

FEELING STRESSED?

TAKE A TIME OUT IN NATURE

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Stress has become a constant for many city residents. Tragic or traumatic situations and events may disrupt people's lives, but are no longer the most common sources of stress. Everyday life now presents chronic stressors such as financial strain, complex family interactions, extended commutes, and other persistent situations. Such everyday, relentless stressors now have a greater impact on health and well-being for many people than any infrequent major upset.

For thousands of years humans have acknowledged the many positive feelings and experiences associated with spending time in nature, in settings ranging from wildlands to enclosed gardens^{(1) (2) (3)}. Beneficial influences were generally attributed to daylight, fresh air, and greenery. Then in the 1970s scientists began to use scientific measures of the effects of nature's influence on the human body⁽⁴⁾. More than 100 studies now confirm that stress reduction and mental restoration are significant benefits associated with living near green areas⁽⁵⁾, having a view of vegetation⁽⁶⁾, and spending time in natural settings⁽⁷⁾. Even watching images on a computer or television monitor has been found to be restorative⁽⁸⁾. Green spaces, including those located within the most built-up areas of cities, provide restorative settings that offer people respite and recovery from daily and chronic stressors. This research synthesis provides an overview of key research findings on stress and the benefits of nature, paying special attention to "nearby nature" and urban environments.



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Understanding Stress

Stress is a response to the challenges, demands, and immediate threats to our everyday functioning and well-being. Stress reactions are often automatic, and can shape behavior in ways that we may not even be aware of at the time. If an event is perceived as stressful, the regions of the brain that react are directly linked to the autonomic nervous system, which

controls basic physiological functions. When one's body is stressed, muscle tension increases, blood pressure rises, the pulse quickens, respiration increases, the digestive system slows, and the body produces more adrenaline. Strong stressors can cause immediate 'fight or flight' behavior*. If stressors are constantly present these immediate physiological reactions can evolve into more long-term and serious symptoms such as frequent headaches, stiff and sore muscles, a weakened immune system, panic attacks, teeth grinding, and digestive problems⁽¹⁰⁾.

Stress is also expressed as psychological symptoms, occurring simultaneously with or distinct from physiological symptoms. Psychological stress tends to be caused by emotional stressors such as the death of a loved one, or by a per-

ceived emotional situation, such as fear of failing at a task. Some of the symptoms of psychological stress include depression, anxiety, inability to concentrate, excess worrying, inability to complete tasks, and feelings of loneliness⁽¹¹⁾.

Chronic Stress

Humans are able to manage moderate and high stress levels for a short period of time. Yet excessive stimulation and persistent stressors day after day can overwhelm people. Chronic stress occurs when an individual is exposed to mild or major stressors for a prolonged period of time with no opportunity for recovery; the response is heightened when the individual feels that he or she has no control over that situation. Persistent stressful situations in urban, modern society can include financial strain, work obligations, complex family interactions,

* Sex differences account for some slight variation in stress responses; females more likely to "tend and befriend" rather than male's "fight or flight". Oxytocin, a hormone secreted in both men and women as a response to stress, has been shown to calm rats and humans, making them less anxious and more social. Male hormones seem to reduce the effect of oxytocin, but the female hormone estrogen amplifies it⁽⁹⁾.

traffic noise, difficult wayfinding in streets or buildings, and visual complexity. For instance, residents of urban, low socioeconomic neighborhoods often experience chronic stress due to higher exposure to noise, violence, unemployment, and crime. Chronic stress, combined with little opportunity for recovery, can lead to unhealthy levels of psychological and physiological reaction. Individuals experiencing chronic stress are more likely to suffer from impaired spatial learning and memory, sleep problems, loss of appetite, poor mental health, cardiovascular complications, and type II diabetes^{(12) (13)}.

