GREENERY AND HEALTHCARE

The positive effects of greenery in urban environments

Version 3

Greenery in and around nursing homes, hospitals and other clinics is good for the climate inside and outside the facility, and has a positive effect on patients' state of mind and recovery, as well as the general well-being of patients, staff and visitors. This document provides information on the benefits of greenery on recovery and well-being in the healthcare context, including references to scientific literature. It concludes with some tips on how to ensure the successful and beneficial inclusion of greenery.

WHAT DOES GREENERY DO?

› Visible greenery, both indoors and out, reduces stress and increases the ability to concentrate.

› Plants in hospitals and other institutions purify the air: they reduce concentrations of CO_2 and volatile organic compounds, keeping the air fresh and healthy.

› Outdoor vegetation reduces heat in and around buildings in the summer, lowering heat stress and reducing the need for air-conditioning.

› Green roofs and façades increase insulation capacity, reducing both heating and cooling expenditure.

› Greenery is more attractive and creates more variety, moving the focus away from pain and stress.

› Indoor plants release water vapour, humidifying the air and reducing the likelihood of headaches.

› If the environment is greener, and therefore more attractive, people will be more likely to go outside and to be more active. This also applies to the elderly and outpatients.

Foto: meerwatplantendoen.nl

APPLICATIONS

› Courtyards and other gardens as relaxation/ quiet areas.

› Courtyards and other gardens as treatment areas.

› Green roofs and façades.

› Green walls and indoor plants in central areas, canteens, waiting rooms and some treatment areas.

› Attractive landscaping of the hospital premises, including green borders, hedges and trees.

› Continuing the landscape's natural flow of greenery around the hospital.

PROVEN SUCCESS

› In a US study, in-bed recovery time was almost 10% shorter for patients who had a view of trees than for patients who had a view of a brick wall.[1]

› In the same study, patients with a view of trees used as much as 30% fewer heavy painkillers.[1]

› In a laboratory experiment, people were able to tolerate more pain when there were houseplants in the room.[2]

› 'I just feel less unwell', said one cancer patient receiving treatment in the 'chemo garden' at Tergooi hospital in the Netherlands.

Sources:

1 R.S. Ulrich (1984), View through a window may influence recovery from surgery. Science 224:420-421.

2 V.I. Lohr, C.H. Pearson-Mims (2000), Physical discomfort may be reduced in the presence of interior plants. Hort-Technology 10(1):53-58.

GREENERY AND HEALTHCARE

More information on the effects of greenery

TEMPERATURE

Many hospitals are located in urban areas, where average temperatures are higher than in surrounding areas (the 'heat-island' effect). This effect occurs in both metropolitan and provincial cities and village centres, and increases as built-up areas become denser. Measured maximum differences vary from one to several degrees Celsius, with peak values of up to approx. 8 °C and incidental values even exceeding 10 °C. Heat stress caused by excessively high temperatures adversely affects health (particularly among the elderly, chronically ill and pregnant women) and can increase mortality rates. It also negatively affects the ability of staff to work and concentrate. Research has shown that 35% of urban areas in the Netherlands already experience heat stress at least seven days a year. Rising urban density and further global warming will increase the frequency of periods of heat stress. However, greenery can help to lower urban temperatures.

HOW GREENERY WORKS

› Greenery provides cooling by blocking solar radiation (i.e. providing shade) and aiding evaporation; a 10% increase in vegetation can reduce the urban heat-island effect by an average of 0.6 °C.[1]

› Green roofs (also paired with green façades) improve building insulation. They reduce warming in hospital buildings, both limiting the effects of heat stress on patients and staff and lowering heating and cooling expenses.[2]

› Planting vegetation has a cooling effect on the environment, provided that the cool air from this vegetation can flow into the environment.[3] Green spaces around hospitals therefore help reduce heat stress in the surrounding area.

› Green areas also help trap CO_2.[4]

› Shade trees above car parks reduce fuel evaporation from tanks and reduce heat in car interiors.[5]

RECOMMENDATIONS

› Green roofs atop health institutions reduce heating and cooling costs.

› More vegetated surfaces and planting trees on nature strips around healthcare institutions reduces the heat-island effect.

