# Landscapes' functions and human health: incidence of environmental changes

Gioia Gibelli<sup>1</sup>, Marialfonsa Fontana Sartorio<sup>2</sup>, Giuseppe Gibelli<sup>3</sup>, Marco Lodi<sup>4</sup>, Riccardo Santolini<sup>5</sup>

<sup>1</sup>Italian Society Landscape Ecology - University of Genoa - gioiagibelli@gmail.com

<sup>2</sup> Quality and Education Association

<sup>3</sup> Cardiology, Healing-Home S.Carlo, Paderno Dugnano (Milan)

<sup>4</sup> Mario Negri Institute, Milan

<sup>5</sup> Ecology and Environmental Biology Institute, University of Urbino

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### Introduction

The idea that gardens may have regenerating and therapeutic functions, dates back to many years ago: more than two thousands years ago, in China, Taoists created gardens and greenhouses because they thought they were positive for health. In the West, the first open spaces carried out with specific aim to give welfare, seem to be gardens and vegetable gardens belonging to medieval Monasteries, which offered shade and sun, medicinal herbs, spaces for meditating and walking. In an age and a world closer to us, the book "English Gardener", published in 1699, suggested spending free time in a garden, looking after plants, because they considered this activity the best way to keep fit. Medicine's scientific development and the romantic attitude of the 17° and the 18° century, turned its attention to beneficial effects of the nature for both the body and the soul, and the 19° century hospitals are generally built as pavilions surrounded by open spaces. From the 18° century people assisted at a change in the treatment of psychological diseases, changing from corporal punishment to psychological safety. Mental hospitals were designed with open spaces, using plants as defence in order to create pleasant and comfortable situations: gardening and horticulture became part of the patients' therapy. For example, during the Second World War, Dr. K. Menninger introduced horticulture as therapy for veterans, inside hospital system. Later, in 1955, Michigan State University conferred the first degree in horticultural and occupational therapy. In the second half of the XX century technological development, both in medicine and constructions fields deleted the relations between buildings and open spaces establishing the use (as for hospitals and nursing homes) of multi-storey blocks, increasing building's efficiency, but removing external world's experience and the possibility that this offers in terms of adjuvant of pharmacological therapies.

Today the therapeutic effect of certain gardens, of the horticulture, etc., is recognised towards several pathologies. Therapeutic gardens, or rather places in which human beings can find the welfare lost because of their permanence in unhealthy places, that is for other causes not necessarily related to environmental problems, they put themselves as spaces in which the dominant functions are the therapeutic ones. They represent an answer of our society, providing new and positive solutions to specific problems.

#### **Therapeutic Functions and Landscapes**

As for landscape, it's useful to explain the meaning of therapy, and consequently the meaning of therapeutic landscape in order to contribute to the clearness of the language and the interdisciplinary dialog, basic during the approach with come **cross themes**, such as landscape, health and the connection between them.

Therapy in medical language means "healing treatment" generally in contrast with a defined pathology. So therapy is an act or a complex of measures which are taken as result of manifestation and identification (diagnosis) of the illness. It could mean that a landscape, in order to be therapeutic, must have healing functions towards defined pathologies. This specificity seems not to be too appropriate to a complex and to a multifunctional entity that is the landscape while it seems more fitting as regards parts of both anthropic and non-anthropic, which could be strongly specialized towards the cure of diseases, as, for example, "volcanic ecosystems" with water and thermal mud, the vegetable gardens and the therapeutic gardens. Moreover, inside the multifunctionality of a vital landscape it's possible to recognize some functions which, depending on users and their state of health, can became therapeutic. Every landscape, although unhealthy, can carry out certain therapeutic functions, or rather they offer curative possibility for psychophysical human health. For example, the landscape of the most polluted city, might offer spaces for outdoor physical activities which could give advantages towards psychical, muscular or rehabilitative problems even though may create problems to the respiratory system.

Another important element is the meaning of prophylaxis, in medical language, term which refers to the complex of measures used to prevent the illnesses' diffusion. As for landscape, the concept of prevention is certainly appropriate, since, in the majority of cases, the beneficial functions of the landscape towards human health usually have a prevention role, it means they are an adjuvant of therapies of other kind in comparison with the so called "environmental pathologies".

With reference to the recalled meanings, it seems restrictive the definition of *Therapeutic landscape*, since it finalizes and specializes the landscape to a specific function towards some pathologies, with the risk of neglecting the complexity which represent the emerging characteristic. While some "therapeutic functions" are certainly recognisable within the Landscape's complex multifunctionality.

#### Healthy Landscape

Also towards specific therapeutic functions, the landscape shows all its complexity and the impossibility to reduce this complexity to single aspects independents from the numberless relations which are on the basis of the contest and of the population. The identification of the possible therapeutic functions, in other words prevention, which the landscape can offer towards certain pathologies, represent a still unexplored research field, in comparison with the structures able to make a landscape healthy or unhealthy.

In those terms a landscape can be considered "unhealthy", since the carrier of the physical and psychical "environmental pathologies", in other words "healthy", if it's proper to human life and to both biological and technological needs.

Concerning this, it is worth to remember the concept of health expressed by *World Health Organisation*: "Heath is a state of entire physical, mental and social welfare and not only the lack of disease or infirmity". This concept gives to the word "health" a wider meaning where the perceived environment, therefore landscape, constitutes an essential variable to reach a satisfactory state of health both to people and to communities.

Another concept close to them so far expressed, but with different hints which determine important consequences in the territory management, it is the definition of *healthy landscape*. This term concerns landscape's functionality and relationship between structure and processes that are on the basis of the vital capability of the landscape itself and of the possibility to offer healthy environment for all practical purposes.

## Social aspects

The importance of healing landscapes for human health, has been pointed out for the first time in modern times, as from the middle of XIX century by F. L. Olmsted, founder of Architecture of Landscape. Olmsted, worried about the foul environmental conditions of cities which get worse with the industrial revolution, proposed that gardens, greenways and wide open spaces created in and around the cities, with the purpose of making citizen's surroundings healthier. In Europe, at the end of the same century, E. Howard declared that garden-city was a healthy and mental rebalancing place.

