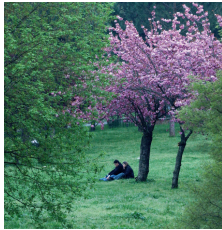




ENVIRONMENT AND HEALTH



New socio-economic scenarios, technological development and lifestyles have changed global exposure to environmental risk factors.

These factors are driven by environmental change. Climate change increases environmental and territorial vulnerability.

Governance of these problems is a very complicated process and there are still many doubts.

European and WHO approaches indicate that environmental prevention tools against risk factors need to be improved.

Introduction

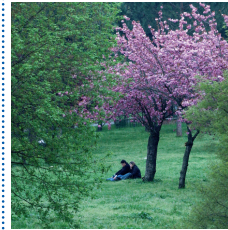
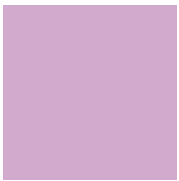
In the last few decades, rapid changes in lifestyles and new socio-political and technological scenarios have both changed the pressures on the environment and, improved conditions of life and prevention systems (especially in the developed countries).

This made it possible to reduce traditional health risk factors, especially those related to hygienic and sanitary conditions. But it has also created an unprecedented global exposure to environmental risk factors of chemical, physical and biological nature with a potential impact on both individual and collective health and well-being.

The drivers of these risk factors are correlated to global environmental change such as: urbanization, fragmentation of territories and ecosystems, globalization and increased social mobility, lifestyles, new technologies, demand for energy and water resources, increased use of chemical substances that persist in the environment and, last but not least, climate change that expands environmental and territorial vulnerability. Inevitably, transforming scientific knowledge (scientific evidence of health risks caused by environmental factors) into institutional action (regulations and global initiatives in the sector) is a complicated process. There are still many doubts on the evaluation of risks, their communication, the realization of an integrated approach and the definition of priorities and areas of action to focus on.

Below is a brief description on the evolution of environment and health problems focusing on the three main areas that govern the entire process: scientific difficulties, institutional awareness and the population's risk perception management.

European and WHO approaches indicate the need to improve environmental tools that prevent environmental risk factors using methods that better represent the exposure and improving information and environmental communication.



Environment and health problems and environmental policies

Scientific complexity

Theoretically, every day each one of us comes into contact with countless risk factors in the form of harmful substances or chemical compounds, bacteria, viruses, allergens, electromagnetic waves and noise sources. However, not everybody develops diseases that research underlines as being associated to single factors.

The uncertainty of each individual outcome is due to numerous exposure variables (the amount of time or concentration of the exposure to a specific substance) and the person's vulnerability. Each population has a wide range of different susceptibilities and some people are more vulnerable than others when exposed to some pollutants. During the various phases of the vital cycle, all living organisms experience different "windows" of vulnerability and susceptibility that can depend on: age and development (children/adolescents and elderly persons), physiological state (pregnancy), clinical state (chronic diseases), lifestyles and socio-economic factors. Susceptibility implies a higher mortality and morbidity risk. Children are more susceptible than adults to the effects of some pollutants (e.g. neurotoxic ones) and have lower threshold levels than those producing effects on adults.

Many risk factors are, in turn, influenced by different determinants such as environmental (urbanization and territorial integrity) and socio-economic contexts (capacity and efficiency of environmental prevention systems and health services, lifestyles, professional exposure, etc.). Furthermore, some risks are caused by conditions that are considered healthy (internal heating) or which belong to lifestyles (using mobile telephones).

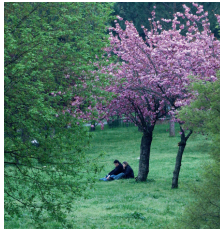
Environmental policies can act directly on some risk factor determinants, for example by protecting resources (water, air, soil, biodiversity) and the integrity of the territory, studying the exposure and spreading information and environmental communication.

Managing healthcare risks posed by environmental determinants is a complex task, calling not only for scientific evidence, arrived at by cross-analysing exposure to risk factors with disease, but also for tools with which to identify priorities, emerging risks, vulnerable populations and feasible actions (Figure 6.1).

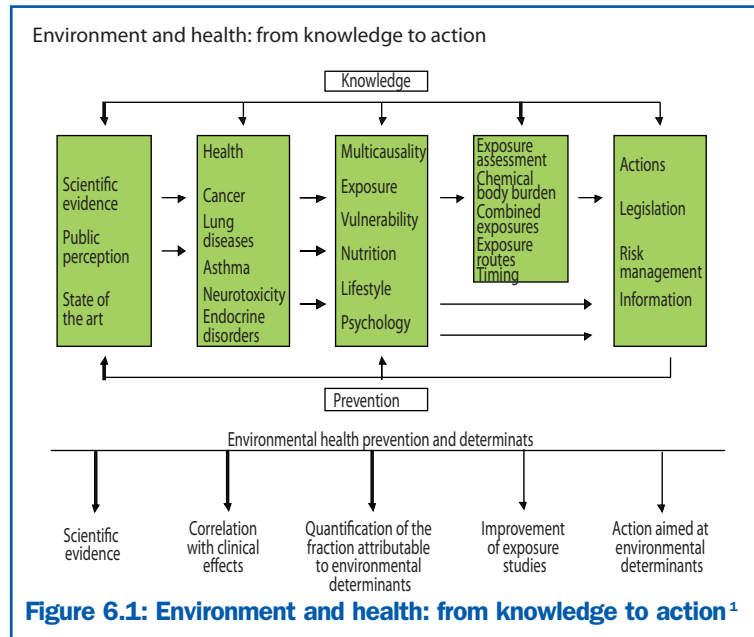
Every day, each of us comes into contact with countless risk factors. However, not everybody develops diseases that research associates with single factors.

Some risk factors are caused by conditions perceived as an indication of wellbeing.

Environmental policies can act directly on some determinants and must take into account emerging risks, local priorities and action feasibility.



Environmental prevention actions are the result of a complicated cognitive process that includes considering risk hypotheses developed by research, their association to clinical effects, studying exposure and identifying preventive action areas and tools. It also includes information and communication.

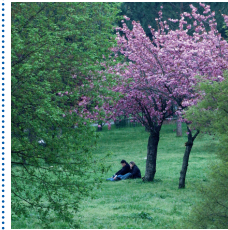
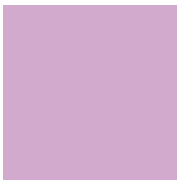


Theoretically speaking, to assess an individual's exposure to a harmful substance, the point of contact (food, air, water, etc.) should be known, together with the number of times and the amount of the substance to which the individual is exposed. The biological response to this exposure, which includes other individual variables, (age, metabolic capacity, etc.), should also be determined. Actually, though toxicology research and epidemiological studies have made possible the identification of dangers and risks, we are exposed to a combination of several substances therefore the process is even more complex. In general, the mitigation of exposure to the identified factors is the most effective preventive approach.

In practice, since individual exposure is impossible to assess, proxy indicators are used. These take into account some characteristics of the environmental factor to which people are exposed

¹ Source: Prepared by ISPRA based on EEA model, 2005

In practice, studying exposure to risk factors is possible by means of proxy indicators but these need to be updated according to new risks and new environmental determinants identified by research.



(concentration or intensity in a specific area of reference, exposed population, etc.).