› Larger green zones in and around hospital areas can help create a more pleasant climate in the broader surrounds, provided the area is structured and landscaped to allow for effective flow of air.

Sources:

1 G.J. Steeneveld, S. Koopmans, B.G. Heusinkveld, L.W.A. van Hove & A.A.M. Holtslag (2011), Quantifying urban heat island effects and human comfort for cities of variable size and urban morphology in the Netherlands. Journal of Geophysical Research. D, Atmospheres 116 (D20129).

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3 B.G. Heusinkveld, G.J. Steeneveld, L.W.A. van Hove, C.M.J. Jacobs & A.A.M. Holtslag (2014), Spatial variability of the Rotterdam urban heat island as influenced by urban land use. Journal of Geophysical Research: Atmospheres 119:677-692.

4 Z.G. Davies, J.L. Edmondson, A. Heinemeyer, J.R. Leake & K.J. Gaston (2011), Mapping an urban ecosystem service: Quantifying above-ground carbon storage at a city-wide scale. Journal of Applied Ecology. DOI: 10.1111/j.1365-2664.2011.0202.x.

5 K.I. Scott, J.R. Simpson & E.G. McPherson (1999), Effects of tree cover on parking lot microclimate and vehicle emissions. Journal of Arboriculture 25(3):129-142.

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GREENERY AND HEALTHCARE

More information on the effects of greenery

AIR QUALITY

The major air pollutants (nitrous oxides (NO_x), particulates (PM10/PM2.5) and volatile organic compounds such as benzene) come chiefly from industry and traffic. Long-term exposure to these substances leads to lung problems and cardiovascular disease. Although air quality at most locations in the Netherlands complies with standards, this does not mean the risk is eliminated entirely. There is no safe lower limit, and concentrations can rise considerably in areas close to busy roads and intersections. Indoor air quality is often poor; large numbers of people in a relatively small space frequently cause CO_2 levels to rise significantly. Volatile organic compounds from construction materials (such as formaldehyde and benzene) may also be present.

HOW GREENERY WORKS

› Indoor vegetation can be used to improve air quality in healthcare institutions. Given enough light and water, plants absorb CO_2 from the air, helping to reduce ambient CO_2 levels.[1]

› Indoor vegetation releases water vapour, helping to humidify dry air inside buildings.

› Plants also filter volatile organic compounds from the atmosphere. For example, it has been shown that the Peace Lily (Spathiphyllum) can absorb and convert 20 mg of formaldehyde per 500 grams of foliage per hour. Formaldehyde is a common disinfectant, but in excessive doses can be poisonous and carcinogenic to humans.[2]

› Patients who receive chemotherapy treatment in a chemo garden rate the location as more comfortable than patients who receive chemotherapy in hospital, citing aspects such as temperature and air quality.[3]

Image: mooiwatplantendoen.nl

RECOMMENDATIONS

› Use indoor plants to improve air quality inside buildings: they remove pollutants from the air (especially CO_2 and volatile organic compounds) and improve humidification.

› Plant shade trees in car parks to reduce the evaporation of fuel from fuel tanks, reduce heat stress for visitors and lower fuel consumption by reducing the use of air-conditioning in cars.

› As ambient air exchange is extremely important for air quality, plant vegetation around healthcare institutions to allow for effective air circulation.

Sources:

1 B. van Duijn, J. Klein Hesselink, M. Kester, J. Jansen & H. Spitters (2011), Report 'Plant in de klas' [Plants in the classroom]. Product Board for Horticulture/Fytagoras/Netherlands Organisation for Applied Scientific Research (TNO).

2 B.C. Wolverton, W.L. Douglas & K. Bounds (1989), A study of interior landscape plants for indoor air pollution abatement (Report). NASA. NASA-TM-108061.

3 Tanja-Dijkstra, K., van den Berg, A., Maas, J., Bloemhof-Haasjes, J., & van den Berg, P. (2017). Chemotherapie in de tuin [Chemotherapy in the garden]. Nederlands Tijdschrift voor Oncologie [Dutch Oncology Journal], 14, 175-181.