In Italy, at the beginning of the 20° century, the bonding between healthy environment and human health, is developed, instead of trying to improve citizen's life environment, promoting stays at the seaside and at the mountains: this is the period of the proliferation of the first tourist's marine and mountain settlement, colonies, which received children and families in order to strengthen the physic after urban winters. It is funny observing how, in Italy, to utilize the benefit of nature, instead of bringing nature in the city, they tried to recreate little cores of city into the nature. This phenomenon is than grew up to the point of deleting the resource that had made it: the nature.

The theme of therapeutic functions and of landscapes' health can't set aside a meditation about the actions which "developed" countries undertake because of health, and about changing determined on the landscape which affect the health.

In the last 30 years, expenses for health board, especially that for the cure of the so called environmental pathologies, are rising exponentially in all "developed" countries. In the same countries the pathologies in some way bonded to the environment are contemporary increased. It seems a paradox: on one hand they spend to cure, on the other they spend to change the environment, because of the improvement of life conditions, towards hostile trims or, not suitable to human health and well being, producing new physical and psychical pathologies. Particularly, in the "developed" countries, the speed of transformation doesn't follow the demographic growth anymore, which has, generally speaking, a quite null coefficient of increase, while this urban growth goes on with really high rhythms, answering to logics different from the ones of the overall need of residences.

For this aim, biologically functional rural areas are destroyed and they are replaced with parts of strongly polluting city and which uses a lot of energy, which don't have any vital functions and which change human environment, making it less healthy and sometimes strongly unhealthy. Figure 1 draws the course of some processes which are important in comparison with the theme of this work.

It seems that the research of welfare undertaken through the building of artificial environments always wider, drives to an overall worsening of health. These are hypothesis because, up to now, the research doesn't seem enough developed on these themes, particularly on the existing links between environmental transformations' effects and all the aspects of human health. Above all, relations between artificial environment and behaviour and between natural environment and behaviour seem lacking.

It's important to understand what affects environmental health towards human nature and real needs of people as individual where physic, mind and movement make up something that is inseparable. So, if we act on the motor system, it gives repercussions on the other systems such as respiratory, metabolism and psychic system, etc.

As result we may think again about the planning and designs of the spaces and about life's customs which in these spaces become stronger, starting from the observation of environmental pathologies and from the causes which produce them.

In fact human beings are immersed in the air, they are made up above all by water and they strongly depend also on soil: it is thus unavoidable that the quality of this elements and of their products determine system's quality and health in all its components.

We found out two big categories to analyse, so we report some data and reflections:

- Alterations of environmental components: air, water and soil pollution
- The landscape spatial organisation and its effects on environmental components and on psychophysical health

# Alterations of environmental components: atmospheric pollution and physical health

The interest in the problems of health linked to air and environmental pollution imposed itself since some decades starting with considerable increases in mortality occurred during atmospheric pollution's extreme risings in Meuse Valley (Belgium) on December 1930



Figure 1 - The figure shows the increasing trend of three variables: environmental diseases coming from the beginning of the last century; health expenses that, coming from the seventies, have soared and doesn't look to decrease (Frumkin, 2004); the living unit/population increase ratio, which has been linear until around 1985. After this date, living units have become to increase a lot, independently of the demographic curve. Scenarios after 2005, show the possibility of a new growth coefficient increasing (curve fork, Liu et al., 2003).

(Nemery et al., 2001) and in London in 1952 (Logan, 1953).

The atmospheric pollution is due to combusting processes. The particulate which, up to now, seems to be the most injurious substance, is produced above all by means of transport.

There are some data which interested some expert but they are still unknown for them. these data show without doubt that atmospheric pollution, besides pathogenic for pulmonary diseases (chronicle inflammations and tumours) is, above all, a strong element of cardiovascular risk effects (heart ischemic disease, heart insufficiency, various kinds of arrhythmia, apoplexy).

The American Heart Association recently adopted a definite position regarding this matter (2004) which expressed into a specific document: Air pollution and cardiovascular disease: a statement for healthcare professionals from the expert panel on population and prevention science of the American Heart Association.

#### Effects of long-term exposure to pollution

It's obviously difficult, in the field of atmospheric pollution, giving a specific risk to the exposure to the single elements, unless they are clearly differentiated such as tobacco smoke, because they contribute together. Thus, until recent times, it wasn't clear if there were specific causes of the increase in mortality, due to the long-term exposure to atmospheric pollution.

In the study Harvard Six Cities (Dockery et al., 1993), the mortalities in cities with different pollution level have been compared, following 8111 adults for 14-16 years. The risk resulted 1.26 times higher in the city with more pollution and this result is strictly bonded to PM 2.5 and sulphate compounds.

The most of deaths caused by pollution occurred because of cardiovascular causes (646 out of 1401).

In the study by American Cancer Society (Pope et al., 2004), about 500.000 people from 50 American states have been monitoring for about 16 years. The data show that for every annual exposure increase in of 10 microgram/m3 to PM 2.5, the overall mortality rises of 4%, the one for pulmonary carcinoma of 8%, the one for cardiopulmonary diseases of 4%. The link between mortality and PM 2.5 level resulted linear, without we could identify a "safety" level. The mortality resulted strictly associated, besides PM 2.5 levels also the ones of the sulphate particle and SO<sub>2</sub>. An association with the evening ozone values/figures was observed. The risk was resulted higher for heart ischemic disease (increase of the risk: 1.18). Also the risk of death for arrhythmias, heart insufficiency, cardiac standstill increased (1.13). We didn't ascertain an increase in mortality risk for other diseases, particularly the respiratory ones.

Also the differences in air quality among areas of the same city are important, in fact they influence cardiopulmonary mortality: a study on 5000 people, monitoring for 8 years, showed how living near main road was associated to an increase in mortality of 1.95 times, proving how motor vehicles' emission could be associate to an increase in mortality (Hoeck G. et al., 2002).

Finally, the statistically more evident association with mortality resulted for PM 2.5 (Pope et al. 2004) and less for sulphates. Deaths' surplus happens because of cardiac causes, above all heart ischemic diseas.