Psychology and Stress

Two theoretical frameworks have emerged to explain the psychological experience of chronic stress and the restorative effect of nature. The framework that has received the most attention, Attention Restoration Theory (ART)⁽¹⁴⁾⁽¹⁵⁾, was developed by Stephen and Rachel Kaplan, and proposes that nature has certain properties that allow a person to recover from the mental fatigue caused by the focused attention needed to get things done at work, school, and in our busy lifestyles. The other perspective, psychoevolutionary theory^{(16) (17)}, looks at restoration from a more general perspective of stress reduction, and posits that people respond to certain perceptual qualities of nature that encourage our physiological systems to relax and recover in ways that help improve behavioral and cognitive performance. Both frameworks generally argue that human beings react positively to certain qualities and characteristics of natural environments.



The central idea of ART is that restoration is the recovery of our capacity to direct attention. The Kaplans describe two types of attention. *Directed attention* is that which requires effort. We often need to pay attention to tasks to accomplish a goal (such as at work or school), and effort is needed to fend off competing stimuli. Working to inhibit distractions makes us susceptible to mental fatigue. Irritability and negative affects result from depleted attentional reserves; as we restore the ability to pay attention, we often feel positive changes in our mood and productivity.

Restorative environments help us to replenish our capacity to focus and again be able to direct attention. In contrast to directed or voluntary attention is *involuntary attention*, often associated with fascination. Fascination occurs when the environment around us is inherently interesting, and no effort is required to pay attention. ART proposes that this attention is activated when one is viewing nature. While using involuntary attention, our capacity for directed attention can recover.

Nature and Stress Recovery

KEY FINDINGS FROM RESEARCH

Many medical studies have been published about the influences of stress on general health and incidence of disease. The sources and consequences of stress are now well understood. Acute stressors – such as loss of a job, or a divorce - were the focus of early work, with resulting recommendations for coping and resilience strategies. Chronic, or background stressors, are now the greater concern of health professionals. How might people alleviate the effects of continuous stress in their lives? Health care providers offer clinical diagnosis and treatment if stress response is expressed as serious disease or disorder, yet a growing collection of scientific studies point to the preventative power of everyday nature experience. Having nearby nature, such as a personal garden, public parks, or trees in the streetscape can aid in stress recovery, improving people's quality of life, and their ability to do better at school and work.

Details of the Key Findings

Can I benefit from simply viewing trees or a garden from my window?

Measureable recovery benefits are possible solely from visual encounters with nature.

Research shows that environments with natural elements have restorative or stress reducing effects, more so than those without nature. Views of nature (such as trees water, or a garden) appear to have more positive influences on psychological and physiological states, compared to those urban scenes that lack natural elements. These effects appear whether one is in a natural environment⁽⁶⁾ or looking out at nature through a window⁽⁷⁾. In a key study, a stress inducing movie was presented to study subjects, then each person viewed one of six videos depicting various built hardscapes and natural environments⁽¹⁷⁾. Response measures included self-rated stress levels and objective physiological indicators such as heart rate, muscle tension, skin conductance and pulse transit time (which correlates with systolic blood pressure). Recovery was faster and more complete for individuals that viewed natural versus

Here are some highlights from the research:

- The cumulative effect of everyday, low-grade, chronic stresses can have a greater impact on health and well-being than 'acute' or extreme events that occur at infrequent intervals (such as loss of a family member or divorce)^{(12) (13)}.
- Measureable recovery benefits are detected solely from visual encounters with nature⁽¹⁸⁾. Urban nature provides calming and inspiring environments that can restore the mind from the mental fatigue of work or studies, improving productivity and creativity.
- Visual or passive exposure to nearby nature (such as trees, grass, and water), as well as moderate activity in green spaces can effectively reduce stress^{(19) (14)} and longer exposure is beneficial⁽²⁰⁾.
- Green spaces enhance and provide opportunities for activity based stress reduction, including exercise, gardening, and walking, lowering cortisol levels and improving cognitive function^{(21) (22)}.
- A neighborhood that incorporates easily accessible green spaces into its design not only contributes to overall lower incidences of stress but may also improve social cohesion, lower community health care costs, and improve residential quality of life^{(23) (24)}.
- Design recommendations to foster positive health outcomes may emphasize general aesthetic principles, but should incorporate key evidence-based elements of stress recovery and be tailored to local needs⁽²⁵⁾.

built settings. With natural views, stress recovery happened remarkably fast—within minutes. Other research findings also break down components of natural environments and show that simply viewing nature helps restore mental fatigue^{(14) (26) (27)}.

