the Ansaldo plant to Genoa.

Translated into square kilometres, the total surface corresponds to 163.02 km². Data regarding roads and railways represent a prudent estimate calculated by multiplying the total length of the network for a width of 7 metres (roads), 7 metres (double track railway lines) and 3.5 metres (single track railway lines). Figures on airports and ports come from Ministero delle infrastrutture e dei trasporti, Conto nazionale delle infrastrutture e dei trasporti anni 2008-2009, Roma 2010.

Recently, the construction of the high-speed railway line Bologna-Firenze has fuelled bitter arguments following damages caused by yards to the hydrogeological system of the Mugello (the drying up and disappearance of 81 streams, 37 springs, 30 wells and 5 rural aqueducts).
calculated using specific conversion factors which take into account the production process of the raw materials employed: this is, however, a partial measure since it essentially concerns the organic substances present in industrial waste. This is nevertheless a useful measure for comparing the pollution load of the different production activities.

The edition of 2002 of environmental statistics does not show the data for various activities, but only the conversion factors, thus it is impossible to estimate the percentage of the total. To provide comparative data find here below the higher conversion coefficients: sugar industry, drinks and tobacco 348; coking plants 96; basic food industries 84; chemical industries 68; nuclear fuels industry 65; paper industry, printing and publishing 60. The conversion factor for the transport industry is 1.7.

The notion of virtual water has been developed by the British geographer John Anthony Allan.

By admission of the creators of the concept of virtual water, it is very difficult to calculate with precision the volume of water employed in the production of industrial goods. The global average has been estimated in 80 litres/US dollar. As to cars estimates vary from 30,000,000 to 40,000,000 litres per 1.1 tons of mass. Assuming an average cost of 10,000 dollars and a volume of 80 litres virtual water should amount to 800,000 litres. Here we have assumed a conservative value of 150,000 litres/unit produced: for our purpose this suffices to show the existing relationship between production volumes and the volumes of utilized water, and not to calculate plausible volumes of virtual water. For estimates on virtual water present in some products cfr. www.waterfootprint.org.

The estimates were calculated still using the value of 150,000 litres/unit in circulation.

In the 90s, concentrations of NO₂ far exceeded the accepted European Union standard (no more than 40 µg/m³ as the annual average) in some sample cities such as Milan (86), Athens (76), Marseilles (72), Madrid (66), Lyon (64), Paris (64), Monaco (52), Frankfurt (49) e Copenhagen (48). Data for PM₁₀ may not be comparable between member states, due to differences in measurement techniques (average of all cities per country): Austria (29.6 µg/m³), Belgium (23.7), Denmark (14.9), Finland (20.7), France (20.5), Germany (38.8), Greece (34.9), Ireland (27.8), Italy (18.7), Luxembourg (18.3), Netherlands (19.6), Portugal (19.0), United Kingdom (16.1), Spain (19.5), Sweden (8.5), EU 15 (22.0).

The estimate for soil occupancy has been obtained by multiplying conservatively, the number of cars in circulation by 6.3744 m² (the surface occupied by a FIAT Punto).

Fuel consumption is a conservative estimate obtained by considering a distance equal to 3,842 km/year and an average consumption of 1 litre per 15 km. PM₁₀ emissions are calculated assuming a production within the urban cycle of 0.1106 g./vehicle-km for the years 1950-1985 and of 0.0946 g/vehicle-km for the years 1995-2001 (with urban circulation of 3,842 km/year). The energy expenditure is expressed in Megajoule per passenger for 1 km traveling and relates to a small/medium capacity car (the number of cars multiplied by 1.5 Mjoule; the consumption of a SUV, e.g., is estimated in 7 Mjoule).

Calculation by the author on the basis of Istat and Enea data.

S₀₂: sulphur oxides; NOₓ: nitrogen oxides; NMVOC: non methane volatile organic compounds; CH₄: methane; CO: carbon monoxide; CO₂: carbon dioxide; N₂O: nitrogen protoxide; NH₃: ammonia.

In the XIII Rapporto auttomobile ACI-Censis (2004) we read on page 5: «Ultimately, from the 12th report contradictions and antinomies emerge that help to understand the complexity of the relationship between Italian citizens and the use of the car: 1) Notwithstanding that the car induces ever more often to modify daily schedules according to the demands of heavy traffic, it is used more and more frequently. A possible explanation rests in the disillusion of the car user for not having found an alternative to the private vehicle; 2) The car is used in order to rationalize daily routines. In fact, four wheel mobility, if it doesn’t grant the certainty of times, it determines an upset of the daily routine making the daily schedule ever more unpredictable; 3) The car represents a means of protection and an interface with the outside world. The subject who stays inside the car has different reactions when he is outside, yet the four wheels become evermore a medium for connection between individuals and places, a kind social and relational city network mesh. 4) The car is increasingly a means of mass transport, but the rules for its use (the highway code) are only known to an elite of car users». 
Chapter VIII