The study of exposure is a significant preventive tool but environmental information must be updated according to research results that indicate new risks and their environmental determinants.

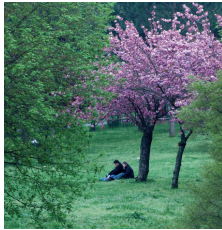
The absorption of a certain substance through exposure can be quantified by biomonitoring techniques, in other words through a chemical and physical analysis of substances from biological samples (blood, hair, urine, etc.). These methods of estimation and measurement do not, however, indicate the possible development of diseases because other factors contribute to this process. This is because there is no linear correlation between exposure (especially chronic) and clinical effects and there are no diseases caused only by environmental factors. In any case, action that prevents exposure to risk factors causing diseases needs to be taken. To date, exposure has been studied only by analysing exceedances of threshold values.

However, scientific knowledge has highlighted that preventive efficiency cannot be governed only by referring to sectors and limit values established by the law. New tools and different approaches are needed, as declared with the European Environment and Health Strategy 2003: *“Until now environmental assessments and policy actions have focused on single pollutants in single environmental compartments (air, water, soil ...) and many related environmental health problems have indeed been solved.*

However, by doing so some health impacts are underestimated, because in reality the situation is much more complicated: pollutants are transferred between different environmental compartments (air to soil, to water, ...); people are exposed to a combination of pollutants that interact in the environment and in the human body. These facts are not sufficiently taken into account in the actual policy responses. Furthermore, the present policy responses are not sufficiently integrated (e.g. air monitoring data are not linked to water monitoring data, to soil monitoring data... and to health monitoring data) and therefore do not always effectively address the specific “environment and health” interface. Such integration is essential to further develop environmental legislation and measures to protect human health...”

Biomonitoring techniques are another tool to assess exposure.

Preventive efficiency cannot be governed only by referring to sectors and limit values but new tools and different approaches are needed, as considered in the EU Environment and Health Strategy 2003.



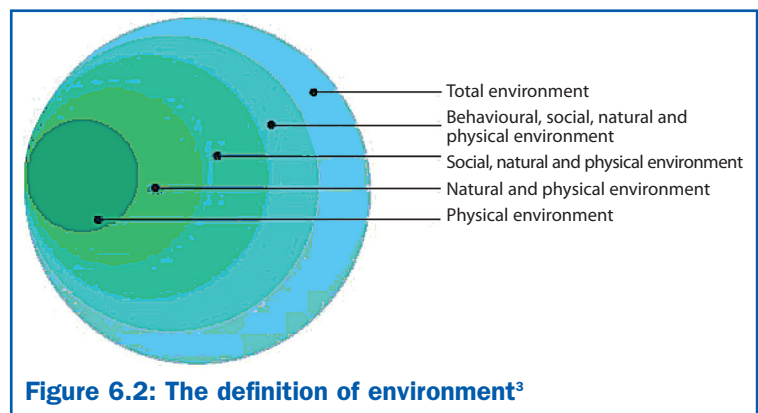
Emerging risks may not be considered by traditional monitoring and environmental information systems.

The figure shows the different systems included in the extended definition of “environment” which influence health and the quality of life.

Finally, we must take into account that traditional monitoring systems can oversee emerging risks that are not controlled by specific regulations. These are due, for example, to changes in environmental scenarios (toxic algae and warming of waters, new allergens, etc.) and combined physical (noise) and chemical (air pollution) exposure which are typical to the built environment.

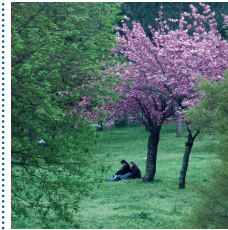
The process of institutional awareness

The initial difficulties met in the governance of the “environment and health” issue, which constitutes a discipline unto itself, are probably due to the extended definition introduced by the European Region of the WHO in 1989² (Figure 6.2) which included many complex subsystems governed by different actors and relevant sectors.



² “Environmental health comprises those aspects of human health and disease that are determined by factors in the environment. It also refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health. As used by WHO/Europe, environmental health includes both the direct pathological effects of chemicals, radiation and some biological agents, and the effects (often indirect) on health and wellbeing of the broad physical, psychological, social and aesthetic environment. (Environment and Health, the European Charter and Commentary, Frankfurt, 1989).

³ Source: Smith, Corvalàn e Kjellstrom, 1999



Prevention policies have already reaped results but determinants need to be considered as a whole.

Today, roles and responsibilities have become clearer but the modern concept of “health” still needs to be integrated with policies of other sectors.

Initially, many Community policies were driven by environmental factors that represented a health risk. Research results and the commitment of institutions have made it possible to use low-impact technologies and adopt preventive measures not only for control and monitoring systems but also for emission sources. An example of this action can be seen in Figure 6.3, which refers to the city of Milan and shows the trend of an atmospheric pollutant that influences the quality of air. Between 1977 and 1993 there was a sensitive reduction of about $100 \mu\text{g}/\text{m}^3$ in the annual mean concentration of Total Suspended Particles (TSP). This progress is due to the preventive measures and action that was taken. Between 1993 and 2003 there were no significant change and the concentration practically remained stable, yet always above the limits provided by the law.

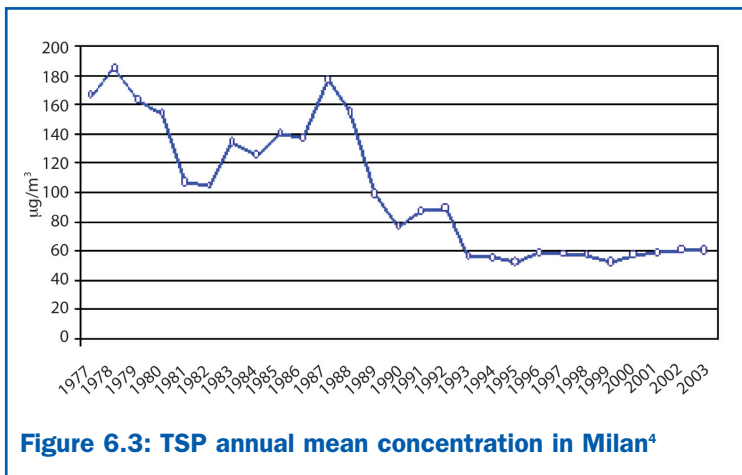
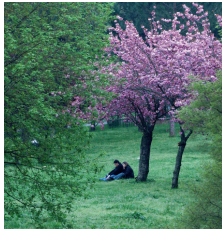


Figure 6.3: TSP annual mean concentration in Milan⁴

Between 1977 and 1993 there was a considerable reduction of about $100 \mu\text{g}/\text{m}^3$ in the annual mean concentration of TSP. This was also due to preventive measures and action taken. Between 1993 and 2003 the situation remained stable and the concentration was almost the same, yet still above the limits provided by the law.

Risk prevention therefore also needs to be aimed at other determinants, such as mobility management, while we wait for low-impact vehicle technologies to be improved.

⁴ Source: ARPA Lombardy



There is a growing awareness that such a complicated system cannot be managed only by identifying threshold values but it needs a specific, integrated, multisector approach.

Europe is creating new preventive tools. The WHO has launched the Environment and Health Action Plans.

Environmental information needs to be in line with new strategic objectives.

Population perception of environmental risk as a factor that influences the quality of life and health is also growing.