#### Effects of brief-term exposure to pollution

Several studies proved how also brief term exposure may have negative consequences on human health.

In a study about 50 millions people living in 20 big United States cities, a significant correlation between mortality and particulate concentration the day before the event was observed; particularly every time the PM10 increased of 10 micrograms/m<sup>3</sup>, the overall mortality resulted increased of 0,21% and the one for cardiopulmonary causes of 0.31% (Dominici et al., 2003).

Data are confirmed by an European study: for 43 million of Europeans in 29 cities, the estimated overall mortality increase of 0,6% every 10 micrograms/m3 of PM10, the increase for cardiovascular causes is of 0,69%. Cities with higher NO<sub>2</sub> concentrations, had solid associations between PM10 concentrations and mortality, so they show that NO<sub>2</sub> strengthen PM10 effect (Katsouyanni et al. 2001).

Finally, these and other data show that atmospheric pollution's increases also in brief-period (days) can cause arrhythmias, heart insufficiency, destabilisation and acute arteriosclerosis complications such as myocardial infarction and preinfarction angina (American Heart Association, 2004).

The mechanism with which inhaled substances can cause cardiovascular complications are linked to the generation of a systemic inflammation state which causes an arteriosclerosis progression and an already present arteriosclerosis' plaques unstable/breaking (cf. Figure 2). The inhalation of irritant substances also causes reflexes starting from pulmonary receptor, which speed up the heart rate, cause vasoconstriction, increase the arterial pressure and may cause arrhythmias. The atmospheric pollution's effects are worrying in the developing countries, as recently highlighted by a W.H.O.'s report which estimates that 600.000 people per annum dies because of this cause in the world (World Health Report, 2002).

In Italy has been carried out a meta-analysis of Italian studies about the atmospheric pollution brief-term effects, referring to eight Italian cities, having an overall



Fig. 2 – The graphics show the relationship between the increase of pollution and daily mortality (high) and the relationship between ozone increase and inflammations (Schwela, 2000).

amount of 7 millions habitants (Italian MISA group, 2001). The MISA study considered the combined effect of more pollutants ( $SO_2$ ,  $NO_2$ , CO, PM10,  $O_3$ ) and it estimated the expected risk determining the pollutants' excess, in comparison with determined reference threshold (% towards pollutant increase of  $10\mu g/m^3$ ) for

Table 1

a subject given, taken out by chance among the 7 million people living in one of the 8 Italian considered cities.

In Table 1, we report the data relative to the considered cities and we summarize the characteristics associates to the pollutant which resulted more significant.

For each considered pollutant, the meta-analysis highlighted a statistically significant association with mortality (increase in deaths for natural, cardiac/cardio-vascular and respiratory causes). In Table 2, there are data related to the proportional increase of deaths every pollutant increase of  $10\mu g/m^3$  (1mg for CO).

The analysis of the study underlines the fact that risks are higher for respiratory pathologies, that old people (> 74 years-old) are more susceptible to injurious effects and that the PM10 particulate's effect on the mortality is higher during the summer.

Many literary reports exist and they are confirmed also by data from Milan (APHEA, in press), which show how natural death's increase noticed during days with higher pollution level doesn't consist only in death's anticipation for people who have an already compromised state of health. The most credible explanation is that pollution influence both people already compromised, anticipating their death or making their hospitalisation necessary and healthier people making their state of health worse and contributing in the maintenance of a susceptible staff. The study shows that if pollution (PM10) was eliminated reaching 10µg/m<sup>3</sup> or if it was kept in  $30\mu g/m^3$ , the immediate effect would be the decrease of 304 or 181 deaths in Milan during the first year respectively. During the following years, the saving of human life would gradually rise, until the mortality would reach a decrease between 1989 and 1252 deaths per annum (long-term mortality).

This method has been applied also to the hospitalisations for respiratory and cardiac causes and for many other pathologies, until the evaluation of the days at limited activity for adults over 20 years-old. The estimate correspond to 233.088 lost days for  $10\mu g/m^{3}$ , of

T	Period	Inhabitans	% Inhab.>65 years old	Depr.	SMR	Temp.	NO <sub>2</sub>	PM 10	NO <sub>2</sub> /PM 10
lown		Census 1991				(average temperature °C)	(average µg/m³)	(average µg/m³)	in µg/m³
Milano	90-94	1 260 221	18.02	0.7	07.5	13,8	105,8	61,8	1,7
Ivillalio	95-97	1.309.231	10,02	0,7	97,5	13,7	86,5	45,2	1,9
Torino	91-94	- 962.507	16,8	1,8	97,9	14,0	84,0	77,6	1,1
	95-99					14,3	74,9	63,8	1,2
Verona	95-99	255.824	17,8	0,3	95,2	14,9	57,8	36,5	1,6
Bologna	96-99	404.378	23,4	0,0	92,6	13,9	60,1	41,2	1,5
Ravenna	91-95	135.844	18,0	-1,6	84,2	14,3	60,5	59,1	1,0
Firenze	96-99	403.294	22,0	-0,1	90,6	15,5	70,1	40,3	1,7
Roma	92-94	2.775.250	14,5	-0,1	102,2	16,9	97,0	69,8	1,4
						16,6	85,8	50,6	1,7
Palermo	97-99	698.556	11,4	2,6	122,4	18,2	61,3	42,9	1,4

Table 2

		Mortality	Admission to hospital		
Causes Emission	Natural	Cardiovascular	Respiratory	Cardiac	Respiratory
	Lag 01	Lag 01	Lag 01	Lag 03	Lag 03
SO <sub>2</sub>	2,2	2,5	4,7	3,6	4,3
	(1,3 3,1)	1,1 4,0)	(1,5 8,0)	(1,4 5,7)	(2,4 6,3)
NO <sub>2</sub>	1,2	1,5	2,0	1,9	3,0
	(0,8 1,5)	(1,0 2,0)	(0,6 3,5)	(1,2 2,6)	(2,3 3,6)
СО	1,4	1,8	3,4	2,8	4,2
	(1,0 1,8)	(1,2 2,4)	(1,5 5,3)	(1,5 4,0)	(3,0 5,5)
PM10	1,3	1,4	2,1	1,1	2,4
	(0,6 1,9)	(0,6 2,2)	(-0,7 1,7)	(0,6 1,7)	(1,7 3,1)
0,	1,0	1,3	-0,2	-0,7	0,8
	(0,2 1,9)	(0,3 2,4)	(-3,5 3,4)	(-1,3 -0,1)	(0,1 1,6)

PM10. In comparison with an average PM10 annual value of  $10\mu g/m^3$  we will have a surplus of 1.142.135 lost workdays, while towards a  $30\mu g/m^3$  level we will have 675.957 lost workdays.