Cars and emissions regulation in Italy (1950-2008)

In Italy the car has not only been a means of transport or a product of technology capable of revolutionising land transport, but it has also been the agent of social transformation, a symbol of freedom, independence, wellbeing and progress all at the same time. The car contributed to create a new symbolism which became established within the collective perception according to which modernization was identified with racing cars of the *Mille Miglia*, economic Fiat cars, the viaducts and tunnels of the *Autostrada del Sole*, the bold architectures of the road system and the *Motta* and *Pavesi* Autogrill (motorway restaurants). The car, however, not only changed daily life. In fact, with the progress of the *motorcar revolution*, physical space also radically changed: the landscape was greatly altered by motorways and by their newly built infrastructure. Furthermore, urban space itself appeared to have been newly planned to suit a new mobility: viaducts, road junctions, petrol service stations, squares and roads filled with parked cars, new suburban high rise tenement blocks defined a new architecture for the expanding city. Environmental changes brought about by the car have presented us with entirely new problems. The other side of motorization was, in fact, the incredible traffic jam caused by the inadequacy of the road system; old town centres defaced by parked cars; air pollution and damages to the landscape caused by infrastructure.

This essay focuses on the environmental problems caused by motor vehicles exhaust and on the political history of automotive emissions regulation since this topic represents an ideal starting point for examining the Italian case in relationship with international historiography which, as to the second half of the 20th century, has been chiefly concerned with environmental problems caused by exhaust.

An inconvenient discovery: the car may damage the environment

The earliest studies linking photochemical smog with the residual products of combustion from motor vehicles were published in the United States in the early 50s: in 1950 Californian biochemist Arie Haagen-Smit showed that there is an undeniable relationship between the smog enveloping Los Angeles and the car exhaust: he was able to establish that photochemical smog was produced by the reaction of hydrocarbon compounds with nitrogen oxides under the influence of sunlight energy. The Air Pollution Control District of Los Angeles (APCD) concluded that road traffic was responsible for 50% of the air pollution in the United States: APCD estimated that a motor vehicle engine produced 3.37 kg of poisonous substances for every ten litres of gasoline consumed, and that for damages caused by smog, every U.S. citizen should pay an annual tribute of ten dollars. In the 50s, even in Italy, the car started to be suspected of being – along with home heating and industrial plants – a major cause of air pollution. In 1952, the problem was reported to the Chamber of Deputies by MP Palenzona who presented a parliamentary question to the Minister of Industry and Trade and Industry and to the High Commissioner for Public Health.

The response of the Minister (Pietro Campilli) was very reassuring: after all, only 781,992 motor vehicles circulated in Italy and the request by MP Palenzona must have appeared as little more than bizarre. The problem of air pollution caused by motor vehicles seemed an issue of secondary importance for at least three reasons. Firstly, Italy was therefore far from being a motorized country: car density continued to be very low. In 1952 there was a car every 92.9 inhabitants, against, for example, 55.9 in West Germany, 21.8 in France, 19.9 in Great Britain, 7.5 in Australia, and 3.5 in the United States. Secondly, technological determinism and technology enthusiasm which pervaded Italian society in the 50s induced to think that scientific and technological progress should have been able to solve eventual problems caused by pollution. Thirdly, environmental protection was considered a luxury which could only be afforded by those enjoying a high standard of life; which is why issues related to environmental policies were considered much less urgent than those designed to ensure better living standards and a minimum of social security to large sections of the population who still lived in conditions of poverty.

The question of atmospheric pollution also was ignored by the car manufacturers themselves that tended to minimize the concerns raised by scientists and to disseminate information contradicting those collected by independent researchers. In the first half of the 50s, the car trade was proving a very profitable business with a huge margin of market penetration and industry was not prepared to see their potential earnings lowered by an investment of money in equipping cars with emission-control devices that, among other things, were not of any stimulus to sales. A second reason why the car manufacturers were opposed to the
dissemination of data on the harmful effects of exhaust fumes was the fear that disclosure of alarming news would inevitably cause a slowdown in car sales at a time when the conditions for an unprecedented expansion of car ownership were at hand.

In November 1957, a Conference on air pollution (Congresso per l’inquinamento atmosferico) was held in Milan, to which fifty delegates took part from twenty three European countries who had responded to calls from the World Health Organization. For the first time in Italy, cars were described as a source of danger and reports showed that in some areas of Milan the percentage of carbon monoxide in the air was similar to that of Los Angeles, or equivalent to one part of oxide out of 4,200 parts of air. Following the conference in Milan, the National Research Council (CNR) entrusted research on the malaria urbana (urban foul air) to a scientific committee whose conclusions were to be used for the preparation of a series of bills.