Different institutions have gradually become aware that a system as complex as air pollution or chemical pollution cannot be managed only by identifying threshold values but requires an integrated approach. This has led the European Union to adopt new tools such as the European Environment and Health Strategy, the Environment and Health Action Plan (2004), the Urban Environment Strategy, the establishment of Food Security Agencies (EFSA) and REACH regulations.

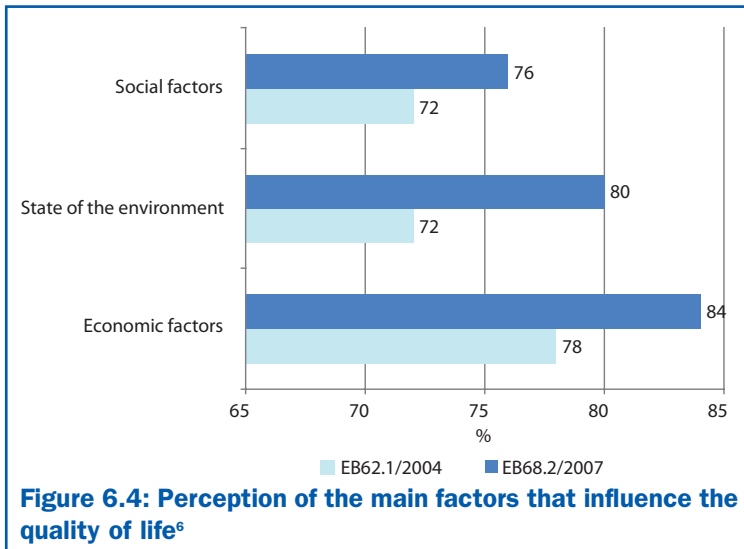
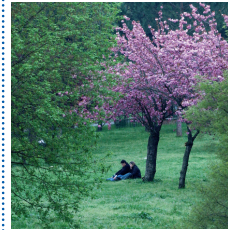
The WHO has reminded the 53 countries of WHO/Europe to adopt National Environment and Health Action Plans (NEHAP). Since 2003, the attention is also more focused on the more vulnerable groups, children, with institutional initiatives such as the Children Environmental Health Action Plans (CEHAP) and the adoption of priority objectives for the European Region or the SCALE initiative of the Commission within the framework of the European Environment and Health Strategy.

Each of these tools needs to be supported by adequate environmental information, in line with the specific strategic objectives.

The population's risk perception

Even the population is growing always more aware of how important the environment in which we live is for our well-being and health. In the recent Eurobarometer⁵ of 2008, over 80% of European citizens associated the quality of life to environmental factors (Italy is above average. In particular, 86% of Italian citizens perceive the quality of life as something that depends on environmental factors, 89% on economic ones).

⁵ The Eurobarometer is a tool created by the European Commission to carry out surveys aimed at knowing and understanding the behaviours of European citizens.



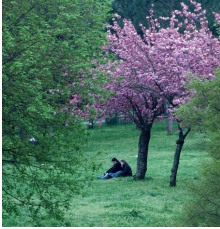
In Europe (25) more than 80% of the population perceives the environment as an important factor that influences the quality of life.

Another survey on the perception of risks that endanger our health (Eurobarometer 2006) highlighted how citizens identify environmental factors as the most serious risk, even compared to crime or serious diseases (Figure 6.5). The perception of Italian citizens is not very different from the European average.

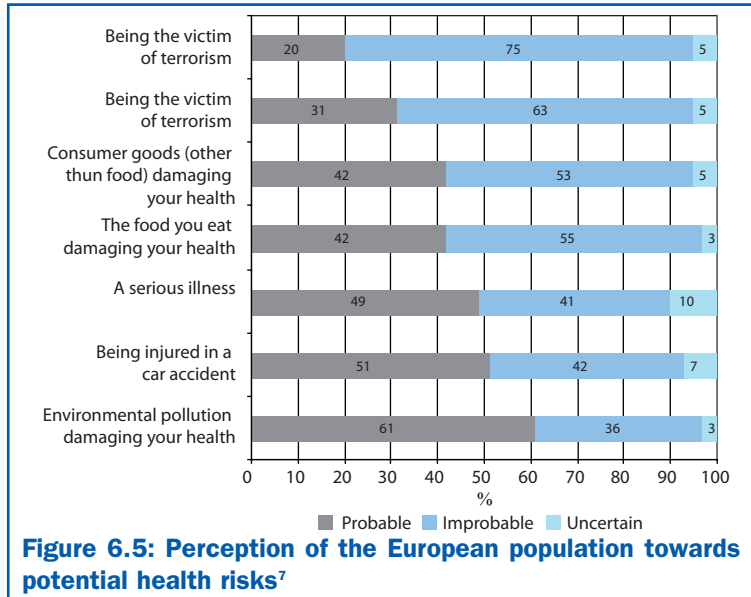
It is therefore necessary to develop a community system integrating information on the state of the environment and including all major health aspects.

Such a significant risk perception calls the attention on the need to develop a community system integrating information on the state of the environment and including major health aspects.

⁶ Source: Eurobarometer



Exposure to environmental risk factors (pollution, food security, etc.) is perceived by European citizens as one of the most probable causes of health risks.



Defining areas of environmental prevention

What are the action areas of environmental prevention in such a complicated system?

Many sources in scientific literature have long highlighted the association between exposure to environmental risk factors and the potential development of some diseases.

As already stressed, exposure to dangerous substances does not necessarily imply the development of a disease or that the exposure could be related only to environmental factors. The methods we have today do not allow us to make an exact estimate of the health effects of long-term environmental exposure to reduced concentrations or exposure to various pollutants, especially when considering long-term diseases (cancer). In addition, there are still many doubts on the complicated methodology and our knowledge on risks associated to many substances and many determinants is still poor.

In any case, research continues to evolve trying to provide more focused information for decision-makers.

⁷ Source: Eurobarometer no. 238 of 2006

Abundant scientific literature has highlighted the association between exposure to environmental risk factors and potential disease development. But we have no knowledge of the long-term effects or exclusive, direct cause/effect relationship.

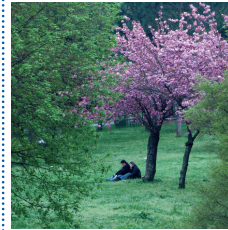
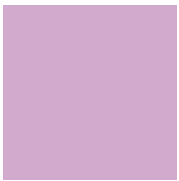


Table 6.1: Major health impacts and some associations with environmental exposures to chemicals and other environmental stressors and lifestyle factors⁸

Health Impact	Associations with some environmental exposures
Infectious diseases	<ul style="list-style-type: none"> • water, air and food contamination • climate-change-related changes in pathogen life cycle
Cancer	<ul style="list-style-type: none"> • air pollution (PM), mainly PM_{2.5} or less • smoking and environmental tobacco smoke (ETS) • some pesticides • asbestos • natural toxins (aflatoxin) • polycyclic aromatic hydrocarbons, e.g. in diesel fumes • some metals, e.g. arsenic, cadmium, chromium • radiation (including sunlight) • radon • dioxin
Cardiovascular diseases	<ul style="list-style-type: none"> • air pollution (carbon monoxide, ozone, PM) • smoking and ETS • carbon monoxide • lead • noise • inhalable particles • food, e.g. high cholesterol • stress
Respiratory diseases, including asthma	<ul style="list-style-type: none"> • smoking and ETS • sulphur dioxide • nitrogen dioxide • inhalable particles (PM_{2.5} and PM₁₀) • ground-level ozone • fungal spores • dust mites • pollen • pet hair, skin and excreta • damp
Skin diseases	<ul style="list-style-type: none"> • UV radiation • Some metals, e.g. nickel • pentachlorophenol • dioxins

Exposure to substances such as pesticides or PMs does not imply the development of a tumour or that the tumour can be directly related only to environmental factors. Objectively speaking, the methods available today do not enable us to make exact assessments on the effects of long-term exposure or exposure to reduced concentrations or more pollutants. It is, anyway, possible to associate some diseases with environmental factors, within the limits of each individual's diversity.

