EUROPEAN LANDSCAPE CONTRACTORS ASSOCIATION

ELCA

ELCA Research Workshop

Green City Europe – for a better life in European cities

www.green-city.eu

Partner countries/associations

Canada
China
Japan
USA
European Arboricultural Council

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The President´s Message

Dear readers, due to demographic changes, the climate change, globalization and structural changes the cities of Europe are facing considerable changes. In this context we can see a development based on parallel processes of growth and decline. Regions and cities are growing above all in metropolitan areas. Rural regions as well as structurally weak regions are in decline. The increasing urbanisation provides the chance to combine sustainable urban development with sustainable planning of free areas in densely populated areas. A sustainable housing structure provides an essential contribution to the reduction of the environmental impact in cities. Avoiding high traffic emissions, providing areas of fresh air, reducing the sealing of land, maintaining and respectively creating water retainment areas as well as green areas – these are the urgently needed planning measures. We are not talking about aesthetic repairs but about the essential basis for future urban development.

The principle of sustainability of interior development before exterior development applies to the same extent to growing as well as to declining regions and must not only encompass structural and civil engineering, but also be applied to the development of green areas. This brings us to the topic of our workshop. For us the green city is the model of the future, creating urban structures with environments with life-quality. The sustainable green development of cities is a task to be continuously developed, which calls for integrated and regionally coordinated activities of all disciplines. The ELCA supports sustainable urban development, which is based upon available resources, climate protection and health targets. Therefore, we also commit ourselves to supporting better research provided with more financial means. European gardening and landscaping with its large variety of tasks depends on scientific results to provide sustainable solutions for better cities. It is important for us to further develop environmental research on construction and vegetation in regard to urban development to provide answers to the problems of the next decades: climate change and the interaction of biosphere and health, water management, biodiversity and the design of green areas. These are the important topics. Sustainable green urban development is a permanent task, which calls for the integrated and regionally coordinated cooperation of all disciplines. Interdisciplinary research activities on a European level are just as indispensable for sustainable urban development. It is necessary to ensure the cooperation of architects, urban planners, natural scientists, and representatives of the public health sector, those making political decisions and artists, who finally represent all European regions.

Our first workshop aims to start these activities, thus providing an important contribution towards sustainable urban development. The scientists from all over Europe have shaped this workshop with their contributions on Green and Health, Green and Particulate Matter, Green and Urban Climate as well Biodiversity in Cities.

In the Committee of the Regions many representatives of European institutions listened to the presentations to later report about them to the respective counselling committees.

Should the eighth EU Research Frame Plan, which is being discussed at present, consider our concerns we would very much appreciate the respective research institutions in Europe in future being granted the opportunity to further deepen the herein mentioned areas of research.

We wish you interesting new insights when reading the papers presented at this workshop.

Emmanuel Mony, President

Introduction

The European Landscape Contractors Association may look back onto a long and successful job. During this time the ELCA has developed into a strong association of 74,000 companies and 330,000 staff members.

Since its foundation the association has been supporting the exchange of young landscaping gardeners all over Europe. With almost 350 participating companies from 22 countries, of which 12 are outside Europe, this has been a flagship project, which is an example for the integration of Europe.

Topics like the reduction of bureaucracy, the prevention of distortion of competition due to European harmonisation, standards and legal standards or the clarification of problems in existing European laws and guidelines have been in the foreground of our lobby work.

In Europe the ELCA contributes in making politics generally better, more practicable and very often more understandable. In doing so the association of the landscape gardeners in Europe sees itself as service provider. For this purpose the landscape gardeners have designed a well-working network registering every positive feedback.

On the European level the ELCA would like to get more support regarding the research into green environmental topics. The effects of green areas on the well-being and the productivity of people are to be researched. On the one hand the results of the research are to show direct effects on the economy, among them the gardening and landscaping industry. On the other hand findings on indirect economical effects are to be expected as well – e.g. on the relief of the health system, lower environmental loads and environmental catastrophes (floods) and not at least on less loss of plants due to better adapted vegetation.

The ELCA does not only initiate research studies but also concentrates on the pragmatic support of the companies. In this connection the support of European public relations, training and further education, supporting of young gardeners and the expert analysis of European laws, especially with regard to the environment as well as of the European rules and standards must be mentioned.

The ELCA regularly participates in so-called consultation-processes of the EU. Since the ELCA is of the opinion that the purpose of such consultations – i.e. triggering a wide spread discussion with all those involved in the industry as well as determining possible measures of improving the efficiency of the domestic market – are reasonable measures of influencing of events. At present for example consultations concerning the topic of "VAT" and "Public placing of orders" are being prepared.

The green profession is no longer afraid of competition. Just the opposite. The industry of gardening, landscaping and building of sport grounds supports more competition and market economy. And we also want that this competition of efficiency is not being distorted. This is just why the ELCA demands the same taxation of landscape gardeners and farmers or producing gardening companies.

The ELCA wants the European Union to increasingly plan for research activities all about green in its "8. EU-Research frame programme 2014-2020" and to provide sufficient funds. The ELCA is of the opinion that it is important and decisive to get well founded facts on the positive effects of green on the environment – including change of climate – and on people's health.

Apart from other industries the industry of gardening and landscaping also depends on such research results. The experts for building with green can by now provide important contributions to a resources-conserving, environmental friendly and competitive economy. These are just the areas the European Union wants to promote in the respective focus of its Europe 2020-concept. The important point will be to improve the chances of application-oriented projects.

There are still research gaps concerning the effects of plants and trees on the environment. The assumed connections must be researched more profoundly and proof must be provided. This is just what working fields of the gardening and landscaping industry depend on to be able to provide solutions. Therefore research into environmental questions must be increased, e.g. to allow us to clearly answer questions concerning the change of climate, the interactions between biosphere and human health, concerning the maintaining of biodiversity as well as a of sustainable city development and green design.

There still is considerable demand for basic and application-oriented research to better understand the benefits of green as well as to evaluate the mechanisms of plants and their efficiency potential in order to provide the responsible persons of politics and economy with sound decision guidance.

The Green City in France – Cité Verte

In France, Green City is called Cité Verte. Cité Verte is a European citizen approach that aims to make the city, understood as a place to live, a place to live better, where plants, landscaping and nature in the city ensure benefits for citizens in terms of quality of life, welfare, development of the economic and social links, ecological links and heritage links. Cité Verte meets society's demand for a life set that is a combination of cultural choices and a future policy.

Val'hor, the French interprofessional association for horticulture and landscaping industries, is the standard-bearer of Cité Verte. Since 2008, under the banner Cité Verte, Val'hor has been active in relation to this particular approach and targeted locally elected representatives, materialized through the think-tank "Le Cercle Cité Verte", the contest "Les Victoires du Paysage", books and brochures, and the event "Les Assises Européennes du Paysage". In 2011, 10th-12th October, in Strasbourg, the central theme will be "Landscape creator of riches".

The members of Val'hor are the representative professional associations; UNEP, for the landscape contractors, FFP for the landscape architects and FNPHP for the growers.

With Cité Verte, landscape professionals work under a common and neutral banner, hosting professionals and everyone who can support by reflexion on their experience, their research expertise.

Promoted by professionals, Cité Verte intends to raise awareness of the real value of plants and landscaping: an issue of general interest to future generations.

Cité Verte is of course one of the partners of the European green city convention, ratified in 2009 by all the Green City European representatives, with the partnership of ELCA.

For more information:
www.lesassises.eu
www.citeverte.com
www.valhor.com

DIE GRÜNE STADT-Foundation in Germany

During the past ten years the discussions on green cities in Germany have become more and more serious. In most cases, however, people above all discussed the costs of green public space, its effect on citizens was – if at all – of minor importance. Therefore, already in 2003 some regional organizations established a national Green Forum to give the debate a new direction. In 2009 this Forum was legally set up as a foundation called Stiftung DIE GRÜNE STADT. This foundation serves as an information desk for all relevant groups. The objective of its operation is to create a pool of knowledge and experience concerning urban green. The foundation and its members are convinced that plants, public green space and nature consciousness must be part of an integrated plan for city development. The organizations that cooperate in the foundation are among others health professionals, building companies and architects, real estate owners' associations, industrial companies, consultants, associations, authorities, Agenda 21 work groups, municipalities and universities.

The foundation DIE GRÜNE STADT incorporates to a large extent organizations operating in horticultural sectors and landscaping in Germany. Close connections to the media make sure that up-to-date information is made available to the industry and beyond. Hanns-Jürgen Redeker, chairman of the Board (Kuratorium): "Due to our close cooperation with the media, our website www.die-gruene-stadt.de and our brochures we are able to support the sector with all relevant information about the benefits of plants and green urban landscapes. We organize symposia, take part in negotiations with politicians and we inform the public about the advantages of successful green urban space and various other green aspects e.g. air quality, noise reduction, climate, vandalism etc. The core message is, that plants and green cities are important keys to a healthier, happier, more productive and more peaceful society."

The central aim of the foundation is to support environmental protection and research, to increase the awareness of citizens, politicians and decision-makers about the value of urban green and to maintain an interdisciplinary debate on the quality of urban life.

A group is more efficient and credible in political lobbying than individual organisations, on national and international levels. Therefore the foundation works together with similar groups in different European countries (www.thegreencity.eu) and with numerous city councils to exchange best practice cases of urban green space.

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www.die-gruene-stadt.de

Green City Hungary – Zöld Város Magyarország

After joining the Green City Movement in Milan 2010, a Green City Workgroup of MAKEOSZ (HULCA – Hungarian Landscape Contractors Association) started to work in two directions: to set up the local Green City organization(s) and to work out the local GC principals.

The Green City organizational structure is:

1. The Green City Council of Hungary. Members of the GC Council are MAKEOSZ (HULCA), Landscape Architect Arm of Chamber of Architects, MÖFÖSZ (City Head Gardeners Association), ZÉOSZ (Green roof Association), Faculty of Landscape Architecture of Corvinus College, West Hungarian University. As of 2011 June the Ministry of Regional Development (Environmental Protection State Secretary) also delegated a representative to the GC Council.

2. For Greener Cities Nonprofit Ltd. (Zöldebb Városokért Nonprofit Kft.) was set up by the presidency of MAKEOSZ – in accordance with the wish of the GC Council – as the official Green City representative and executive Organization of the Country.

The 4 basic principals towards green cities were identified as:

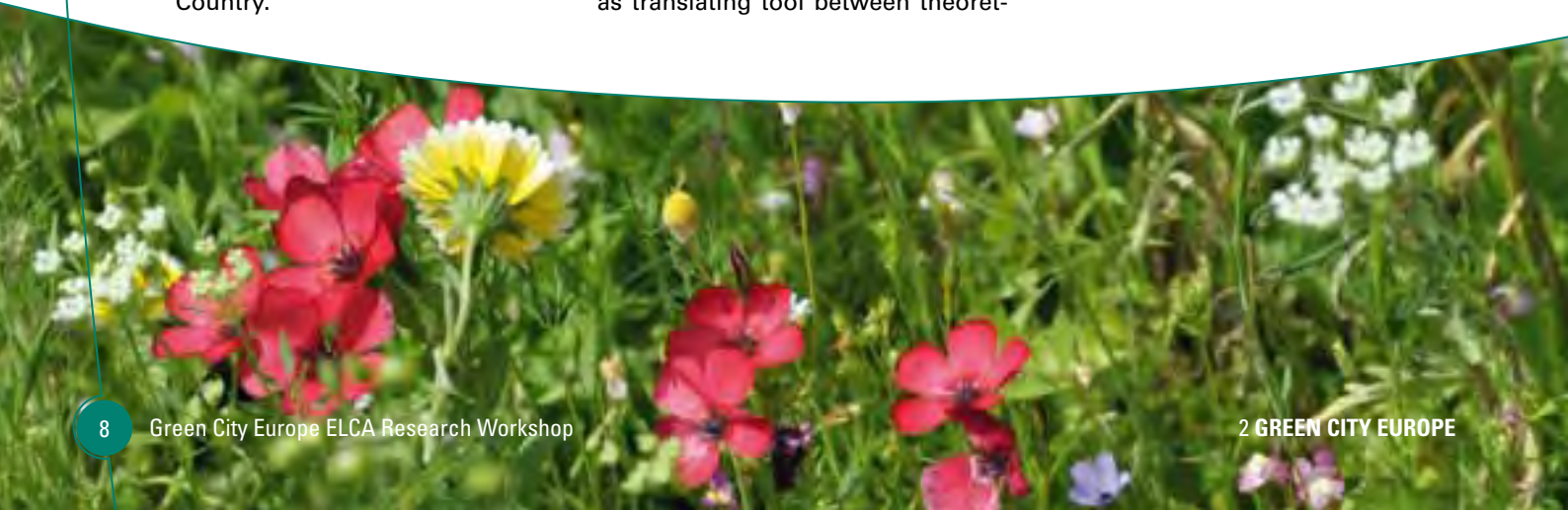
1. Cities have to be reconnected to the ecosystem in order to enjoy nature's free services.
2. Integrated approach – real green has to be part of all city planning activities from the very first thoughts.
3. Interdisciplinarity – extended team planning and execution.
4. Sustainability – Green must not be the overlooked part of the sustainability triad (human-economy-environment) any longer - otherwise the balance between the above three cannot be achieved.

The Hungarian Green City organizations have to act as catalysers, bring the different players of the green or green related sectors together in order to MAKE GREEN CHANGES HAPPEN NOW.

Based on numerous discussions the creation of a marketable accreditation point system was decided and implemented. The Green City Accreditation Point System is based on the European Green City and partly the overseas knowledge base acts as translating tool between theoretical knowledge and work in practice. It is available for all European Green City organizations for checking, commenting or test using. Together with the Dutch GC Toolkit coming out in this autumn it will be a comprehensive, thought driving system. Year 2011 is the GC APS's first – test – year with increasing numbers of test projects. The first Green City candidate, Miskolc, the steel city – has decided in a contract of interest that all of its city projects will have to pass the Green City accreditation level.

Communication activities are the core part of our local Green City strategy. Besides the new website, we run Green City conferences, GC lectures on other conferences, workshops as well as high school and university lectures. We have been on TV and radio several times and more than a dozen articles have been placed in gardening and architecture related journals.

For more information:
www.green-city.hu



Green City Italia

Green City Italia was founded as a non-profit association on 19th June 2010. The President is Andreas Kipar, architect and landscape architect. He works in planning, landscaping and environmental requalification of historical green areas, both in Italy and abroad. He is the official Italian foreign correspondent for IBA Fürst Pückler Land 2010.

The co-president is Giovanni Sala, agronomist; professionally he designed and directed the restoration and design of green public spaces, the environmental recovery of old quarries, dumps and dismissed areas.

They both carried out teaching activities in various universities and they are co-founders of the LAND group, dealing with Landscape, planning and nature development.

The Scientific Committee, as well as the operative structure of Green City Italia, is made up by persons coming from different disciplines and with complementary expertise: architects and landscaping architects, agronomists, teachers, historians, physicians.

Green City Italia: philosophy

Green City Italia implements and develops the objectives of the homonymous European associations and foundations active in Europe; in particular it aims to improve the quality of open spaces, as a potential to bring enrichment across business and society. We call this approach "the Green City Initiative": to consider the landscape structure from the beginning of the planning process and to put open space on an equal footing with buildings and infrastructure.

The Green City philosophy is based on the concept that plants can bring social, economic and environmental benefits. And more plants and green space can make the difference.

Green City Italia: recent actions

"Green City" is a response to the current social and political challenges: it aims to inform the economy and policy, but also the citizens, about the many positive features we mentioned, in order to create a shared culture for more liveable and green cities.

Starting from 2009, Green City Italia has developed the following measures:

1. Spreading awareness of the potential of urban green space to increase the welfare of citizens, as well as the economical managing of urban transformations;
   "Working with nature",
   Roma 2010-2012
   "The signature of the Green Charta",
   Milan, 06.06.2010
2. Promoting research and projects for the improvement of urban quality;
   "Milan Green Rays", for the Milan Expo 2015
3. Uniting all those who are interested in promoting ecological culture in design, implementation and management;
   "First European Green City Forum",
   Milan, 04.06.2010
4. Connecting public administrations, organizations, professionals and scientists;
5. Promoting activities on environmental sustainability issues, such as:
   cultural activities: forum, workshops, exhibitions, competitions;
   "Green Lectures",
   Triennale Milano, 30.06.2011
   editorial activities: publications and promotion of books, conference proceedings, research, projects;
   "Il Verde è benessere, l'azione benefica delle piante sulla nostra salute" and "Alberi e piante, danno respiro alle città", published in June 2010
   project activities: good design practices for sustainability;
   urban horticulture projects:
   "The vegetable garden of faith",
   Milan 2011
   social activities: initiatives related to health and wellness.

Green City Italia: future vision

1. "Charta Milano" 2015: a manifesto for better nutrition and against world hunger*: an idea that will allow the Expo event to leave a tangible mark on the planet
2. Green City – Health City (a big event in Milan for 2012): create sustainable cities for human health and disease prevention: slow and green mobility, good nutrition, food quality, landscape for sports and well-being.
3. Green infrastructure as the central point of investigation and development: Green City Italia will support the European Commission in regard to these issues and goals.
4. Towards Expo 2015: Feeding the planet, energy for life. A slow city in fast times, Milan is taking advantage of the forthcoming Expo 2015 to transform its open spaces. Green City Italia promotes the Green Rays strategy, providing new symbols for the city future and the greatest challenges for today's cities. This strategy is the aim of the European movement, the European Green Cities Network (EGCN).

Scientific Committee

Andreas Kipar, president, landscape architect

Giovanni Sala, co-president, agronomist

Virginia Bombelli, environmental biologist

Aldo Castellano, architect, professor at Politecnico of Milan

Paolo Veronesi, oncologist, president of Umberto Veronesi foundation

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The Green City in the Netherlands – De Groene Stad

In the Netherlands, no less than 65% of the population lives in urban areas, and this trend will continue over the coming years. The rapid increase of the urban population has meant an increase in building density and, in turn, adverse consequences for urban public green space. In response to this, Plant Publicity Holland developed 'The Green City' in 2002. The Green City is a concept that demands a different approach to urban development. According to this concept, the design and reconstruction of urban areas should involve all the relevant disciplines (architecture, water management, civil engineering, landscape architecture, urban planning, construction industry, etc.) right from the start of the planning process if the ultimate design is to be successful. The Green City philosophy thus demands an integrated approach in which green space is an essential component.

To realise this objective The Green City that evolved in the Netherlands led to various projects, the most striking and recent of which are described here.

Promoting The Green City internationally means promoting Dutch business

Plant Publicity Holland is going to team up with the Dutch Ministry of Economic Affairs, Agriculture and Innovation; the International Association of Horticultural Producers (AIPH); and the internationally known landscape architecture firm of Niek Roozen bv to promote The Green City concept internationally as an integrated vision for developing our residential, working and recreational environments in a socially and economically responsible way. For its more sustainable policy of developing living environments on an international level, The Green City concept is receiving the support of the Ministry of Economic Affairs, Agriculture and Innovation. In other words, this would mean using The Green City concept to benefit Dutch economic interests: in addition to the horticultural sector, this would also involve the construction industry, architecture and landscape architecture, the health care sector, etc. in international activities.

Green Amenities Pay!: a campaign advocating their economic benefits

Spending cuts are currently the focus of policy plans at all levels of the government in the Netherlands. And green amenities are not being spared. In order to show administrators, politicians, and policy assistants as well as private organisations, etc. that cuts made to public green space eventually do nothing but cost money instead of saving it, a number of parties dedicated to the importance of public green space and the ANWB (the Dutch tourist association) have taken it upon themselves to draw public attention to the fact that investing in green space pays. Green space is not a cost item but a social and economic investment that will pay for itself. The objective of this campaign is to quantify the value of green space under the auspices of The Green City as based on interviews, practical examples, recognitions and research findings. Presented to launch the campaign was Groen Loont (green pays), a book about the economic benefits of green amenities. As a follow-up, four newsletters with the theme of "residential, working and recreational environments and green space & well-being" are being published in 2011. In addition, the Entente Florale Nederland conference to be held on 27th October will focus on the Green Amenities Pay! campaign.

Competition for the Green City Award calls attention to an integrated approach

It is important that developers, organisations involved in construction and urban planning professionals start realising that an approach that integrates the parties directly involved with the built environment and the parties involved in green space is necessary for creating a liveable environment. The quality of life in urban areas is closely related to the effective embedding of green spaces within urban environments. As an incentive to this development, and to draw attention to it, Plant Publicity Holland and VHG, (the Dutch association representing the horticulture and landscaping sector) have developed a special Green City Award especially for this purpose in 2011.

For more information:
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www.degroenestad.nl

The UK Green Forum – communicating the benefits of plants and green space

Urban green infrastructure emerged through the last decade to become a significant part of the discussion around sustainability, liveability, development and regeneration in the UK. The "Green City Philosophy", which can be summed up as being that plants and green space are not a cost but bring value from a social, economic and environmental point of view, was being developed during the decade. This culminated in 2009 when a new group of organisations including university departments, green space charities, trade bodies and commercial organisations came together under the banner of the UK Green Forum.

These organisations are now working together to promote the key message of the Green City initiative – that the case for green space can best be made in an evidence-based way, independent of sectoral interests. Therefore improving the transfer of information within and between organisations, fast-tracking the results of scientific research into industry and policy and working and learning in an international context are at the basis of what the Forum does.

Each organisation involved brings practical skills, networks and experience to projects and communications.

International agreements

The UK Green Forum has been a signatory of three international agreements since 2009 – Strasbourg (2009), Milan (2010) and Zurich (2011). Each of these has set out statements asserting the critical importance of green space for successful, sustainable urban development and living. They represent important "landmarks" in the development of the initiative. Participation in international meetings and knowledge transfer enables the UK to benefit from information and ideas that emerge elsewhere.

National actions

The Green City is an active part of the UK Garden Centre Association's support for retailers who wish to develop their green and community credentials through an exciting award scheme. Competing for the "Green Community Award" gives retailers the chance to show customers their commitment to the local community and environment. Not only do they do this through their actions, but their communications are enhanced through the use of a logo scheme and an annual award. The Forum works with professional garden writers through a tie-up with the UK Garden Media Guild to sponsor a further award for journalism that promotes the "real value" of plants and gardening.

In planning with forum members right now is a professional seminar which will explore such themes as the role of the social context on tree survival rates, including the ways in which communities can come to value and "own" their green spaces for the benefit of all. A productive event is expected later in 2011. We work actively with Forum members through the year to promote their own green space-related events through our newsletters, website and other networks. We are preparing for a period of intensive lobbying of politicians and decision-makers this autumn.

For more information:
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Invitation

ELCA Research Workshop
Green City Europe

ELCA Research Workshop

Current Research on the Importance of green and open spaces in European Towns

Tuesday, May 24, 2011

Committee of the Regions
5th Floor, Room JDE 51
Rue Belliard 99 - 101
1047 Brussels

The ELCA wants to create a platform for scientists from all of Europe with the first research workshop in the Committee of the Regions of the European Union.

Key research areas on the topics greenery and health, greenery and micro particle pollution, greenery and town climatology as well as biodiversity in European towns will be presented, but research deficits will also be highlighted and proposals for new continued research ideas will be compiled.