In 1964, in the September-October issue of the Annals of Public Health, the Ministry for Health published a study by Prof. Cominelli which unequivocally accused road traffic as a major source of pollution. Still in June 1964, urged by the Council of Europe’s Consultative Body since 1961, an European Conference on air pollution was held, during which it was decided to create a Committee of Experts which, however, only became operational in June 1966: its activities included the monitoring and analysis of pollutants, the collection of statistical data and the carrying out of research aimed at the study and the comparison of national legislations.

The first law on air pollution and the malaria of cities

In this climate, on 29 September 1965 the Senate Health Standing Committee began hearing of the first bill aimed at controlling air pollution. As to motor vehicles, the bill restricted itself to some very general statements: the first stated that motor vehicles were not to «produce polluting effluents, however caused» and the second that diesel vehicles were not to «emit fumes of an opacity above the levels set by the regulation». The only concrete measure taken in the bill provided that the periodic overhauling of these vehicles should include the monitoring of pollutants. As to the installation of devices on motor vehicles to reduce the toxicity of exhaust gases, the bill stipulated that the Ministry for Health was empowered to make it mandatory only after asking a long series of opinions. The act (No. 615, 13 July 1966) was received with much criticism by the Italian experts, since in its text any reference to planning and technical tools to seriously limit the emission of poisonous substances was absent. Although Italian legislation was not regarded as in line with legislation concerning air pollution as existed in other countries with a high motor vehicle density, in reality the rules approved by Act No. 615 were not very different from those passed in other European countries: the main difference was that Act No. 615 did not prompt any real provision capable of lowering the levels of air pollution since the Italian Parliament did not approve the rules for the effective enforcement of the law.

The most advanced legislation came undoubtedly from California: in 1963 this American state recommended the adoption of the recirculation of exhaust gases and in 1966 it approved the first rules limiting the car exhaust: the concentration of carbon oxide could not exceed 1.5 percent and that of hydrocarbons 275 ppm. Furthermore, the concentration of carbon dioxide and nitrogen monoxide was also monitored. Finally, in 1967, the Californian legislation was implemented by the Federal Government in the Air Quality Act.

In France, on 2 August 1961 a framework act was passed which for the first time considered the phenomenon of air pollution as a whole, establishing standards for motor vehicles and domestic heating. The French legislation (updated with the Decree of 12 November 1963) required the control of exhaust emissions for all motor vehicles and also indicated the measuring instrument: a photoelectric cell opacimeter approved by the Ministry of Public Works and Transport. In addition, the measure stated precisely for each type of vehicle the level of opacity of the exhaust gases which was not to be exceeded in any way. A further provision of 28 July 1964 required the monitoring of gases emitted by engine sumps.

In England, the Road Traffic Act of 1964 stated the upgrading of manufacturing techniques so as to prevent the emission of visible smoke or gases. Moreover, it prohibited the use of devices capable of increasing the fuel flow to engine while in motion and decreed that the use of a motor vehicle emitting an excess of gases or fumes was a punishable infringement. The Road Traffic Act, however, did not regulate in any way the emissions of invisible substances that were unanimously regarded by experts as the most dangerous and responsible for the increase in air pollution. In 1964, Belgium and West Germany began to draw strict regulations which declared that all pollutants, solid and liquid, could alter the natural composition of the atmosphere.

Act No. 615 was passed at a time – i.e. the second half of the 60s – when Italy was slowly developing a growing interest in issues related to pollution so that the issue also received
increasingly more space in motor magazines. In February 1969, the problem of pollution caused by motor vehicles was discussed during the work of fact-finding inquiry on Italian motor industry promoted by the 12th Standing Commission of the Chamber of Deputies\textsuperscript{11}. During the hearing, Giovanni Agnelli and Dante Giacosa (the person in charge of industrial planning at Fiat), merely asserted that Fiat was taking «a lot of resources to solve two fundamental problems of air pollution and safety». They also asserted that internal combustion engine would have undergone some improvements, but would still enjoy «a long life, perhaps very long, for technical and economic reasons». The Chairman of Alfa Romeo (Giuseppe Luraghi) was sceptical about the effectiveness of anti-pollution measures and he aimed to belittle the legislation adopted in the United States. Luraghi, like Giacosa, remained convinced that the “domination” of the internal combustion engine would have lasted long, in spite of the fact that the major car manufacturers had been studying for some time two new engine types (one a rotary engine and the other one a turbine engine) and stressed that competition would inexorably limit the development of research.

The representative of the Italian Automobile Union (Sindicato italiano dell’automobile) denied manufacturers’ claims and – denouncing the backwardness of Italian industry in the study and development of an alternative to the internal combustion engine – said that «the advent of a transformation of the car» could be further delayed only by the «big interests consolidated around the traditional techniques and economies linked to it».

In March 1969, a conference on pollution caused by motor cars was held in Milan, promoted by the environmental organization Italia Nostra\textsuperscript{12}. The meeting of Milan was characterized by an harsh debate. In presenting the published proceedings, Carlo Ripa di Meana\textsuperscript{13} highlighted how in Italy the issue of pollution from cars was a taboo subject because of the backwardness of sector studies and for “possible crises in employment and competitiveness of the car industry” following the eventual adoption of mandatory anti-emission devices.