According to this data, it is possible to carry out a speed estimate on the economic impact of the atmospheric pollution pathologies. Considering a workday average cost of  $200 \notin$  (monthly cost of  $3.500 \notin$ , for 22 workdays, more eventual costs for hospitalisation and cures), we will have an overall cost of  $135.191.400 \notin$  per annum in the second hypothesis.

# Other elements bonded to environmental components' alterations

An interesting example is given by social diseases caused by pollution, such as acoustic pollution which is a physical factor and which produces lesions to the auditory system, causing ACUFEMA, constant troublesome noises in the ear, which may disturb the sleep. This permanent pathology, caused by external physical factors, may be faced with psychotherapeutic interventions, which want to diversify the brain's answer to the ache.

We may enumerate also other disturbs, such as the rise in allergies, which increase is registered above all into urban areas. The causes of the rise in allergies seem to be numerous, so it isn't possible, at the actual condition of knowledge, identify a prevalent agent. Moreover, artificial powders and, at the same time, the excess of cleanliness above all during the first years of life, seem to be some of the most probable causes. We think that the example about allergies bonded to cleanliness it's interesting because physical disease is caused by a behaviour (see also next paragraph).

# The landscape's spatial organisation and its impact on environmental components and on physic and psychic health conditions

In this context, what interest us are the pathologies caused by this second category of transformations. As highlighted before, the environment becomes pathogenic because of imbalances caused by pollution, or because of reasons bonded to definite natural or anthropical processes, which produce situations stressful or threatening for health. There are numerous examples: we know stress, or even shocks caused by natural calamity, instead of by situation made by man, such as population density's excessive increase, the elevated traffic, the noise, etc.

# Psychological effects of the environmental pathologies

One of the main themes is probably bonded to a spatial-temporal break produced by the so-called west-culture development. In fact the speed with which technological society developed, make the adaptation really difficult which depends on biological times, very longer in comparison with the ones imposed by the technological culture. M Gurian (1996), infantile age psychologist, about this matter declares: "Our brain is based on a kind of life which determined itself 5.000 years ago, in other words for an agricultural life oriented to nature. From a neurological point of view, humanity couldn't keep up with the nowadays environment, which have too many goads. Some adapt themselves pretty well, others no. Lack of relation with nature and its rhythms seems to affect it."

Relation with nature and para-natural environment attending, may surely help in regaining possession of the knowledge of that values which allowed human spirit to evolve. Human spirit meant like product of creative elements of the natural evolution, above all of free hereditary transmission, of the genetic modification and the Natural Selection (Lorenz 1984). Anyway, evolution forces have strongly been modified during last ten thousand years. Cultural changes with their effervescent and Lamarckian nature, up to now, outclassed the biological evolution, insomuch nowadays the genetic DERIVA, the genetic directional changes have a modest effect and the natural selection is quite frozen (Cavalli Sforza 1993, Gould 2003). The technocracy which dominated on world scale and which makes the globalisation easier, is about to level, flattening, every cultural difference. Some authors think that the decline of cultural values (Küppers in Lorenz 1984) and some overpopulation diseases, such as the increase in some destructive competitions in the communities instead of cooperation derive from the diversity's disappearance.

Particularly, environmental influences produce two different pathological situations for human mind:

a) Stress situations determined by abnormal "overloaded" of human activity, which are underlined, in other word limited, depending on landscape-environmental situations. Stress parted in two: eustress and distress. Eustress is the right quantity of stress which optimises the performance, distress is the one which invalidate it. For example, the first situation is made easier by life in "pedestrian city" where distances are on human scale, the second by life in metropolises where time for daily transfers is very long and people are dependent on means extraneous to their transfer capacities (as synthesis between locomotive and cognitive capacities which consent choices about for example the journey).

New landscapes created by globalisation are connoted by the functional division of the settlements with a territorial organisation which tend to focus services and workplaces on areas distinguished by residential functions. That determines, besides car dependence, the denial of collective spaces for socialisation in cities and the concentration of social activities in trade centres. That has worrying indirect effects. Relaxation environment is an artfully built place (sub-nature) in which amusement is bonded to money. This makes easier freetime/money connection, supporting weak people's dependence on money and changing their relation. They don't make effort to fill up free time, in fact they don't carry out activities in contact with nature (walks, explorations, experiences) and its rhythms (dawn-sunset, warm-cold, light-darkness) self run and low cost, but with expensive induced amusement in immutable artificial spaces. In this way nature is replaced by limited environments, without regenerating capacities and which use a lot of energy, aseptic and repetitive for defined aims, removing the unforeseeable due to its not knowledge.

b) Creation of particular (pathologic) situations in environmental components.

Among these there are:

Efficiency and control need, which promote the realisation of artificial and artfully environments and specialised infrastructures, has as consequence the habit and the research of a clean, tidy and safe environment. The concept of tidiness and safety excludes unforeseen events bonded to natural changes. Capacity of answer to unforeseen is one of behaviours which make humans less vulnerable, increasing adaptation capacities, in other words the strategies of survival. Moreover the habit to live in pre-ordered environments accentuates the sense of anxiety, every time that the individual has to face novelty. But novelty is based on evolution. Another aspect which can indicate a trend to "evolutionary freezing" (sensu Cavalli Sforza, 1993). The refuse of such a model may be cause of alienation of individuals which don't have this background in their culture.

The continuative stay in artificial spaces seems to be the cause of a series of evident disturbs, above all in children. An example is the deficiency of care syndrome, which seem to be caused by a surplus of passive goads to which they are exposed. Lack of unforeseen events and variety, typical of urban environments, reduces self-consciousness, sense of danger, creativity, increasing the number of anxious and depressed children and the vulnerability (fragility towards new events), as people, of future adults.