Research on the importance of greenery in towns aims to find contributions for solving the big challenges of our time in the environmental sector.

The landscape garden industry relies on scientific results in its fields of work to be able to offer solutions based on state-of-the-art science and technology.

Therefore the environmental research on technical topics relating to construction and vegetation must be expanded to be able to have answers for the problematic areas of the next decades.

Among these are for example the questions on climate change, the interaction between the biosphere and human health, managing water resources, the conservation of biodiversity, sustainable urban development and designing green areas.

We would be very pleased to welcome you.

Emmanuel Mony
President

Dr. Hermann J. Kurth
Chief Executive

Please note:

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Programme

Tuesday, May 24, 2011

09:00 am **Welcome Coffee**

09:30 am **Welcome**
Emmanuel Mony, ELCA President
Moderation: Robert Schäfer, TOPOS

09:45 am **Introduction**
Resilient urban development in Europe - without green?
Professor Dr. Diedrich Bruns, President of the European Council of Landscape Architecture Schools (ECLAS)

10:00 am ***EU funded environmental research and outlook towards a common strategic framework for research and innovation***
Arnoldas Milukas, *European Commission, DG Research & Innovation, Directorate I - Environment*

10:15 am **Green and Climate Change**
Modelling the benefits of urban forests for better management
Alfred E.G. Tonneijck, *Expertise Centre Triple E, Arnhem, NL*
Measurement of particle deposition to urban vegetation
Dr. Marcel Langner, *Humboldt University of Berlin, DE*
Green cities and climate change
Professor Eduardo Croci, *IEFE – Centre for Research on Energy and Environmental Economics and Policy, Commercial University Luigi Bocconi, Milan, IT*
Urban climate and urban green
Professor Dr. Lutz Katzschner, *University of Kassel, DE*

11:45 am **Urban Green and Biodiversity**
Bio-diverse cities
M.Sc. Marco H.A. Hoffman,
Wageningen University & Research Centre, NL
Studies on urban ecology and urban ecosystems at the University of Helsinki, Finland
Dr. Vesa Yli-Pelkonen, *University of Helsinki, FI*

12:30 pm ***Judith Merkies,*** *MEP, S&D,Group of the Progressive Alliance of Socialists and Democrats*

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Programme

Tuesday, May 24, 2011

12:45 pm **Lunch Break**

1:45 pm **Green and Town Development**
Integration of garden and landscape construction in administrative regulations and planning tools based on scientifical safe and sound knowledge of their positive effects and value
Dipl.Ing. Bernhard Scharf, *University of Natural Resources and Applied Life Sciences Vienna, AT*
An expert system for calculating the costs of open spaces over their entire life cycle
Dipl.-Ing. Florian Brack,
Zurich University of Applied Sciences, CH

2:30 pm **Sirpa Pietikäinen,** *MEP, EPP, Group of the European People's Party (Christian Democrats)*

2:45 pm **Coffee Break**

3:00 pm **Green and Health**
Green factor to maximise the potential of health benefits for all
Dr. Ulrika K. Stigsdotter, *University of Copenhagen, DK*
Vitamin G
Dr. Jolanda Maas, *National Institute for Public Health and the Environment (RIVM), Bilthoven, NL*
Plants, health, well-Being and urban planning
Dr. Sandrine Manusset, *Market Research Institute "Environment and Society", Nevez, FR*
Determinants and strengths of restorative (stress-alleviating) experiences in favourite green, waterside and urban environments in Finland
Professor Dr. Kalevi Korpela, *University of Tampere, FI*

4:30 pm **Summary, Future Perspective**
Andreas Kipar, *LAND Milano Srl, President Green City Italia*
Emmanuel Mony, *ELCA President*

5:00 pm **Reception, 6th Floor, Atrium 6**

Resilient Urban Development in Europe – without Green?

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Diverse and friendly green urban open spaces are desirable. This is reflected in high real estate values adjacent to attractive open spaces. There is a hypothesis that green contributes not only to tangible but also to intangible landscape services such as benefiting human health and well-being. Individual studies report on the benefits of green to human health, both physically and mentally, on green open spaces affording ventilation and thermal comfort in urban heat islands, on retention of storm water, on preventing air pollution, and on people using such areas for food and fuel/energy production. Functions that are important for the quality of life, adapting to climate change and for emergency management related to natural hazards such as floods, fires and earthquakes (WHO 2005). Thus, green open space would contribute to resilient societies. However, there is little proof that substantiates such hypothesis and much research is needed to better understand such complex relationships.

Urban Green and Society

Hippodamus (498 BC-408 BC) included a so-called 'Agora' into the layout of Milet, his home town. This Agora probably had trees. Hippodamus understood that urban open spaces form city centres not only geographically but also as the focal points of society. It is these places that lend a city identity. The Agora of Hippodamus' time became a political and commercial space. Of all people who lived in a Greek Polis, those who were the most important ones lived the closest to the Agora.

This model lives on today. Anybody who played the game Monopoly knows well how the legendary Park Place is a very expensive property where rents and mortgage values are among the highest. Everybody dealing in real estate today is keenly aware about the importance of location, and, taking the example of London, England, finds the finest properties are located at green open spaces, such as Regents Park. To quote from a current advertisement:

*"Amazing location, nestled amongst the famous **nash** terraces of **regents park**... ...with magnificent views overlooking **regents park**. this property is in a truly..."*

Not all people are so fortunate and wealthy enough to own property next to an urban green space. Many live in multi-storey-buildings, some with balconies as the only opportunity to enjoy fresh air. How do people grow up in such locations? To try and find out if and how people spend time outdoors we have interviewed, for example, teenagers who live in less privileged sections of cities. We find that such teenagers, like people of all ages, very much enjoy green open space. What we have also learned is that, among others, these young people have Hate Places and Favourite Places. They hate, by and large, unsafe places lacking a minimum in social control (confirming, again, what we remember from reading Jane Jacobs). Such findings indicate how Urban Green might contribute to **Social Resilience**. However, these are mere spot checks and offer no reliable proof of a real relationship between availability of Urban Green, the appreciation of green open spaces by different cultural groups, feeling of safety, degree of vandalism and crime, etc. More extensive studies report on determinants of restorative experiences in favourite places (Korpela et al. 2008).

From different research we have learned how much Urban Green may contribute to **Health Resilience**. Personal health is an important factor in public health. There appears to be conflicting information regarding correlations between health and health-related quality of life indicators on the one hand and the accessibility of green space and the amount of time people are able to spend in contact with green areas on the other hand (Maas et al. 2008, Grahn & Stigsdotter, 2010, Stigsdotter et al. 2010). Some epidemiological studies report findings that appear to be supporting the view that based on few clear indicators green space has beneficial health effects, thus raising the possibility of trans-European epidemiological studies (Mitchell et al. 2011). However, establishing a causal relationship is difficult, as the relationship is complex. Simplistic urban interventions may therefore fail to address the underlying determinants of urban health that are not remediable by landscape redesign (Lee & Mahes-waran 2010). To find evidence for the physical and non-physical health benefits of urban green spaces, a number of parameters must be considered. These would include environmental factors such as the quality and accessibility of green spaces and how they affect its use for physical activity. User determinants, such as age, gender, ethnicity and the perception of safety, are also important (Lee & Maheswaran 2010).

In every city, we find not only Hate Places and Favourite Places, but also Hot Places and Cool Places. In their dissertations Sandra Lenzenhöver and Hendrik Laue have studied the microclimatic properties of urban open space (Laue 2009, Lenzenhöver 2010). Urban Green has an important role in people's well-being in such places and, as every one knows from personal experience, people are searching for shade dur-ing summer days and for sunny spots during the winter. Urban Green offers both, and everything in between. Beyond thermal comfort, **Climate Resilience** with Green extends as far as Hazard Management. Where, if not the urban open spaces, would we store water during flooding events? Where, in fact, would we place collecting places during emergencies, including earth quakes, if it were not for the (mostly green) open spaces? Urban green also contributes to **Ecological Resilience** in cities. Included are urban nature areas as well as well used garden plots, such as allotment gardens, but certainly also nature development areas such as restored rivers and streams.

All of these points lead to my final point: **Identity Resilience** and how Urban Green supports people's sense of place. Green projects, such as nature development projects in urban areas, are always located very near to where local people live and work, where they go shopping and where they spend recreational times. People give value to these places and make them part of their lives. Planning and constructing new green areas are exciting events and people wish to be included. This is the spirit of the European Landscape Convention: landscape is what people make it, make it in material terms, and make it in their minds and hearts. Modern forms of place making and of taking ownership include a great variety of people, such as those who have lived at one place for all of their lives, and those who are what we have learned to call migrants, even young urban professionals, and also those who initiate gentrification of run down neighbourhoods. What we should want to know is how new and seemingly strange cultural mixes might help enriching our professional work. We need to try and understand how urban open spaces are perceived and what people would want to do in these spaces. There is indeed much still to be learned.

References

De Groot, R.-S.; Wilson, M.; Boumans, R. (2002): A typology for description, classification and valuation of ecosystem functions, goods and services. Environmental Economics 41: pp 393-408.

Fisher, B.; Turner, R.K., Morling, P. 2009: Defining and classifying ecosystem services for decision making. Ecological Economics 68: 643-653.

Grahn, P. & Stigsdotter, A.U.K., 2010, 'The relation between perceived sensory dimensions of urban green space and stress restoration ', Landscape and Urban Planning , vol 94, nr. 3-4, s. 264-275.

Korpela, K.M., Ylén M., Tyrväinen, L., Silvennoinen, H., 2007. Determinants of restorative experiences in everyday favorite places. Health Place. 2008 Dec;14(4):636-52. Epub 2007 Oct 23.

Laue, L., 2009. Gefühlte Landschaftsarchitektur – Der Einfluß der Planung auf das thermische Empfinden in mikroklimatischen Freiraumeinheiten innerhalb städtischer Strukturen. Dissertation University Kassel.

Lee, A.C.K. Lee, Maheswaran, R., 2010. The health benefits of urban green spaces: a review of the evidence. J Public Health (Oxf). September 10.

Lenzholzer, S., 2010. Designing atmospheres. Research and design for thermal comfort in Dutch urban squares. PhD thesis Wageningen University, Wageningen.

Maas, J., Verheij, R. A., Spreeuwenberg, P., Groenewegen, P. P., 2008. Physical activity as a possible mechanism behind the relationship between green space and health: A multilevel analysis. www.biomedcentral.com/1471-2458/8/206 (BioMed Central Ltd.).

Mitchell, R., Astell-Burt, T., Richardson, E. A., 2011. A comparison of green space indicators for epidemiological research. J. Epidemiol. Community Health February 4.

Mitchell, R., Popham, F., 2008. Effect of exposure to natural environment on health inequalities: an observational population study. Lancet 372: 1655-60.

Stigsdotter, A.U.K. , Ekholm, O., Schipperijn, J., Toftager, M., Jørgensen, F.K. & Randrup, T.B. ,2010. ' Health promoting outdoor environments: associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey ', Scandinavian Journal of Public Health , vol 38, nr. 4, s. 411-417.

Termorshuizen, J.; Opdam, P., 2009. Landscape services as a bridge between landscape ecology and sustainable development. Landscape Ecology. Doi: 10.1007/s10980-008-9314-8.

WHO, World Health Organisation, 2005. Ecosystems and Human Well-Being. Health Synthesis. A Report of the Millennium Ecosystem Assessment. Core writing team: Corvalan, C., Hales, S., McMichael, A., Geneva.

1 Forum was the Roman equivalent of the Agora

2 In 1811 the Prince (later King George IV) commissioned architect John Nash to create a master-plan for the area that is now the 166 hectare Regents Park. The park is lined with elegant white stucco terraces of houses. Originally the park was largely comprised of informal open grass-land until the early 1930s when gardens were formed within the park, including the garden for Queen Mary who died in 1936.

Plants, Health, Well-being and Urban Planning

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In 2010, we realized a study about the positive impacts of plants in the cities under the guidance of Plante et Cité that is a national platform for experiments and technical information for green spaces and urban horticulture. The UNEP participated in the following committee of this study with the Union of the horticulture (Val'hor), the University of Angers (AgroCampus) and the CRESGE of the Catholic University of Lilles.

The study focuses on urban green spaces. The first aim of the current study is to describe and to comment the impacts of green spaces from a systemic synthesis based on international research in urban ecology, sociology, psychology and geography in particular between 1980's to nowadays. That permits to point out the plurality of effects of the green parks. For the needs of the analysis, the allergen effects of the plants were not evaluated. In total, more than 100 studies had been consulted. Secondly, the results were applied as urban planning recommendations.

Since 2000 years, the development of sustainable urbanism principles has resulted in a strong demand by urban residents for green space for aesthetic enjoyment, recreation and environmental preoccupations. Thirdly, we identified the people, scientists and no scientists, who continue to work in this way.

For the ELCA Research Workshop, we will present the partners of this study. Secondly, we will expose the methodology and the results. In conclusion, we will come back to the data and comment on the limits of this study. What research perspectives are possible, as of today, to help us define the necessary level of green parks to implement sustainable urban planning into practice?

Methodology

From a systemic perspective Plants, Health, Well-being and Urban Planning, this bibliographical analysis comprised of 30 publications selected by the committee of the study from a first bibliographic background of 104 publications.

The bibliographic background was constituted in two parts, at first by Plante et Cité. Secondly, I myself completed it to balance the different disciplinary approaches that it represented. I used the ScienceDirect database on the web. Finally, as the Table1 shows us, there is an important difference in the number of scientific publications from country to country. This could mean, as far as the question of plants in the cities, that it is a question of strategy and means of publication much more than a question of national relevance.

So, the synthesis presents the results of international research over the past twenty years. We collected some research in urban ecology, in public health and from sociologists and psychologists. In monographies the spaces that are the most studied are green parks and in other studies the density of green on a city scale.

Results

The principal and original result of the study is the global and systemic point of view on the positive impact of the vegetation and of the green parks in urban areas.

Now, I propose that you look more precisely at the kind of data that we have available today. I will expand on the data that appears on each petal of the figure. There is some quantified data and also some qualified data in correlation with the different disciplines that are represented.

Germany	3
England	9
Switzerland	2
France	**20**
Holland	4
Sweden	4
Canada	5
United States	45
China	2
Australia	1
Unknown	9
TOTAL	**104**

Fig. 1 : Number of publications by country

Environmental impacts and public health

From an environmental point of view, through their growth processes the absorption capacity of plant leaves improves air quality and decreases the level of atmospheric carbon and other "greenhouse" gases (Nowak and al, 2005, 2007)

The second result that was shown by Mc Pherson is the decrease of local temperatures by a modelisation of the tree shading (Mc Pherson and al, 1988, 1999, 2002). I have to point out that this research was conducted in California.

Public health

The second impact of green parks in cities concerns residents' health. Several studies have found a correlation between the proximity of parks to housing areas and childhood obesity (Michel and Popham, 2008; Weil, 2009).The same outcome of the effect of green spaces on health was confirmed for two categories of people: the elderly and the poor (Mitchell and Popham, 2008; Maas, 2009).
Bell (2008) has delved into surprising results about the correlation between the density of green parks and the practice of physical activity in rural and urban spaces: urban growth in rural areas can be a contributing factor for obesity, the residents being dependent on their car in daily life to go to work, to school, to the supermarket and so on.

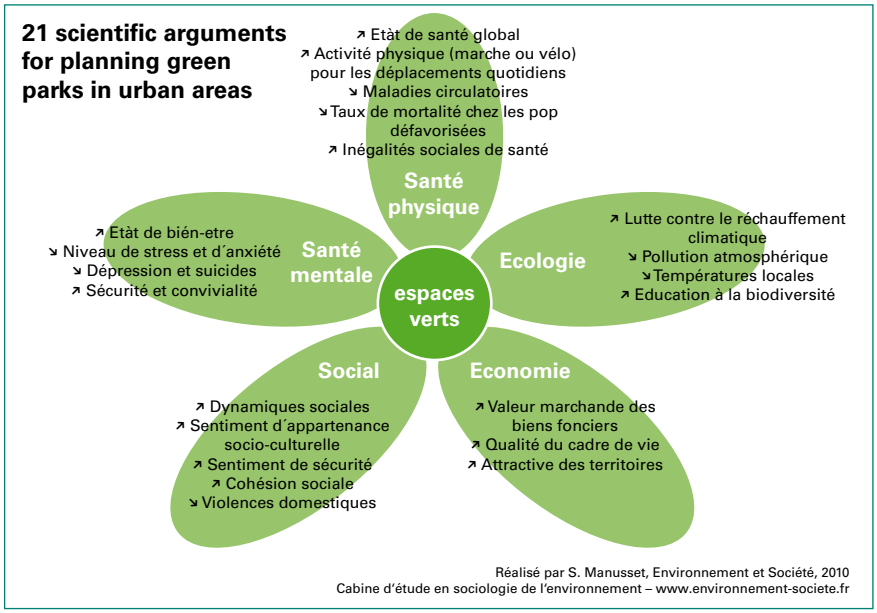
Sociological impacts

Three studies present the motivations to use green parks (Schipperijn and al, 2010; Stahle (2009), Seeland and al, 2009) that I can resume with the following equation: green parks = nature = leisure i.e practicing a sport, meeting some friends or somebody else, listening to birds singing and so many other social activities.

We can specify, with the works of Kuo and Sullivan (1996, 1998, 2004), two American psychologists in Chicago, that the presence of just some trees may reduce domestic violence by faciliting social relations, creating a positive atmosphere to talk together for example. It is often the first act of a social relation.

Results indicate that the presence of trees and grass is proportionally related to the use of outdoor spaces; the amount of social activity that takes place within them, and the proportion of social to non-social activities they provide. Green places influence social contact among neighbours and provide evidence that nature plays an important role in creating vital neighbourhood spaces.

Another study conducted in Zurich confirms the role of public green spaces for social inclusion of youths from different cultures (Seeland and al, 2009).



The positive sociological impacts of green parks could be due to the impact of vegetation on the psychological frame of mind of each individual.

Psychological impacts and well-being

Many studies deal with the positive impact of plants on people's stress and anxiety levels (Sheet and Manzer, 1991; Sullivan and Kuo, 2001, Sterp de Vbries and al, 2003; Kuo and Taylor, 2004).

It is the cognitive facet of human interaction with plants.

The power of the physical environment to influence agression has been well-established. Over-crowding, high temperatures and noise have all been linked to aggression and violence via mental fatigue.Tests for the proposed mechanism and for alternative mechanisms indicate that attentional functioning is accelerated with access to nature.

Some authors suggest the usage of the therapeutic psychological impact of plants in hospitals to accelerate convalescence (Ulrich, 2002) or in the treatment of child hyperactivity (Kuo and Sullivan, 2004), or just for the good development of children (Jutras, 2003).

Conclusion and perspectives

Our review confirms the positive impact of green spaces on public health, the increasing quality of the urban environment and on well-being.

It also shows the social and psychological impacts of plants favoring the arguments that green parks are beneficial to the environment as well as to the ecology concerning public health. What I mean to say is that plants create a social place by humanizing urban spaces. How to conceive some urban planning integrating sustainable development without placing human health and well-being at the heart of them?

The implicit extrapolations of all sorts of bibliographies need to be adjusted to European urban areas.This study is based on a lot of American research.

We need a real interdisciplinary research programm to confirm these first results.

It is a challenge for the French researchers.This study has signaled the state of research in different European countries. In France, there is a lack of global approach crossing environmental, sociological and urban management perspectives. The situation is different in comparaison to other European countries such as Great Britain, Germany and Sweden, where the relationship between Health and Urban Planning is more often taken into consideration. I think about the work of Johanna Maas who is here with us today.

It is also a political challenge, because taking vegetation into consideration in its globality and its complexity is the way to address the high expectations of urban dwellers across Europe.

Thank you for your attention.

Bibliography

1. Barbosa Olga, Jamie A. Tratalos, Paul R. Armsworth, Richard G. Davies, Richard A. Fuller, Pat Johnson, Kevin J. Gaston, 2007, Who benefits from access to grenn space ? A case study from Shieffield, UK, 8 p
2. Bell Janice F., Jeffrey S. Wilson, Gilbert C. Liu, 2008, Neighborhood Greenness and 2-Year Changes in Body Mass Index of Children and Youth, 7 p, USA
3. Coley Rebekah Levine, Frances E. Kuo, William C. Sullivan, 1997, Where does community grow ? The social context created by nature in urban public housing, 30 p, Environment and Behaviour/Université de Illinois
4. Fuller Richard A., Katherine N. Irvine, Patrick Devine-Wrigh, Philip H. Warren and Kevin J. Gaston, 2007, Psychological benefits of greenspace increase with biodiversity, 5 p, Biology Letters
5. Grahm Patrik, Ulrika A Stigsdotter, Ann-Margreth Berggren-Bärring, 2004, A planning model for designing sustainable and healthy cities. The importance of people's need of recreational environments in an urban context, 8 p,Suède, Swedish University of Agricultural Sciences
6. Jutras Sylvie, 2003, Allez jouer dehors! Contributions de l'environnement urbain au développement et au bien-être des enfants, 11 p, Canada, Société canadienne de Psychologie, Québec
7. Kessel et al, 2009, Multidisciplinary research in public health: A case study of research on access to green space, Public Health, 7 p
8. Kuo et al, 2001, Coping with add. The Surprising Connection to Green Play Settings, Environment and Behaviour, Vol. 33 No. 1, January 2001 54-77
9. Kuo Frances E., Andrea Faber Taylor, 2004, A Potential Natural Treatment for Attention-Deficit/Hyperactivity Disorder: Evidence From a National Study, American Journal of Public Health, 7 p, USA
10. Maas Jolanda, 2008, Vitamin G: Green environments – Healthy environments, 254 p, Hollande, report NIVEL, Netherlands Institute for Health Services Research Hollande
11. McPherson E. Gregory James R. Simpson Klaus I. Scott, 2002, Actualizing Microclimate And Air Quality Benefits With Parking Lot Shade Ordinances, Actualizing Microclimate,14 p, USA
12. McPherson Gregory 1990, Cooling urban heat islans with sustainable lanscapes, 21 p, USA , Extrait d'ouvrage Urbanization and terrestrial ecosystems
13. McPherson Gregory, James Simpson, 2001, Effects of California's urban forests on energy use and potential savings from large-scale tree planting, 35 p, USA, Californie
14. Mitchell R., Poham F., 2008, Effect of exposure to natural environment on health inequalities: an observational population study, 19 p, GB, Université Glasgow
15. Nowak David J., 1993, Atmospheric carbon reduction by urban trees, Journal of Environmental management, 11 p, USA
16. Nowak David J., Patrick J. McHale, Myriam Ibarra, Daniel Crane, Jack C. Stevens and Chris J. Luley, 1998, Modeling the effects of urban vegetation on air pollution, 9 p, USA, Extrait d'ouvrage Air Pollution Modeling and its applications
17. Rubin Haya R., Gregory B. Diette, Noah Lechtzin, Edward Haponik and Aline Devrotes, 2003, Distraction therapy with nature sights and sounds reduces pain during flexible brochoscopy, Baltimore USA, 10 p, USA
18. Schipperijn Jasper, Olga Ekholm, Ulrika K. Stigsdotter, Mette Toftager, Peter Bentsen, Finn Kamper-Jørgensen, Thomas B. Randrup, 2010, Factors influencing the use of green space: Results from a Danish national representative survey, Landscape and urban planning
19. Scott Klaus I., James R. Simpson E. Gregory McPherson, 1999, Effects of tree cover on parking lot microclimate and vehicle emissions, Journal of Arboriculture, 14 p
20. Seeland Klaus, Sabine Dübendorfer, Ralf Hansmann, 2009, Making friends in Zurich's urban forests and parks:The role of public green space for social inclusion of youths from different cultures, Forest Policy and Economics Swiss, 8 p, Suisse
21. Sheets Virgil L., Manzer Chris D., 1991, Affect, cognition and urban vegetation Some effects of adding trees along city streets, 20 p, Environment and Behaviour / Université de Illinois
22. Ståhle Alexander, 2009, Réussir la ville dense en l'ouvrant sur la nature, Pour une approche sociale de la trame verte et bleure, 124 p, Suède, thèse/Actes de conférence, Com. perso
23. Sullivan William C., Frances E. Kuo, 1996, Do Trees Strengthen Urban Communities, Reduce Domestic Violence?, 4 p, USA, Forestry Report
24. Sullivan William C., Frances E. Kuo and Magdalena Bacaicoa, 1998, Transforming inner-city lanscapes tree, sense of safety and preference, Environment and Behaviour, 32 p
25. Sullivan William C ., Frances E. Kuo, 2001, Agression and violence in the inner city. Effects of environment via mental fatigue, Environment and Behaviour, 29 p, USA, / Université de Illinois
26. Sullivan William C. Frances E. Kuo, 2001, Environment and crime in the inner city. Does vegetation reduce crime?, Environment and Behaviour, 25 p, USA, / Université de Illinois
27. Ulrich Roger S., 2002, Health Benefits of Gardens in Hospitals, 10 p, USA, Communication pour conference, Plants for People, USA Floride
28. Vries (DE) Sjerp, Robert A Verheij, Peter P Groenewegen, Peter Spreeuwenberg, 2003, Natural environments - healthy environments? An exploratory analysis of the relationship between greenspace and health, Environment and Planning, 15 p, Hollande
29. Weil Marcos, 2009, Les chemins pour piétons dans le paysage genevois, 3 p, Suisse, Art. sc. dans La Santé de l'Homme / INPES, www.inpes.sante.fr

Landscape architecture in Milan towards EXPO 2015

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Around the world, people are moving to cities at unprecedented levels, forcing a re-evaluation of city design. Cities are looking for ways to refashion themselves that are both subtler and more substantive. At the same time, sustainability has become an urgent concern, and cities, beset by infrastructural and environmental challenges, are responding with green initiatives that privilege landscapes. Finally, cities are forced to consider the afterlives of derelict sites, which are often in advantageous spots – like waterfronts, city centers or rail corridors.