Despite the resistance of the automobile industry, in Italy too there was a strong debate about pollution caused by motor vehicles. In the course of 1970 the clash between environmental problems experts and the car industry went on. The incompatibility of the two positions clearly emerged out of two important conferences: the first, promoted by Italian branch of British Petroleum, took place in Milan on 18 April 1970; the second, organized by National Hydrocarbon Corporation (ENI) took place in Rome on 18 and 19 June 1970. During the Milanese meeting it was emphasized the opposition to which the car was subjected. In short, car industry feared that the intervention of the legislator would end up with bearing excessively on production costs as well as discouraging the purchase of cars\textsuperscript{14}.

The conclusions of the Rome conference were diametrically opposite, since the majority of interventions were designed to demonstrate how pollution would cause harmful effects on health and on the quality of the air\textsuperscript{15}. During the Roman assembly it emerged also that the costs of clean air were not prohibitive. One study calculated, in fact, that it was possible to equip all motor cars with catalytic converters at a cost per unit of about 37,000 Italian lire, and estimated for the period 1971-1981 an annual average investment of between 19 and 40 billion lire. The same car manufacturers postulated an intervention in three phases: the first triennium through the adoption of the Clean Air Package devices; in the second one with systems called Man-Air-Ox and in the final triennium through catalytic converters. This meant, for the period 1970-1985, an increase in spending for the purchase of motor vehicles of approximately 2,000 billion lire and an additional prime cost equal to 2,200-2,400 billion\textsuperscript{16}. However, both the assumptions put forward at the Rome conference, and that of the car manufacturers were not implemented; despite this, the motor magazines – apparently alarmed by a new increase in costs for motor car owners – took an ambivalent attitude: on the one hand they strongly denounced the existence of the problem, on the other, however, they expressed many doubts on the actual need to adopt legislative measures aimed at limiting pollution caused by motor vehicles. The monthly of the Commission for Industrial Motoring of Italian Automobile Club (ACI), for example, published the report of the General Motors shareholders’ meeting in which it was alleged that the major causes for air pollution were attributable to industrial fumes\textsuperscript{17}.

During 1970, the ACI’s weekly magazine wavered between the publication of articles with encouraging contents and that of some polemical pieces with particularly alarming tones. Two editorials signed by Filippo Carpi de Resmini, the President of the Automobile Club, had a great impact. He believed that the issue of pollution could be seriously tackled only through a change in the composition of petrol by removing lead additives in order to make possible the installation of catalytic converters on vehicles. The ACI President, however, proved not confident in the ability of the industry to implement agreements to quickly market unleaded petrol and motor cars fitted with catalytic converters. He also complained that Italian car engines were among the dirtiest in the world, so that some models did not follow the «standard of eligibility»\textsuperscript{18}. 

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The problem raised by the President of the Italian Automobile Club finds its explanation in the peculiarities of the development of the car in Italy: one of these was the obsolescence of automobiles in circulation which remained (chiefly until the 1990s) a constant characteristic of Italian motorization. In Italy the motorization process has always been characterized by its poverty: whereas in European countries with a high car density (not to mention the United States) medium to medium-large capacity automobiles were predominant, in Italy the majority of car drivers owned low-powered cars (up to 1000 cc). Furthermore, once bought a car, the Italian car owners – whose mean income remained lower than that of other countries of the European Community – were not at all keen to replace their car with a new one since they did not possess the necessary financial resources. The opposition against the adoption of anti-pollution technologies was chiefly due to fears of an economic nature: Italian car owners feared that the adoption of anti-pollution technologies meant higher expenses in the use and upkeep, and first of all that this would mean to replace one’s own car more frequently.

From the second anti-smog act to the struggle against unleaded fuel (1971-1989)

Despite the vibrant tones of the internal debate and the spreading of alarm on the unstoppable decay of the urban environment produced by the exponential growth of traffic and air pollution, resistance against legislative measures aimed at lessening the environmental impact of cars continued to be considerable for at least two reasons. The first concerned the predominant role of the automobile industry in the Italian economy: up until the restructuring of firms which occurred during the first half of the 1980s, the car industry sector directly employed around 160,000 people (5.7% of the total of manufacturing industry workers), while by induction it insured jobs for two million workers. Public opinion was therefore staunchly against the introduction of any automotive emissions regulation since it feared that this may cause – in the event of a significant increase in the cost of motor vehicles caused by the installation of anti-pollution devices – a decrease in car sales which would generate a crisis for the entire Italian system of domestic production. The second motive is strictly connected with the public opinion’s perception of the car as a distinguishing shopping good. The commercial fortune of the car is to be attributed – if not only in Italy – to the complex symbolic connotations which it carries. Since its first appearance the car has become the emblem of modernity and of the achievement of prosperity. In newspaper and magazine articles, for example, the car was presented as a means for a better life and it assumed the role of a healing device capable of solving all problems that confront daily life, and enabling its owner to become a more modern and even more highly educated person. The car was presented as the prime symbol of freedom and not only because it enabled its owner to reach any place without time-table restrictions, without wasting time and without the effort of carrying luggage by hand, but most of all because the very ownership of a vehicle made one feel like a citizen and not like a subject and conferred the awareness of owning a tool which enabled one to conquer time and space. The car was therefore at the same time cause, effect and symbol of social progress, of financial prosperity and freedom. Precisely at a time when – under the pressure of the up and coming environmentalist movement – in Europe and in the United States the earliest legislation aimed at reducing (through the control of emissions) the environmental impact of motor vehicles, the car was establishing itself as an emblematic object (object-sign, as Roland Barthes put it) even among the lower classes, as a sort of modern fetish through which one asserted himself before the others as one who had achieved prosperity and a new social status.