⁸ Source: EEA information (*Environment and Health* EEA Report no. 10/2005) processed by ISPRA

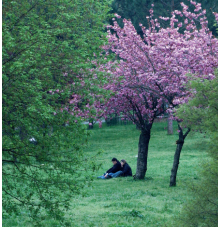
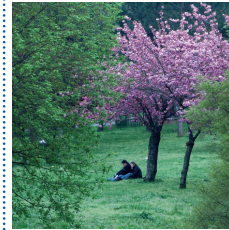


Table 6.1: Major health impacts and some associations with environmental exposures to chemicals and other environmental stressors and lifestyle factors

Health Impact	Associations with some environmental exposures
Diabetes, obesity	<ul style="list-style-type: none"> • food, e.g. high fat • poor exercise
Reproductive dysfunctions	<ul style="list-style-type: none"> • polychlorinated biphenyls (PCBs) • DDT • cadmium • phthalates • endocrine disruptors • pharmaceuticals
Developmental (foetal and childhood) disorders	<ul style="list-style-type: none"> • lead • mercury • smoking and ETS • cadmium • some pesticides • endocrine disruptors
Nervous system disorders lead	<ul style="list-style-type: none"> • PCBs • methyl mercury • manganese • some solvents • organophosphates
Immune response	<ul style="list-style-type: none"> • UVB radiation • some pesticides
Increased chemical sensitivity	<ul style="list-style-type: none"> • multiple chemical exposures at low doses

With the need to identify preventive priority action, more attention is being paid to both the power of association between environmental stressors and clinical effects and the feasibility of preventive actions.

In its “Environment and Health” Report (2005), EEA provides results of a study (Table 6.2) aimed at establishing: the degree of correlation between some diseases and specific pollutants; the potential impact in quantitative terms and the possibility of taking preventive action against risk factors. For example, the correlation between radon and lung cancer is considered “very likely”.



Despite this, the impact is assessed as “moderate” because exposure to radon does not involve the whole population (radon is only found in some areas). On the contrary, the possibility of taking preventive action is identified as “high”.

Table 6.2: Strengths of associations between environmental factors and a selection of diseases, corresponding population impact and prevention possibilities⁹

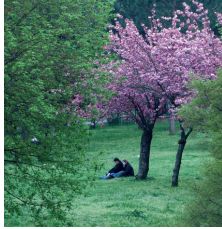
Disease/pollutant	Strenght of Association	Qualitative descriptor	Population Impact	Prevention possibilities
Cancer/ radon Neurodevelopment/ lead	Very likely (90-99%)	Statistical significance: beyond all reasonable doubt	moderate	high
Neurodevelopment / mercury	Very likely (90-99%)	Statistical significance: beyond all reasonable doubt	low	high
Respiratory diseases / air pollution	Very likely (90-99%)	Statistical significance: beyond all reasonable doubt	high	moderate
Neurodevelopment / POPs (Persistent Organic Pollutants)	Likely (66- 90%)	Reasonable certainty: sufficient scientific evidence	moderate	moderate
Asthma causation / air pollution	medium likelihood (33-66%)	Balanced of evidence: strong possibility	high	moderate
Cancer / EMF (Electromagnetic Fields)	low likeli- hood (10-33%)	Scientific suspicion of risk	high	low
Cancer / low level radioactivity	very unlikely (1-10%)	Low risk	moderate	high

Results of the study contained in the EEA “Environment and Health” Report show the degree of association between some diseases and specific pollutants and the potential impact on the population, in quantitative terms. The study also highlights the possibility of influencing the considered factors through preventive action.

In its recent report “Preventing disease through healthy environments” (2007), the WHO introduced a similar operative approach for the management of the environment and health issue.

The international study defines operational areas for environment and health policies introducing new determinants, such as *built environment*, climate change and agricultural practices, in addi-

⁹ Source: EEA information (Environment and Health EEA Report no. 10/2005) processed by ISPRA



Apart from protecting the quality of natural resources, the WHO identifies other areas of preventive action: built environment, climate change and agricultural practices.

The WHO has defined action areas for environment and health policies and has highlighted areas of intervention. The contribution of environmental factors to the causing of diseases has also been assessed.

tion to the traditional biological, chemical and physical risk factors (water pollution, indoor and outdoor air pollution, noise, ionizing radiations, etc.). In the specific case of the *built environment* this new determinant is defined as a set of factors which includes urban planning¹⁰, mobility areas and land use, all of which influence causes of death either directly (road accidents) or indirectly (through a reduced quality of life or physical inactivity which are known as being health risks common to many diseases representing the main causes of death and disability in the world (diabetes, cardiovascular diseases, obesity). The report also highlights feasible areas of intervention. Taking the diseases as an end point, the report considers and assesses environmental risk factors that can realistically change using available technologies, policies and preventive environmental and health action.

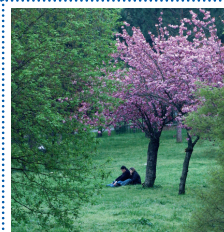
The study also assesses the contribution of environmental factors in causing diseases that acknowledge them as a joint cause. In particular, the report highlights that:

- Environmental factors contribute to 85 of the 102 main diseases considered in the *World Health Report* of the same international organisation.
- Globally, about 25% of diseases and 23% of early death cases can be attributed to environmental factors of chemical, physical and biological nature or to factors that encourage unhealthy behaviours which have a well-known exposure chain (lack of physical activity).

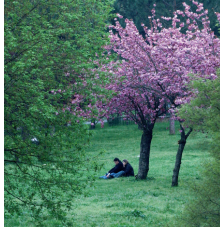
The study also highlights that the weight of environmental factors also depends on other determinants, such as socio-economic, managerial and organizational contexts that vary according to the different continental regions and the pathology that is considered. In developing countries, for instance, the main effect of environmental factors is their contribution to the incidence of infectious diseases and mortality, in developed, it is their contribution to neoplastic diseases. However, the WHO reminds that these

¹⁰ In particular, some aspects in the modern organization of cities such as circulation, generally influence the quality of life through air pollution, reduced physical activity, noise, accidents and social isolation which often are due to the lack of urban space available for vehicle circulation.

assessments are underestimated with respect to actual facts, since they do not include categories of exposure to many environmental risks (prolonged exposure to chemical pollution, endocrine disruptors, new technologies) and it is still not clear whether they are associated to clinical effects. According to this new WHO approach, most health determinants cannot be directly controlled by public health authorities and attributed to the efficiency of health services, since they are strictly correlated to policies and strategies of other sectors (protection of natural resources and the territory, urban planning, mobility and transport, energy, productive activities and socio-economic variables). Environmental information relevant to health could be extended even to new areas of action. Among these are built environment, climate change and agricultural practices.