Air pollution harms human health, particularly in those already vulnerable because of their age or existing health problems. Evidence shows that air pollution at current levels in European cities is responsible for a significant number of deaths, hospital admissions and exacerbation of symptoms.

Exposure to air pollutants is largely beyond individual control and requires action by public authorities at national, regional and even international levels. Some 40 million people in the 115 largest cities in the European Union (EU) are exposed to air exceeding WHO (World Health Organisation) air quality guideline values for at least one pollutant. Especially in the northern region of Italy the air pollution is heavily contaminated. According to WHO, life expectancy in Milan is nine months shorter than somewhere else in Europe.

To manage these environmental problems different programmes were arranged at European level, for example: The Kyoto-Protocol, the Stragety "Europe 2020" or the Convenant of Mayors.

Landscape architecture

Landscape architecture is a discipline equipped to untangle these urban challenges, based on issues of ecology and on an organisation of large surfaces with many overlapping and competing systems.

Landscape becomes the agent through which the city can be re-designed and re-planned.

Successful public spaces are seen as an essential ingredient of making successful cities, where there is life and vitality. The qualities of individual urban forests and other green spaces make cities more competitive and attractive. These local, everyday green spaces do play a very important role, e.g. in terms of offering nearby recreation environments to local residents. For green space city branding, it is crucial not only to focus on external branding (catering to tourists and business), but take internal branding seriously as well. Branding should combine the work of green space professionals, planners, and professional marketeers.

Milan is the city, where I was born and grew up. Therefore it was my personal dream and the dream of my partners to make Milan a permeable city. A slow city in fast times, Milan is taking advantage of the forthcoming Expo 2015 to rearrange its open spaces. Usually perceived as a city of much work and free-time, Lombardy's main city is promoting its green potential, opening up new and old liveable public spaces. In 2003 we promoted together with AIM (Metropolitan Interest Association) a new strategy: GREEN RAYS. 8 Green Rays provides new symbols that can define the urban landscape within the daily life of Milan. Existing green spaces together with public space create the greatest challenges for today's cities. The master plan involves a wholly new strategic approach to designing Milan's system of open spaces. Until now, the city's dense development was interrupted by green surfaces and public plazas only at a few locations. Projected for development now is a network of foot and cycling paths that are oriented by a set of eight "green rays" which will connect both previously existing as well as new open spaces. Beginning at the "Spanish Walls", these rays will extend throughout the entire metropolitan area, and will join together to form a green belt 72 km in length that runs around Milan's surroundings. The project connects existing hidden, abandoned or simply isolated areas of the city's life. The Green Rays strategy has been implemented in the new PGT (Piano di governo del territorio = Territorial Governance Plan) recently adopted by the Municipality of Milan, becoming one of the main resources in making Milan a more sustainable city. The "Piano Verde" ("Green Plan") could become the environmental strategy for the new PGT. The Raggi Verde intercepts the development poles of the metropolitan area, that as multipliers, reproduce them in the whole Milano region. The territorial Green Rays are the engine of the metropolitan city, a territorial identity without borders.

This strategy is the aim of the European movement: the European Green Cities Network was started up in 1996 in connection to EU Thermie project European Green Cities – as a forum for the dissemination of Sustainable Urban Housing initiatives and good examples etc. Part of the European network are Holland, Germany, France, Hungary, UK and Italy. Green City aims to improve the quality of life in cities with more public and private green. The green has many positive effects – such as on the well-being of people on social life and on the environment. These positive effects are reflected in economic, ecological and socio-cultural values. The "Green City" is a response to the current social and political challenges. The initiative aims to promote awareness of the value of green in European cities. This will be done through the following measures: inform the economy and politics, but also the public about the many positive features of vegetation and green spaces for the quality of life, the well-being, the enrichment of social ties, stimulate the economy and the preservation of the environment.

The Green City movement had participated in the 7th Framework. A proposed project for the 7th Framework program was "Green Cities and climate change". Some of the projects objectives are:

- developing a methodology related to the evaluation of green performances of cities, policy guidelines to realize the Green City and identify the most appropriate policy tools
- analyzing whether and under which conditions a Green City has an improved adaptive capacity in respect to likely local impacts of climate change
- identifying which innovative solutions in terms of policies, provision of services and business activities can encourage the development of a Green City

Expo 2015 Feeding the planet, Energy for life

Expo 2015 intends to offer a chance for global communication and a genuine world food forum where scientists, consumers, businesses, experts, citizens, the mass media, researchers, politicians, international dignitaries and members of NGOs (Non Government Organisation) can come together to analyse, discuss, debate and plan for the future. The Expo is a coherent choice for Milan, Italy and all Europe: a more effective and coherent development of solidarity to provide the basis needed to encourage sustainable development (Milan as a bridge between development and poverty). The Bidding Committee has already outlined a series of initiatives that will increase awareness and conformity with the themes.

The central aim of Expo 2015 is to demonstrate that it is possible to guarantee, today, in this world, food safety, food security and sustainable development for all mankind. The Expo 2015 will focus attention on the criticalities and opportunities that the opening of developing countries can bring with it in material and other terms. It will try to take stock of how far we have come and what corrective action is still needed to ensure we move toward growth and not further under-development, particularly with regard to food. Expo 2015 intends to take a close look at biotechnology and make a balanced and scientifically rigorous assessment, providing accurate and objective information on the eventual risks to food. The round tables of the Expo are: tourist accommodation, infrastructures, energy and environment, agribusiness, healthcare, credit and loans, arts and culture, non-profit, young people.

An expert system for calculating the costs of open spaces over their entire lifecycle

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In architecture, the costs that will be generated by a building or facility and its expected life expectancy are already clear at the planning and installation stage. But what is the situation with open spaces? Here maintenance is considered only cursorily, and renewal and lifecycle not at all. Research has shown that the literature also has little to offer. Considering these facts, the Center for Green Area Management at the Zurich University of Applied Sciences (ZHAW) in Wädenswil has developed a software program to calculate lifecycle costs in collaboration with nateco, green management and the German Database Association GmbH (d.b.g.) as business partners, and with financial support from the Commission for Technology and Innovation (CTI). The expert system supports the following areas:

- Application of lifecycle considerations, as in current facility management practice, to outdoor spaces.
- Optimisation of construction projects with regard to economic, ecological and social sustainability.
- Calculation of lifecycle costs in the context of open space design competitions and new project implementation.
- Creation of maintenance cost documentation and transparency for customers, users of green areas, politicians and administrative offices.
- Planning of conservation measures in existing facilities and early assurance of financing.
- Planning of renovation and renaturation measures at the best possible time.
- Improvement of green space care in general.

Initial situation

The construction of a green space is an intervention with implications for the following 10 to 50 years (or longer). Initial investment costs make up only about 15% of the total lifecycle costs of a facility[1], and the much higher amounts required for maintenance over the coming decades are estimated at the planning stage (Figure 1). All too often new facilities have had to be removed or structurally adjusted because human and financial resources were not available for the necessary maintenance. Alternatively, the overall appearance of the facility no longer fulfilled users' expectations and needs, due to a lack of resources to ensure this.

In our era of holistic, proactive thinking, it is vital to transparently present the costs of caring for green spaces over a future period spanning several years, or, if possible, for their entire life cycle. This is the only way to ensure that the financial impact of the projects can be objectively evaluated at the planning phase. Furthermore, a holistic way of thinking includes not only economic aspects; in times of increasing urbanisation and persistent climate change, both public and private green spaces in urban areas can be expected to make an increasingly vital contribution to a socially and ecologically sustainable environment.

The research project

Together with the business partners mentioned above, researchers at the ZHAW have sought ways to visualise the lifecycle of a green area, together with the various elements it comprises (coverings, planted and seeded areas, trees and shrubs, equipment, etc.), and to calculate the associated maintenance costs. After about two years of research and development, the software GreenCycle® was developed, enabling various calculations for the lifecycle of a facility to be made (see Figure 2).

The project team was supported during the development period by an advisory panel of experts and representatives from cities, Swiss trade associations (BSLA, VSSG, VSS, Jardin Suisse) and private companies. The software is currently being tested in pilot projects in various cities.

Target groups

GreenCycle® is a tool for planning and consulting firms, and for investors in the private and public sectors. These include property management

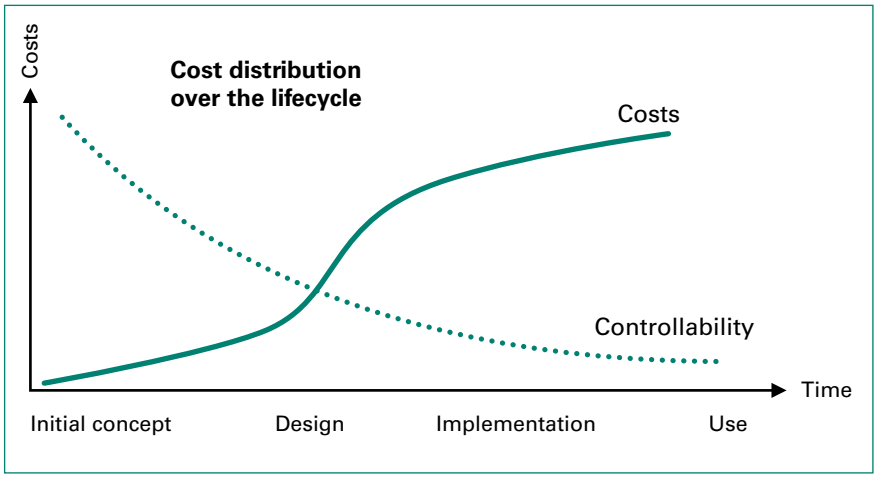

Figure 1: Cost allocation in life cycle2. As the lifecycle of a facility progresses, costs are increasingly difficult to control. The highest expenses are those for maintenance in the years after construction.

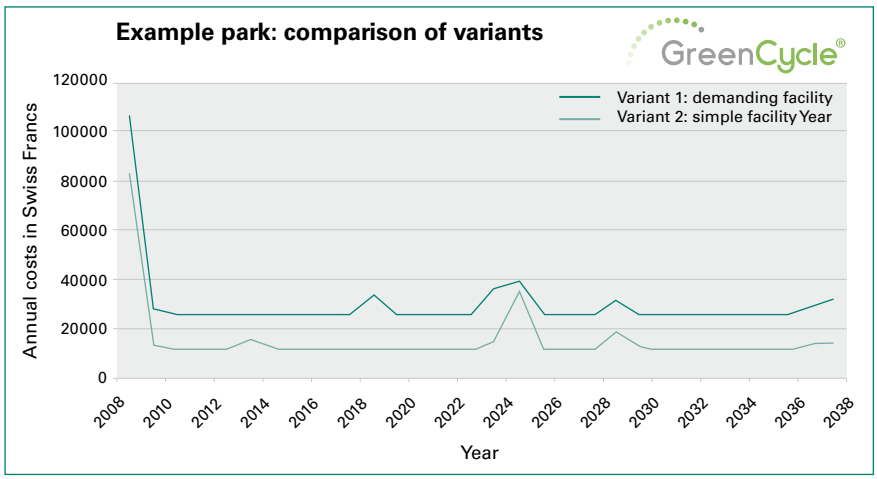

Figure 2: Example of a model covering 30 years for a park built in 2008, consisting of different types of surface coverings, green areas, trees and shrubs, and elements of equipment. Variant 1 allows for intensive design and maintenance; Variant 2 is a simpler version requiring less care. The high costs in 2008 are due to the construction of the facility. In subsequent years partial renovations must be allowed for in both variants.

companies, town planning offices and cooperatives, as well as landscape architects and general planners. These all have an interest in a sustainable and secure long-term investment. In addition, GreenCycle® can be used by cities and communities to assess and optimise the maintenance of green spaces.

Applications

The project partners have now been using GreenCycle® for over six months in their consulting practice. The applications are already very diverse:

- A landscape architect needed to show the investor that a new project would entail lower maintenance costs than the existing arrangement. By comparing current with future maintenance costs, a savings potential of 20 percent was demonstrated.
- The costs of green space maintenance in various municipalities were reviewed using GreenCycle®. The communities wanted to verify the plausibility and efficiency of work done. It was shown that the expenses were generally justified. There were also pointers on how priorities in green space maintenance should be selected in future and where renovation is unavoidable.
- GreenCycle® is already used in different communities and landscape gardening companies to define standards for the maintenance of green spaces. This offers the advantage, especially in larger companies, that quality can be uniformly guaranteed and customers can be assured of this.
- During a tendering procedure for green space maintenance, the data submitted by the bidders were reviewed and evaluated. The main focus was on the detection of obvious dumping prices, which were associated with an excessive risk to the client.

GreenCycle® is growing

There is considerable interest in GreenCycle®. The first programs have been sold and are in use. In Switzerland, the Association of Swiss City Garden Departments (VSSG) has set itself the goal of optimising the data from GreenCycle® for its own purposes as part of the project "Open Green Space Costs" In 2010 and 2011, the work of maintenance teams in many green spaces throughout Switzerland is being surveyed in detail. This data will be used as the basis for a "VSSG data collection" in GreenCycle®. This should enable standards to be set for all cities, which can then be enforced collaboratively.

It was crucial for the project team that the data models can be used flexibly in GreenCycle®, which allows the basic data to be continually optimised. To achieve this continual improvement and refinement of the software for use in everyday situations, the project partners have set up a common fund into which they pay a portion of their revenue. To ensure that all users can profit from the progress made, regular updates of the GreenCycle® database are planned.

Publications

Brack, Florian; Buser, Hans; Semmler, Ralf: GreenCycle – ein Instrument für die nachhaltige Bewirtschaftung von Grünräumen aus der Schweiz. In: Neue Landschaft: Fachzeitschrift für Garten-, Landschafts-, Spiel- und Sportplatzbau. - Berlin-Hannover: Patzer Verlag, 5163 2/10, p. 45 ff. ISBN/ISSN: 0548-2836

Brack, Florian: Bewirtschaftung optimieren. In: Kommunalmagazin. - Rüschlikon: Docu Media Schweiz GmbH, 2, pp. 22 ff.

Brack, Florian: Was kosten Grünräume? In: Werk, Bau und Wohnen: Zeitschrift für Architektur und Städtebau. - Zürich: Werk AG, 9, p. 67 ff.

Project implementation period

September 2007 to December 2009
Current: Follow-up project involving 7 Swiss cities and the Association of Swiss City Gardening Departments

Sources
1 Zehrer, H., Sasse, E., 2005: Handbuch Facility Management. Landberg am Lech.
2 Niesel, A. (Hrsg.), 2006: Grünflächen-Pflegemanagement. Stuttgart.

Urban climate and Urban Green

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The Urban Heat Island (UHI) effect is one of the environmental issues which have been documented in many cities. In search of the various environmental solutions to mitigate the UHI effect, urban greenery has been found to be an effective measure. This presentation will focus on the findings of a number of research projects conducted world wide to study the effectiveness of urban greenery to ameliorate the UHI effect. Specifically, the thermal benefits of greenery in reducing the ambient air temperature and cooling energy consumptions at both macro and micro level will be highlighted. At macro level, the cooling effects of city parks and road side trees are researched through extensive field measurements and computer simulations. At the micro level, field measurements have been conducted to examine the shading effects of trees on buildings and rooftop greenery and their direct and indirect thermal benefits were documented. The presentation will also highlight the need for a policy to promote the implementation of urban greenery.

Introduction

The problem of the increased global temperature is more intensive in urban structures. Heat load and heat stress situations have worsened. Heat waves have a severe affect inside the urban heat island. Figure 1 shows the time development while in figure 2 the areal distribution is seen. Much is known about the urban heat island and its development. In all the global climate changes scenarios, with the respective downscaling methods a shift in the heat load situation especially in cities due to the radiation and ventilation factors is observed. Mitigation factors are urgently needed.

So one perspective in urban climate is the introduction of green and vegetation concepts to reduce heat stress, but more quantitative data are needed in order to justify the measures. Main effects are seen in green facades, changing surfaces and the linkage of green in cities.

For any human-biometeorological evaluation the heat balance of man has to be considered. Ventilation and the short and long wave radiation have the major effect but can also be easily influenced and changed through vegetation. With rapid urbanization, there has been a tremendous growth in population and buildings in cities. The high concentration of sealed surfaces triggered many environmental issues. The Urban Heat Island (UHI) effect and with it the urban thermal aspect have worsened the conditions in densely built cities. The primary root of UHI is the rapid urbanization which replaces natural landscapes with enormous hard surfaces such as building facades, roads, pavements in cities. First, these hard surfaces in built environments re-radiate solar energy in the form of the long-wave radiation to surroundings. A lack of extensive vegetation further incurs the loss of natural cooling means which cools surrounding air through evapotranspiration. Also, the UHI is aggravated by the lack of moisture sources due to the large fraction of these impervious surfaces in cities. The rain water is discharged quickly. Such increases in temperature and increases in long wave radiation with the presence of air pollutants can result in the accumulation of smog, damage the natural environment and jeopardize human health. It also costs consumers more money because it takes more energy to cool buildings. Green areas in cities are considered ecological measures for concrete jungles since plants can create an 'oasis effect' and mitigate the urban warming at both macro and micro level. As soon as a bare hard surface is covered with plants, the heat-absorbing surface transfers from the artificial layer to the living one. Leaves can seize most of the incoming solar radiation. For example, trees were observed to intercept 60% to 90% of the radiation (Lesiuk 2000). Except for a very small portion transformed into chemical energy through photosynthesis, most of the incident solar radia-

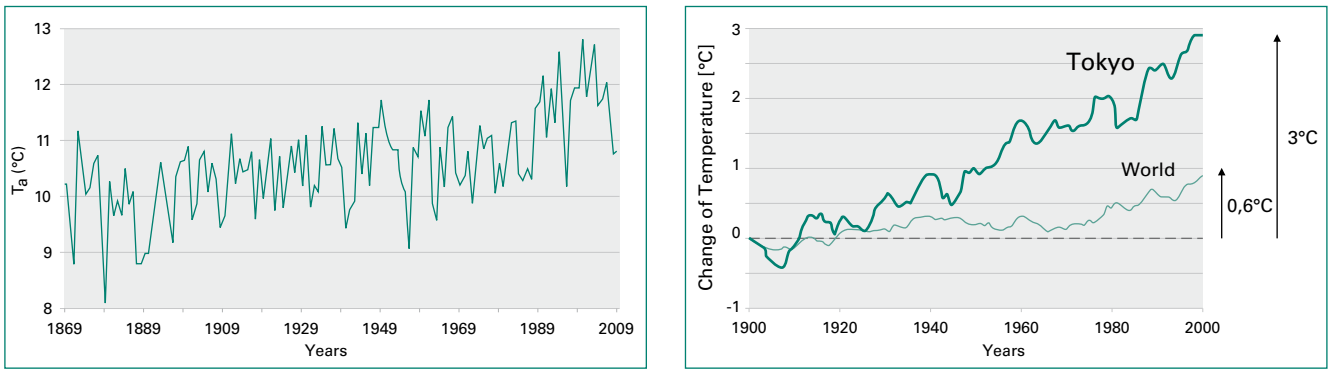

Figure 1: Air temperature increase and impact of cities

Figure 2: Urban climate map (heat island) of Kassel in the present situation (left) and in a 2030 scenario (right)

tion can be transformed into the latent heat which converts water from liquid to gas resulting in a lower leaf temperature, lower surrounding air temperature and higher humidity through the process of evapo-transpiration. At night, the energy of the outgoing net radiation from a green surface is fed from the thermal heat flux and the latent heat flux. Therefore, the temperature around the green area is lower than that within the built environment.

Results in respect to urban greenery

From figure 3 no clear relation can be noticed between the urban fabric and thermal comfort (PET index). But if one looks at the microclimatic conditions of open spaces the important influence of vegetation can be seen. In figure 3 the daily course of short wave radiation fluxes during a summer day is shown. The diffuse shadow of the trees has an enormous effect on sun radiation and would at the same time improve the thermal situation. On the other hand the graph shows that the usual way of calibrating urban clime by H/W factors or SVF is not sufficient.

Another aspect in urban climate and greenery is the human comfort in open spaces. In this respect research was carried out in a national program on climate change in cites with the influence on open space planning and an EU project RUROS. How to design open spaces in respect to urban climate. In figure 5 the results from interviews combined with measurements show the switch of cooling from very warm to warm. This could be achieved by vegetation shadow too.