In this context the final push towards the approval of an automotive emissions regulation was given by the European Community with a guideline (No. 70/220/EEC, 20 March 1970) which recommended the unification of the laws of member states concerning measures against air pollution caused by motor vehicles exhaust. The European guideline had been conceived after long and laborious discussions for the abolition of technical standards for motor vehicles within the context of the World Forum for Harmonization of Vehicle Regulations (known as Working-Party 29 of the United Nations Economic Commission for Europe UN-ECE, instituted in Geneva in 1952) and of the Working party three (WP-3, instituted within the General Management of Industrial Affairs of the European Economic Community).

To put into effect the directive No. 70/220, the Italian Parliament passed an act (No. 437, 3 June 1971) stated that among necessary features to obtain the type-approval of vehicles those relating to the limitation of pollutants should be included. The act also decreed that tests regarding the type-approval had to take place in the presence of an official of Ministry for Health and of Italian National Health Institute. The Act No. 437 only contained provisions designed to limit the emission of carbon monoxide while ignoring other pollutants such as lead oxides, tetraethyl lead and also nitric oxide in fuel used by diesel vehicles which were excluded from the bill.
Meanwhile, between 1966 and 1971, pollutant emissions from motor vehicles had increased overall by 46.3 percent: the percentage increase was 6.7 percent for fine particulate matter, 6.5 percent for sulphur dioxide, 7.2 percent for nitrogen oxides, 7.6 percent for hydrocarbons, 8 percent for carbon monoxide and 8 percent for lead. As sulphur dioxide is concerned, the most polluted region was Lombardy followed by Liguria, Veneto, Piedmont and Emilia Romagna. The conclusions of the *First report on the environmental situation of the country* (Prima relazione sulla situazione ambientale del paese) – drawn by Tecneco in collaboration with the Ministry of Scientific and Technological Research and «under the auspices» of the Prime Minister’s Office – highlighted how the approved laws (No. 615/66 and No. 437/71) did not contemplate any possibility of real control, not even «on the occasion of periodic overhauling». There was in fact «no clear obligation» to owners prescribing adequate maintenance and overhaul of vehicles and, moreover, no penalty was contemplated «for people driving vehicles and not complying with the requirements established by law». Finally, both the 615 and the 437 laws completely ignored motor cycles and established no limit to the pollutants emitted by motor cars except carbon monoxide and hydrocarbons.

In this situation, the ACI Stresa Conference took note of the environmental problems devoting the thirtieth edition (27-30 September 1973) to the subject *The automobile in society*. The reports presented during the proceedings were focused on analyzing the known data about pollution caused by motor vehicles: it was up to Carlo Pollone (deputy director of Fiat’s Technological research Unit) the task of summarizing the technological and legislative developments on the matter. Pollone admitted the delay of European car manufacturers in the study of anti-emission systems, but according to data presented by American car manufacturers, he stated that installing anti-pollution devices would have led to a substantial burden of costs for both producers and customers because of higher maintenance costs.

Furthermore, anti emission systems involved major problems for companies such the difficult handling of the high temperatures generated by catalytic converters, and the determination of the allowable tolerance on various components. In short, Fiat and other car manufacturers were not enthusiastic at the idea of having to equip their cars with new technologies which were already successfully tested in the U.S.: Chrysler for first had developed a modified engine that was called *Cleaner Air Package* which consisted in the calibration of the carburettor so as to provide particularly poor mixtures capable of cutting down carbon dioxide and hydrocarbons emissions. In the United States systems of fuel injection, additional devices to control emissions and appliances to limit the escape of petrol fumes from car tanks were also developed. In Italy, the only measure that was designed and applied was the gas recirculation valve (blow-by). Car industry, already for many years, had studied some alternatives to the internal combustion engines, especially the «turbocharged internal combustion engines, or Rankine cycle, Stirling engines, electric propulsion, diesel engines with plungers».