Removal from nature and its rhythms involves the removal from our body, nature par excellence. It isn't followed in its cyclical changes (birth, adolescence, maternity, death) and everyday changes (pleasure/ delight), related to seasonal rhythms, but it is lived as "body-machine", which have to give performances on our demand (increase in use of stimulants to keep rhythms of life imposed by society and by metropolitan environment created by the society itself).

Removal from our body takes to anxiety and panic, or even to deviant behaviours. It is sufficient thinking about the proliferation of courses and therapies, finalized to recovering relation between body or natural elements: dance therapy, pet therapy etc. born to heal handicap and now really diffused among "normal" people: this fact make think that the socalled "normality" has something pathologic. In fact in 2004 the analysis gathered by the Medco

In fact in 2004 the analysis gathered by the Medco Health Solutions, the major pharmaceutical company in United States, revealed that the use of psycho medicines (antipsychotics, benzodiazepines and antidepressants) underwent an increase of 49% between 2000 and 2003. Relation with environment may also not influence on heavier depression cases, but it is anyway known that experience in contact with nature may attenuate the impact of some type of stress in everyday life, principal causes of depression (Louv, 2006).

The human being is a unity made up by physic, mind and movement. A crescent number of researches join directly and positively our state of mental, physic and spiritual health in report with nature. Minor time spent by young people in natural environment implies that sensory capacities atrophy (both on physiological and psychological point of view). This fact reduces human experience richness, (Louv, 2006) limiting our own resources to face and resolve situations which life present.

This separation tend to reduce the instruments of which human nature is provided to interact with external world. Current environment tend, in fact, to privilege, among the five senses, the sight, and less the hearing. Touch, olfaction and taste seem destined to an always more limited use. In our society with the myth of clean environment, we tend to eliminate human smell, really important signal in not only affective relations.

In an experiment made during the Course of Landscape's Ecology (University in the wood 2006) with a group of 20 students of various extraction, during an excursion in a wood, participants were asked to fill a questionnaire about the aspects bonded to perception. We found out that visual goads are, without doubt, the easier to decode (135 opinions out of 10 perceptible aspects), tactile sensations followed (96 out of 10 aspects, of which half concerning sensations bonded to atmospheric situation: drywet, warm-cold), only 36 about sounds (out of 12 sound types) and 27 about odours (out of 6 types). It is significant the fact that, as regards sounds, only two people got the rustle of leaves, while the major part of perceived signals were bonded to people and insects, as if the threshold of sensibility was elevated and bonded to, like touch, more to the person than to the decode of the surroundings (Gibelli, unpublished data).

From what we said before, it emerged that two main processes exist, which determine unhealthiness levels of the landscape (Figure 3):

- acts related to the organisation of the living system, which operate on its functioning and on its regenerating capacity;
- b. acts derived from quality of single elements constituent of the landscape, which introduce psycho-physical and material effects.



Figure 3 - The two main groups of causes of human health alteration. Landscape oraganization impacts both directly, mainly on psychic human health, and indirectly, on physic human health: it acts on the alteration on environmental components and causes the loss of health. Actions for environmental amelioration generally concentrate on components (that are the effect) and on causes. It is clear that in this way the problem is not resolvible.

#### Landscape's changes and health

If landscape's organisation is the place where acting to reach health's goals which a developed society can whish, it is necessary looking for criticalities offered by places of life, with the sole object to identify addresses of planning and design of the territory, which consider the efficiency of functioning, but maybe the liveability referred to the possibility to grant suitable standards to human health.

A view on recent changes of urban reality, may provide significant starting points of reflection. The industrial revolution first and the economic boom during the second postwar period then, produced the flight from the countryside in name of wealth and of life wellbeing that the agricultural world didn't let. The sudden "urban migration" produced nowadays' cities, moulded by the fast growth and by the problems that it produced: air and water pollution, social problems and their impact on health, growth of individualism, etc. In more recent times, from the end of 70s, the research of more healthier places, combined with building's price raise in main cities, produced the exodus from towns and it contributed to the cities' lack of concentration which took name of "urban sprawl". It is a phenomenon common to all urban areas that in lots of areas is concerning to 70% of the urbanized areas (Gibelli, 2003). This diffused anthropization, added to efficiency's research of some ecosystems (agricultural for example), and to the overemphasizing which the west society gives to the technological aspects, instead of biological, of the environment destined to human life, it determines a contrast always more pronounced between anthropic and natural landscape, made acute by some managerial modalities which see a clean separation between the

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type of landscape: on a side total protection of natural environment, with an isolate tendency to isolate human presence, on the other the progressive elimination of what is natural from the areas occupied by the men, both urban and rural.

Table 2

This fact generated also a clean separation in very short times between human life and agricultural life, its culture and tradition, creating many adaptation problems.

It is useful to observe how processes determined by changes of lifestyle, act on landscape and, more or less consequently on social structure and on individual behaviour.

Table 3 synthesizes mutual relations among processes, territorial and landscape structure and modifies social and individual behaviour, typical of the "urban fringe" areas which are result of recent installing models.

But urban sprawl determines a series of problems, maybe bigger towards the ones produced by the crowded city: for example it produces considerable soil consumption, in fact the space really occupied by scattered buildings is only a little part of the space really influenced by the presence of buildings. The fragmentation which these buildings determine, influences on he possibility of use of the surrounding territory. Figure 4 shows an aerial photo of an area of the Venetian plain, interested by urban sprawl. Red circles correspond to some zones in which influence of buildings in agricultural landscape was noticed. It should be observed how left spaces generally constitute areas of wreckage in which it becomes very difficult to practise a multifunctional agriculture which contains also functions useful to habitants well-being. In some areas the space "lost" because of urban sprawl covers 50% of the territory, while surfaces occupied by buildings are less then 10%. This fact determines such a fragmentation of the territory, so it was impossible

to organise healthy multifunctional spaces, besides increasing individualism, because they limited collective spaces in favour to houses with per head elevated standard, totally autonomous.

