

## CHAPTER 2

# CONTRIBUTIONS OF NATURAL ELEMENTS AND AREAS IN RESIDENTIAL ENVIRONMENTS TO HUMAN HEALTH AND WELL-BEING

SJERP DE VRIES

*Alterra Green World Research, Wageningen University and Research Centre, P.O.  
Box 47, 6700 AA Wageningen, The Netherlands. E-mail: [sjerp.devries@wur.nl](mailto:sjerp.devries@wur.nl)*

**Abstract:** This paper gives a brief overview of the research literature on the effects of nature and green space on human health and well-being, with special attention to green areas in residential environments. A preliminary descriptive framework is presented and used to delineate the focus of the paper. The review of the studies is organized by the mechanisms that are supposed to explain the positive effect of nature on health. Seven of such mechanisms are distinguished. Although the evidence is mounting, the main conclusion is that the research on nature and human health is still in its early stages. The results thus far do not offer much support for evidence-based policy making nor can they be translated into practical guidelines yet.

**Keywords:** green space; nature; living environment; mechanisms; residential preferences; evidence-based policy-making

### BACKGROUND

Globally more and more people live in an increasingly urbanizing environment. Almost by definition this implies that their contacts and interactions with natural environments and elements decrease. At the same time, many people feel that such contacts and interactions are beneficial: they perceive them as enriching their lives and/or promoting their well-being (cf. Staats et al. 2003). If these people are right, then the urbanization of human habitats may have negative side-effects that seem not to be taken fully into account thus far. For example, within The Netherlands nature management and public health tend to be quite separate policy domains. The same holds for spatial planning and public health. As far as natural elements and areas are explicitly included in Dutch policy making for other domains, for example in the case of public housing, this tends to be in terms of beautification and offering attractive leisure settings. In other words: natural areas and elements are looked upon more as a luxury than as a necessity. But is this neglect of green spaces for health purposes justified? This paper focuses on what is known about the relationship between natural elements and areas on the one hand and human health

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and well-being on the other hand. It does so from a scientific perspective. We shall not focus on philosophies or ways that people *think* the world works (or should work) but on outcomes of well documented studies in this subject area. First a preliminary theoretical framework will be presented that delimits and structures this brief overview.

### THEORETICAL FRAMEWORK

At this point we will sketch a very global and descriptive framework for the relationships between natural elements and areas on the one hand and human health, well-being and quality of life on the other hand. More process-oriented models will be given later on, exemplifying different mechanisms by which nature may influence health and quality of life. The descriptive framework will distinguish several topics within the research area and position them in their mutual relationship. We use the International Classification of Functioning, Disability and Health (ICF) as published by the World Health Organisation (WHO) as our starting point. Especially the ICF's subsection on environmental factors is used. The ICF classification fits our purposes well, in that this subsection contains a category 'natural environment and human-made changes to environment' (e200 – e299). This comprises:

“... animate and inanimate elements of the natural or physical environment, and components of that environment that have been modified by people, as well as characteristics of human populations within that environment”.

We focus exclusively on this category. Its subcategories are:

- Physical geography (e210)
- Population (e215)
- Flora and fauna (e220)
- Climate (e225)
- Natural events (e230)
- Human-caused events (e235)
- Light (e240)
- Time-related changes (e245)
- Sound (e250)
- Vibration (e255)
- Air quality (e260)
- Natural environment and human-made changes to environment, other specified (e298)
- Natural environment and human-made changes to environment, unspecified (e299)

There are also many subcategories that still fall outside the scope of this paper. Our focus is on the effects of natural areas and elements on the cognitive, emotional, behavioural and social functioning of people, to the neglect of the physical aspect. For example, we shall not deal with the effects of air quality on physical well-being. To put it differently, we will focus on effects of perceiving and interacting with

natural environments and elements. The paper is written from a social-science perspective, more than from the biological or life-science perspective.

An environmental factor may have different effects, at different levels: some physiological and others more social. Therefore it is not possible to assign all of the above subcategories as uniquely affecting either the physiological or the social functioning of human beings. Also, sometimes it may be hard to tell by which mechanism the environment affects people's health (most). However, we will zoom in on the 'social' effects of physical geography (e210) and flora and fauna (e220).

Now that the theme of this paper has been delineated, we zoom in on the distinctions we would like to make within this domain. The first one is the type of contact that people may have with natural environments and elements. We distinguish mainly perceiving and experiencing the natural *environment* from interacting or working with natural *elements*, such as plants and animals. The assumption is that one does not interact with the environment as a whole, but rather with specific elements within this environment (or a natural element within an otherwise non-natural environment). We will speak of experiencing the environment when there is no purposeful interaction with a natural element, even if this environment consists of a single natural element such as a solitary tree. In this paper we will focus on perceiving and experiencing natural environments. Furthermore, we will concern ourselves mainly with the outdoor environments. The paper by Elings will focus more on interacting and working with natural elements.