Pollone – anxious to demonstrate how the *advantage* of pollution reduction was counterbalanced by the economic *disadvantage* – failed to say that in Italy the problem was more serious than in other countries since the Italian fleet of motor cars was mainly composed of economy cars, far more polluting than more powerful cars because the high compression ratio of the engine caused a very imperfect combustion: the result was a remarkable concentration of pollutants such as nitrogen oxides and unburned hydrocarbons. Pollone could not avoid to note the delay of EC legislation in comparison to American and recognized that the adoption of the *Clean Air Act* and the establishment of the Environmental Protection Agency (EPA) had stimulated «an enormous expansion of research and development programs». American laws stipulated the minimum standards of air quality, provided the adoption of any necessary measures to fulfil the approved standards and required that in 1975 emissions of carbon monoxide and hydrocarbons were to be lowered by 90 percent, while motor vehicles produced in 1976 would have to emit nitrogen oxides at a rate 90 percent lower than that allowed in 1971.

European legislation was far more permissive than the U.S.: it required a reduction in emissions of carbon monoxide and hydrocarbons by 50 percent and 35 percent as compared to vehicles not fitted with anti-emission systems. Furthermore, it called for recirculation of exhaust gases (blow-by) and laid down a safety limit for the carbon monoxide emitted by idling engines at 4.5 percent, which many experts judged too high and extremely harmful to health. Moreover, European legislation imposed a further reduction in carbon monoxide and hydrocarbons present in car exhaust, while it did not establish any limits for nitrogen oxides. Engineer Pollone, not without surprise and disappointment, declared that Sweden and Australia had decided «for reasons not clearly understood» to align with the standards of the United States. The reasons were not so unclear and lay in the inadequacy of European legislation and concerns about health hazards: in the United States some new very detailed studies had been published and these were showing, with an increasing wealth of data, the riskiness of car exhaust.
Since the late 70s, the motor magazines – whose attitude was constantly torn between the demand for anti-pollution measures and protecting the interests of car manufacturers – reserved an ever larger amount of space to the growing problem of pollution caused by motor vehicles.

In early 1977, Quattroruote published two articles devoted to the hydrogen engine in which it remembered how the first patent, applied for by the American AF Burstall, dated back to 1927 and that in Italy, an engineer (Massimiliano Longo) was successfully testing an hydrogen engine on a Alfa Romeo 1300 Giulia. In December 1977, Quattroruote spread a report on the electric engine to which worked Fiat, Ansaldo, Enel, Garelli, Magneti Marelli and Piaggio Zagato. The result was a series of prototypes such as Zele Zagato (range of 60 km), Fiat XI 23 (excellent performance and range of 70 km), the Fiat-Enel Van (range of 50/80 km, operating costs equal to 3,000 Italian lire per 100 km) and the Taxi PGE (range of 100 km at an average speed of 50 km per hour). In July 1979, at last, Quattroruote gave great prominence to the Fiat 131 model powered by a hybrid electric-petrol engine presented by Fiat at the Detroit Motor Show29.

In 1983, the controversy about the harmful effects produced by leaded petrol emerged in Italy too. The issue was raised in 1981 by British consumer associations with the dual aim of denouncing the high toxicity of leaded petrol and obtaining the cancellation of a rule by the European Community which forbade member states to produce unleaded fuel. In April 1983 – after a study had found that the car was responsible for 70 percent of lead emitted into the atmosphere – the British government passed a law making it compulsory to use unleaded gasoline for all cars produced beginning from 1986. Furthermore, the law set to 1995 the date for withdrawal from the market of leaded petrol. The British government’s decision was shared by other European countries, except Italy and France. Germany also imposed the adoption of catalytic converters – needed to limit the emissions of five substances (nitrogen oxides, carbon monoxide, unburned hydrocarbons, sulfur dioxide, aldehydes) and working only with lead-free fuels – in all cars produced beginning from January 1986: the measure was motivated by the need to drastically reduce the substances responsible for acid rain (nitrogen oxides, unburnt hydrocarbons, sulphur dioxide) that were severely damaging the German forests. The Italian government had not followed the line of other member states in order to support the position of Italian car factories who requested the use of unleaded gasoline with a high octane rating (around 96), whereas in Europe the choice prevailed diminish the amount to 92.

The solution of the problem of car pollution still seemed very far away since the production of unleaded gasoline sparked a bitter controversy between those who wanted to encourage its use on cars not catalyst-fitted and those who sought to restrict the use of unleaded fuel only to cars fitted with catalytic converters. The crux of the matter was represented by benzene and other aromatic hydrocarbons – highly carcinogenic substances – found in unleaded petrol which
served to maintain a high octane. Using these fuels to power cars not equipped with catalytic converters meant, therefore, filling the air with highly toxic and dangerous substances just like lead. Of this, car manufacturers were aware, along with refiners and even politicians. In fact, in April 1989 the findings made by Commission of inquiry on fuels were released, which proposed reducing the maximum percentage of benzene from 5 percent in volume to 3 percent in weight and considered undesirable the use of unleaded petrol in not catalyst-fitted cars since this would have resulted in an increase of pollutants (mainly aldehydes and aromatic hydrocarbons).