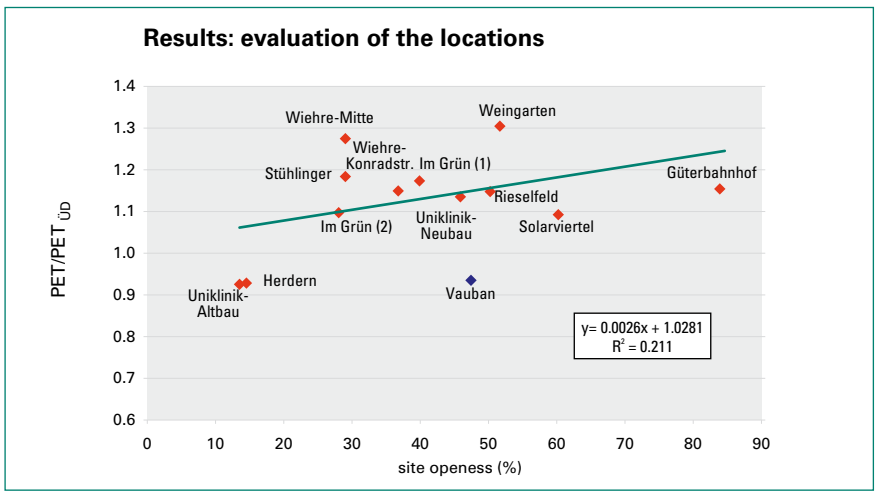

Figure 3: Relation between urban structures and thermal index PET

Urban Parks

Although a single tree can already moderate the climate well, its impacts are limited to microclimate. Large urban parks can extend the positive effects to the surrounding built environment. Within the park, it can be seen that most average temperatures were relatively lower than those measured in the residential blocks. From locations 1 to 4, the average temperatures range from 25.2 to 25.5°C. On the other hand, there is an orderly elevation of average temperatures for locations within the surrounding residential blocks. It shows that the park has cooling impact on the surroundings but it depends very much on the distance.

Road trees

Trees planted at road sides are very effective. The original purposes were to provide shade for pedestrians and for aesthetics. However, the thermal effect of road trees on surroundings cannot be ignored especially in an environment with low-rise buildings and mature trees.

Rooftop gardens

Plants strategically introduced into buildings can also benefit the surrounding environment by reducing the ambient air temperature. The comparison of the external and the internal surface temperatures measured on the facades are important. Generally, the surface tempera-

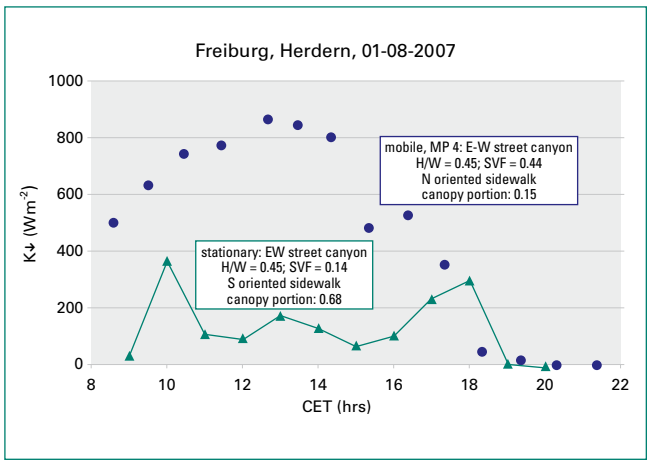

Figure 4: Effect of vegetation on radiation fluxes in cities

tures measured on the external walls were lower than those on the external walls of The differences can be around 1 to 2°C at night and around 4 to 8°C during the daytime. (Wong 2006) It could be concluded that by introducing greenery to the rooftop, the cooling energy consumption of a building can be reduced by about 20%. Even if this effect is located to the roof garden itself and does not influence the Urban Canopy layer in total the positive effect is seen on the microscale level.

Vertical landscaping

In order to explore the shading effect of plants on facades, some pilot measurements were carried out on some low-rise buildings where trees are planted closely to the facades (Wong 2006). The combined strategic introduction of plants on the facades saves energy and at the same time reduces the long wave radiation and therefore lowers the heat stress conditions.

Perspective

The urban heat island phenomena is not only for large or mega size cities. The mitigation effect of greenery has a very high dimension in the short and long wave radiation fluxes so that much can be done in urban planning.

Two main issues are not yet well understood:

- The quantification of thermal stress in open spaces, depending on the mesoscale conditions: percentage of greenery together with SFV or H/W dimensions and thermal comfort, development of a greenery factor with calibration
- The downscaling process from IPCC scenarios to urban climate

Therefore especially an EU project could do research in the comparison of urban climate in the different climate regions of Europe using the same methodology and therefore get a quantifiable benchmark, which can be used in urban development and open space planning processes.

Literature

Chao, R.; Ng, E. Katzschner, L. 2010 Urban Climate Map Studies. A review, International Journal of Climatology, DOI: 10.1002/joc.2237

EU-RUROS 2004 Rediscovering the Urban Realm and Open Spaces - co-ordinated by CRES, Buildings Department. http://alpha.cres.gr/ruros

KLIMES 2009 Hitzestress im Stadtquartier - Identifizierung und Mitigation, BMBF, Koordination Universität Freiburg

Klimzug 2010 Klimaanpassung Mitte, Modellregion Nordhessen, Universität Kassel

Katzschner, L. 2010 Urban Climate in Dense Cities, in: Designing high-density cities, earthscan UK, ed: E. Ng, p. 71 - 83

Lesiuk, St. 2000 Biotecture II: Plant-building interaction. Retrieved 09 September 2000 from the World Wide Web: http://forests.org/ric/good_wood/biotctll.htm

Wong, N.H. 2006 Proceedings of PGBC Symposium 2006 Urban Climate + Urban Greenery December 2006, Hong Kong

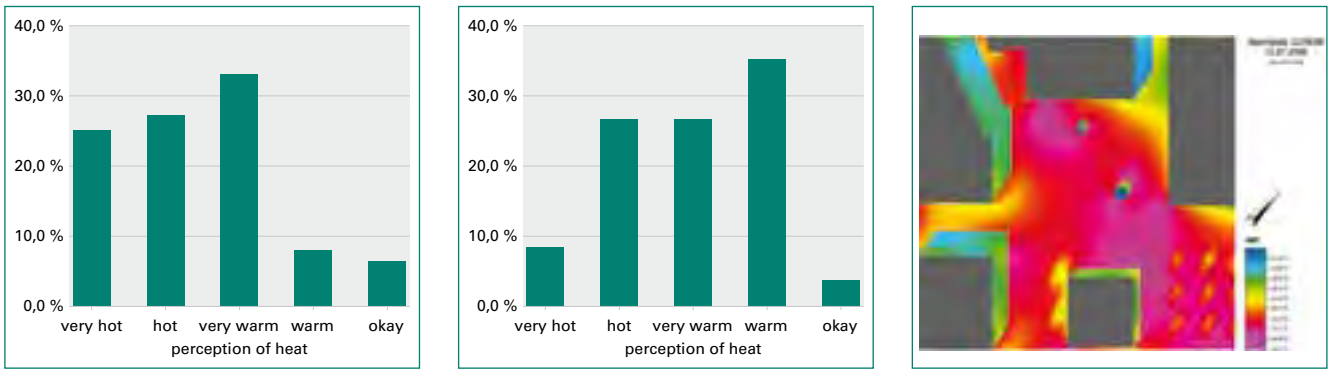

Figure 5: Thermal perception in the course of time (Kassel/Germany) and the spational distribution for human comfort planning

Measurement of particle deposition to urban vegetation

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Ambient airborne particles can cause adverse health effects on humans. According to the WHO, exposure to ambient particles decreases life expectancy of every person in the WHO European Region by an average of almost one year, mostly due to increased risk of cardiovascular and respiratory diseases, and lung cancer. Although the mechanisms, through which these adverse health effects are caused, are only poorly understood, it is known that health effects depend on various parameters, mainly on particle size and chemical composition of particles. The particle size is an important factor, since it determines how deep a particle can penetrate into the human lung. Simply speaking, only particles with diameters smaller than 10 µm (PM10) can pass the larynx und reach the lower respiratory tract. Therefore, limit values for these particles were set by Directive 2008/50/EC on ambient air quality and cleaner air for Europe. The Directive contains long-term limit values for PM10 (40 µg.m-3) and PM2.5 (25 µg.m-3) referring to annual means and a short-term limit value for PM10 with a 24-h-average of 50 µg.m-3, not to be exceeded more than 35 times a calendar year. Air quality plans are requested in the case of exceedances of the limit values, 'so that the exceedance period can be kept as short as possible'.

Those air quality plans often focus on the reduction of particle emission. Hence, they include measures like the ban of high-emission vehicles from the inner parts of the city or the fitting of particle filters to combustion plants and diesel cars. Another strategy to decrease particle pollution may be an increase of particle deposition to surfaces. Since vegetation is characterised by a large leaf area compared to the ground on which it grows, deposition velocities of particles to plant canopies are mostly higher than deposition velocities to bare soils or technical surfaces. Therefore, air quality plans of some cities include an increase of green spaces or roadside trees as a possibility to reduce concentrations of ambient particles. However, only few measured data of deposition velocities are available for plants in an urban environment.
In urban areas, two main kinds of deposition have to be considered. Dry deposition comprises all deposition processes in the absence of precipitation; wet deposition encompasses deposition processes in the presence of precipitation. Dry deposition includes different mechanisms like diffusion, interception, inertial forces and sedimentation. It depends on several parameters like particle size, meteorological conditions and properties of the surface, on which the particle is deposited. Deposition velocities are used to quantify dry deposition. The deposition velocity is calculated as the quotient of deposition flux and ambient particle concentration. It is known from semi-empirical physical models, that particle size has a major influence on deposition velocity (Fig. 1). For particles smaller than 0.1 µm, diffusion is dominating, particles larger than 1 µm are mainly deposited by sedimentation, interception and inertial forces.

Methods and research sites

Measurement approaches to determine particle deposition requiring homogeneous surfaces (like eddy-covariance techniques) are not applicable in the case of vegetation canopies in urban areas, since they are very heterogeneous. Another problem arises from particle agglomerations on leaves, which make it difficult to distinguish single particles and hence hinder the determination of particle sizes (Fig. 2).

To obtain data of particle deposition to urban vegetation, two projects were conducted in Karlsruhe and Berlin, two cities in Germany. In the first project, particle flux through a single crown of an Acer platanoides (Norway Maple) was investigated during the vegetation period 2002 in Karlsruhe. Deposition velocities to a roadside Tilia cordata (Small-leaved Lime) in a street canyon in Karlsruhe and a shrubbery with mainly Acer platanoides (Norway Maple) at an urban highway in Berlin were investigated within the second project from 2008 to 2009. In both projects, a comparable methodology was used including sampling of PM10-particles with low-volume samplers on quartz fibre filters, collecting dry and wet

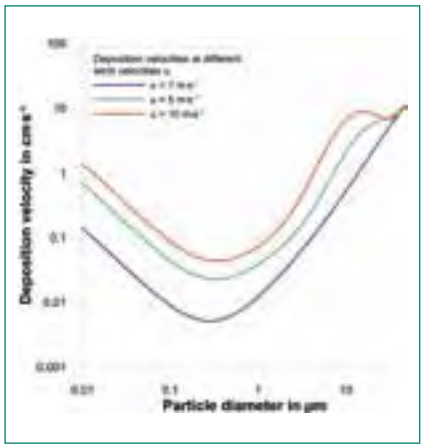

Figure 1: Dry deposition velocity of particles to a vegetation canopy as a function of particle size and wind velocity. Calculation is based on the model of Slinn (1982) and on parameters from an Eucalyptus forest (after Endlicher et al. 2011: 10, modified).

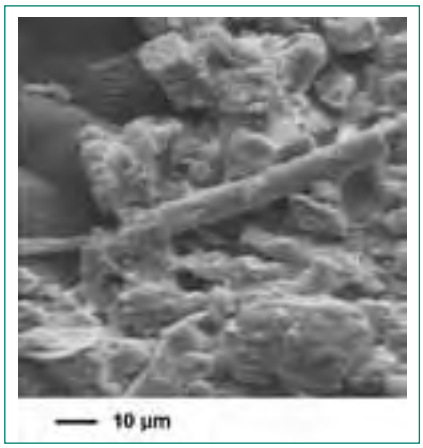

Figure 2: Particle agglomeration on a leaf of Acer platanoides, which was harvested on 21 August 2002. Photo was taken with a scanning electron microscope (Langner 2006:35).

deposition in 3 000 ml glass beakers using wet-dry samplers and washing off particles from collected leaves with a brush. Concentrations of trace elements were used to estimate the fraction of PM10 in the dust samples.

Particle flux through a crown of a single roadside tree

The measurements at the roadside Acer platanoides in Karlsruhe revealed that dust deposit on leaves showed strong gradients in a profile perpendicular to the road. Leaf deposit decreased both with horizontal and vertical distance from the road (Fig. 3). The lower total dust load in October is caused by the beginning leaf fall in September. A comparison with simultaneously measured airborne concentrations of different particle sizes revealed, that mainly coarse particles were deposited on leaves, which is in good agreement with the above mentioned size-dependent deposition velocities.

However, compared with particle fluxes beneath the tree crown, particle deposit on leaves could be neglected. Since the main goal of the project was to estimate the total particle flux through the tree crown, further analyses focused on particle deposition beneath the tree crown (Fig. 4). To calculate additional deposition due to the tree crown, an interpolated grid based on four corner points, which were not influenced by the tree crown, was subtracted from an interpolated grid based on all measurement points. The difference yielded the particle flux caused by the tree crown. An overall mass flux of about 2 kg through the tree crown during a vegetation period was calculated. About 75% of this mass flux was caused by wet deposition.

Based on element concentrations of Pb and V, the fraction of PM10-particles was estimated to account for 20% of the total mass, whereas the remaining 80% are thought to belong to particles larger than PM10 and biogenic material arising from the tree itself. A calculation of emissions of vehicle-derived particles at the road section adjoining the tree yielded about 3.5 kg during the same period. Since only a certain fraction of these particles belong to the airborne particles flowing through the crown, it was estimated that less than 5% of these particles were captured by the leaves.

Estimation of particle deposition velocities to urban trees

The aim of the second project was to determine deposition velocities of PM10-particles on various urban surfaces, including vegetation canopies. To separate PM10-particles from larger particles, a tracer element had to be selected, which is present in PM10-particles, but in negligible concentrations in particles coarser than PM10. Therefore, measurements of trace element concentrations in PM2.5, PM10 and TSP (total suspended particles) were conducted at an urban highway in Berlin. The

	Li	Al	V	Mn	Fe	Co	Ni
PM_{10}/TSP	0,22 ± 0,31	0,44 ± 0,20	0,83 ± 0,13	0,70 ± 0,11	0,85 ± 0,12	0,58 ± 0,14	0,60 ± 0,31
$PM_{2.5}$/TSP	0	0,01 ± 0,03	0,40 ± 0,07	0,16 ± 0,02	0,18 ± 0,02	0,08 ± 0,06	0,20 ± 0,11
	Cu	**Zn**	**Rb**	**Sr**	**Sb**	**Pb**	
PM_{10}/TSP	0,96 ± 0,13	0,75 ± 0,21	0,58 ± 0,09	0,52 ± 0,12	1,02 ± 0,15	0,93 ± 0,07	
$PM_{2.5}$/TSP	0,23 ± 0,02	0,32 ± 0,11	0,17 ± 0,07	0,05 ± 0,06	0,26 ± 0,02	0,60 ± 0,25	

Table 1: Average proportion of concentrations of several trace elements in PM2.5 and PM10 within TSP (Endlicher et al. 2011:43)

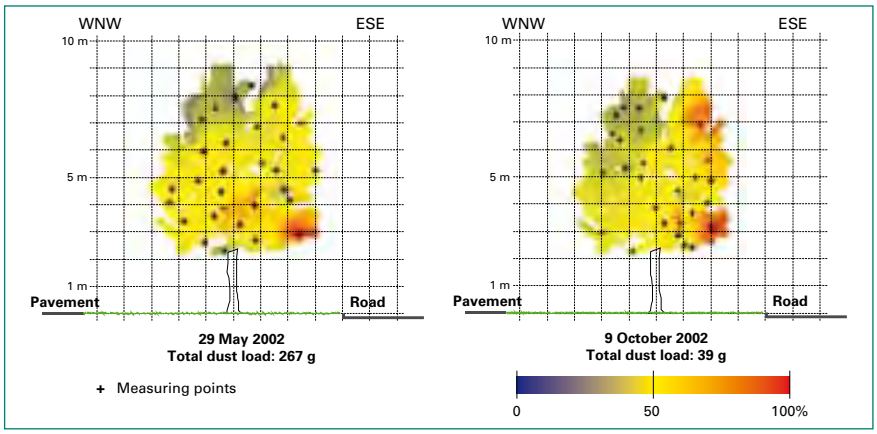

Figure 3: Interpolated relative dust load on the leaves during the first and the last sampling in 2002 (Langner 2006:95, modified).

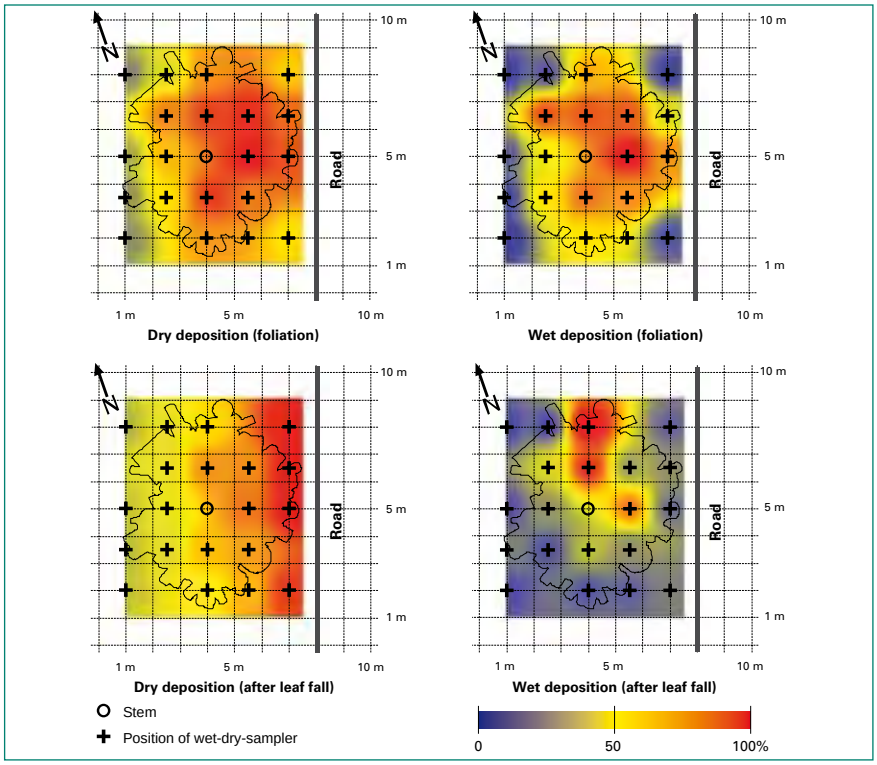

Figure 4: Interpolated relative wet and dry deposition beneath the tree crown during foliation and after leaf fall (Langner 2006:106, modified).

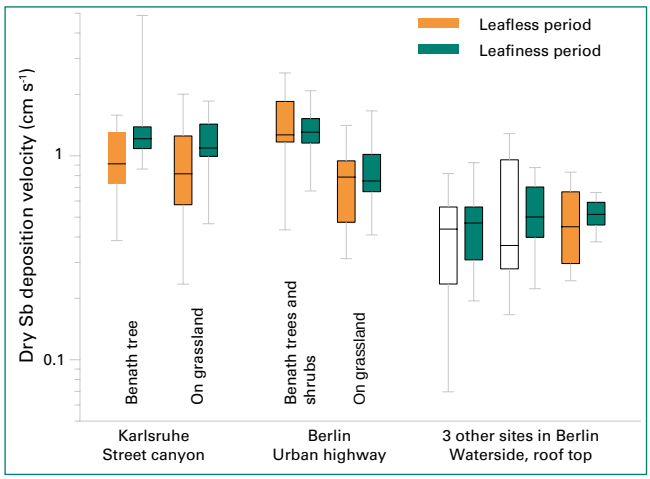

Figure 5: Dry deposition velocities of Sb at two roadside sites with tall vegetation and three other sites in Berlin (Langner et al. 2011:XX, modified).

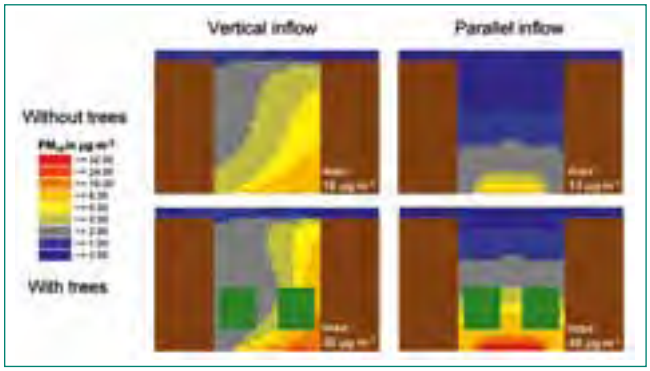

Figure 6: Simulated particle distribution in a street canyon using four scenarios described in the text.

results showed that antimony (Sb) was the most suitable trace element, since it fulfilled the requested condition (Tab. 1).

At a height of 2 m above ground, deposition velocities of 0.8 to 1.3 cm.s-1 at roadside sites and from 0.4 to 0.5 cm.s-1 at the other sites were determined (Fig. 5). These differences can be explained by higher mass concentrations of coarse particles showing higher deposition velocities due to sedimentation at roadside sites.

As in the first project, accumulated particles on leaves during the vegetation period could be neglected, since most of the particles were washed off. Deposition velocities to canopies of tall vegetation were calculated using differences in wet deposition fluxes between sites beneath tall vegetation and on grass. For the two different canopies almost identical deposition velocities of 0.45 cm.s-1 at the Tilia cordata and 0.51 cm.s-1 at the Acer platanoides-shrubbery were obtained. This increases deposition velocities remarkably, which were measured at the ground beneath the canopies.

Opportunities and challenges for further research

Based on these results, several recommendations for further investigations can be given. Roadside vegetation can capture particles and reduce re-suspension of particles. This has been proven by increased deposition velocities due to vegetation canopies. But deposition velocities do not tell us how air quality is improved in terms of ambient mass concentrations of particles. This can be evaluated by the use of numerical dispersion models. Therefore, such models have to be used to simulate effects of additional vegetation structures in urban areas.

Numerical simulations rely on measured deposition velocities. Up to now, only few data are available for vegetation canopies in urban environments. Therefore, the question has to be answered whether other species, especially oaks, conifers and herbaceous plants, show similar deposition velocities like Acer platanoides and Tilia cordata.