Urban sprawl needs big quantities of energy, talking about the same number of habitants settled. The elevated soil consumption and the fast change of the traditional landscape locally induce habitat and biodiversity reduction and homologation of places and styles of life and decrease in social relations. Moreover increase in power and building materials consumption produced by low density house typologies, has widespread spin-offs and it is recognised by some authors as first cause of world's biodiversity loss (Liu et al., 2003), with all its spin-offs on human health.

Urban sprawl strongly increase dependence by private means of transport with an infrastructural request for road network, increase in traffic and in global pollution even if it doesn't reach crowded cities' concentration. Traffic intensity seem strongly conditioned by urban structure. It is in fact known how urban sprawl



Figure 4 - Urban sprawl in the province of Treviso.

isn't compatible with a rational management and an economic sustainability of public transport.

Increase in per-head kilometres is documented in many studies. Holtzclaw (1994) demonstrate that an higher urban density, for the same economic wealth, is generally joined to a minor number of private cars and a minor number of miles covered by every traveller. In this study, a double density (apart of very scattered habitants) centre 292.000 km are covered by Leipzig habitants per-week and 251.000 by habitants of the suburbs per week, for an overall increase of 543.000 km per-week. This fact evidently affect fuel use and pollution. It is estimated an increase in benzene pollution greater than 50mg/mc, thus more than 30mg used by Misa Group for the estimate of the increment of sick leave caused by pollution.



Figure 5 – Density of cars (number of cars for 1000 people) and population – 2002-2003 (APAT. 2005). In Italy only Venice has the same density of cars as Berlin, and anyway more than Paris.



Figure 6 – Private cars trend from 1970 to 2000 (number of cars each 1000 people). Italian values are similar to american values, while landscape structure is quite different (European Commission, DG TREN; Energy and Transport in Figures, 2002).

determines a 30% reduction of the covered miles, when the habitants' density is accompanied by a good public service, a mix of urban functions and a good pedestrian area (see also Cerbero and Gorham, 1995).

Moreover modifications of trade system induced by globalisation strongly affect the territory's infrastructural need, thus the fragmentation, the traffic and many other aspects identified in the firsy column of table 3. Some data referred to the opening of a new Shopping Centre in Leipzig are significant. The Centre is used by 40.000 people per-week. To reach the Staying in the traffic causes stress, contentiousness increase, physical activity and time dedicated to socialising in family and community decrease (Frumkin et al., 2004). This last aspect is intensified because of chronic lack of spaces of aggregation and tendency to live in their own private spaces evidently wider than urban ones, with an increase in individualism, decreasing in bonding with places, which creates estrangement and production of social deviant behaviour.

Increase in traffic in residential neighbourhoods and on thoroughfares represent the main factor which brought to containment of children's spatial range of action. In this way children's knowledge of environment of life is restricted, but also possibility of autonomous exploration, maturation of experiences, self-confidence and sense of responsibility which it involves.

But traffic doesn't create only pathologies: car accidents are the first cause of mortality in quite all developed countries even if this aspect isn't highlighted between threats to human health. In fact we saw antialarming campaigns towards presumed epidemics (cf. "mad cow disease", sars etc.) with probably exaggerated precautionary measures and the most of citizens more worried about risks of eating a chicken than the ones derived by a transfer by car. Moreover traffic effects have strong repercussions on social behaviours, with important psychological effects which can change into real pathologies.

An other aspect is the one bonded to dynamics induced by city extension and by its poor quality, which determines "flight" from the urban-technology environments during week ends and holidays, looking for places more suitable to the biological human nature. This phenomenon, important for psycho-physical well being affects environmental quality on territorial scale, producing sometimes enormous flows of vehicles with energy dispersion and loads of emissions in atmosphere and discharging on maybe sensible environment a very high concentration of people in suddenly. Parks may play a very important role or at least in mitigating this phenomenon deeply-routed in urban social life, offering spaces to feed vital original component of human nature, not far from everyday places.

#### Limit's benefit

Regarding to what is written it seems that the solution of the problem isn't in crowded city/wide city alternative, even though crowded city has some problems easier solvable than the ones of widespread city.

It seems rather important start thinking again about real and deep human needs in its entire technological, biological and ethical nature so it is possible to suggest models or simply criterion to redesign human "technological" men, favouring choices which tend to mortify the other two components of its nature both biological and ethical, may destroy the biological environment in its own and around themselves. "Technology" is considered by many the survival strategy of human species, to defend themselves by "hostile" nature, in other words to adapt nature to itself, in fact without biological equipment necessary to adaptation to environment: effectively human species is the only species which can live everywhere, thank to its capacity not to adapt, but to change environment about its needs. In fact technology abilities (e.g. technical + rationality) are possible because of biological nature and choices by ethic nature. If life environment is changed keeping in mind only one of the three components, physical and psychical alterations become unavoidable. Technological growth, if it isn't supported by a cultural and ethical growth of the human being towards itself and the environment which surround themselves, which provides for the recognition and the acceptation of the limit as value may take to very strong imbalances in human being/individual and in the society.

Acceptation of the "limit" as foundation of their own and other's humanity which moreover is one of the few laws of ecology, founding principle and which condition ecological systems and the development's supportability. About this fact we remind Liebig's Law of the Minimum (1840) and the precious contribution of Baetson (1989), which remind us that we can do everything we want of our world, but it, finally, will show us the bill because "biological processes can't be moked". Liebig's law, highlights how distribution of a species in environment (thus also of human species) depends on the factor presented by environment itself in minimum quantities regarding to the species' needs: nature put thus limits strongly conditioning the development. The unrecognizability of such bounds can take to very strong lacks, till extinction.

Biology can be positively united to technology, introducing ethic as comparison moment and allowing to act on world and environment so they enable continuity of processes which determined evolution of human species.