The new WHO assessment approach confirms that most health determinants cannot be directly controlled by public health, being the efficiency of health services strictly correlated to policies and strategies of other sectors.



Starting from the disease, as end point of the process, the table analyses environmental factors realistically susceptible of change and assesses them by means of available technologies, policies and preventive action on environment and health. For example, the percentage that can be attributed to the environment (for indoor air pollution) varies between 5% and 25% of cases of chronic bronchopathy. This high value is due to the common practice of using biomass for lighting, cooking and heating in developing countries. The risk can be mitigated by adopting basic energy practices.

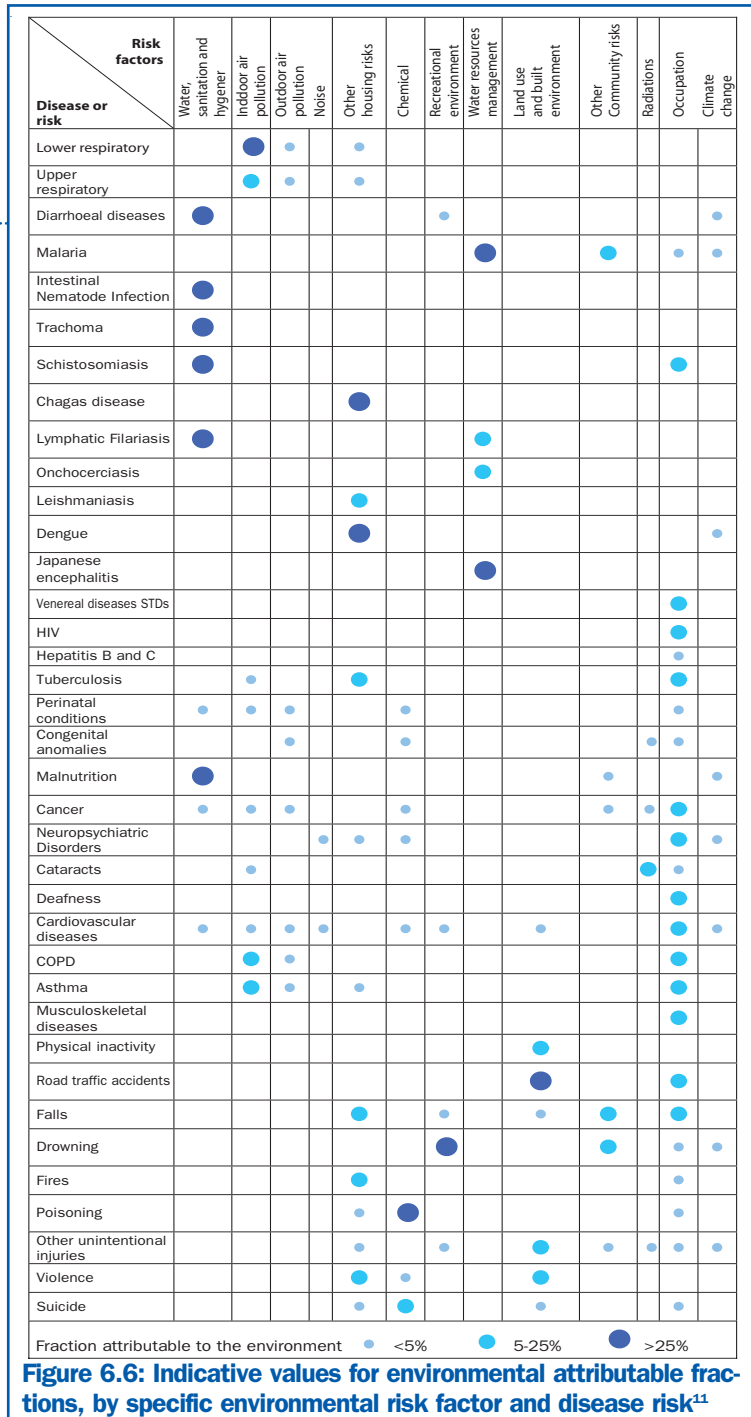
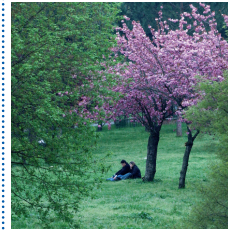
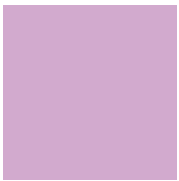


Figure 6.6: Indicative values for environmental attributable fractions, by specific environmental risk factor and disease risk¹¹

¹¹ Source: A. Prüss-Ustün and C. Corvalán (Eds) PREVENTING DISEASE THROUGH HEALTHY ENVIRONMENTS *Towards an estimate of the environmental burden of disease*, WHO 2007



Emerging issues

Children's environmental health

In scientific and institutional contexts there is a growing awareness towards the effects that environmental factors have on children's health (allergies, respiratory diseases, paediatric cancer, alterations of neurological development, lack of physical activity and obesity). According to many scientific studies, children are more vulnerable and more exposed to a variety of environmental agents existing in outdoor and indoor air (houses and schools), water and food. This is due to their biological nature and behaviour, even if their exposure is different according to their age and socio-economic conditions. Scientific knowledge indicates that exposure to chemical substances, which are hazardous to their development, starts at prenatal stage.

In 2004, a WHO study conducted in Europe estimated the burden of disease on children with respect to 5 environmental risk factors: outdoor and indoor air pollution, quality of water, sanitation systems, exposure to concentrations of lead, accidents. In general, 1/3 of the global burden of disease on children aged between 0 and 19 can be attributed to these factors, with some differences according to age subgroups and risk factors.

In the same period, in Budapest, the Inter-Ministerial Conference on Environment and Health was dedicated to children's health. Government delegations signed their commitment towards:

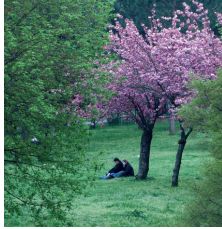
- 1) The adoption of the CEHAP: *Children Environmental Health Action Plan*.
- 2) The adoption of measures for achieving the *Regional Priority Goals* (RPGs).

Regional Priority Goal I: prevent and significantly reduce the morbidity and mortality arising from gastrointestinal disorders and other health effects, by ensuring that adequate measures are taken to improve access to safe and affordable water and adequate sanitation for all children.

Regional Priority Goal II: prevent and substantially reduce health consequences from accidents and injuries and pursue a decrease in morbidity from lack of adequate physical activity, by

In scientific and institutional contexts there is a growing attention towards the effects that environmental factors have on children's health (allergies, respiratory diseases, tumours in infancy, alterations of neurological development, lack of physical activity and obesity).

The WHO establishes the four main goals for protecting children's environmental health.



The EU Environment and Health Strategy COM (2003) identifies children's environmental health as a priority on the basis of some fundamental scientific evidence.

promoting safe, secure and supportive human settlements for all children.

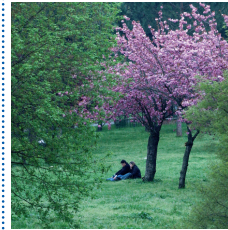
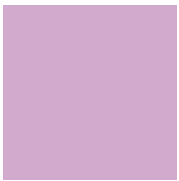
Regional Priority Goal III: prevent and reduce respiratory disease due to outdoor and indoor air pollution thereby contributing to a reduction in the frequency of asthmatic attacks in order to ensure that children can live in an environment with clean air.