These models have also to consider the damping of dispersion caused by dense tree covers in street canyons. Fig. 6 shows the results of a numerical simulation of pollutant dispersion using Win-MISKAM (flow and dispersion model for the microscale prediction of flow and concentration fields) in an idealized street canyon, using four scenarios:

- Inflow vertical to canyon, without trees
- Inflow vertical to canyon, with trees
- Inflow parallel to canyon, without trees
- Inflow parallel to canyon, with trees

A vertical inflow induces a vortex in the canyon, leading to a shift of particles emitted on the road. Both the vertical and parallel inflow scenarios show an increase in particle concentrations at certain sections of the street canyon with dense tree cover. Hence, it is recommended that a loosely arranged cover of tall vegetation in street canyons should be used to optimize air quality – but was does 'loosely arranged' mean in quantitative terms? Theoretical approaches (see Fig. 1) suggest that the capture of ultrafine particles (particle below 0.1 µm) by urban vegetation should be more efficient compared to the capture of PM10-particles. Since these particles are thought to have particular adverse effects on human health, a special research focus should be put on the deposition of ultrafine particles on plants.

Acknowledgements

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References

Endlicher, W., Langner, M., Dannenmeier, S., Fiedler, A., Herrmann, I., Ohmer, T., Dalter, D. (2011): Einfluss innerörtlicher Grünflächen und Wasserflächen auf die PM10-Belastung. Berichte der Bundesanstalt für Straßenwesen, Heft V 202

Langner, M., Kull, M. & W.R. Endlicher (2011): Determination of PM10 deposition based on antimony flux to selected urban surfaces. Environmental Pollution 159(8-9): 2028-2034

Langner, M. (2006): Exponierter innerstädtischer Spitzahorn (Acer platanoides) – eine effiziente Senke für PM10? Karlsruher Schriften zur Geographie und Geoökologie. Band 21. Karlsruhe

Slinn, W. G. N. (1982): Predictions for particle deposition to vegetative canopies. Atmospheric Environment 16(7):1785-1794

http://www.euro.who.int/en/what-we-do/health-topics/environmental-health/air-quality/facts-and-figures

Studies on urban ecology and urban ecosystems at the University of Helsinki, Finland

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The University of Helsinki was established in Turku in 1640 and it moved to Helsinki in 1828. Main tasks of the University of Helsinki are research, teaching and societal interaction. The University of Helsinki is bilingual (Finnish and Swedish), but nowadays tuition is also provided in English to some extent. The university has eleven faculties, 35,000 degree students, 30,000 continuing education and Open University students, 8,160 employees, including 3,930 researchers and teachers. The budget of the University of Helsinki in 2010 was 644 million Euros. The university operates on four campuses in Helsinki and 17 other locations throughout Finland.

The University of Helsinki has two urban ecology related research groups, both in the Faculty of Biological and Environmental Sciences and more precisely in the Department of Environmental Sciences of the faculty. The research groups are Urban Ecology Research Group (based in Helsinki) and Urban Ecosystems Research Group (based in Lahti, 100 km north from Helsinki) (Fig. 1).

The Urban Ecology Research Group, led by professor Jari Niemelä, is one of the few groups in Finland focusing on the research and teaching of ecology in the urban setting. The research group has 14 researchers from six different countries at the moment and numerous MSc students yearly. The Urban Ecology Research Group addresses e.g. regeneration, trampling, edge effect, decaying wood, fragmentation, connectivity and human recreational experiences in the research in urban ecosystems such as urban forests, parks, semi-natural grasslands and small water bodies. Furthermore, they study the effects of urbanization on flora and fauna (e.g. Carabid beetles, amphibians, birds) and biodiversity, ecosystem services provided by urban nature, ecological-social systems interaction in urban areas, planning and management of urban green infrastructure, and use of ecological information in urban planning. Furthermore, the aim is to provide information to end-users (urban planners and decision-makers, managers, citizens) and thus enhance understanding of urban ecology to aid urban planning. The research projects run by the group are presented at the group's website http://www.helsinki.fi/urbanecologyresearch. Prof. Jari Niemelä has recently edited a major book on the research field, titled Urban Ecology: Patterns, Processes, and Applications (Niemelä et al. 2011), which was published by the Oxford University Press (Fig. 2).

Figure 1. The Helsinki Metropolitan Area illustrating the urban areas of Helsinki and Lahti.

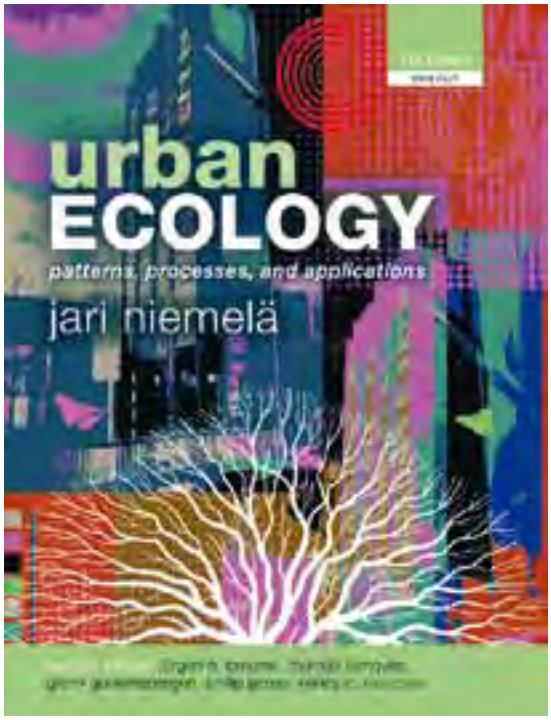

Figure 2. A new Urban Ecology book by Jari Niemelä et al (2011).

One of the group's large ongoing research projects Enhancing urban biodiversity: habitat planning and strategic management of urban green areas focuses on the role of certain key urban habitats (i.e. semi-natural grasslands and decaying wood). More specifically, the project addresses the possibilities of enhancing biodiversity in urban areas through habitat creation and restoration, i.e., how do urban habitats and especially newly created, open habitats such as semi-natural grasslands, and the addition of dead and decaying wood, contribute to and complement the biodiversity of urban areas. The study is being conducted in the most urbanized part of Finland, the cities of Helsinki and Vantaa.

For instance, if urban grasslands are managed as the heterogeneous mosaic of semi-natural grassland habitats, can this lead to the establishment of a meadow ecosystem with low nutrient levels and complex assemblages of nectar feeding insects and their host plants? The other key aspect of the project, dead and decaying wood, is an important habitat feature enhancing biodiversity in forests. Numerous species are dependent on dead wood, and urban parks and forests have the potential for preserving such species. Dead and decaying wood in urban environments can combat soil erosion, provide nursery stands for the regeneration of trees and provide certain ecosystem services, e.g. nutrient cycling.

Other examples of the research group's work include studies on urban remnant forest patches which are highly fragmented with sharp edges and are heavily used for recreational purposes. Indigenous understorey vegetation responds negatively to effects of the edge up to 50 m into the forest patches and at least up to 10 m from forest paths. Thick urban forest edges limit the extent of the edge effect. This result is mirrored in the restorative effects of these forests, e.g., thick urban forest edges provide greater restorative values to residents compared to thin forest edges.
The group also studies the biodiversity of golf courses. The objective in this study is to identify the habitat components and management options of golf courses that enhance biodiversity by examining assemblages of Carabid beetles, birds and amphibians. At this point of the study it is evident that golf courses harbour a species rich Carabid beetle fauna and are much richer in species than forests. Communities are variable between the golf courses and are dominated by generalist and open habitat species. According to our studies even tiny fragments of vegetation within courses hold a fauna of beetles that represent the fauna that was present in the area before it was converted to a golf course. The future work could address the conservation potential that golf courses could provide to certain species groups.

The research group has a strong focus on studying ecosystem services in urban areas. Diverse urban nature areas provide ecosystem services, which are essential for the well-being of urban residents (Niemelä et al. 2010). For instance, urban forests and meadows provide a wide range of regulating and cultural ecosystem services. Many of these services are dependent on how these urban ecosystems are managed.

The Urban Ecosystems Research Group led by professor Heikki Setälä (http://www.helsinki.fi/urbanecosystems/) and based in the City of Lahti, is the only research group in Finland focusing on the research and teaching specifically about urban ecosystem ecology. At the moment, the research group has six researchers and four MSc students. The research group mainly focuses on urban ecosystem ecology and the various ecosystem services carried out by the urban green areas and urban soils – their decomposer food webs and the activities carried out by them. Soil-derived ecosystem services, i.e. the processes by which the environment produces resources that humans often take for granted, such as clean water and detoxification of harmful substances, lie at the core of several research projects. Furthermore, studies on the urban hydrological cycle (stormwater as an indicator) and urban vegetation affecting urban air quality and carbon sequestration are the recent and ongoing strong research focuses. Research questions of the group are mostly socio-ecological by nature, dealing with both basic and applied sciences.

A recent research initiative, in which both research groups presented here are involved, is the Green Roofs in Urban Areas, which is an interdisciplinary research project with several partners. The project addresses if green roofs can be rich in biodiversity, act as compensating habitats (dry meadow) and what determines the success of species on green roofs. Moreover, certain key ecosystem services related to green roofs such as control of storm water flow from roofs, carbon sequestration potential, aesthetic, social and health benefits, and cultivation potential in urban settings, will be addressed in the project (http://www.luomus.fi/english/botany/research/greenroofs/).

The members of both groups are also actively involved in Urban Ecology related teaching, e.g. in the regular courses and seminars and in the Master's Degree Programme in Multidisciplinary Studies on Urban Environmental Issues (http://www.helsinki.fi/urban/).

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References

Niemelä J, Saarela S-R, Söderman T, Kopperoinen L, Yli-Pelkonen V, Väre S & Kotze DJ (2010) Using the ecosystem services approach for better planning and conservation of urban green spaces: a Finland case study. Biodiversity and Conservation 19(11): 3225-3243.

Niemelä J, Breuste JH, Guntenspergen GR, McIntyre NE, Elmqvist T & James P (2011) Urban Ecology: Patterns, Processes, and Applications. Oxford University Press.

Determinants and strength of restorative (stress-alleviating) experiences in favourite green, waterside and urban environments in Finland

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Topic: Greenery and health
Research was done during 2005-2006

This paper addresses the question of the restorative (= stress-reducing) and well-being effects of **different types of real-life, favorite natural environments**. Experimental evidence shows that visiting or seeing natural environments – typically parks or woods – alleviates both attentional fatigue and physiological and emotional stress more than built urban environments (Hartig et al., 2003; Berman et al., 2008; Parsons et al., 1998). This alleviation involves renewal of directed attention capacity, physiological changes from tension and stress toward relaxation, and positive mood change. These positive changes in activity are called restorative outcomes and experiences. To date, there is only little knowledge about which types of environments or which kind of landscape elements contribute most to these restorative and well-being effects. However, this kind of knowledge would be important in understanding the effects of natural environments and particularly in environmental planning and construction.

Moreover, although the restorative outcomes related to green space vs. urban sites are quite well documented, there is very little knowledge about the situational, personality, or demographic factors associated with restorative experiences in everyday life and leisure. In this study, we also investigated some of these determinants of the restorative experiences in order to (statistically) control them and thus more clearly find out the effect of the environment per se. Furthermore, many earlier studies have used students as participants and there is a lack of knowledge about other population and age groups.

Reflecting the early phase of research in this field, there has been a predominance of experimental studies comparing the restorative and well-being effects of only two coarse settings: natural and urban (Velarde, Fry & Tveit, 2007). Epidemiological studies have related not the types but the overall percentage of greenery within a certain area to health outcomes, such as morbidity (Maas et al., 2009) and mortality (Mitchell & Popham, 2008). About half of the 31 studies reviewed by Velarde et al. (2007) have been conducted using images of landscapes, not in real environments. Only seven studies (23%) have compared different kinds of natural environments. The main subcategories of natural environments in these studies have been green space, water environments, forest, golf course and high or low openness of the scene. However, all these types have not been included in any single study. Many of these studies a) have used students as participants and b) have been experimental studies where the researcher, not the respondents have chosen the environments where the study was carried out.

In sum, our study aimed to contribute to this field by comparing the restorative experiences in five types of real-life, everyday places in residential areas (in two Finnish cities). Consistent with our earlier research, we used favorite place as a window or unit of analysis (for other favorite place studies, see e.g. Jorgensen et al., 2007; Korpela, 1992; Korpela and Hartig, 1996; Korpela and Ylén, 2007, 2009; Newell, 1997; Tyrväinen et al., 2007). Thus, the places were selected by the respondents themselves and were valued or important to them in their everyday life. Moreover, the respondents were not sampled from a student population but were between 15 and 75 years of age and were obtained as a random sample from the Population Register Center. Our main aim was thus to increase our understanding of the ways in which people make deliberate use of different types of everyday environments for restorative experiences over extended periods of time. The present study analysed the associations between the use of favorite places, restorative experiences, and their determinants.

Method

A simple random sample of 1273 Finnish-speaking inhabitants, aged between 15 and 75 years, of two major cities in Finland (Helsinki and Tampere) completed a postal questionnaire. A subsample of the answers from inhabitants with a self-reported distance from home to a favorite place of 15 km or less (n = 1089) was analysed.

Sixteen types of places (see results) were evaluated according to their personal importance. The respondents selected their favorite (most important) place from these sixteen settings. Restorative experiences in a favorite place ('What changes in

your experiences typically take place there?') were measured with six items summing up as a Restorative Outcome Scale (ROS) (Korpela et al., 2008). Three of the items reflected relaxation and calmness (e.g. 'I feel calmer after being here'), one item reflected attention restoration ('my concentration and alertness clearly increase here') and two items reflected clearing one's thoughts (e.g. 'I can forget everyday worries here'). To investigate differences in restorative experiences between types of environments, an analysis of covariance with the ROS as an outcome measure, the type of favorite place (five categories) as a fixed factor, adjusted for nine determinants (covariates) was performed.

Results and discussion

Factor analysis (principal axis factoring, oblique Promax rotation) regarding the importance of the sixteen place items (see underneath) produced five main place factors/categories (Figure 1), which were

(1) extensively managed nature areas (including large forest areas, small-scale wooded areas, scenery fields and meadows, small-scale natural state areas such as river valleys, wetlands, bushes and rocks),
(2) built-up green spaces (large green lots, green areas within housing blocks, decorative plantations and glorious flowers, traffic green areas such as wind-breaks, green lanes and tree avenues, parks including grass and plantations),
(3) waterside environments (beaches and harbour areas),
(4) exercise and activity/hobby areas (playgrounds, recreation trails, sports grounds, allotment gardens, dog parks) and
(5) indoor and outdoor urban areas (street areas and indoor places within the city center). This result shows that the types of places in brackets tend to be equally important for our participants in everyday contexts.

Restorative experiences in favorite exercise and activity outdoor areas, waterside environments, and extensively managed natural settings (mainly urban woodlands) were somewhat stronger than in favorite places in built urban (indoor and outdoor) settings or green spaces in urban settings (mostly parks) even after statistically controlling for the nine most effective situational and personality determinants of restorative experiences (Fig. 1). These determinants included "immediate" use of the favourite place (duration and frequency), personal background of nature experiences (nature orientedness, nature hobbies, childhood nature experiences), and situational factors in life which were related to stress (hassles at work and with money, satisfaction with life) and to social relations (uplifts of social relations, visiting alone vs. in company) (Korpela et al., 2008).

The overall result when considering urban vs. natural places in general concurs partly with earlier research on restorative environments (Ulrich et al., 1991; Hartig et al., 2003; Velarde et al., 2007). However, it contributes to the existing knowledge by widening our view of the potentially health-enhancing types of natural areas.

The similarity in the strength of restoration between urban favorite places (indoor and outdoor city areas and places) and urban green spaces (mostly parks) was unexpected. The earlier evidence from restorative environment studies suggested that parks provide stronger restorative experiences than built urban environments. The results do not support the possibility that people selecting favorite urban places and having less intensive restorative experiences simply do not have the need for restoration in these places, because this need was controlled in our statistical analyses (daily hassles or worries about work and money, uplifts generated by social relations and satisfaction with life). Thus, favorite city places – which in this study and in any city may include at least some green elements such as plantings, city trees and flower-pots – may provide equally strong restorative experiences as favorite parks in conditions where people select from familiar places according to their own preferences and emotional attachments. In consequence, future theoretical and applied developments should take note that the experimentally proven superior restorativeness of natural places in comparison to urban places does not necessarily hold for all types of urban and natural places in everyday life. In particular, the question of the sufficient degree or amount of green elements for restorative effects in an otherwise ur-

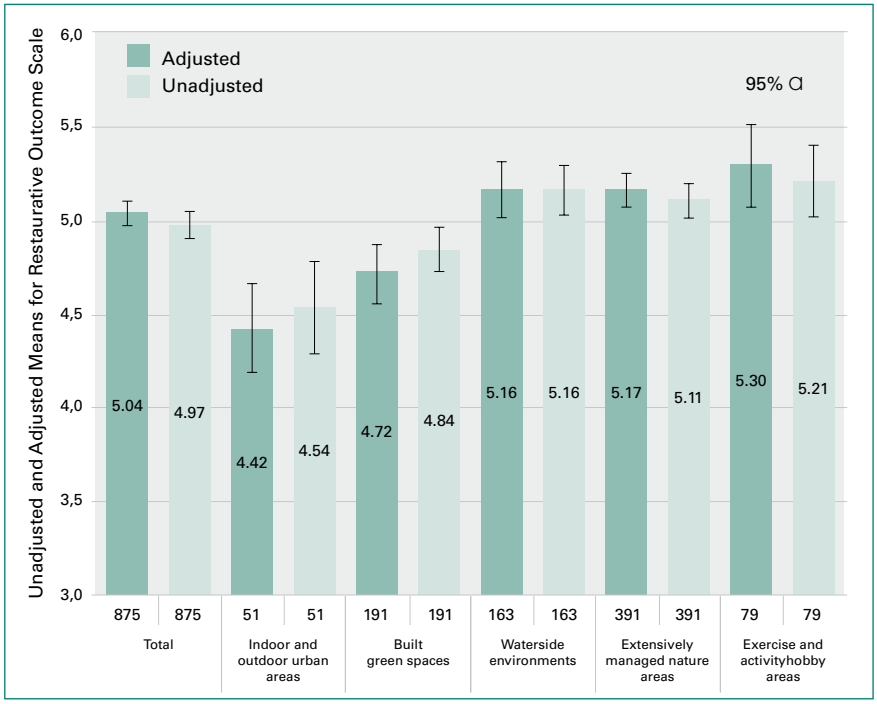

Figure 1. Adjusted (nine covariates) and unadjusted means of restorative outcomes (ROS) by favorite place type (confidence intervals of the mean are included). Numbers under the bars represent the frequency of mentioning the favorite place type (listwise deletion in ANCOVA). Published in Korpela, K., Ylén, M., Tyrväinen, L. & Silvennoinen, H. (2010). Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland. Health Promotion International, 25, 200-209. Downloaded from http://heapro.oxfordjournals.org at Tampere University Library on May 20, 2010.

ban environment, such as on a street, requires much further study.

Concerning the question of the types of landscape elements contributing most to the restorative effects, we note here a single study by Nordh et al. (2009) as an example of the possible ways for future research in this area. This kind of research might provide landscape planners and constructors further concrete results for applicative purposes. Seventy-two small "pocket parks" (< 3000 m2) from cities in Sweden, Norway and Denmark were investigated. Each park was represented by a photo and its physical characteristics were quantified as percentage of the scene. Landscape elements quantified were the size of the park, hardscape, grass, lower ground vegetation, flowering plants, bushes, trees and water/no water. The photos were assessed in terms of preference, likelihood of restoration, and components of restoration by a student sample. The landscape elements most predictive of the likelihood of restoration were the percentage of ground surface covered by grass, the amount of trees and bushes visible and apparent park size.

References

Berman, M. G., Jonides, J. & Kaplan, S. (2008). The cognitive benefits of interacting with nature. Psychological Science, 19, 1207-1212.

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. Journal of Environmental Psychology, 23, 109-123.

Jorgensen, A., Hitchmough, J., Dunnett, N. (2007). Woodland as a setting for housing – appreciation and fear and the contribution to residential satisfaction and place identity in Warrington New Town, UK. Landscape and Urban Planning, 79, 273-287.

Korpela, K. M. (1992). Adolescents' favourite places and environmental self-regulation. Journal of Environmental Psychology, 12, 249-258.

Korpela, K.M., Hartig, T. (1996). Restorative qualities of favourite places. Journal of Environmental Psychology 16, 221-233.

Korpela, K. & Ylén, M. (2007). Perceived health is associated with visiting natural favourite places in the vicinity. Health & Place, 13, 138-151.

Korpela, K. & Ylén, M. (2009). Effectiveness of favorite-place prescriptions - A field experiment. American Journal of Preventive Medicine, 36, 435-438.

Korpela, K., Ylén, M., Tyrväinen, L. & Silvennoinen, H. (2010). Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland. Health Promotion International, 25, 200-209.

Korpela, K., Ylén, M., Tyrväinen, L. & Silvennoinen, H. (2008). Determinants of restorative experiences in everyday favourite places. Health & Place, 14, 636-652.

Maas J., Verheij R.A., de Vries S., Spreeuwenberg P., Schellevis F.G., Groenewegen P.P. (2009). Morbidity is related to a green living environment. Journal of Epidemiology and Community Health, 63, 967-973.

Mitchell, R. and Popham, F. (2008) Effect of exposure to natural environment on health inequalities: an observational study. The Lancet, 372, 1655-1660.

Nordh, H., Hartig, T., Hägerhäll, C. M., & Fry, G. (2009). Components of small urban parks that predict the possibility for restoration. Urban Forestry & Urban Greening, 8, 225-235.

Parsons, R., Tassinary, L.G., Ulrich, R.S., Hebl, M.R., Grossman- Alexander, M., 1998. The view from the road: implications for stress recovery and immunization. Journal of Environmental Psychology 18, 113-140.

Tyrväinen, L., Mäkinen, K., Schipperijn, J., 2007. Tools for mapping social values of urban woodlands and other green areas. Landscape and Urban Planning 79, 5-19.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. Journal of Environmental Psychology, 11, 201-230.

Velarde, M. D., Fry, G., & Tveit, M. (2007). Health effects of viewing landscapes – landscape types in environmental psychology. Urban Forestry & Urban Greening, 6, 199-212.

Research ideas on how to plan and design natural environments based on evidence-based health design and validated guidelines in order to maximise the potential health benefits for all

ELCA RESEARCH WORKSHOP BRUSSELS MAY 24TH, 2012

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The positive associations between visiting natural environments and human health could be described as a rediscovery. Once again health is an important issue in city/landscape planning and garden design, but today we face new types of health problems that need new solutions and actions.

Research proposes that natural environments have positive effects on human health through:

1. encouraging physical activity
2. encouraging social contact
3. providing psychological and physiological restoration

The paradox is that everyday life offers fewer opportunities for these activities. This is connected to the increasing number of people moving into cities and of urban densification, which reduces urban green spaces. The WHO has identified the lack of urban green spaces for everyday recreation as a problem to people's health and well-being, and encourages local administrators to increase the provision thereof.

To realise the salutogenic potential of natural environments, a detailed understanding of how to plan/design and manage them is needed. Existing detailed empirical evidence and depth of understanding on which to base clear policy and planning guidance are insufficient.

Seven research ideas are presented, based on a research strategy with two foundations:

- evidence-based health design/planning
- health promotion and ill health improvement

Paper outline

Background

The positive associations between visiting natural environments and human health could be described as a rediscovery. Once again health is an important issue in garden design and in city/landscape planning, but today we face new types of health problems that need new solutions and actions compared to before.