A second distinction deals with the social context in which the contact takes place. We will mainly focus on the residential context, rather than on, e.g., a therapeutic or health-care context. This also more or less implies that, with regard to type of effect, we will be focusing on preventative effects and those that enhance well-being or, even more general, quality of life. So we will pay little attention to, e.g., curative effects, and even less to possible pathogenic effects.

A final dimension is the targeted group of people. This may range from the population at large, marginalized groups, to groups with a specific disease or challenge. In our case it will be (urban) residents. So, to summarize we will give a brief overview of the research literature with a strong focus on the following dimensions:

- type of contact: perception and experience
- type of context: residential
- type of effect: preventative, enhancing quality of life
- type of people: urban residents.

And we will do so from a social-science perspective.

## STATE OF THE ART ON GREEN SPACE AND HEALTH

### *Overview of possible mechanisms linking nature and well-being*

In this chapter we will concentrate on the effects of perceiving and spending time in a green environment, including the local supply of green areas. We will not deal extensively with the explicit use of green areas in a therapeutic setting here. Recently, the Health Council of The Netherlands has made an overview of the

effects of nature on health in which empirical studies are not only described, but also evaluated regarding the strength of their conclusions (Gezondheidsraad 2004). This contribution makes extensive use of that overview.

At least three studies have shown the availability of nearby natural areas and elements to be related to human health in a real-life setting. The first one focused on the hospital environment (Ulrich 1984). The other, more recent studies focused on the residential environment (De Vries et al. 2003, Takano et al. 2003?). De Vries et al. (2003) show a relationship between the local amount of green space and self-reported health at a national level. This relationship persists after controlling for socio-demographic characteristics known to affect health. Takano et al. (2002) show a relationship between the (self-reported) availability of green walking spaces and longevity of elderly inhabitants of Tokyo in their longitudinal study. However, all three studies, especially those on the residential environment, do not prove convincingly that the availability of natural areas or elements was instrumental in the observed relationship. Furthermore, the studies offer little insight into the mechanism(s) behind such an instrumental relationship.

In the literature, several mechanisms by which natural environments may affect human health and well-being are mentioned, often also focussing on different aspects of health and well-being. Most often suggested, besides the physical quality of the environment (e.g. air quality), and selected by the Health Council of The Netherlands to be described in more detail are:

- reduction of stress and restoration of attentional fatigue
- promoting (more) physical activity
- enhancing positive social contacts with neighbourhood members
- healthy development of children
- personal growth of adults/enhancing quality of life.

We will first briefly describe the research on each of these five mechanisms separately, following to a large extent the overview of the Health Council of The Netherlands (Gezondheidsraad 2004).

#### *Stress reduction and attention restoration*

The two most important theories on the influence of nature on stress reduction and attention fatigue are Ulrich's psycho-evolutionary theory on stress reduction (1983) and the attention-restoration theory (ART) of Kaplan and Kaplan (1989). Hartig et al. (1996) suggest that both outcomes are quite likely to be strongly related. Following this suggestion, the Health Council of The Netherlands also considers one mechanism to be operational and concludes that it is the one that is best supported by the empirical evidence (p. 60-62). Nineteen studies of sufficient methodological quality have been identified. In these predominantly experimental studies, most of the times subjects were first presented with a stressful event or task, and then viewed or experienced as either (an illustration of) a natural environment or an urban/built-up environment. Stress levels tend to be lower and the capability to concentrate higher when confronted with (the illustration of) a natural environment.

*Stimulating physical activity*

The importance of sufficient physical activity on mental and especially physical health has been well documented (U.S. Department of Health and Human Services 1996). Furthermore it is well known that most people prefer a natural, green setting for such leisure activities as walking and cycling (see, e.g. Herzog 1992). This makes it reasonable to suggest that an attractive nearby green environment may stimulate physical activity in the form of participating in such recreational activities more often or longer (Owen et al. 2000, see also; Pikora et al. 2003). However, empirical research that corroborates this influence of nearby nature is hardly available. Two studies evaluating specific programmes suggest that when a (semi-) organized activity takes place in a group setting and a natural environment, this makes people more motivated to stay active in this way. One of the evaluated activities is walking for pleasure (Reynolds 2002a), and the other consists of voluntary nature management activities (Reynolds 2002b). However, both studies do not preclude that other factors than the natural environment are responsible for this heightened motivation, for example the social setting. Other studies have clearly shown that people with more green space nearby, or green space nearer to home (De Vries 2002; Grahn and Stigsdotter 2003) visit green areas more often and/or spend more of their leisure time within a green area. However, more visits to/more time in a green environment does not necessarily imply more physical exercise in the form of leisure activity. People may not be that active within the green area, or in case of a less abundant supply of green areas, they may be as active, but in a non-green environment.