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GREENERY AND HEALTHCARE
More information on the effects of greenery

STRESS AND STATE-OF-MIND

Visiting or staying in hospital is a stressful experience for most patients, and high stress levels can stand in the way of speedy recovery. Greenery in and around an institution can help reduce stress in patients, thereby facilitating and accelerating their recovery. Working in such environments is also stressful for nursing staff. For more information on the benefits of greenery for employees, please see the fact sheet on Greenery and Work.

HOW GREENERY WORKS

› Plants in waiting rooms reduce stress.[1]

› Plants in hospital rooms reduce anxiety and pain.[2]

› Visiting an indoor garden lifts the spirits of children in hospital treatment. [3]

› Patients who receive chemotherapy treatment in a chemo garden report slightly more positive and restorative feelings than patients who receive chemotherapy indoors. [4]

RECOMMENDATIONS

› Make sure the view from hospital rooms includes greenery (preferably visible from the bed), and the same for views from other locations frequented by patients (e.g. waiting rooms, common rooms).

› Create attractive green outdoor areas (gardens) for ambulatory patients (and care providers) to relax and get away from it all; make sure these areas are accessible to people in wheelchairs or with other mobility restrictions.

› Ensure easy access to the indoor and outdoor green areas, including areas that are not necessarily part of the institution itself, such as public green spaces.

› Also use other means to promote the use of these green spaces (information, signs, facilitated activities, etc.).

› Create larger green areas in the immediate environment to provide places where staff and patients can go for walks, promoting greater productivity and recovery.

Sources:

1 C.J. Beukeboom, D. Langeveld & K. Tanja-Dijkstra (2012), Stress-reducing effects of real and artificial nature in a hospital waiting room. The Journal of Alternative and Complementary Medicine 18(4):329-333.

2 S.H. Park & R.H. Mattson (2009), Ornamental indoor plants in hospital rooms enhanced health outcomes of patients recovering from surgery. The Journal of Alternative and Complementary Medicine 15(9):975-980.

3 S.A. Sherman, J.W. Varni, R.S. Ulrich & V.L. Malcarne (2005), Post-occupancy evaluation of healing gardens in a pediatric cancer center. Landscape and Urban Planning, 73, 167- 183.

4 K. Tanja-Dijkstra, A. van den Berg, J. Maas, J. Bloemhof-Haasjes & P. van den Berg (2017), Chemotherapie in de tuin [Chemotherapy in the garden]. Nederlands Tijdschrift voor Oncologie [Dutch Oncology Journal], 14, 175-181.4.

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GREENERY AND HEALTHCARE
More information on the effects of greenery

RECOVERY

Greenery in and around hospitals provides relaxation and diversion for convalescing patients.

HOW GREENERY WORKS

› Having a view of greenery from the hospital room helps reduce the length of hospital stays (by nearly a day).[1]

› In an American hospital, patients recovering from gall-bladder surgery who had a view of trees from their room used fewer heavy painkillers than those whose view was of a brick wall.[1]

› A view that includes greenery shortens hospital stays.

› Hospitals that incorporate greenery in their design observe more social support for their admitted patients.

RECOMMENDATIONS

› Green indoor and outdoor areas can also be used to provide therapies in a less stressful environment (e.g. chemo gardens or green physiotherapy exercise rooms).

Source:

1 1 R.S. Ulrich (1984), View through a window may influence recovery from surgery. Science 224:420-421.

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FURTHER INFORMATION

This document is one of a series of five on the added value provided by greenery in our living environment.

The remaining documents take a closer look at the role of greenery in Work, Education and Residential environments and at a number of more general aspects (biodiversity, water management, noise and property prices).

All the documents and large amounts of background information can be found through the Greenery and Well-being portal of www.groenkennisnet.nl.

There are many real-life applications and studies that illustrate and demonstrate the added value of vegetation.

Other useful sources of information include:

- https://www.groenkennisnet.nl/nl/groenkennisnet/portalen/leefomgeving/groen-en-welbevinden.htm
- https://ruimtelijke adaptatie.nl/hulpmiddelen/factsheets-groen/
- This also provides a table listing 120 tree species and their specific benefits as vegetation.
- www.degroenestad.nl
- www.royalfloraholland.com
- www.wur.nl

Specific questions on topics such as reference projects, research results, etc. can be sent directly to joop.spijker@wur.nl.

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