Regional Priority Goal IV: reducing the risk of disease and disability arising from exposure to hazardous chemicals (such as heavy metals), physical agents (e.g. excessive noise) and biological agents and to hazardous working environments during pregnancy, childhood and adolescence.

The EU Health and Environment Strategy COM (2003) 338, with the SCALE initiative (*Science, Children, Awareness, Legal instrument, Evaluation*) launched during the 4th Inter-Ministerial Conference, identifies children's environmental health as a priority on the basis of some fundamental scientific evidence:

“Over the last few decades, asthma and allergies have increased throughout Europe. On average, 10% of children suffer from asthmatic symptoms..... In Western Europe, the symptom rate is up to ten times that in eastern countries. This suggests that a western lifestyle is associated with allergic diseases in childhood. In European countries, 1 out of 5,000 children is estimated to be diagnosed with cancer before the age of 15. Although the role of environmental exposure in childhood cancer is limited, children are more prone to biological events potentially related to the development of cancer because exposure to carcinogens during childhood can be reflected in cancer occurrence later in life....

The developing nervous system is particularly vulnerable very early in life to damaging effects of exposure to specific contaminants such as lead, methylmercury and polychlorinated biphenyls (PCBs). A child can absorb as much as 50% of the lead present in food, while an adult takes up only 10%. Exposure to such substances has been associated with developmental disabilities in the form of physical, cognitive, sensory and speech impairments, including in particular learning disabilities and intellectual retardation. Prevalence rates are up to about 10% in certain populations. When



incurred early in life such developmental effects are likely to be permanent”.

Environmental knowledge should therefore also be focused on studying the exposure of the more vulnerable age groups.

Climate change and health

Climate variability and change contribute to creating new environmental scenarios. These continually evolve and have an impact on social and economic systems, which depend on the availability of resources and meteo-climatic and structural stability of territorial contexts. It is known that the evolution of climate change is substantially controlled by global mitigation policies, while action required for reducing the environmental impacts and the social, health and economic effects associated to climate change are, instead, managed by national and regional strategies.

Their efficiency does not only depend on the investment possibilities of the country, but also on the technical and managerial capacity of preventive systems to respond to emergencies and the way local production systems adapt to these new environmental scenarios. There are therefore many actors involved, with complex responsibilities and integration of actions taken by single relevant sectors.

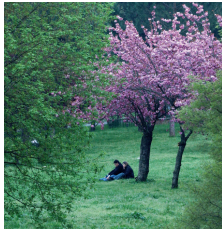
There are many needs to know more about the phenomena that are taking place and the future local scenarios that will be responsible for emerging or re-emerging risks.

Meteo-climatic changes observed and future scenarios shared by the international scientific community therefore also require an adjustment of environmental prevention and territorial protection systems.

Major changes such as global and sea warming, the sea level rise and the increase in the frequency of storms, floods and droughts cause environmental conditions (more pollution of waters during floods) that increase risks for human beings as they come into contact with environmental factors that contribute to causing many diseases. The correlation between climate and environmental change and effects on people's health and on certain health determinants (overcrowding) is summarized in Figure 6.7.

Climate variability and change have created new environmental scenarios that have an impact on social and economic systems.

The efficiency of national and regional strategies to adapt to new scenarios also depends on the technical and managerial capacity of prevention systems.

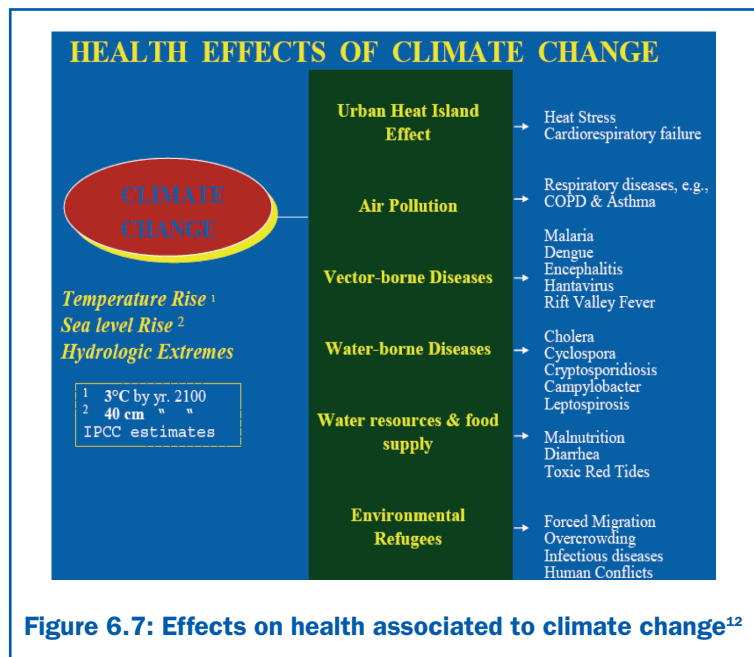


Environmental determinants induced by climate change and variability, relevant to our health, have been identified.

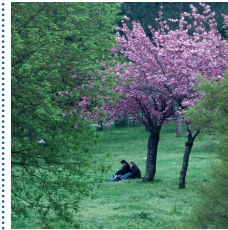
Major changes such as overheating, sea level rise and the increase in the frequency of storms, floods and droughts cause environmental conditions (more pollution of waters during floods) that increase risks for human beings as they come into contact with hazardous environmental factors.

Environmental determinants induced by climate change and variability, relevant to our health, have been identified. Among them are:

- Increase in disastrous events (heat and cold waves, floods, droughts, hurricanes and storms, etc.) associated to climate change and variability;
- Alteration of pollution levels and of the type of atmospheric allergens;
- Changes in the distribution and quantity of insects carrying infectious diseases;
- Production and quality of food due to climate influence on distribution and vegetable diseases;
- Quality of water used for bathing, drinking and irrigation;
- Urban planning and construction.



¹² Source: Jonathan Patz. *Meeting Report Workshop Environmental change and infectious disease*, Stockholm, 29–30 March 2007 - European CDC Ed, 2007



The report entitled “*Cambiamenti climatici ed eventi estremi: rischi per la salute in Italia*” (APAT, 2007), drawn up by APAT-WHO, provided a first screening of available information to assess the environmental and territorial vulnerability of our country, highlighting emerging health risks. It was then followed by other more detailed studies carried out for the National Conference on Climate Change of 2007. Globally, the analysis stressed that our country already has conditions of vulnerability both for direct (hydrogeological risk) and indirect damages (increase in infectious disease risk). These are related to the alteration of environmental quality and meteo-climatic conditions.

In terms of territorial vulnerability, other national studies (Basin Authority, MATTM, APAT) have identified about 13,000 areas where there is a high and very high risk of floods, landslides and avalanches. These cover a surface area of about 30,000 km² and involve 6,352 municipalities including urban centres, infrastructures and productive settlements. In the period between 1999 and 2007, about 1,982 million euros were allocated for 2,671 interventions only for hydrogeological instability recovery works (Legislative Decree 180/98 and Law 179/02).