Consequently, Minister for the Environment Giorgio Ruffolo suggested to the government to put a ban on the sale of unleaded fuel for not catalyst-fitted cars, to adopt a measure to establish the maximum aromatic hydrocarbons, to reduce the price of unleaded petrol and to allocate sales incentives for the purchase of catalyst-fitted vehicles. Some bills were also introduced aiming at limiting benzene to 3 percent in weight and aromatic hydrocarbons to 30 percent, in observance of the European directive to the effect that unleaded gasoline should not represent an additional source of pollution.

However, following a bitter campaign promoted by the Italian Oil Union (Unione petrolifera), on 12 July 1989 Minister Ruffolo signed a letter of intent for the reduction of aromatic hydrocarbons which set the maximum percentage of benzene at 4.5% in weight and that of other hydrocarbons at values set for unleaded petrol marketed in other European Community countries. It was an insulting measure – suffice to think that in Japan and the United States the maximum level of benzene was 1.5 percent – since the rules were too lax and unable to produce a real reduction in the amount of aromatic hydrocarbons in the air.

In October 1989, a response to such an ineffectual decision by the government came from Quattroruote which proposed its own anti pollution therapy focused on a clean engine without catalytic converter. The proposal of the monthly magazine was a compromise between the positions of environmentalists and those of Italian car manufacturers, who had always been very lukwarm towards anti-emission technologies. Meanwhile, between inconclusive ideas and farcical measures, the pollution problem grew more serious.

From the 1990s to the early twenty-first century

In 1990, in Italy, 430 million tons of carbon dioxide were emitted into the atmosphere (96 by transport), 1.938 of nitrogen oxides (1.141 by transport, including 945 by motor vehicles), 2.192 of non-methane volatile organic compounds (1,121 from transport, including 954 by vehicles), 1.653 of sulfur oxides (124 from transport of which 102 by vehicles). So, motor vehicles represented a significant source of pollution: in 1991 they produced 643.3 million tons of carbon dioxide out of 82.3 by aircrafts, 20.7 by ships and 8.7 by trains. Air quality was affected in almost all medium to large urban conurbations, Milan in particular then Rome, Naples, Turin, Bologna and Florence. In Milan and in 34 other municipalities of the Milan hinterland, values of carbon monoxide exceeded the 20 milligrams (the alarm threshold was fixed at 10 mg) and those of nitrogen dioxide permanently surpassed the 400 micrograms set by the World Health Organization as alarm threshold.

Fig. 2 A satirical cartoon against the high cost of fuel
Despite the large body of opinion opposed to anti-pollution measures, in 1994 came the approval of a ministerial decree (No. 114, 15 April 1994) which established an urban system for monitoring carbon monoxide, sulphur dioxide, nitrogen dioxide, ozone and fine particulate matter. Once exceeded the levels of attention and alarm, municipalities had to adopt the measures deemed necessary. The adoption of anti-pollution measures was mandatory in case the alarm lasted for at least three consecutive days.

Local authorities tried to break down pollution levels with some buffer solutions such as the adoption of traffic on alternate days (targhe alterne), the restriction of road traffic in some time-course and on sundays (sundays on foot). With regard to structural measures to reduce traffic volumes, Communes proposed a series of imaginative proposals such as sales incentives for electric vehicles, shared taxis, entrance fee in the historic centers (eco-pass). These measures were received by angry protests on the part of professional and craft associations (especially those of truck drivers, taxi drivers and traders) and citizens forced not to use their cars.

To begin from the second half of the 1990s, we have seen a considerable increase of sales of medium-high to high-powered cars: in the northern regions this increase has been above 35%. This clearly indicates that consumers’ choices are especially inclined towards vehicles capable of undertaking even daily long journeys and that provide more comfort and safety. From an environmental view point, however, the diffusion of large and powerful cars has caused the occupation of more space, parking difficulties, more road congestion, higher fuel consumption and more polluting emissions. These vehicles (SUV included) are used in cities on short distances with only the driver on board: such behaviour, therefore, results in a higher contribution to pollution in urban areas and in a higher degree of road congestion. The diffusion of such vehicles has ended with undermining environmental improvements due to a progressive diffusion of cars responding to the more recent European recommendations (Euro 3 and Euro 4): it is clear that on the basis of equal power and fuel consumption a new generation vehicle has an inferior environmental impact to that of an older vehicle, however, this positive factor has been partly neutralized by the expansion of powerful cars and by those fulled by diesel oil.