Can urban green spaces help relieve the stress from everyday tasks and life events?

Visual exposure to nearby nature (such as window views and green roadsides) alone or combined with moderate activity in green spaces, can effectively reduce stress.

Multiple studies demonstrate the restorative benefits of nature when participants complete a stressful task followed by prompts of natural or built areas. Blood pressure lowers when study subjects look out a window with a view of trees⁽²⁸⁾. Nature walks are associated with blood pressure improvement, better task performance, and decreased anger compared to results of an urban walk⁽²⁸⁾. And heart rate decreases more rapidly with a window view of a natural scene compared to a view of a blank wall or a natural scene presented on a plasma screen⁽²⁹⁾.

Research has also explored the psychological consequences of time spent within urban green space. A survey of people conducted before and after entering an urban green space found that both the amount of time spent in the green area and visit frequency were positively related to the self-reported level of mental restoration. Increase in length of stay from 0.5-1 hour to 1-1.5 hours statistically increased the restorative effect. Additionally, the more an individual was stressed prior to the green space visit, the more stress reduction that was gained. In considering other factors, the study found that the individuals who had previous experiences in natural settings (such as nature hobbies or childhood exposure) had greater restorative experiences than individuals with limited prior nature experiences⁽²⁰⁾.

There are potential medical applications of nature therapy. A recent study tested the correlation between stress and cognitive function under various conditions in women diagnosed with breast cancer. Participation in activities and/or interacting with natural environments was shown to reduce and help stave off negative cognitive experiences such as mental fatigue both before and after breast cancer treatment or surgery⁽³⁰⁾.

What activities should my community promote in our outdoor spaces?

Benefits from nature can be enhanced by many non-strenuous outdoor activities.

Play and exercise are an important part of children's and adults' development and brain function. In play children develop cognitive thinking and reasoning abilities⁽³¹⁾. Exercise provides multiple positive physiological and psychological benefits for adults, such as weight reduction and reduced stress. For elders exercise likewise helps increase and maintain the brain's cognitive capacity⁽³²⁾.

Urban green spaces encourage exercise and are more restorative environments than indoor settings, and have a greater positive effect on mental health⁽²¹⁾. When comparing activities with

restorative outcomes in urban green space, simply being in a green space decreased stress levels, but engaging in sports reduced stress more, compared to pursuing less-strenuous activities⁽³⁷⁾. Additionally, urban green spaces offer a free, accessible, public environment in which to exercise and play for those who do not own a private gym membership.

The benefits of tending to vegetables and flowers in an urban community garden is a fast growing research topic among environmental educators and urban health researchers. One study presented a stressful task situation to study participants, followed by a gardening or indoor reading condition⁽²²⁾. After gardening or reading, both groups showed a decrease in cortisol (a non-invasive indicator of stress), indicating that both activities were relaxing to

some degree. Cortisol levels decreased more in the gardening group, especially during the second half of the activity, during which cortisol levels stopped dropping for the reading group. This suggests that while reading can have some restorative effect, prolonged reading does not continue to relax, whereas activity in nature does.

How can green spaces benefit my neighbors and community?

Benefits of nature extend beyond the individual, to affect households and social groups.

Community residents with access to a garden or local green space experience less stress and have a lower incidence of obesity, likely due to more outdoor activity and more active modes of travel (such as walking or cycling)⁽²⁴⁾. In a study investigating children and access to nearby natural settings, participants with greater exposure to natural settings were more likely to experience lower impacts of stressful life events on psychological well-being⁽³⁸⁾. Urban residents near long-term noise annoyances, such as nearby busy highways, experienced a reduction in noise-associated stress impacts when access to nearby green areas increased⁽³⁹⁾.