New research proposes that natural environments have positive impacts on human health in three main ways:

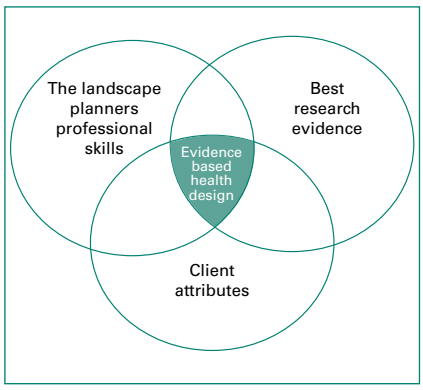
1. Indirectly, through encouraging physical activity
2. Indirectly, through encouraging social contact
3. Directly, through providing psychological and physiological restoration

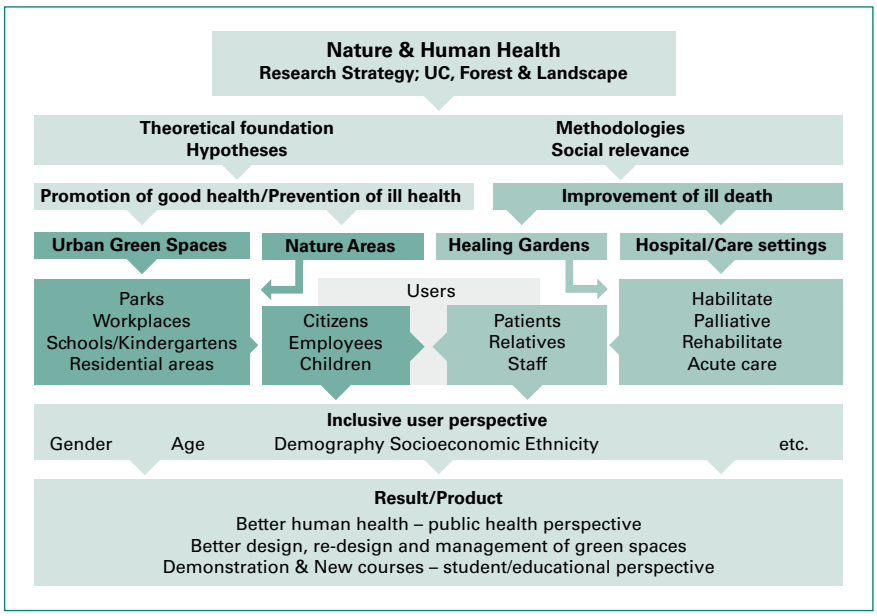
Evidence also suggests that there may be synergy between the three ways, for example, physical activity in a natural environment having greater psychological and physiological benefits than in a non-natural environment, such as a gym.

The paradox is though that today, in the 21st century, everyday life offers few opportunities for both physical activity and psychological and physiological restoration. This is connected to the fact that people live in an urbanised world. As a consequence of the increasing number of people moving into cities and of urban densification, which results in building and construction on urban green spaces, the natural environments available for physical activities, social contact, psychological and physiological restoration are reduced. As a result, the WHO has identified the lack of accessible urban green spaces for everyday recreation as a problem for people's health and well-being, and they encourage local administrators to increase the provision thereof.

Research deficits

There is already sufficient evidence to warrant an expectation that natural environments can act to help keeping us well (health promotion) and as a supportive environment for therapies used to help when we become sick. Policy makers, land managers and health professionals have realised the potential in these relationships. Many recent policy documents from governments, health service providers and land mangers highlight the potential for natural environments to play a role in reducing the burden of poor health and narrowing health inequality. However, more effective landscape design, planning, management and access for all in society are needed to maximise the potential benefits and this requires a solid understanding of 'how' natural environments and health and wellbeing are, and could be, connected.





The Vice Director of Forest & Landscape Denmark, Kjell Nilsson, initiated and chaired the COST Action E39 'Forest, Trees and Human Health and Wellbeing'. The main objective was to increase the knowledge about the contribution that forests, trees and natural places have, and might have, on the health and wellbeing of people in Europe. The final outcome of the COST Action is the newly published, first comprehensive European textbook on the topic 'Nature and human health' . The book draws together work carried out over the four years by more than 100 scientists from 25 countries working in the fields of forestry, health, environment and social sciences, and captures the state of the art in terms of scientific understanding. The book articulates the tremendous economic and clinical significance of poor health in Europe, and highlights the vast potential of Europe's natural environment if we can learn how, and for whom, access brings health benefits. The book presents a clear standpoint: natural environments can play an important role in health promotion, prevention and the cure of significant health problems, which may result in that Europe's natural environments take on a new value, particularly those accessible to the 70% of the population living in an urban area. It also follows that if these environments (or access to them) are threatened or altered by exploitation, poor city planning, poor landscape design or bad management their salutogenic potential may be seriously harmed.

To realise the salutogenic (health creating) potential of natural environments, we need to have detailed understanding of how to design, manage and promote them, and of what to expect these environments to be able to achieve. We lack detailed empirical evidence and depth of understanding on which to base clear policy and planning guidance.

Research strategy proposal

We know today that there are three main ways via which health effects might be generated but we don't know which, or which combination, of these is most likely to affect different target groups, what type of natural environment might produce them, or how to configure and manage them to do so. More effective landscape design, planning, management and access for all in society are needed to maximise the potential benefits and this requires a solid understanding of 'how' natural environments and health and wellbeing are, and could be, connected.

Evidence-Based Health Design/Planning

Our overall research strategy proposal has its foundation in what we call evidence-based health design/planning (EBHD). Thus, the EBHD process calls for practitioners (landscape architects/city planners) to make practice decisions based on an integration of the best available research evidence and proven experience with their practice expertise and with their knowledge of clients attributes (such as variation in perception, preferences, circumstances, values, needs and health status).

Two health perspectives

Viewing natural environments from a salutogenic viewpoint positive health effects can be utilised both in a health promotive and ill health preventive and ill health improvement (therapeutic) context. Figure X illustrates these perspectives in research strategy for the Nature & Human Health research group at Forest & Landscape Denmark. The salutogenic effects seem most profound on diseases and disease pathways which are responsible for a large proportion of the burden of poor health in the 21st century Europe; poor mental health, cardiovascular and respiratory disease.

List of new concrete research ideas

1. Deficit: A remarkable large amount of 'Nature & Health' studies are cross-sectional, which are vulnerable to confusion, and even a strong statistical association between greater access to natural environments and better health cannot be taken as evidence of a causal relationship.

   Research idea: Addressing the remarkable lack of longitudinal studies on health impacts of change in access/use to natural environments is a significant priority for this research area. This could be done partly by using all ready existing register data and by using web based questionnaires. Also the quality of the nature area should be taken into consideration.

2. Deficit: Municipalities ask for guidelines on how to plan urban parks in order to enhance physical activity.
   Research idea: Larger study, including questionnaires, on site behavioural studies, focus groups interviews and workshops.
3. Research idea: How to plan health promotion urban green spaces for all – especially targeting weaker groups such as: children, teenagers, different ethnicity, girls/women.
4. Deficit: Many guidelines on how to design therapy gardens for different patient groups exist, but how reliable are they?
   Research idea: Realiability studies of therapy gardens constructed on transparent design guidelines
   Cases: The Healing Forest Garden Nacadia, University of Copenhagen, and The rehabilitation garden at Alnarp, Swedish University of Agricultural sciences.
5. Deficit: Many results from therapy gardens rely on narratives
   Research idea: Provide a validated tool box for evaluating the effect of horticultural therapy as well as for the design of therapy gardens
6. Research question: Investigating both urban parks and therapy gardens etc. costs money – but could money be saved by improved health?
   Research idea: Cost benefit and cost utility analyses should be incorporated in the above mentioned research ideas.
7. Research question: New roles for old green spaces?
   Research idea: Could older urban green spaces be transformed/redesigned in order to get new roles as health supportive? Could churchyards be redesigned in order to support the grief process?

List of own publication on the topic Greenery and Health

Peer reviewed papers

Stigsdotter, UK., Ekholm, O., Schipperijn, J., Toftager, M., Kamper-Jørgensen, F., Randrup, TB. 2010. Health promoting outdoor environments – Associations between green space, and health, health-related quality of life and stress based on a Danish national representative survey. Scandinavian Journal of Public Health, volume 38, issue 4, pp. 411-417.

Grahn, P. & Stigsdotter, UK. 2010. The relation between perceived sensory dimensions of urban green space and stress restoration. Landscape and Urban Planning, volume 94, issues 3-4, pp. 264-275.

Schipperijn, J., Stigsdotter, UK., Randrup, TB., Troelsen, J. 2010. Influences on the use of urban green space – a case study in Odense, Denmark. Urban Forestry & Urban Greening, volume 9, issue 1, pp. 25-32.

Corazon, S.S., Stigsdotter, UK., Claudi, A.G., Kjell Nilsson. 2010. Development of a Nature-Based Therapy Concept for Stress Patients at the Danish Healing Forest Garden Nacadia. Journal of Therapeutic Horticulture, volume 20, pp. 34-51.

Corazon, S.S, Stigsdotter, U.K., Ekholm, O., Pedersen, P.V., Scopelliti, M., Giuliani, M.V. In press. Activities to alleviate stress and the association with leisure time activities, socioeconomic status and general health. Journal of applied biobehavioral research. Volume X, pp. x-x.

Schipperijn, J., Ekholm, O., Stigsdotter, UK., Toftager, M., Bentsen, P., Kamper-Jørgensen, F., Randrup, TB. 2010. Factors influencing the use of green space: Results from a Danish national representative survey. Landscape and Urban Planning, volume 95, issue 3, pp. 130-137.

Toftager, M., Ekholm. O., Schipperjin, J., Stigsdotter, UK., Bentsen, P., Grønbæk, M., Randrup, TB., Kamper-Jørgensen, F. In press. Distance to green space and physical activity: a Danish national representative survey. Journal of Physical Activity & Health.

Stigsdotter, U. 2005. Landscape architecture and health. Evidence-based health-promoting design and planning. Dept. of Landscape Planning, Alnarp, SLU. Acta Universitatis agriculturae Sueciae vol. 2005:55. (Doctoral diss.)

Stigsdotter, U. & Grahn, P. 2003. Experiencing a Garden: A Healing Garden for People Suffering from Burnout Diseases. Journal of Therapeutic Horticulture Vol 14.

Grahn, P & Stigsdotter, U. 2003. Landscape Planning and Stress. Urban Forestry & Urban Greening Vol 2, pp 1-18. Urban & Fischer Verlag, Jena.

Stigsdotter, U. & Grahn, P. 2002. What Makes a Garden a Healing Garden? Journal of Therapeutic Horticulture Vol 13, pp 60-69

Grahn, P & Stigsdotter, U 2002. Parks and Nature in people's everyday life: Green areas significance for people's health and well-being. Urban Forestry & Urban Greening, vol 2, no 1.

Peer reviewed book chapters

Stigsdotter,UK., Palsdottir, AM., Burls, A., Chermaz, A., Ferrini, F., Grahn. P. (In press) Nature-Based Therapeutic Interventions. In: Nilsson, K. & Sangster, M. (eds.) Forests, Trees and Human Health. Chapter 11. Pp. x-x.

Grahn, P., Tenngart Ivarsson, C, Stigsdotter, UK., Bengtsson, I-L. 2010. Using affordances as a health-promoting tool in a therapeutic garden. In Ward Thompson, C., Aspinal, P., Bell, S. (eds.) Innovative approaches to researching landscape and health. Chapter 5, pp. 116-154. Routledge, London.

Popular scientific publications

Lamm, B., Stigsdotter, UK., Hare, R., Bentsen, P., Randrup, TB. 2010. Udeskole og Læringsmiljø – Empiriske perspektiver. (Outdoor education and learning environments – empirical perspectives) In: Kural, R., Jensen, BB., Kirkeby, IM (eds.) Aprops – Arkitekur, Pædagogik og Sundhed (Apropos- Architecture, Pedogogy and Health). Chapter 3, pp. 36- 43. Kunstakademiets arkitektskoles forlag, København. (in Danish)

Hare, R., Bruun, K., Regnarsson, I., Bentsen, P., Sundahl, M., Stigsdotter, UK. Mygind, E. 2010. Læringsmiljø nærmiljø (Learning environment nearby environment) Skov & Landkab, Frederiksberv C. (in Danish)

Schipperijn, J., Stigsdotter, UK. 2010. Lok folk ud i byens grønne områder.(Attract people out into the urban green spaces) Grønt Miljø. Nr 5/Juni. (in Danish)

Corazon, SS. & Stigsdotter, UK. 2009. Naturens puls- Om terapi haver og naturbaseret terapi. (The pulse of nature – on therapy and nature-based therapy) Angst Avsien, nr. 26. pp. 8-9. (in Danish)

Stigsdotter, UK. & Randrup, BT. 2008. Konceptmodel Terapihaven Nacadia. En model for terapihaver og haveterapi for stressramte i Danmark. (A Konceptuel Model for therapeutic gardens and horticultural therapy for people suffering from

stress) Skov & Landskab, Københavns Universitet, København. (in Danish)

Randrup, BT. & Stigsdotter, UK. 2008. Mere sundhed med grønne områder. (Green spaces genrerate better health) Vækst, 1, 2008 pp. 12-14. (in Dnaish)

Randrup, BT., Schipperijn, J. Ipsen Hansen, B. Søndergaard Jensen, F. & Stigsdotter, UK. 2008. Natur og sundhed. Sammenhæng mellem grønne områders udtryk og brug set i forhold til befolkningens sundhed. (Nature and Health) Park- og Landskabsserien, 40/2008. (In Danish) (Rapport)

Stigsdotter, UK. & Randrup, BT. 2007. Sundhed og Landskabsarkitektur. (Health and Landscape Architecture) Landskab Landscape. 2007, 88, pp. 152-155. (In Danish) (Fagblad)

Stigsdotter, U. 2005. SLU Alnarp, Institutionen för Landskapsplanering/SLU Alnarp, The Department of Landscape Planning In: Paulsson, J (ed.) Universal Design Education/ Design för alla utbildning. Pp. 158-174. (In Swedish and English)

Stigsdotter, U. 2003. Utemiljöns betydelse för hälsa och välbefinnande, (The importance of outdooe environmnets om human health and well-being) pp 265-282, in Stålbom G & Johansson B (eds), Människan inomhus: Perspektiv på vår tids inneliv, Formas, Stockholm. (In Swedish)

Stigsdotter, U. 2000. Solbergaparken - en park för hälsa och välbefinnande, (Solbergaparken – a park designed for improving health and well-being) Gröna Fakta/Utemiljö 1/2000. (In Swedish)

Stigsdotter, U. 1999. Rekreationsmiljöer och hälsa, (Recreational areas and health) in Andersson & Mårtensson (eds.) Miljömedicinskt samarbete i Skåne - Verksamhetsplan november 1999. (In Swedish)

Stigsdotter, U. 1999. Klosterträdgården - ett paradis på jorden, (The monstry garden – a paradise on earth) Svensk rehabilitering, 3/1999. (In Swedish)

Conference proceedings and Peer reviewed abstracts in conference proceedings

Stigsdotter, UK. 2010. On the relation between green space and human health. I: Dåsnes, M. (ed.) Nordisk Park-og friluftskongress, Oslo, 2-4 June 2010, pp. 4. (Abstract in conference proceedings)

Lindholst, AC., Stigsdotter, UK. 2010. An experience based method for green-space planning at small scales: A conceptual development and critical assessment. In: Findeis, G., Arnberger, A., Eder, R., Schuster, K (eds.) The 13th European Forum on Urban Forestry "Urban People Meet urban Forests", May 25-29 2010, Tulln an der Donau, Austria. pp. 32. (Peer-reviewed abstract in conference proceedings)

Lindholst, C., Schipperijn, J., Stigsdotter, UK. 2010. The greenspace experience asa tool for planning at small scales. In Goossen, M., Elnads, B. and Marwijk, R (eds.). Recreation, tourism and nature in a changing world. The Fifth International Conference on Monitoring and Mangement of Visitor Flows in Recreational and Protected Areas, Wageningen, The Netherlands, 30 May-3 June. Pp. 89. (Peer-reviewed abstract in conference proceedings)

Stigsdotter, UK., Toftager, M. Schipperijn, J., Ekholm, O., Kamper Jørgensen, F. 2009. Relationships between distance to and use of green space, physical activity and health-related quality of life – Results from a Danish national representative survey. In: Ecology and Forests for Public Health, Tellnes, G., Furuberg, M. (eds.). Pp. 8. (Book of Abstracts)

Stigsdotter, UK., Netterstrøm, B. 2009. Natur og sundhed – helbredelse. In: Koch, NE. (ed.) Skov & Landskabskonferencen 2009. Tema: Nya roller for natur, skov og landskab i velfærdssamfundet. pp. 21-22. (Book of abstracts)

Stigsdotter, UK, Ekholm, O., Schipperijn, J., Toftager, M, Kamper-Jørgensen, F., Randrup TB. 2009. The relation between green space and human health – Results from a Danish national representative survey. In: Hunziker, M., Bauer, N., (eds.) Health and Recreation in Forest and Landscape, April 1st to 3rd, Birmensdorf, Switzerland. Pp. 67. (Book of abstracts)

Toftager, M., Ekholm, O. Schipperijn, J., Stigsdotter, UK., Bentsen, P., Grønbæk, M., Randrup, TB., Kamper-Jørgensen, F. 2009. In: Hunziker, M., Bauer, N., (eds.) Relation between distance to green space and level of physical activity - Results from a Danish national representative survey. In: Health and Recreation in Forest and Landscape, April 1st to 3rd, Birmensdorf, Switzerland. Pp. 74. (Book of abstracts)

Stigsdotter, UK, Schipperijn, J., Randrup, TB. Measuring the experienced quality of urban green space – method development. In: Sarlöv Herlin, I. (ed.) 20th Conference of European Schools of Landscape

Architecture. New Landscapes new lives. New Challenges in Landscape Planning, Design and Management.

September 11-14 2008, Alnarp Sweden . pp. 21. (Book of Abstracts)

Schipperijn, J,. Stigsdotter, U.K., Randrup, T.B. What do Danish users want from their urban green space?

In: Sarlöv Herlin, I. (ed.) 20th Conference of European Schools of Landscape Architecture. New Landscapes

new lives. New Challenges in Landscape Planning, Design and Management. September 11-14 2008, Alnarp Sweden. pp. 19. (Book of Abstracts)

Grahn, P., Tenngart, C., Stigsdotter, UK. 2007. Horticultural therapy. State of the art and future research needs and priorities. Cyprus COST E 39, pp. 1-7. Parker og Urbane Landskaber, Frederiksberg. (Conference Proceedings)

Grahn, P., Stigsdotter U., Berggren Bärring, A-M. 2005. Eight experiences qualities in urban open spaces. In: Werquin et al (eds.) Green structure and urban planning. COST Action C11 Final report. COST Office, Luxemburg. Pp 240-248. (Conference Proceedings)

Grahn, P., Stigsdotter, U., Berggren Bärring, A-M. 2005. A Planning Tool for Designing Sustainable and Healthy Cities. The Importance of Experienced Characteristics in Urban Green Open Spaces for People's Health and Well-Being. In: De Vres, J. (ed.) Quality and significance of green urban space. Arnhem/Velp 2005.04.14 -2005.04.15, Van Hall Larenstein Univ Velp.pp. 29-38. (Conference proceedings)

Stigsdotter, U. 2005. Urban green spaces: Promoting health through city planning. Inspiring Global Environmental Standards and Ethical Practices. The National Association of Environmental Professionals', NAEP, 30th Annual Conference, 16-19 April 2005, Alexandra, Virginia, USA. (Conference proceedings)

Grahn, P., K Stigsdotter U., Berggren Bärring, A-M. 2005. A Planning

Tool for Designing Sustainable and Healthy Cities. The Importance of Experienced Characteristics in Urban Green Open Spaces for People's Health and Well-Being. In J. De Vres (ed) Quality and significance of green urban space. Arnhem/Velp 2005.04.14 -2005.04.15, Van Hall Larenstein Univ Velp.pp. 29-38. (Conference proceedings)

Grahn, P., K Stigsdotter U., Berggren Bärring, A-M. 2005. A planning model for designing sustainable and healthy cities. Inspiring Global Environmental Standards and Ethical Practices. The National Association of Environmental Professionals', NAEP, 30th Annual Conference, 16-19 April 2005, Alexandra, Virginia, USA. (Conference proceedings)

Stigsdotter, U . 2004. A Garden at your Workplace May Reduce Stress, pp 147-157 in Dilani A (ed) Design & Health III - Health Promotion through Environmental Design, International Academy for Design and Health, Stockholm. (Conference proceedings)

Stigsdotter, U A. & Grahn, P. 2004. A Garden at your doorstep may reduce stress - Private gardens as restorative environments in the city. Proceedings Open Space - People Space, Scotland A OPEN Space Research Centre, Edinburgh College of Art The International Play Association, Forestry Commission, Scottish National Heritage Open Space: People Space Conference Edinburgh. (Conference proceedings)

Stigsdotter, U. 2003. Health Promotion through Accessibility to Gardens. Design and Health, 3rd World Congress and Exhibition, Montreal 25-29 June 2003. Palais des Congrès. Design & Health, Book of Abstracts, p. 18.

Stigsdotter, U. & Grahn, P. 2003. The healing garden at Alnarp campus – Description and interpretation. Design and Health, 3rd World Congress and Exhibition, Montreal 25-29 June 2003. Palais des Congrès. Design & Health, Book of Abstracts, p. 43.

Grahn, P. & Stigsdotter, U. 2003. Natur og Sundhed. I Christensen, (Nature and Health) C.J. (red). Skov & Landskabskonferencen 2003. Center for Skov, Landskab og Planlægning. 2003, sid 100-105. (In Danish)

Allocation to one of the topics

Greenery and health.

(All publications are within the topic of greenery and human health)

Short declaration on when the research was done

Most of the research is ongoing. The international and multidisciplinary 'Nature & Health Research Team' at Forest & Landscape Denmark, University of Copenhagen was established in 2006. A wide range of research questions on interactions between man, human health and the environment are being studied. The research has two main perspectives:

1. The health promotive perspective
2. The ill health/therapeutic perspective

From a health promotive perspective the importance of supportive and restorative nature environments are being studied. These relate to workplaces, schools, playgrounds, pocket parks located in the dense city as well as other natural environments. Focus from a ill health/therapeutic perspective is on healing landscapes at acute care hospitals, healing gardens at refuge centres for battered women and children, and therapeutic gardens for stress patients.

The research outcome is to provide evidence for defining guidance for policy makers, city planners, landscape architects, and therapists translating the gained knowledge into practice.

The study of the Eight Sensory Percieved Dimensions is an ongoing research project in collaboration with the Swedish University of Agricultural Sciences.

The 'Susy Green' study based on a Danish national representative survey was done 2008-2010.

Publications published until 2005 were mostly part of a PhD project.