*Enhancing positive social contacts*

Positive social contacts by themselves may already be considered to enhance one's quality of life. But there are also indications that people with more positive social contacts feel healthier, have a lowered probability of getting cardiovascular diseases (CVDs), and tend to live longer (Berkman et al. 2000). Especially for the elderly, a lower level of loneliness has been shown to coincide with a lower probability of mortality, depression and loss of cognitive functions (Penninx et al. 1997). So, if green areas do stimulate such contacts, it is also along this route that they may have beneficial effects. However, empirical research on this issue is quite scarce. Of the few available studies, the most well-known have been conducted by the Chicago-based research group of Kuo and Sullivan (Kuo et al. 1998; Kweon et al. 1998). They both studied the effect of nearby green space on social ties within the neighbourhood. Although the results of these studies offer some support for this mechanism, it is a rather small empirical basis, also because both studies focused on inhabitants of the same social housing project (Robert Taylor Homes).

*Healthy development of children*

Based on an extensive overview of the literature, Gebhard (1994) argues that the availability of adventurous natural settings that may be freely explored is important

for especially the socio-emotional development of children. According to Cornell et al. (2001), free exploration of the environment is also important for the cognitive development of children. Furthermore, outdoor play has also been argued to be important for the motor development (Karsten et al. 2001). However, most of the research on which these arguments are based is either descriptive of qualitative in nature, not permitting strong conclusions on causal relationships. Moreover, only a few studies focussed explicitly on the naturalness of the setting, see e.g. Faber Taylor et al. (1998) and Wells and Evans (2003). Consequently, it is not clear what the importance of the *naturalness* of the adventurous environment to be freely explored actually is.

#### *Personal growth/enhancing quality of life*

Spiritual well-being is not only a goal in itself, but also has been shown to be related to mental, physical and social well-being (see, e.g. Heintzman 1999). Several studies suggest that the process of reflection and developing a sense of purpose, which is thought to be important for spiritual well-being, is facilitated by a natural setting (see e.g. Frederickson and Anderson 1999). Based on the results of studies on wilderness experiences, Fox (1999) proposes the 'Spiritual Experience Process Funnel'. According to this model, when people start to feel relaxed during a wilderness trip and more autonomous and competent, they also open up to the beauty and symbolic meaning of nature, and become more inclined to reflection and sense of purpose. The symbolic meaning of nature does not seem to be limited to wilderness areas: according to Chenoweth and Gobster (1990), also urban nature (trees, allotment gardens, water surfaces etc.) may act as a symbol. However, the Health Council of The Netherlands states that most of this research is either descriptive or correlational, or otherwise does not allow for strong conclusions (self-selection, lack of control group). Alternative explanations, such as social contact and (vigorous) physical activity, cannot be precluded.

#### *Other possible mechanisms and aspects*

The five mechanisms and/or aspects that are distinguished by the Health Council of The Netherlands are not the only ones that can be found in the literature. We will briefly discuss two additional ones. A relatively new aspect is the effect of a natural setting on aggression. Although in the public opinion urban greenery is more often associated with socially unsafe environments, there are a few studies that suggest that in some cases a green environment may help to reduce aggression and crime rates (Kuo and Sullivan 2001b; 2001a). The mechanism behind this relationship is still fairly unclear. It may be strongly related to the mechanism for stress and fatigue reduction mentioned earlier, and/or be a consequence of stronger social ties with the neighbourhood, leading to more social control or an otherwise less inviting environment for displaying aggressive and/or criminal behaviour. The other way around it goes without saying that less aggression and crime within the neighbourhood will enhance the quality of life.

With regard to quality of life, it is also well-known that most people prefer to live in a neighbourhood with a fair amount of green space. However, the supply of houses in such neighbourhoods is often less than the demand for them, thereby raising prices and making them less affordable. As a consequence many people live in a neighbourhood that does not match their preferred environment (De Vries 2001). It is still unclear whether this incongruence also has negative effects on health and well-being, besides its impact on the quality of life. However, it is not unlikely that people that can afford to do so will move to more attractive neighbourhoods, leaving a relatively poor segment of the population behind. Recently conducted analyses showed that, within the more urban residential environments, the local availability of opportunities for recreational walking and cycling in a green environment was related to the composition of the population (De Vries and Van Zoest 2004). Low availability of recreational opportunities, in relation to the demand for such opportunities, coincided with a stronger presence of non-western ethnic minorities, usually not the wealthiest segment of the population.