# Landscape's healthiness: benefit of natural environments and open spaces in the city

We don't want to say that use of nature is a panacea for all diseases, but certainly it makes better some situations both in some places and as help to the redesign of an urban structure nearer to the "entire" men needs. An unbreakable limit may be the respect of natural laws, particularly of environment's self generation needs, also towards its regenerating capacities for the single individual. In the most of the cases designed open spaces don't care about this aspects. Above all urban ones tend to suggest again structures and shapes "stolen" by architecture and indifferent to natural elements which form them and human who live them. In fact a large part of designed open spaces, generally speaking request a very considerable effort and good energetic supply, in fact the administrators are always very worried because of costs which they create. This often derives from the fact that urban open spaces are little and with lengthen or indented shapes, so plants (generally too big for the spaces in which they are) interfere with streets, infrastructures and houses and have to be contained. This type of bond isn't self regenerating at all. Moreover

very structured spaces aren't fit for creative use, for example, for children, who should be the major users.

But presence of open spaces in the city, don't seem to limit to the advantages in fruition (Gibelli and Santolini, 1999). There is an increasing number of researches which affirm that visual environment deeply influences physical and psychical well-being both on prevention (people whose windows overlook green spaces fall less ill), and therapeutic (reduction of stay in hospital and rehabilitation from traumatic experiences) (Frumkin, 2004 e Ulrich, 1984).

Beyond benefits towards real pathologies, natural landscape offers many opportunities for the balanced children's growth. For example, unlike television, nature don't steal, but overdraws time, inspires creativity because it requests a process of elaboration of visual goads and allows the use of all five senses brings again to a true reality, children and boys who live a lot of their time into virtual realities (cinema, television, computer, videogames, etc.) are hardly able to discriminate the two realities, with always more evident problems in facing the world.

In accordance with results of some studies, nature may represent a very good therapy for attention deficit disorder and hyperactivity and may be a valid completion or, if it is indicated, a substitute of medicines or of other behaviour therapies (Louv, 2006). As for this kind of disturb, experiences in nature help to keep concentration on a determinate element and have relaxing effects towards hyperactivity.

Protecting open spaces and incorporating them into the fabric of the city may be fundamental in resolution of children's obesity which is in rapid increase. A 2001 report by Centres for Diseases Control and Prevention (U.S.A.) revealed a connection between urban growth which don't leave space to sidewalks and cycle-lanes and a society which is overweight and afflicted by cardiopathies (Jackson, Kochtitzky, 2001). In Europe overweight increase in children between 5 and 11 years old is in rapid rise, the annual increase is of 400.000: a children out of 5 is overweight (EU, 2005).

#### Benefits of contact with nature

We can derive a first list of physic and behaviour diseases by numerous bibliographic sources, towards which artificial environment directly affect and for which positively play contact with nature: Obesity (diabetes second type), Stress, Depression, accident, Attention Deficit Disorder, some cancers, sensorial capacities atrophia. Following Table highlights the benefits produced by activities in contact with nature.

There also are all social aspects bonded to house building sector, which doesn't care too much about end user who will stay there and strongly conditioned by economic aspects. Building is, nowadays, above all a product sold in (summer) market rather than an answer and a primary demand of the citizen (habitant of the city). It is however difficult to insert adequate relations between public and private spaces, close and open spaces, natural and artificial environment, efficiency in energy and in use of resources, also because we lost the idea of "strategic design" which can integrate the many aspects of the complexity of the urban system, in a design of the city which respond to real needs. City, today, is thought as separate parts, according to the opportunities which present themselves from time to time. In this way we lost the great opportunity to reorganise some spaces useful for life of people, for conservation of resources, for saving of energy and for containment of pollution. In this way, the overall cost of the city is probably much more higher than what could be.

If we consider, for example, that inside urban areas, climatic conditions result to be more "continental" and the edaphic conditions are often very different from the ones of the surrounding areas. In fact we are witnesses to production of a significant production of heath which is about 3-5°C; soil temperature is significantly higher (until 7°C) in comparison with rural areas because of soil rainproofing. Because of this fact, rainwater isn't available and so air takes a lower rate of humidity; pressure wave assume a whirling and sudden features. This changes determine an increase in pollution and an increase in expenses for air-conditioning of buildings and convoy of rainwater, with high expenses for managing of drainage system.

Effectively the current town planning provides for about 50% of standards is dedicated to open spaces and to the recovery of pedestrian areas in town centres. These seem two inalienable "achievements" and always more diffuse and shared: open spaces are nowadays recognised as indispensable infrastructures such as aqueducts and streets. The problem is that the different functions of urban open spaces are hardly recognised and tree-lined road or green street way are part of standards such as a park. Open spaces which are generally designed aren't ecological auto regenerating processes, but it is a system which uses a lot of energy.

#### Measures effectiveness and "Good Procedures"

Some Administrators moved with success, at least partial, towards traffic problems, for which, moreover, we understood that in weightily situations it is difficult and often useless or negative and always troublesome, activating partial measures (e.g. Sunday traffic arrest). It is necessary to intervene with important resolutive and permanent acts.

In *Dublin* in 1990 it was forbidden to burn coal into the city. Mortality 72 months before and after the measure

Fantasy and creativity	Û	Autonomous playing	Û
Attention Deficit	Û	Relaxation	Û
Sense of danger, sense of responsability	Û	Attention deficit	Û
Unexpected events, autonomy and self-confidence	Û	Physical activity	Û
Lenght of staying in hospital during convalescence	Û	Self-esteem	Û
Attachment to places and affectivity	Û		

#### **Benefits of phisical activity** (Martin et al., 2004, modified)

Life expectation	Û	Prostate and pancreas cancer	Û
Cardiovascular diseases	Û	Osteoporosity	Û
Diabetes type II	Û	Bile-stones	Û
Obesity	Û	Depression (also infantil)e	Û
Colon cancer	Û	Stress resistance	Û
Breast cancer	Û	Indipendence in the third age	Û

have been compared. Deaths not caused by trauma resulted reduced of 5.7% and cardiovascular mortality of 10.35%. the estimated reduction of cardiovascular deaths was of 243 per annum (Clancy et al., 2002), following the mechanisms illustrated in Figure 2.

In *London* the insertion of the toll for circulation in the city, reduced of 18% total traffic volume, with 32% increase in Kilometres covered by bike (with a probable improvement also in overweight phenomena), a significant reduction in the number of accidents for cars, pedestrians, cyclists and motorcyclist. We found out also a reduction of about 50% of car accidents if we talk about cars from 2001 to 2004 (source: Congestion charging, 2005).