Bio-diverse cities

ELCA RESEARCH WORKSHOP BRUSSELS MAY 24TH, 2010

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The year 2010 has been proclaimed the year of biodiversity by the United Nations. The main reason for this was to raise the awareness of the importance of biodiversity. More and more species of our flora and fauna worldwide are under threat or disappearing, mainly due to advanced urbanization, industrialization and large scale agricultural practices.

Especially urbanization is not just a threat, it also offers new possibilities. Rich and varied greenery in the city is not only appreciated by citizens, but it can also significantly contribute to the increase of biodiversity. Urban greenery offers a home and a food source to many kinds of insects, birds and other animals. An additional positive effect is, that it brings nature closer to the people. The creation of high quality greenery in the city in combination with good management and the right species choice of trees, shrubs and perennials is essential.

History of research

In the past, Applied Plant Research has done research on several aspects of biodiversity in gardens and cities. We worked on different topics on the level of plant communities, e.g.:

- use of perennials and shrubs underneath trees
- combinations of perennials and bulbs for long-lasting plantings
- use of low-maintenance perennials in cities
- ecological banks along canals
- regional plantings
- natural enemies of pests in nursery crops
- use of plants on green roofs and green walls.

At species level we have done research on:

- the functionality of alien species compared to native species
- the value of new (street) trees for our cities
- the attractiveness of certain plant species for butterflies, bumblebees and bees
- many variety trials

Dutch Brochure

To encourage greener and more biodiverse cities Applied Plant Research (PPO), together with Plant Publicity Holland (PPH), issued a (Dutch) brochure: "Biodiversiteit in tuin en plantsoen" ("Biodiversity in gardens and parks"). The brochure gives examples to green space managers, landscapers and policy makers as information and inspiration. The brochure provides background information on biodiversity in the city, and there are useful tables of plant species that attract bees, butterflies or birds. The brochure also provides tips about certain types of plantings and examples of creative initiatives of municipalities to stimulate biodiversity. The data are based on years of experience in many research projects on applications of green in the city and on a literature review.

Dutch brochure on biodiversity

Factors that affect biodiversity

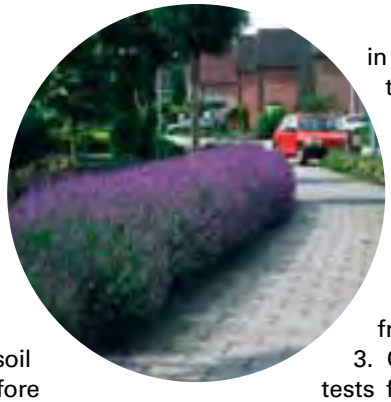
Biodiversity is influenced by many factors. The most important factors in urban green are:

1. Plant diversity: The larger the variety of species and cultivars used, the more biodiversity it creates.
2. Types of plantings: Some types of planting can stimulate biodiversity, because they usually include a variety of plants or they provide shelter for certain animals. Large scale planting of monocultures is not recommended. Interesting plantings are: prairie-plantings, mixed borders, (mixed) hedges, banks and ponds, green walls and green roofs and underneath plantings of trees.
3. Individual choice of species and cultivars: By choosing certain plant species, bees, butterflies, birds, etc. will be attracted. Some insects need specific host plants to survive.

a. Species attracting bees: Acer spp., Malus spp., Tilia spp., Calluna vulgaris, Cephalanthus sp., Hedera helix Arborescent Group, Salix spp., Symphoricarpos spp., Aster ageratoides, Geranium macrorhizum, etc.
b. Species attracting butterflies: Buddleja davidii, Rubus fruticosus, Agastache spp., Anchusa spp., Centranthus ruber, Echinacea purpurea, Sedum spectabile, Verbena bonariensis, etc.
c. Species attracting birds: Amelanchier spp., Aronia spp., Berberis spp., Cornus alba & sanguinea, Lonicera spp., Sambucus spp., Sorbus spp., etc.

Native versus alien species

The discussion about the use of native or alien species shares many aspects with the issue of biodiversity. Many ecologists promote the use of native species, because they are better adapted to the local circumstances. But there are two difficulties:



1. Habitat of the city: The growing conditions for plants inside cities are quite different from the conditions in the countryside. The temperature is higher and because of all the pavements the soil is much drier. Therefore many alien species or provenances are better adapted to the city-climate.
2. Climate change: Our climate is changing very fast. Adaptation by evolution will go too slowly. More and more certain alien species or provenances will be better adapted to the new climate than the native ones.

Most of the high quality greenery in cities already consists of alien species and/or cultivars. This makes it possible for landscapers and architects to create high quality green designs with a high ornamental value, surprising creations, healthy plants and a good integration with the architecture of buildings. Alien species and cultivars can have a positive influence on biodiversity. But there are some exceptions. Sterile and double flowered cultivars are less attractive to many animals, because they have less food (pollen, nectar and/or berries). In natural areas native plants have precedence because they represent the national green heritage. Some alien species can be harmful because of their invasive character.

Creative initiatives

Many municipalities make an extra effort to promote biodiversity or bring it closer to the citizens. This is to the benefit of a city or village, because biodiversity creates a healthy environment where people like to live and where tourists like to visit. In the Netherlands already several creative initiatives have been conceived and executed. Below are some examples:

1. Some municipalities provide a package of plants or a tree for free for use in (front)gardens. This is to the benefit of the entire neighbourhood and city.
2. Sponsoring of tree-gardens. Typically, these are the spaces under the street trees at the front doors of citizens.
3. Organisation of contests for citizens: who has the most beautiful garden, the tree with the x-factor, or the most innovative green idea.
4. Sometimes municipalities stimulate initiatives of citizens to revive old monastery gardens or city gardens in decline.
5. Lectures or excursions on specified topics or areas can open the eyes of citizens (e.g. a tree tour through the city or a lecture about butterflies).
6. Volunteer clubs can play an important role, for example the cutting of willows, putting up owl nest boxes, performing butterfly counts, etc.
7. Several cities with canals, such as Amsterdam and Leiden, have introduced floating islets ('floatlands') with various water and bank plants. Water birds and other animals can use them to rest, feed and nest.
8. Some municipalities have turned their city into an arboretum. It is a friendly competition to plant as many tree or shrub species in the city as possible.
9. Picking gardens have proven to be a very successful initiative of agricultural entrepreneurs. Set-aside land is sown or planted with a mixture of flowers. Residents can pick their own bouquet for a small fee.
10. Many municipalities provide grants for certain plantings, for example for planting green roofs, wall gardens, regional species, etc.
11. Attention for monumental trees, by setting out walking/bike routes along them.

European approach

The (Dutch) brochure on biodiversity is very successful; there is a large demand and users are very enthusiastic. Until now we have mainly focused on the Dutch situation. But the subject is fit for an international approach too, because it is relevant for the whole of Europe. Environmental care is a typical European item, that doesn't stop at the borders and different European countries can learn from each other's expertise and experience.

An important factor to deal with, are the effects of climate change in the near future. This needs new research based on specific circumstances for different countries and cities. The following three items for new European Research are suggested:

1. What plant species can be used and which plantings and plant combinations (plant communities) are most successful for increasing biodiversity in urban areas?
2. What is the effect of climate change on biodiversity and how can we counteract this by adapting the greenery in the city?
3. How can we involve citizens most effectively with the biodiversity in their city and what matters are most important for them?

Publications

Hoffman, M.H.A. (2010): Met flora meer fauna de stad in trekken – Tuin en Landschap 26, p. 25-29

Hoffman, M.H.A. (2010): Biodiversiteit in tuin en plantsoen - Brochure edited by Plant Publiciteit Holland, 19 p. (Download: PDF: http://edepot.wur.nl/154296)

Modelling the benefits of urban forests for sustainable management

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Urban forests are beneficial to society both in environmental and in economic terms. With respect to their management, it is important to sustain the net benefits rather than the aesthetic values. The crosslinking of costs and associated benefits is essential to achieve sustainability in urban forestry. With a newly developed model, we have quantified the environmental and economic benefits for both the capacity of an individual tree to remove PM10 from the air, and the potential capacity to reduce the Urban Heat Island-effect (UHI). Urban trees have clear potential in mitigating air pollution and UHI. Since crown projection area appeared to be an important tree characteristic, research is needed to determine the current tree coverage in our cities and to calibrate existing crown diameter models to local conditions. For quantification of the overall economic benefits, it is necessary to develop model applications within a GIS environment and to obtain more data on the returns of investments of green measures. Besides, urban soils must be managed well for optimal performance of the trees.

Introduction

There is a vast amount of scientific data indicating that urban forests are beneficial to society both in environmental and in economic terms, and promote the well-being of citizens (e.g. Konijnendijk et al., 2005). Thus, urban forests enhance the attractiveness of cities and improve the biodiversity, reduce the level of air pollution, alleviate the intensity of the urban heat island, help to control rainfall runoff and flooding, reduce human stress levels and improve the health of citizens. Urban green space furthermore increases home values and is an important factor for companies to consider when searching for an appropriate location for the establishment of their activities.

With respect to the sustainability in the urban forestry sector, Ferrini and Fini (2011) emphasized the importance of sustaining the net benefits of urban forests rather than the aesthetic values thereof. Whereas aesthetic and beautification assumed top priority until the last part of the past century, environmental and socioeconomic aspects have now become greater concerns. Urban forests provide the city with large values which often exceed the level of investments with respect to forest management.

However, when it comes to investments, the economic benefits of urban forests are generally overlooked, and there proper care is neglected. It is clear that the costs associated with the planting and maintenance of green space, are much higher in urban than in rural areas. But so are the benefits. With respect to the management of urban forests however, the municipality generally commits the large investments but does not receive the returns.

In our view, the crosslinking of costs and associated benefits is essential to achieve the sustainability in urban forestry. Thus, it's not just a matter of evaluating the benefits, it's a matter of financing these benefits and of the creation of a market (payment). So far, the economy has failed to provide authorities with the right tools. The Triple E FEDS-model (Financial Economic Decision Support Model) however provides solutions for these needs. Policy makers, green professionals and urban planners need quantitative data to integrate the multiple benefits of urban forests in proper design, planting and maintenance. To achieve new (financial) arrangements, information about the economic benefits also is necessary to get insight into the stakeholders who benefit from urban green space. Taking all these aspects into account, Triple E has developed a first version of a computer model called BETULA (Benefits of Trees in Urban Landscapes) - with which we are currently able to quantify the environmental benefits on a tree-per-tree basis, for both the capacity of trees to remove PM10 from the air, and their capacity to reduce the Urban Heat Island-effect. Other benefits such as avoiding water runoff and effects on house prices will be incorporated in the near future. The model also captures the values and payment for these benefits. Our paper presents the first results of the BETULA model with respect to PM10 removal and the urban heat island effect.

The removal of PM10 by urban trees

Deposition

The general process by which PM10 is removed from the atmosphere, is called deposition. This deposition can occur by precipitation as wet deposition and by dry deposition. Dry deposition to leaf surfaces is governed by the nature and concentration of the air pollutant, turbulent transport processes and leaf characteristics (Hanson and Lindberg, 1991). Because trees have a larger surface area than other land cover types and also promote vertical transport by enhancing turbulence, they provide good opportunities for the capture of PM10 particles (McDonald et al., 2007). Different tree species have different properties which will affect the capture efficiency (Freer-Smith et al., 2004; Hewitt, 2003).

Our model calculates the yearly dry deposition of PM10 (g y-1) to a canopy of an individual tree (see Appendix for a short description of the methodology). Data is available for circa 100 different tree species. The

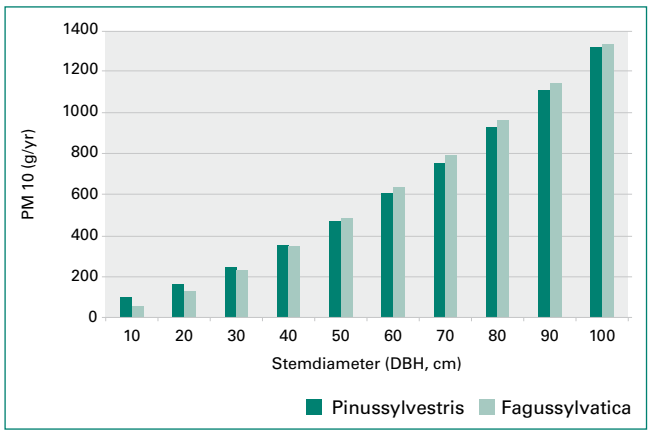

Figure 1. Calculated removal of PM10 (g/yr) by a coniferous (Pinus sylvestris) and a deciduous (Fagus sylvatica) tree species in relation to stem diameter.

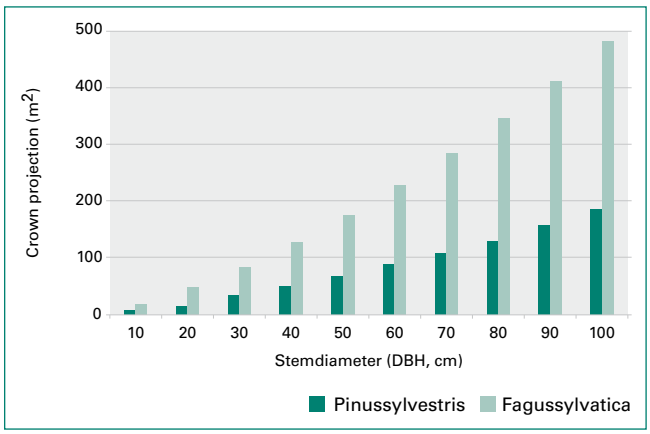

Figure 2. Modeled crown projection area of a coniferous (Pinus sylvestris) and a deciduous (Fagus sylvatica) tree species in relation to stem diameter.

crown diameter of a tree was calculated using species-specific crown diameter models, using tree diameter at breast height (DBH) as input (Condes and Sterba, 2005; Hasenauer, 1997; Kalliovirta and Tokola, 2005; Peper et al., 2001; Purves et al., 2007). If species-specific crown diameter models were lacking, genus-specific crown diameter models were used. If no crown diameter models were available, the average dry deposition values reported by McPherson et al. (1994) were used. Results of a field test with 60 individual trees showed that the measured values of crown projection amounted to circa 80% of the modeled ones. Our calculations have been corrected for this difference between observed and modeled values of crown projection area.

Model results showed that the removal of PM10 by an individual tree increased with increasing stem diameter (Figure 1). A mature tree with a stem diameter of one meter was calculated to remove approximately 11 times (beech) and 8 times (Scots pine) more PM10 than a corresponding tree with a stem diameter of 20 centimeters. At the lower stem diameters (≤ 30 cm), Scots pine appeared to be slightly more efficient in capturing PM10 than beech. Our results clearly indicated that it is important for urban trees to become mature.

Conifers had been found to be more effective in removing PM10 from the atmosphere than deciduous trees (e.g. Freer-Smith et al., 2005). Coniferous trees have a more complex leaf structure compared to deciduous ones and do not lose their leaves during the winter. However, our study showed that the yearly removal of PM10 by an individual beech tree was about similar to that of Scots pine for stem diameters equalling or exceeding 30 centimeters. Compared to Scots pine, the higher crown projection area in beech in response to the increase of stem diameter might well have compensated for the reduced removal capacity during the winter.

Economic benefits of pm10 removal

The monetary value of the removed PM10 is estimated based on the annual costs to reduce PM10 concentrations in the Netherlands. With respect to the improvement of the general air quality throughout the Netherlands, our central government has decided to spend € 210 million each year to reduce the emission of PM10 with 9.8 kilotons. Using the method of shadow pricing, this means that one kilo of PM10 that is removed by urban trees, represents a value of €21.4.

However, additional policy measures must be taken for the so-called hot spots where PM10 frequently exceeds the air quality standards. These additional measures amount to € 1,05 billion each year and are expected to result in an extra reduction of the PM10 emission of 2.6 kiloton. By applying the same methodology of shadow pricing, it can be calculated that the removal of one kilogram of PM10 at an hot spot represents an economic benefit of € 40.0.

Apparently, the economic benefit as a result of the removal of PM10 increased with an increase of the stem diameter for both tree species. The better the performance of the tree, this is the greater the stem diameter, the greater is the economic benefit.

Spatial planning based on calculations of source-sink relations

Scientific literature has shown that the removal capacity of an urban forest hardly reduced the average concentration of PM10 in cities (Nowak et al., 2006) unless the percentage of tree coverage is increased substantially (McDonald et al., 2007). However, the quantitative data about the air pollution removal capacity of trees are especially important since these data can be used to calculate source-sink relationships, thereby improving the procedures of spa-

DBH (cm)	Pinus sylvestris		Fagus sylvatica	
	Background site	Hot spot	Background site	Hot spot
20	3.4	6.4	2.7	5.0
50	9.9	18.4	10.2	19.1
100	27.9	52.2	28.2	52.8

Table 1. Yearly economic benefit (€) of PM10 removal by individual trees of two different species growing at a background location or at an hot spot, in relation to stem diameter (DBH).

tial planning. For instance, the emission of PM10 by cars (0,067 g per car kilometer) is expressed in units of weight as is the case for the removal capacity of trees. Thus, the removal capacity of a mature beech tree with a stem diameter of one meter equals the amount of PM10 that is emitted by a personal car over a distance of circa 20,000 kilometers.

Trees and the Urban Heat Island effect (UHI)

Air temperature is often higher in cities than in the countryside. This phenomenon is known as the Urban Heat Island effect. As is shown in a recent Dutch study, urban forests appeared to alleviate the intensity of the urban heat island (Klok et al., 2010). Due to the transpiration of water, the temperature under the canopy of a tree might well be 15 degrees Celsius lower than at some meters distance. We performed a first attempt to get some insight into the cooling potential of individual trees.

DBH (cm)	Pinus sylvestris	Fagus sylvatica
60	111	291
80	171	444
100	244	617

Table 2. Estimates of the potential cooling capacity (10^6 kJ) of mature trees of two different species in relation to stem diameter (DBH).

A mature tree needs 400 to 800 liters of water per meter square of crown projection area per growing season depending on site characteristics (Joye et al., 2008). An individual tree uses about 95% of this water for transpiration. For our calculations, the amount of transpiration was set at 570 liters of water (95% of 600 liters) per meter square of crown projection area irrespective of the tree species. For one kilogram (liter) of water to evaporate, 2,257 kJ of energy is required (evaporative heat). The more water evaporated by the tree, the greater the required evaporative heat and the greater the potential cooling capacity of the tree. Our results indicated that a mature beech tree had a greater potential cooling capacity than Scots pine (Table 2) because of its greater crown projection area (see Figure 2).

This type of information can be used to select the right tree species if the trees are planted to reduce air temperatures. Of course, the trees can only perform their 'job' properly if sufficient water is available. This is especially important since the frequency of dry and hot summers is expected to increase due to global climate change.

Conclusions and research needs

Urban forests have great potential in removing PM10 from the air and in mitigating UHI. Green management must be directed towards the increase of the percentage of tree coverage rather than of the total number of trees. Visual tree assessments should incorporate the measurement of crown projection area in the future and additional research is needed to determine the current tree coverage in our cities.

All residents benefit from the positive effects of urban forests with respect to the PM10 pollution removal and the reduction of air temperatures, and share responsibility to enhance the quality of the urban environment. Current knowledge should be made available in applicable ways to stimulate residents to green their private gardens.

When it comes to the real economy, we need scientific data to quantify the positive effects of urban forests on e.g. property value and to determine the beneficiaries. For quantification of these benefits, it is necessary to develop model applications within a GIS environment and to obtain more data on the returns of investments in green measures.

For optimal performance, urban trees need to grow old and should grow on well managed soils. Green professionals have claimed a more than a 50 % increase of performance of trees at poor soils after application of mycorrhiza, compared to untreated ones. Mycorrhizal applications warrant further research to determine if these treatments are profitable to the city as a whole.

References

Condes, S. and Sterba, H., 2005. Derivation of compatible crown width equations for some important tree species of Spain. Forest Ecology and Management 217, 203-218.

Ferrini, F. and Fini, A., 2011. Sustainable management techniques for trees in the urban areas. Journal of Biodiversity and Ecological Sciences 1, winter 2011, 1-20.

Freer-Smith, P.H., Beckett, K.P. and Taylor, G. (2005), Deposition velocities to Sorbus aria, Acer campestre, Populus deltoides x tricocarpa 'Beaupré', Pinus nigra and X Cupressocyparis leylandii for coarse, fine and ultra-fine particles in the urban environment. Environmental Pollution 133, 157-167.

Freer-Smith, P.H., El-Khatib, A.A. and Taylor, G., 2004. Capture of particulate pollution by trees: a comparison of species typical of semi-arid areas (Ficus Nitida and Eucalyptus Globulus) with European and North American species. Water, Air and Soil Pollution 155, 173-187.

Hanson, P.J. and Lindberg, S.E. (1991), Dry deposition of reactive nitrogen compounds: A review of leaf, canopy and non-foliar measurements. Atmospheric Environment 25A, 1615-1634.

Hasenauer, H., 1997. Dimensional relationships of open-grown trees in Austria. Forest Ecology and Management 96 (1997) 197-206.

Hewitt, N., 2003. Trees are city cleaners. Sylva/Tree News, 1-2.

Joye, T., Ramaekers, J., Herp, P. V., Wael, J. D., Geerts, P. and Schauvliege, M, 2008. Technisch Vademecum Bomen, Agentschap voor Natuur en Bos, Brussel., 2008.

Kalliovirta, J. and Tokola, T., 2005. Functions for estimating stem diameter and tree age using tree height, crown width and existing stand database information. Silva Fennica 39(2), 227-248.

Klok, L., Ten Broeke, H., Van Harmelen, H., Verhagen, H., Kok, H. and Zwart, S., 2010. Ruimtelijke verdeling en mogelijke oorzaken van het hitte-eiland effect. Report TNO-034-UT-2010-01229_RPT-ML. TNO, Utrecht, The Netherlands.

KNMI, 2008. http://www.knmi.nl/kd /normalen 1971-2000/

Konijnendijk,C. C., Nilsson, Randrup, T. B. and Schipperijn, J. (Eds), 2005. Urban Forests and Trees. A Reference Book. Springer. Berlin, Heidelberg, New York.

McDonald A.G., Bealey, W.J., Fowlera, D., Dragositsa, U., Skibaa, U., Smitha, R.I., Donovanb, R.G., Brettc, H.E., Hewittd, C.N. and Nemitza, E., 2007 Quantifying the effect of urban tree planting on concentrations and depositions of PM10 in two UK conurbations. Atmospheric Environment 41: 8455-8467.

McPherson, E.G., Nowak, D.J., Rowntree, R.A. (Eds.), 1994. Chicago's Urban forest Ecosystem: Results of the Chicago Urban forest Climate Project. USDA Forest Service, Northeastern Forest Experimental Station, Radnor, PA.

MNP, 2007. Cijfers achter kaarten. http://www.mnp.nl/nl/themasites/gcn/kaartenjpeg /pm10_2006.html

Nowak, D.J., 1994. Air pollution removal by Chicago's urban forest. In: McPherson, E.G., Nowak, D.J., Rowntree, R.A. (Eds.), Chicago's Urban forest Ecosystem: Results of the Chicago Urban forest Climate Project. USDA Forest Service, Northeastern Forest experimental Station, Radnor, PA, pp. 63-81.