#### *Interactions between mechanisms*

By presenting each of the mechanisms separately, it may appear that they are quite unrelated. However, 'between the lines' some suggestions have already been made that in daily life several mechanisms and aspects are often interrelated. While stress and mental-fatigue reduction has been shown to occur independently of the other mechanisms and aspects, this reduction may be enhanced by positive social contacts taking place while spending time in a green area. Likewise, the fact that people select a nearby green area to perform a leisure activity may lead to them spending more time in this type of environment than they otherwise would have done. Apart from the beneficial effects of the possibly larger amount of physical activity, the larger amount of time spent in a green environment may have beneficial effects by itself. The possible relation between aggression reduction and other mechanisms has already been mentioned above.

#### FROM RESEARCH TO EVIDENCE-BASED POLICIES AND PRACTICAL GUIDELINES

The interrelations mentioned above make it difficult to assess the contribution and relative strength of the different mechanisms in a field setting. On the other hand, experimental studies are usually only able to show the existence of a process because it produces immediate but short-term effects. The impact of the green environment in the long run, in a daily environment cannot be established in this way. For all practical purposes many of such issues may remain academic: if it works, it works. However, this point of view becomes problematic when a) considerable costs are involved, and b) changes in (the use of) the environment are only a part of the package or treatment. In those cases one would like to know what the contribution of the natural setting is. When new green areas are created at substantial costs and preclude other types of land use, this is likely to be a choice

that has to be argued convincingly. And also the importance of the continued existence of already available green areas is likely to require a solid empirical basis, especially in (urban) regions in which land is scarce. A second but related reason for research into the operating mechanisms, their relative contributions and preconditions, is that knowledge about these mechanisms may make it possible to plan and (re)design green space more efficiently with regard to its contribution towards health and well-being. The next paragraph elaborates on these issues.

*Relevant characteristics of the natural environment*

Up to now relatively little attention has been paid to the preconditions under which the proposed mechanisms will operate or will work best. In general the research seems to be in its early stages, mainly focusing on showing that effects and/or relationships do exist. For example, in experimental studies often crude distinctions between natural and non-natural environments are used. Nevertheless, some of these mechanisms/aspects seem to be linked to a specific type of natural environment. For example, personal growth seems an outcome that is frequently mentioned in connection with wilderness experiences and/or survival activities in a natural setting. However, these types of links often remain implicit in the sense that little is known about the preconditions the natural environment has to fulfil in order to result in or maximize the desired health effect. What follows is a list of possible relevant characteristics (drawn up with a residential context in mind):

- amount of green space, in square metres, within a certain distance
- spatial structure of the green space: its distribution over the city or neighbourhood, composition in terms of surfaces and linear structures
- type of green space: wilderness, forest, park, cultivated land, etc.
- design and management of specific green areas, including accessibility, infrastructure, amenities, facilities, level of maintenance/grooming, security measures
- type and number of other users of the area (in relation to amount of green space).

The relative importance of these characteristics may vary from mechanism to mechanism. For example, for physical (leisure) activities to take place within the green area, its 'technical' suitability as a place to perform certain activities will be a significant factor (infrastructure and facilities for specific activities). One of the interesting issues that have not been resolved yet, is the importance of the perceived beauty of the natural area as a mediating factor. Since this perception may differ from person to person, this brings us to another aspect: the segment of the population for which a mechanism may be (most) beneficial. Once again, almost no studies are available in which the effect of a certain natural setting on different groups is systematically compared. At a spatial micro-level, however, it seems reasonable to expect that the stress-reducing effect of greenery is most needed in stressful situations. It is not a coincidence that the few field experiments tend to concentrate on such situations: hospital environment, prison, dentist's waiting room. But this is more a matter of context than of individual differences.

## CONCLUSIONS

- Several possible mechanisms linking green environments to human health and well-being have been identified in the literature.
- Usually the empirical support for the mechanisms is still rather weak, with the exception of stress reduction and attention restoration.
- Little is known about the size of health effects in a real-life setting, about the relative contribution of the different mechanisms, about the preconditions under which each mechanism operates best, and about for which subgroup of the population it does so.
- As a result, practical guidelines for policymakers, spatial planners, landscape architects, health practitioners, if available at all, are seldom evidence-based.

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