Similar considerations are valid for marine and coastal areas, which need preventive and cognitive action. As regards risks, it has been estimated that of the 4,863 km of Italian low coasts (over a total of approximately 8,353 km of coast) about 1,170 km are already eroding and risk overflowing.

Floods also contribute to water and biota contamination. The density of pathogenic agents is amplified by the flow of flood waters contaminated by material coming from flooded fertilized soils, sludge and sewage treatment plants as well as animal carcasses. Microbial agents can contaminate human beings by direct contact with water, consumption of fish or fresh fruit and vegetables, through irrigation waters or contamination caused by floods.

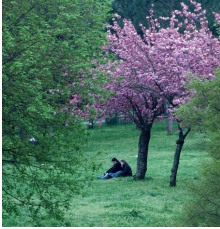
Furthermore, the increase in the earth and sea’s temperature also produces an increased toxicity of lake and marine bathing waters (toxic algae) and changes in the distribution of marine pathogens. Indeed, climate change can influence water toxicity both directly and indirectly. Environmental factors such as temperature, solar radiations, pH and salinity can influence the biological cycle of

The report drawn up by APAT/WHO entitled: “Cambiamenti climatici ed eventi estremi: rischi per la salute in Italia” (APAT, 2007) provides a first screening of our country, highlighting emerging health risks.

Our country already has conditions of vulnerability for both direct and indirect damages.

Floods are also an important source of water and biota contamination.

Climate change can influence water toxicity.



Many environmental factors induced by climate change contribute to increasing the risk of diseases caused by vector bites (ticks and mosquitoes) carrying viral, bacterial and parasite diseases.

autochthonous microorganisms and influence the survival of pathogenic organisms introduced in the natural environment by human activities (sewage discharges, agriculture and animal breeding). Climate, population and ecological changes have produced a larger distribution of bacteria, viruses and parasites which, for this reason, are considered “emerging”. Viruses, especially RNA and segmented RNA, are subject to frequent mutations and genetic reassortments. They therefore have more probability of emerging as new pathogens.

An example is the rapid diffusion, all over Europe, of a new variant of Norovirus GII-4, which is probably more virulent and stable in the natural environment than the already existing strains (Lopman, 2004). Of similar nature is the presence of Hepatitis E (HEV) in non-endemic areas, while molecular analyses say the virus genetically diverges from strains of endemic areas (Casares et al., 2003).

Many environmental factors induced by climate change contribute to increasing the risk of diseases caused by vector bites (ticks and mosquitoes) carrying viral, bacterial and parasite diseases.

Below are some meteo-climatic and environmental factors that increase the distribution of vectors, environmental receptivity and the reproduction period of hematophagous arthropods (mosquitoes, Phlebotomus and ticks):

- increase in global temperature, milder winters, reduction of nightly thermic excursions;
- floods, alternation of meteorological events, drought and other cofactors related to global and individual changes.

The increase in the quantity and distribution of vectors is therefore a phenomenon that, in itself, is specifically associated to climate change. Italy is not exempted from this risk and in 2007 the country “hosted” the first epidemic caused by a virus transmitted by the tiger mosquito to the European continent. This showed how mosquitoes can act as vectors introducing new viruses, environmental conditions permitting.

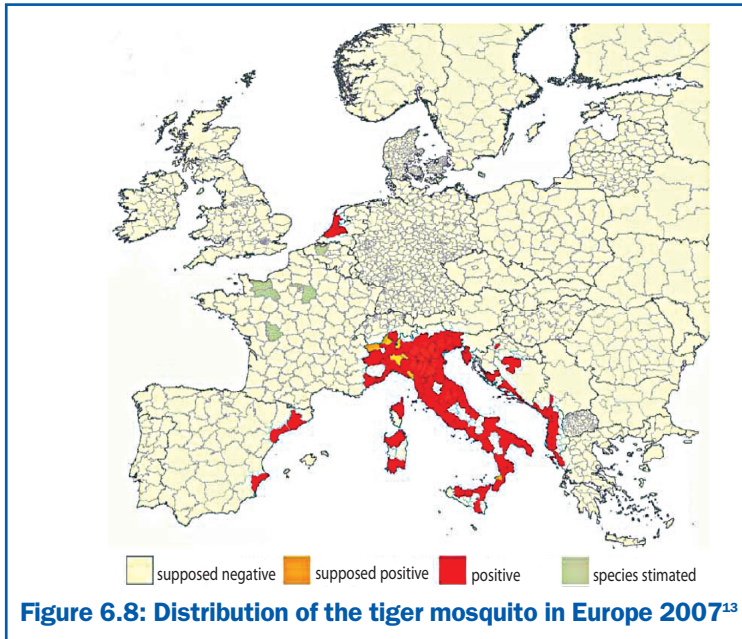
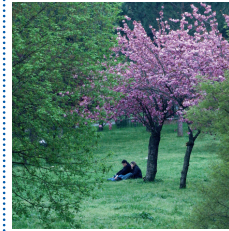


Figure 6.8: Distribution of the tiger mosquito in Europe 2007¹³

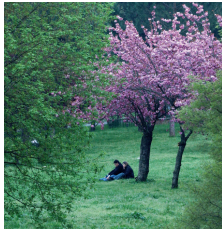
In 2007 Italy, where the tiger mosquito has become ubiquitous in very few years, “hosted” the first epidemic caused by a virus transmitted by the tiger mosquito to the European continent. This showed how mosquitoes can act as vectors introducing new viruses, environmental conditions permitting.

In august 2007 in the region of Emilia Romagna, particularly in the province of Ravenna, over 200 cases of “*Chikungunya* arboviral disease” occurred. This virus belongs to the Togaviridae family and is transmitted by the tiger mosquito. Before then, the disease’s endemic basin was typical of different tropical areas of Asia and Africa.

The only tool we have available is the vector’s environmental control.

The tiger mosquito, which is ubiquitous in our territory (see Figure 6.8), is also responsible of other effects/inconveniences deriving from its direct bites and due to its well-known aggressiveness and urban settlement capacity. The insect has required expensive local control interventions which were estimated to have cost between 10 and 15 million Euros only in 2005. This amount does not include the costs directly incurred by families in terms of personal protec-

¹³ Source: *European CDC Report*, 2007. National data supplied by ISS



Environment and health governance mainly started in the 1990s and it rapidly evolved in the following years.

The fundamental Community documents of reference are the 6th Environment Action Programme, the European Environment and Health Strategy and the Environment and Health Action Plan.

tion systems (repellents, domestic insecticides, traps, mosquito nets, etc.) as well as medical and pharmaceutical treatments that can be estimated between 20 and 30 million euros. A favourable habitat for the development of these vectors is also found in artificial open water basins, which are generally used for managing water resources especially in dry territories. In some African countries the adoption of these practices has increased the incidence of malaria, because of lack of water due to climate change. The synergy between environment and health systems should be improved in order to anticipate risks and manage them in a sustainable way. Even in this case, environmental information should include environmental risk factors.

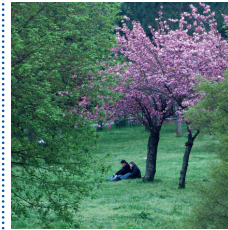
Institutional action responses and environment and health information

As highlighted above, environment and health governance mainly started in the 1990s and it rapidly evolved in the following years. The main national, European and international documents on this issue are summarized in the reference list below.