A neighborhood that incorporates easily accessible green spaces into its design may also improve social cohesion and interaction. As a result, the mental health of individuals may also remain positive due to a decreased chance of depression and feelings of isolation, and increased self-esteem. Effective social support networks have been found to restore feelings of personal control and self-esteem by buffering the effects of stress and poor health^{(40) (41)}.

Green spaces, such as community gardens or even the shade of a large tree, encourage social contact by serving as informal meeting places and sites for group and shared activities. Green

SHINRIN-YOKU OR FOREST WALKING AND BREATHING

Long a tradition in Japanese culture, many people travel to the edge of cities for several hour walks in forests. Shinrin-yoku, or forest walking and breathing, appears to reduce stress and produce other health benefits⁽³³⁾. Studies found that walking in a forest was more effective at decreasing blood glucose levels than other forms of exercise, such as walking on a treadmill^{(34) (35)}. Forest walking participants have higher activity levels in the immune system cells that act to reject tumors and cells infected by viruses, and have reduced levels of stress indicators (including systolic blood pressure and noradrenaline and cortisol levels). Diabetic forest walkers have decreased blood glucose levels. Across multiple studies, negative feelings decrease and positive emotions increase as a result of such activity. Forest walking within urban parks was found to ease acute emotions (such as boredom and depression), and the higher the self-reported initial stress level, the greater the positive effect⁽³⁶⁾.

spaces can serve as a sort of community catalyst, as marginalized people can find empowerment, respite from stresses, and personal involvement in environmental stewardship⁽⁴²⁾. Useable and safely accessible gardens or green spaces not only foster a sense of community, but also provide psychological benefits among its members⁽²³⁾.

Specifically concerning the elderly, social interaction is important as less loneliness is correlated with lower mortality rates, depression, and cognitive impairment^{(43) (44)}. Lowered health care costs at the community level could be a direct and broad benefit. Additionally, in a study of elderly populations that prefer natural over built environments, there is a positive correlation between familiarity of the environment and restorativeness⁽²⁶⁾. The elderly require easily accessible spaces due to their more limited mobility, so having parks and green spaces in close proximity to their neighborhoods or care centers is especially important.

Implications of stress extend not only to a person's immediate community but also to the public realm, as stress can be the source of community health problems, general burnout and depression, and lowered overall productivity. The World Health Organization identifies stress and inadequate levels of physical activity as two of the leading contributors to premature death in developed nations⁽⁴⁵⁾. The health impacts of stress in developed nations have a significant monetary cost to the public sector. The public costs in the United States of stress-related disease alone are calculated to be in the hundreds of billions of U.S. dollars.

How can my city begin to implement small, open green spaces?

Urban design for reduced stress and better health should be tailored to local needs. A review of sixteen years of urban planning research on how humans interact with outdoor urban environments found six consistent themes across diverse cultures and political systems⁽²⁵⁾. As a basis for design, research shows that users' aesthetic preferences for outdoor spaces center around scenic beauty, degree of cleanliness, and pleasant sounds. When planning an outdoor public green space, planners should take note **"Urban residents worldwide express a desire for contact with nature and each other, attractive environments, places in which to recreate and play, privacy, a more active role in the design of their community, and a sense of community identity"**⁽²⁵⁾. City planners who incorporate local needs and opinions in the design process are more likely to create a sustainable public space that speaks to site-specific sources of stress^{(46) (47) (48)}.

Conclusion

Green spaces are important assets in promoting healthy lifestyles, buffering stress, and providing opportunities for healing and social connections. Recent research demonstrates that responses to outdoor spaces and vegetation can be linked directly to health, and in turn related to economic benefits of lowered health costs and increased quality of life. Research on the benefits of nature in urban environments, a field of study that is growing quickly⁽⁴⁹⁾, offers compelling evidence that investment in and promotion of urban green spaces for the health of our community is profoundly important and necessary.

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