In the United States was born a movement, called "greenprinting", an approach to urban ecology which crept all over the country, with the aim to protect open spaces, generally speaking. Initiatives are having success in Seattle, Chattanooga, Atlanta, along Brooklyn East River, only to quote some. In these cities, the movement guides a process in four phases: "the vision", in other words the future imagined by public administration and private organisations, a "wide public dialogue", a survey about "how to pay the land" and finally "finding of the land". For example the electors of Jacksonville approved a half cent tax on sales to buy the open space. In some cities they preferred to buy the rights on estate development by landowners, above all farmers who are thus "payed" for cultivating instead of selling to estate agencies. Designers use models similar to the ones in use for the definition of ecologic networks for estimating faunal habitat conditions to design acquired spaces' optimal configuration, in this way maximum ecologic efficiency is granted.

With some of this attitude Milan Provincial Administration, in its PTCP, has proposed a project which provides for Milan open spaces network's requalification, the "*Dorsale verde Nord*" project corresponding to a strongly congested area and interested in a widespread deterioration of the environment determined by a feverish urban increase and by the numerous infrastructures which cut across it.

Ecological network concept, which is at the base of the north green ridge project started as strategic instrument for natural conservation, with particular regard to maintenance exigencies and increase in biodiversity and acquires a set of values and meanings which pass over the classic ones about ecological network, inserting in our goals the ones bonded to life's quality, including citizens' health. Moreover it is fit very well for complementary instrument to other parts of the Plan, because it is an ordering territory and a not built or in change landscape element.

Since traditional modalities of "making urbanity", based on the definition of areas to urbanise failed, province want to try a new way: *starting from open spaces to plan better also urban areas*.

Moreover such a project represents a strategic structure in which environmental compensation works derived by new territorial infrastructures are united (e.g. roads such as "Pedemontana", urban expansions, quarries). In this way local deterioration elements become resources to produce environmental quality in a crucial territorial zone for the balance in the north of the province.

Ecological network project is based on a mathematical model which registers territorial information collected during on-site survey campaigns and give them back as lines which values correspond to different suitability levels, which constitute the reference for ecological network. This network is traced out so it joins together higher quality areas which are identified by this model and which don't always correspond to protect areas and PLIS. In this way, it is easy to identify network route, depending on environment's and landscape's requests, but it is also easy to identify areas with higher needs or intervention priorities.

In United States a new word, Smart growth, has been coined to define cities development methods, finalised to human well-being. This concept is become a network made in 1996 by EPA.

The 10 Smart Growth principles are the followings: 1 mix land uses

- 2 take advantage of compact building designs
- 3 create a range of houses opportunity and choices
- 4 create walkable neighbourhoods
- 5 Foster Distinctive, Attractive Communities with a Strong Sense of Place
- 6 Preserve Open Space, Farmland, Natural Beauty and Critical Environmental Areas
- 7 Strengthen and Direct Development Towards Existing Communities
- 8 Provide a Variety of Transportation Choices
- 9 Make Development Decisions Predictable, Fair and Cost Effective
- 10 encourage community and stakeholder collaboration.

These general principles are completed by an other list which include principles for

community, regional principles and principles about managing of plans.

#### Conclusions

Landscape functions and antrophical needs. In the multiplicity of landscape functions and from its complexity we can derive functions potentially therapeutic or, anyway, fundamental for human well-being. To do this it is necessary start again from real human needs, which aren't only the physical or material ones, which can be satisfied by technological world, but which concern to mind and ethic, the only instrument which allow us to take decisions stamped to human species conservation and not human-being conservation in despite of community. The

first step is to untie the knot "I do the damage then I repair it" which help only to increase energetic needs which are introduced into the system and determine important changes on the environment till it won't be suitable for human life on the Earth.

Multifunctionality and artificialisation. It is really important to respect the complex landscape features also working on its therapeutic functions, in order not to specialize in a too monofunctional way parts of territory too wide and to respect original features of the places, the limiting factors, their evolutionary potentialities, also during transformation processes. This is what keeps alive a landscape, on the contrary, a plan finalised towards therapy may have two effects: the resulting landscape will lose a big part of its efficacy, in other words we replace a functional autoregenerating unit with a high energetic consume unit which has nothing to do with the place's potentialities. In this case we do nothing different from the actions which take to artificial environment (Figure 7). This second approach can't solve the initial paradox, but it exalts it. It is thus necessary think again the cities as complex organisms constituted by different and interactive parts, in which natural functions enter and therapeutic gardens constitute tesseras of an healthy well-constructed mosaic which includes parts expressly finalised to therapeutic functions towards some pathologies.



Figure 7 - schematises the artificialization process described and highlights its loop.

Awareness and Nature. But there is an aspect particularly critical: the detaching of "urban metropolitan animal" by the nature, put him away from its conscience, from processes which are at the base of food production, of the food chain, of the processes which happen without human intervention and problem's awareness. What we don't know is generally fear: the tendency is to keep at distance or to escape. Urban generations which form themselves without knowing the nature, without set up an also affective relationship with it and with the land, won't be able to feel responsible for the environment when will be their turn to make decisions which interact with the environment. A quote which synthetize very well what is written: "What does a condor extinction mean for a children who never saw a wren?" (the naturalist Robert Michael Pyle). Nature is out the cities, but the cities are government places where ideas born and decisions are made about the destinies of far places. How can we decide reasonably about objects and, above all,

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unknown processes? So, contact with nature doesn't have the only meaning to contribute to psycho-physical well-being of the human being or some communities. It has a wider meaning of giving base for a sustainable management of Earth system in the following years, so it may guarantee the survival in environments suitable for life of human beings, besides of the other animal and vegetal species which have always constituted the environment which allowed the evolution of human species itself.

A change of trend seems unpostponable: care for health, to a deeper and complete health may be the incipit for a new cycle.

A new environmental accounting, which insert indicatives of use of the metropolitan areas which count direct, indirect and differed in time costs of the rising infrastructures, savings due to favourable environments, access to services, to places suitability, to human well-being.

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