The approach of integrated governance recommended under the European Environment and Health Strategy (COM (2003) 338) is a recent development, having already been proposed with the 6th Environment Action Programme, which highlighted the importance of environment and health information¹⁴.

The 6th Environment Action Programme defines strategic action (adequate application of laws, policy integration, individual behaviours, role of the market, urban planning) and priority areas (climate change, biodiversity, health, resource and waste management). The European Community action is aimed at contributing to reach a high level in the quality of life and social well-being of its citizens creating an environment where the pollution level does not have harmful effects on human health and the environment. This aim can be reached also by increasing research in the fields of health and environment and including these priorities in other policies.

¹⁴ Specifically requested also with the Aarhus Directive, implemented in our country in 2005.



The European strategy identifies strategic action principles aimed at favouring the integrated development of different sectors by means of a new approach. This involves:

- Integration of information;
- Integration of research activities;
- Integration of environment and health applications in the various policies which can have direct or indirect effects on health and the environment (transport, agriculture, etc.);
- Integrated action that is also able to assess the feasibility of interventions (from a technical, economical and practical point of view), analyse the cost-benefit ratio and make considerations of ethical nature, among others, which also encourage individual behaviour changes;
- Integration of the subjects involved.

The long-term objectives are:

- Reducing the impact of the burden of diseases caused by environmental factors in the EU;
- Identifying and preventing new health hazards related to environmental factors;
- Strengthening EU capacity to promote policies in this sector.

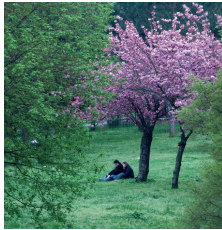
The subsequent Action Plan implementing the 2004-2010 Strategy (*Action Plan for Environment and Health*¹⁵) considers three fundamental themes identified by the European Strategy. These are:

- Implementing an integrated Community System of control and action in the field of environment and health in order to assess the global impact that the environment has on human health and develop integrated information systems and indicators on environment and health;
- Promoting research for the purpose of increasing our understanding of basic themes related to environment and health;
- Reducing exposure¹⁶.

Both documents mention the commitment to renew environmental information: "...The added value of the proposed European Environment and Health Strategy [...] is therefore the development of a Community System integrating information on the state of the environment, the ecosystem and human health".

¹⁵ COM (2004) 416.

¹⁶ European Environment and Health Strategy, June 2003 – COM (2003) 338.



Environment and health governance needs to make use of adequate environmental information that can support a global process. This will be aimed at improving and implementing: environment and health approaches; assessment of exposure; research priorities and communication of risk (both at national and local level).

Providing adequate information on the environment is a valid support for managing health prevention systems, communicating risks, knowing the emerging risks and developing response tools. In other words there is the need to establish integrated risk governance.

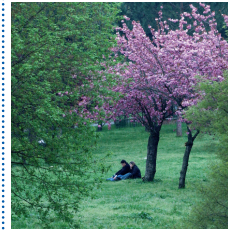
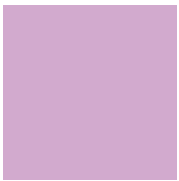
We are assisting a global process that will initially need to pursue three main goals (both at local, national and Community level). These are:

1. Improving and implementing approaches in the field of environment and health.
Tools such as Environment and Health Action Plans (NEHAP; CEHAP) are a valid reference for multisectorial discussions and programs. In our country, both Action Plans will be presented at the next Inter-ministerial Conference on “Environment and Health” that will be hosted in Italy in 2009;
2. Improving the assessment of environmental exposure as a scientific reference in order to formulate proactive risk management strategies which have operative effects on environmental information and knowledge systems;
3. Defining assessment strategies and research priorities to inform and communicate emerging risks.

Knowing the extent and type of health risks and impacts is, indeed, essential for developing information aimed at identifying priorities and action areas for certain environment and health determinants. It is also fundamental for developing preventive action aimed at creating specialised environmental information systems on new issues, such as the built environment, climate change and health, and children’s environmental health. These will, most probably, be the main points on the agenda of the next Inter-ministerial Conference on “Environment and Health” that will be held in 2009.

In conclusion, European and international approaches highlight the need to establish a strategic and focused governance of “environment and health” issues. Information on the environment cannot be limited to concentration or emission indicators. There is a common feeling that environment information systems need to be adapted to feature the population’s exposure and not only to provide data reporting.

The aim is also to provide always more updated information to improve health prevention systems, develop risk communication, have a more in-depth knowledge of emerging risks and endow prevention systems with adequate response tools. In short, there is the need to establish integrated risk governance.



REFERENCE

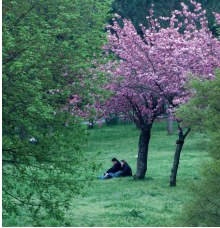
The main national, European and international documents on environment and health

International

- 1972 - UN Conference on Human Environment (Stockholm)
- 1983 - UNEP World Commission on Environment and Development "Brundtland Commission"
- 1987 - Brundtland Report: birth of sustainable development "environment-health-economic development"
- 1992 – Rio de Janeiro: UN Conference on Environment and Development: WHO publication "Our Planet; our health"
- 1997 – G8 Declaration on Environmental health
- 2000 - Millennium Development Goals
- 2002 - Johannesburg World Summit: strategies of sustainable development
- 2006 - IV IPCC Assessment: climate and health
- 2006 - Dubai International Agreement on Chemicals Management

World Health Organization/Europe

- 1989 – Establishment of Inter-ministerial Conference on Health and Environment (Environment and Health delegations from 53 countries)
- 1989 – 1st Frankfurt Conference on the adoption of the: European Charter on Environment and Health
- 1994 – 2nd Helsinki Conference: first European assessment report on environment and health
- 1999 – 3rd London Conference: NEHAP, PEP, Protocol on Water and Health
- 2004 – 4th Budapest Conference on: children's environmental health, four regional priority goals (RPGs) CEHAP
- 2009 – 5th Italy Conference 2009
- 1990 - Establishment of WHO European Centres for Environment and Health
- 1999 - Establishment of the European Environment and Health Committee



European Union

Articles 152 and 174 of the Amsterdam Treaty
1999 – Community action program on diseases related to pollution (Decision 1296/1999/EC of the European Parliament and Council)
2001- Sustainable Development Strategy
2002- Community action program on public health (2003-2008), Decision 1786/2002/EC
2002- 6th Community action program on the Environment (Decision 1600/2002/EC)
2002 - Commission Communication on impact assessment (COM(2002)276)
2002 – Establishment of the EFSA (*European Food Safety Agency*)
2003 - European Strategy on Environment and Health 2003
2004 – Action Plan implementing the Strategy 2004-2010 (*Action Plan for Environment and Health - COM (2004) 416*)
2004 - Establishment of the SCENIHR (*Scientific Committee on Emerging and Newly Identified Health Risks*)
2004 – Community Directive REACH (*Registration, Evaluation, Authorisation and Restrictions of Chemicals*)

National

1986 - Establishment of the Ministry of the Environment
1994- Establishment of the Environmental Agency System
1999 – Art. 7 quinquies D.Lgs. 229/99
2000 – Introduction of environment and health in the National Health Plan 1998-2000
2005 - Establishment of the Disease Control Centre (CCM) – Ministry of Health
2006 – Art. 5 Doctor's Deontology Code
2008 - NEHAP and CEHAP *in progress*