Notwithstanding the fact that Italy has applied European recommendations in matters of air pollution with Ministerial Decree No. 60 of 2 April 2002 – setting much more severe limitations to the main pollutants – almost all the chief cities of Italy continue to disregard the limits imposed by European guidelines in spite of these having been accepted by national legislation. For what concerns nitrogen dioxide, this goes well above the established limits in almost all the major Italian cities. For what concerns ozone (European legislation has established the limit at 120 μg/m$^3$ not to be exceeded for more than 25 days in a year) this limit is observed in only four cities. Fine particulate matter (PM$_{10}$) remains the pollutant presenting the gravest problem. Notwithstanding the growing number of measures of a non structural nature aimed at reducing the concentration of fine particulate matter in the air (stops to traffic, alternate number plates etc.) the effectiveness of such measures is unsatisfactory since no city is capable of remaining within the limits imposed by legislation (50 μg/m$^3$ not to be exceeded for more than 35 days in the year)$^{33}$.

**Conclusion**

In conclusion, despite the constant updates of legislation and the introduction of measures aimed at containing pollution within an acceptable threshold, environmental emergency caused by vehicular traffic is still far from being resolved.

If replacing leaded petrol with unleaded gasoline, improving diesel fuels and using catalytic converters has decreased the concentrations of lead in the air, carbon oxides, nitrogen dioxide, sulphur dioxide and other pollutants such as benzene and fine particulate matter remain well above danger levels. According to the Report on air pollution in Italian cities: impact on health compiled by the National Agency for Environment (Agenzia nazionale per l’ambiente) and by the World Health Organization, only PM$^{10}$ fine particulate matter is responsible, in eight major Italian cities, for 3,500 deaths, 1,900 hospitalizations for respiratory problems, 2,700 hospitalizations for cardiovascular diseases and 31,500 acute bronchitis fits$^{34}$.

To radically reduce pollution, there is only one way forward: the replacement of internal combustion engines with new engines powered by electric energy or hydrogen. In the immediate future, however, it is unlikely that these technologies will be adopted on current models: electric cars continue to have high costs and a limited range. While those that do not produce hydrogen gas on board (hydrogen is placed in a refrigerated tank at −253 °C) pay for the problem related to the lack of a distribution network, still far from being developed. Hydrogen engines with reformer technology (a sort of chemical plant that draws fuel from methanol or petrol) have unsustainable costs that prevent any kind of mass production$^{35}$. 

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The slow diffusion of hybrid models and alternative fuels – little-used are also reformulated gasolines (containing low amounts of aromatic hydrocarbons, substituted with additives of plant origin) and white diesel (a mixture of water, oil and additives) – suggests that the clean car is destined to remain an utopia for many years to come.

Notes


4 Atti parlamentari, I Legislatura, Camera dei Deputati, Discussioni, Interrogazione dell’on. Palenzona a proposito del ministero dell’Industria e del commercio Campilli, 12 December 1952.

5 Car density is the measure used in the statistics published by the Italian Association of the Automotive Industry (Anfia) to measure the level of motorization. The density of cars indicates the relationship between resident inhabitants per car: the higher is the number of resident inhabitants, the lower is the level of development of private motorization.


7 Indeed, a bil was introduced by Communist Senator Scotti on 20 November 1958. The measure decreed that industrial cities or cities with heavy car traffic should provide weather stations specialized in the monitoring of pollution sources. It also authorized communes to take the necessary step to reduce car traffic whenever the level of air pollution had reached concentrations deemed dangerous. The Scotti bill remained with the Senate Health Standing Committee and it was never passed. To begin from 1960, pollution caused by motor vehicles began to feature in the motor press which provided space devoted primarily to the relationship between the inhalation of poisonous substances released by car exhaust and the onset of respiratory diseases. In its first issue of 1961, the journal of the Commission for industrial motorizing (Commissione per l’automobilismo industriale) of the Italian Automobile Club (ACI) emphasized the role of motor vehicles as sources of air pollution and listed the harmful effects of smog. The following year, the ACI weekly highlighted the fact that in Italy there was not a law against gas, while the monthly of the Touring Club’s Experimental Institute for the Roads Commission (Istituto sperimentale della Commissione strade) published an article with preoccupied tones indicating the morbility related to air pollution.

8 «Annali della sanità pubblica», XXV. September-October 1964.

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Ibidem.


See Legambiente, Smog e dintorni 2006. L’inquinamento atmosferico e acustico nelle città italiane, Legambiente, Roma 2006; Agenzia per la protezione dell’ambiente, Qualità dell’ambiente urbano, Apat, Roma 2006; Istituto superiore per la protezione e la ricerca ambientale, Annuario dei dati ambientali 2009, Ispra, Roma 2009.

WHO-Europe, Health Impact of PM_{10} and Ozone in 13 Italian Cities, WHO Regional Office for Europe, Copenhagen 2006.

This book collects some of papers I have presented at conferences of the European Society for Environmental History, the American Society for Environmental History, the Association for East Asian Environmental History and the Round-Tables on European Urban History. Chapters I, II, III, VI are unpublished. The Introduction and Chapter IV have been published in Italian. Chapters V, VII, VIII have been published in English on Italian journals in a different version. With this book, I want to propose again these essays in a context that highlights their unitary plot.

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