Nowak, D.J., Crane, D.E., Stevens, J.C., 2006. Air pollution removal by urban trees and shrubs in the United States. Urban Forestry and Urban Greening 4:115-123

Peper, P.J., McPherson, E.G. and Mori, S.M., 2001 Equations for predicting diameter, height, crown width and leaf area of San Joaquin valley street trees. Journal of Arboriculture 27(6), 306-317.

Purves D.W., Lichstein J.W. and Pacala S.W., 2007. Crown Plasticity and Competition for Canopy Space: A New Spatially Implicit Model Parameterized for 250 North American Tree Species. PLoS ONE 2(9): e870. doi:10.1371 /journal.pone.0000870.

Zinke, P.J., 1967. Forest interception studies in the United States. In: Sopper, W.E. and Lull, H.W. (Eds.), Forest Hydrology. Pergamon Press, Oxford, pp. 137-161.

Appendix

Calculation of pm10 removal

The yearly dry deposition (g y-1) of PM10 to the canopy of a tree has been calculated with the following equation according to Nowak (1994):

DEP	=	C x CP x (Vd on-leaf x Ton-leaf + Vd off-leaf x Toff-leaf)
Where:		
DEP	=	yearly dry deposition of PM10 to the tree canopy (g y-1)
C	=	Concentration (µg m-3) of PM10
CP	=	Crown projection (m2), the total area under the tree crown
Vd	=	Deposition velocity (m s-1) in the on- or off-leaf season
T	=	Time (seconds) of the on- or off-leaf season

The deposition velocity is dependent on the Leaf Area Index (LAI) of a tree, so different values have been set for deciduous trees and conifers in the on- and off-leaf season. The LAI of deciduous trees was set to 6 during on-leaf season, with Vd= 0.0050 m s-1. During off-leaf season the LAI was set to 1.7 with Vd= 0.0014 m s-1. The LAI of conifers was set to 9 for both the on- and off-leaf season, with a Vd = 0.0080 m s-1. These values are assumed to be constant and are based on a 50-percent resuspension rate of particles back to the atmosphere (Zinke, 1967).

The on-leaf season in the Netherlands starts in May and ends in October. This leaves November through April as the off-leaf season. During precipitation, dry deposition of PM10 is set to zero. The average amount of hours of precipitation was obtained from the Royal Netherlands Meteorological Institute (KNMI, 2008). By subtracting the total precipitation time from the total time in a season, the effective time per season is calculated in which dry deposition takes place.

The average annual concentration of PM10 (µg m-3) was obtained from the Netherlands Environmental Assessment Agency (MNP, 2007) and was set at 28 µg m-3 for our calculations.

Vitamin G: the importance of a green living environment for people's health

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Although notions of the beneficial effects of green space have existed throughout history and people generally believe that green space is good for their health, scientific evidence for a direct relationship between the amount of green space in the living environment and health is scarce. Therefore our research group worked on a coherent research program from 2005 until 2010 titled 'Vitamin G', in which the G stands for green space.

Objectives

The Vitamin G research program had three aims:

1. To investigate the relationship between the amount and quality of green space in people's living environment and health;
2. To investigate the importance of three possible mechanisms behind this relationship viz. stress reduction, physical exercise and social integration;
3. To translate the results into spatial planning and public health policies.

Methods

The program consisted of three projects at different scales: at a macroscopic scale using data on the Netherlands as a whole, at an intermediate scale looking into the specific effects of green space in the urban environment, and at micro scale investigating the effects of allotment gardens. The projects are observational studies, combining existing data on land use with health interview survey data, and collecting new data through questionnaires, interviews and observations.

Results

The results of our studies have shown that:

- people who live in a greener environment have a better self-rated health (see figure 1 for an indication of the strength of the relation), have fewer physician diagnosed diseases and report less acute complaints and a better mental health
- people in a greener environment experience less stress and have more social contacts and this (partly) mediates the relationship with health indicators (see figure 2)
- people (at least adults) who live in a greener environment do not engage more often in physical exercise
- especially the quality of streetscape greenery seems to be important.

Conclusion, discussion and research deficits

The Vitamin G research program provides evidence for the proposition that green space is more than just a luxury good, since the availability of green space is positively related to perceived and objective health and to feelings of social safety. Our findings indicate that the development of green space should be allocated a more central position in policies related to health, nature and spatial planning. Although our studies provide lots of interesting new results, they also raise questions such as:

- Is the relationship between green space and health the same in different countries?
- To what extent is the relation between green space and health a causal one?
- How does actual exposure to green space, measured using diaries or GPS devices, influence health?
- Which type of green space has the biggest impact on health?
- How much green space is needed to optimally influence health?

List of publications

De Vries, S., Groenewegen, P. P., & Spreeuwenberg, P. (submitted). Nearby nature and human health: Stress reduction, social cohesion and physical activity as possible mediators. Submitted to Social Science and Medicine.

De Vries, S. (2010). Nearby nature and human health; looking at mechanisms and their implications. In: Ward Thompson, Aspinall & Bell (Eds.), Innovative Approaches to Researching Landscape and Health; Open Space: People Space 2. Oxon/New York: Routledge. Pp. 77-96.

De Vries S, Classen T, Eigenheer-Hug S-M, et al. Contributions of natural environments to physical activity; theory and evidence base. In: Nilsson K, Sangster M, Gallis C, et al (Eds.). Forests, Trees and Human Health. New York: Springer, 2010.

Groenewegen, P. P., Van Den Berg, A. E., De Vries, S., & Verheij, R. A. (2006). Vitamin G: Effects of green space on health, well-being, and social safety. BMC Public Health, 6, 149. http://www.biomedcentral.com/1471-2458/6/149

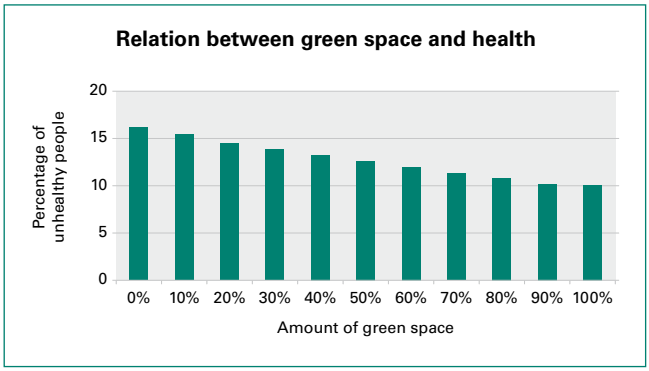

Figure 1. Relation between amount of green space (in a 3 km radius) and self perceived health (percentage stating their health is less than good) based on a logistic multilevel model controlling for age, gender, income, education, and urbanity (taken from Maas et al. 2006).

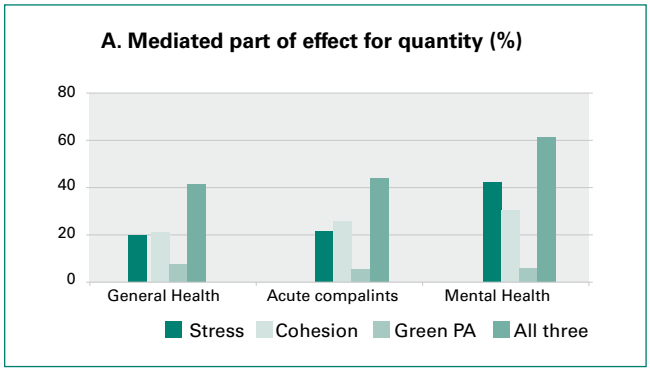

Figure 2. Indirect effect on health indicators as percentage of the total effect of quantity of streetscape greenery for the three mediators separately and combined, controlling for gender, age, education, income, life events, having children living at home, smoker, and excessive drinker (taken from De Vries et al, submitted).

Hartig T, Van den Berg AE, Hagerhall CM, et al. Health benefits of nature experiences: psychological, social and cultural processes. In: Nilsson K, Sangster M, Gallis C, et al (Eds.). Forests, Trees and Human Health. New York: Springer, 2010.

Maas, J., Verheij, R. A., Groenewegen, P. P., de Vries, S., & Spreeuwenberg, P. (2006). Green space, urbanity, and health: how strong is the relation? Journal of Epidemiology and Community Health, 60(7), 587-592.

Maas, J., & Verheij, R. A. (2007). Are health benefits of physical activity in natural environments used in primary care by general practitioners in The Netherlands? Urban Forestry and Urban Greening, 6(4), 227-233.

Maas, J., Verheij, R. A., Spreeuwenberg, P., & Groenewegen, P. P. (2008). Physical activity as a possible mechanism behind the relationship between green space and health: A multilevel analysis. BMC Public Health, 8, 206. http://www.biomedcentral.com/1471-2458/8/206

Maas, J., van Dillen, S. M. E., Verheij, R. A., & Groenewegen, P. P. (2009). Social contacts as a possible mechanism behind the relation between green space and health. Health & Place, 15(2), 586-595.

Maas, J., Verheij, R., De Vries, S., Spreeuwenberg, P., Schellevis, F., & Groenewegen, P. (2009). Morbidity is related to a green living environment. Journal of Epidemiology and Community Health, 63: 967-973

Maas, J., Spreeuwenberg, P., Van Winsum-Westra, M., Verheij, R. A., de Vries, S., & Groenewegen, P. P. (2009). Is green space in the living environment associated with people's feelings of social safety? Environment and Planning A, 41(7), 1763-1777.

Maas, J. (2009). Vitamin G: Green environments - healthy environments. (PhD Dissertation, University Utrecht). Utrecht: NIVEL. http://igiturarchive.library.uu.nl/dissertations/2009-0122-200330/UUindex.html

Van den Berg, A. E., Maas, J., Verheij, R. A., & Groenewegen, P. P. (2009). Green space as a buffer between stressful life events and health. Social Science and Medicine, 70(8), 1203-1210.

Van den Berg, A. E., & Custers, M. H. G. (2011). Gardening promotes Neuroendocrine and Affective Restoration from Stress. Journal of Health Psychology, 16(1), 3-11.

Van den Berg, A. E., Van Dillen, S. M. E., Van Winsum-Westra, M., & De Vries, S. (2010) Allotment gardening and health: a comparative survey among allotment gardeners and their neighbors without an allotment. Environmental Health, 9:74.

Van Dillen, S. M. E., De Vries, S., Groenewegen, P. P., & Spreeuwenberg, P. (submitted). Greenspace in urban neighbourhoods and residents' health: Adding quality to quantity. Submitted to Journal of Epidemiology and Community Health.

Research demand for healthier and safer cities

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Humans and plants go together

The usage of plants played a key role in the history of humans, the development of settlements and civilizations. The human physiognomy is adjusted to our native green habitats like forests e.g. our eyes can focus on green surfaces best. The presence of green calms us down.

Probably these are two exemplary reasons why citizens still have high sympathy for green areas like parks etc. People appreciate "green" subjectively in their neighbourhood, being aesthetic and environmental friendly. Real estates in city districts with a high ratio of green areas are more expensive.

Plants and the urban environment

It is undisputed that the presence of plants e.g. in parks, roof or façade greenings or simple potted plants on balconies, contribute to the melioration of the urban environment. Some effects to be named are

- Reduction of air temperature
- Increase of air humidity
- Reduction of air pollutants
- Retention of rainwater
- Reduction of noise
- Increase of biodiversity and connection of habitats

The "actual" city

Even though the positive effects of plants in city landscapes are well known, the actual situation concerning the presence and/or application of "green technologies" (= planted and/or permeable infrastructure surfaces) sufficiently in European cities is predominantly sobering. Building architecture and city quarter development do not include "green technologies" such as roof and façade greenings sufficiently. The planning routines seem to stay unchanged since decades and do not use plants directly.

So called green architecture does not mean roof and façade greenings or high quality and functional open spaces. It only means that the materials used are environmental friendly and the energy demand is low.

Beauty is not enough

The gap of the expected ratio of green areas in city landscapes due to their positive effects and the actual situation may be explained as follows

- green technologies do not comply with planning routines of architects and city developers
- the positive effects and necessity of plants are not sufficiently appreciated and present in the education of city developers and architects
- green technologies are not sufficiently integrated in rules and regulations
- need for transdisciplinary project development including landscape constructing experts

Conclusion

If one assumes that plants play a key role for quality of life in cities and contribute to increasing safety (storm rainfall water retention) and the health of citizens and reduce the energy demand for the heating and cooling of buildings it is clear that green technologies need to be promoted urgently. Following the prognoses of climate researchers green areas will gain significantly in relevance.

Research demand

As a precondition to the promotion of "green technologies" their properties concerning

- Water retention
- Microclimatic effects
- Building physical properties
- Particular matter reduction potential
- Noise reduction
- Comfort of home
- Cost/benefit analysis
- Habitat specification

need to be examined comprehensively. The results have to be reliable and calculable, generated on the basis of a standardized methodology. The various effects have to be quantifiable for the application of the respective "green technology" in regard to project development.

The knowledge of the "green technologies" properties allows their integration in authority´s regulations and planning processes.

Authority regulations

Authorities have established various instruments for regulation and steering at European, national and regional level. The most relevant ones on this topic may be summarized for the following groups:

- Spatial planning and development
- Public funding systems
- Environmental protection
- Water and waste water management

Some of the regulations already promote the application of "green technologies", as e.g.

- Splintered waste water charge in Germany

All of the named groups of regulations may support the application of "green technologies" by e.g.

- Maximum building energy demand for public funded buildings
- Minimum amount of green surfaces for public funded buildings
- Maximum reflected radiation and sensible warmth
- On site seepage of rainfall
- Maximum temperature for city quarters (counteracting urban heat island phenomenon)
- Maximum seepage water amount for city quarters
- Habitat provision and connection for protected species

Planning tools and processes

The planning processes for architecture and city development are usually software based using CAD and GIS. Planners are used to having comprehensive knowledge of the materials properties they are using e.g. thermal conductivity of bricks. Hence, the energy demand of buildings can be calculated for the planning process and adjusted according to regulations etc.

The generated knowledge of the properties of "green technologies" has to be compiled and converted to software tools, allowing planners to use "green technologies" in their project development just like bricks and concrete.

Another precondition to the successful introduction of "green technologies" in urban planning processes is the development of technical standards and guidelines to be used in biddings and to ensure technical quality.

The future city

City landscapes have to be adapted to their citizens needs for health, safety and quality of life. Green technologies will certainly play a highly relevant and irreplaceable role in that context. The climate change problem reinforces the need for plants in urban landscapes.

Unfortunately current knowledge does not allow the promotion of "green technologies" in a directed and reliable way. A research effort is necessary to provide the data needed and make the vision of green, livable cities come true:

Design for London (Living Roofs and Walls, Greater London Authority 2008)

ELCA Research Workshop – Summary and Outlook

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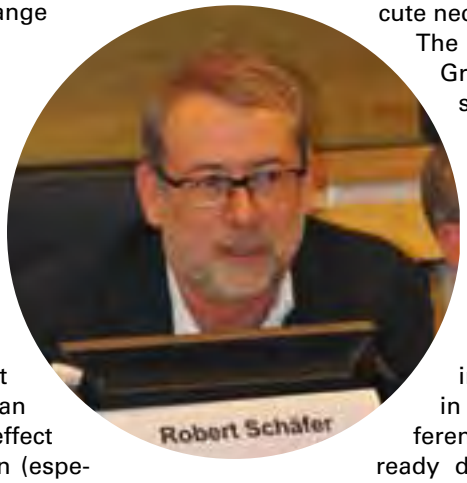
The topic of urban green is vast and can be discussed from many angles. Various of those have been presented in the ELCA Research Workshop at Brussels and corresponding publication, with many international scientists putting forward their research interests and perceived need for further study and analysis.

The overlying theme of the workshop was the range of benefits urban green can provide, all of which are in the end linked to health benefits, may that be through the amelioration of climate change and particulate matter or through conserving ecosystems to allow for recreation and its many direct health benefits to the urban population.

Under four headlines scientists from all over Europe presented their research. All topics were similarly interesting and in their fields of study of current significance. They lead however to another relevant question: How can these many different approaches be accommodated to allow for meaningful European collaboration for better scientific research and interdisciplinary action?



Under the headline of Green and Climate Change the sustainable management of urban green spaces was discussed, as was the cost-benefit analysis in environmental as well as economic terms. The significant reduction of urban heat island effect and air pollution (especially concerning particulate matter) was generally agreed upon. The "Oasis Effect" (Katzschner) of urban greenery for human comfort in dense urban settings was an important point; nonetheless there was call for strategies to implement networks of urban green to improve the situation further. All speakers impressed upon the audience of international scientists and European politicians the importance of appropriate policies (yet to be designed) to execute necessary changes.

The debate on Urban Green and Biodiversity also engaged to some extend in the subject of climate change. The need for diverse urban ecosystems was put forward referring to changing temperatures in Europe which in turn promote different plants for the already difficult urban habitats. Strategic management of urban green spaces and habitat planning were seen as the necessary (and again political) tools to deal with the implementation of further action. An understanding of "ecosystem services" (Pelkonen), the ways in which different types of urban green promote the well-being of residents, and environmental as well as cultural values, was considered to be of the utmost importance.

Carsten Henselek, Hanns-Jürgen Redeker, Karl-Heinz Florenz, Toni Berger

In an early summary of the benefits of urban green the scientists concerned with Green and Town Development illustrated the many values of greenery, listing aesthetics, ecological value, microclimatic effects, particulate matter reduction, water retention, noise reduction, residents' health, safety and quality of life as well as increased property values. The seldom use of "green technology" (Scharf) including roof and facade greening and planted and/or permeable surfaces was criticised. Again the need for comprehensible measurements of benefits was stressed and a better understanding of maintenance and life cycles of urban green was demanded.

The subject of Green and Health was mainly concerned with the direct health benefits of urban green spaces. There is already significant evidence that urban green promotes physical activity and social contact as well as stress reduction, thereby increasing psychological and physiological restoration. The immense leverage of this with respect to the economic weight of health expenses in national budgets is blatantly obvious. Yet ongoing densification leaves much of the population with less access to green spaces and introduces a sociographic variable into the discussion, where socially disadvantaged residents often have less access to urban green space than others. Research called for by the speakers includes the understanding of the benefits of different types of greenery. Lack of "global research" (Manusset) is pointed out, again asking for (political) consolidation of different demands on urban green.

The necessity for an interdisciplinary approach is obvious from all research angles presented. Only through well founded and scientific studies "research gaps" (as mentioned by Emmanuel Mony, president of the ELCA) can be closed, "designing and maintaining a future environment worth living in". The promotion of urban green in politics and thence the understanding of the various benefits vegetation in an urban setting has to offer has to be one of the prime objectives of all disciplines involved. Projects on a European level can do exactly this by taking a step back from specialised and in depth research of singular topics and instead examining the multi-layered functions urban greenery can provide. Research needs to look into different types of urban green and open spaces and into the compatibility and exclusion of different benefits they can offer. Only this evaluation of qualities of variations of urban green could allow communities to estimate and understand how to plan green spaces for their particular needs and thence to begin to value the potentials vegetation in an urban setting has to offer.

The research team brought together by the ELCA for their Research Workshop in May 2011 is excellently positioned to do exactly this: Cross professional boundaries to provide in depth knowledge of the different topics involved so that a combination and consolidation of knowledge and data can lead to a better political standing of urban green in the future.

ELCA-Research Workshop – Participants

Speakers

1.	Dipl.-Ing. HTL Florian Brack	Zurich University of Applied Sciences	CH
2.	Prof. Dr. Diedrich Bruns	ECLAS President, University of Kassel	DE
3.	Marco Hoffman	Wageningen University & Research Centre	NL
4.	Prof. Dr. Lutz Katzschner	University of Kassel	DE
5.	Andreas Kipar	President of Green City Italia, Milano	IT
6.	Prof. Kalevi Korpela	University of Tampere	FI
7.	Dr. Marcel Langner	Humboldt University of Berlin	DE
8.	Dr. Jolanda Maas	National Institute of Public Health and the Environment, Bithoven	NL
9.	Dr. Sandrine Manusset	Market Research Institute "Environment and Society", Nevez	FR
10.	Arnoldas Milukas	European Commission, DG Research & Innovation, Directorate I – Environment	LT
11.	Emmanuel Mony	ELCA President, Lyon	FR
12.	Sirpa Pietikäinen	MEP, EPP, Group of the European People's Party (Christian Democrats)	FI
13.	Dr. Giovanni Sala	LAND Milano Srl	IT
14.	Univ. lec. Bernhard Scharf	University of Natural Resources and Applied Life Sciences Vienna	AT
15.	Robert Schäfer	Moderator, chief editor TOPOS, Munich	DE
16.	Ass. Prof. Dr. Ulrika Stigsdotter	University of Copenhagen	DK
17.	Alfred Tonneijck	Expertise Centre Triple E, Arnhem	NL
18.	Dr. Vesa Yli-Pelkonen	University of Helsinki	FI

Guests

19.	Marie André	University of Liege	BE
20.	Jouko Antere	Journalist	FI
21.	Tom Bade	Director of the Expertise Centre Triple E, Arnhem	NL
22.	Laurent Batreau	TECOMAH – CCIP, L'Ecole de l'Environnement et du Cadre de Vie, Jouy-en-Josas	FR
23.	Antoine Berger	ELCA Vice-president, Berger Gartenbau, Zürich	CH
24.	Pierre Emmanuel Bois	Union Nationale des Entrepreneurs du Paysage (UNEP), Chief Executive, Paris	FR
25.	Dr. Ing. Florian Bellin-Harder	University of Kassel	DE
26.	Henrik Bos	Viheraluerakentajat ry, President, Helsinki	FI
27.	Edda Burckhardt	ELCA office, Bad Honnef	DE
28.	Océane Chmakoff	University Gembloux	BE
29.	Beke Clasen	University of Kassel	DE
30.	Ron de Jonge	Managing Director of Weverling Groenprojecten, Monster	NL
31.	Edward Demicoli	EU-Commission, member of the cabinet of EU Commissioner John Dalli	MT
32.	Gaëtan Duhamel	Plante & Cité, Angers	FR
33.	Dr. Ir. E.Dinand Ekkel	University CAH Dronten / Almere	NL
34.	Jean-Francois Ferrant	Fédération Belge Entrepreneurs Paysagsites – BFG-FBEP President, Gent	BE
35.	Simon Fierens	University Gembloux	BE
36.	Karl-Heinz Florenz	MEP, EPP, Group of the European People's Party (Christian Democrats)	DE
37.	Szilvia Golya	Green City Hungary, Budapest	HU
38.	Wolfgang Groß	Bundesverband Garten-, Landschafts- und Sportplatzbau e. V. (BGL), Bad Honnef	DE
39.	Jan Habets	De Groene Stad, Boskoop	NL
40.	Michalena Magdalena Hadala	Hadart SP.zo.o., Warszawa	PL
41.	Mathieu Halford	University of Liege, Unity Biodiversity and Landscape	BE
42.	Christoph Hartmann	Bundesverband Garten-, Landschafts- und Sportplatzbau e. V. – BGL, Vice-president, Berlin	DE
43.	Carsten Henselek	Fachverband Garten-, Landschaft und Sportplatzbau Berlin und Brandenburg e. V., Chairman, Berlin	DE
44.	Dr. Michael Henze	Bundesverband Garten-, Landschafts- und Sportplatzbau e. V. - BGL, Bad Honnef	DE
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