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URBAN FLOODING – PLANNING FOR A BLUE AND GREEN CITY – EN INTERNATIONELL KONFERENS I MALMÖ 14–15 MARS 2012

I våras arrangerade Föreningen vatten och Peter Stahres Stipendium en internationell konferens för att inspirera till kreativa lösningar för blå och gröna dagvattenlösningar som en viktig del i det hållbara stadsbyggandet och för att inspirera till flera stipendieansökningar. I detta nummer av Vatten presenteras korta sammanfattningar av föredragen tillsammans med en sammanfattning av de workshops som genomfördes som avslutning på konferensen.

Efter två dagar med inspirerande föredrag från Europa och Amerika första dagen och Sverige andra dagen var det dags för deltagarna att bidra aktivt genom medverkan i tre olika workshops för att definiera behovet av ny kunskap om hållbar dagvattenhantering.

Tema 1 – Hur får man ut mest av blå och gröna stråk? (Drift och underhåll av gröna stråk), Diskussionsledare: Arne Mattson Malmö Stad och Marianne Beckmann VA SYD

Tema 2 – Hur påverkar den täta staden gröna och blå lösningar? (Dagvatten i planering och politiska beslutsprocesser) Diskussionsledare: Agneta Persson, Lunds kommun och Tilla Larsson, Jordbruksverket

Tema 3 – Nya risker och ny strategi i Köpenhamn – kan den appliceras på andra platser? (Riskvärdering samt riskeliminering och – minimering) Diskussionsledare: Henriette Berggren, projektleder for blå-grøn strategiplan Köpenhamn och Karin Fernström, VA SYD

Upplägget var inspirerat av Café-metoden och under två timmar, inklusive tid för kaffe, växlade deltagarna mellan diskussioner vid olika bord med olika delfrågor inom respektive tema. Som avslutning samlades alla för en kort summering från diskussionsledarna. Diskussionsledarna har därefter i punktform gjort sammanställningar från respektive tema och med dessa som grund har en koncentrerad sammanfattning av hela diskussionen sammanställts av Anders Kristoffersson, SLU Alnarp och Henrik Aspegren VA-Syd.

Man kan säga att deltagarna med stor entusiasm tog sig an frågeställningarna med konferensens breda ansats. Det betyder att trots den tematiska uppdelningen visade resultaten från grupperna många gemensamma drag. Man kan bl.a. hitta följande gemensamma drag utan inbördes prioritering:

- Samarbetet mellan blått, grönt och även svart är en viktig förutsättning för ett lyckat arbete med dagvattenfrågan.
- Att tydliggöra de legala aspekterna av hur ansvarsfördelningen mellan olika parter ser ut är avgörande för det ansvar respektive part är beredd att ta.
- Det finns mycket kunskap hos olika parter som förtjänar att sammanställas mer systematiskt som grund för den fortsatta utvecklingen.
- Efterfrågan på tekniska beskrivningar av gröna lösningar är stor vad gäller allt från gröna tak och väggar till dammar och växtval.
- Att sträva efter multifunktionella lösningar är en nyckelfråga för framgång.
- Det krävs politiskt stöd genom t ex en dagvattenpolicy – det gäller bl.a. att skapa plats, sätta pengar på värdet, visa bidraget till klimatanpassning och påverka projektörernas inställning.
- Återkommande är också att det krävs kostnadsjämförelse mellan hållbara och konventionella dagvattenlösningar.
- Bearbetning av olika aktörers inställning till hållbara dagvattenlösningar lyfts också fram som en viktig faktor för framgång.
- Modellutveckling för olika tillämpningar är viktig för att förbättra lösningarna och förståelsen för hur de fungerar. Det gäller t.ex.: dimensionering av anläggningar, regnens variation och vattnets väg vid översvämning.

Hur väl lyckades då de olika temagrupperna med att besvara utgångsfrågeställningen? De kortfattade sammanfattade svaren ser ut som följer:

Tema 1 – Hur får man ut mest av blå och gröna stråk? *Genom samarbete och kostnadsjämförelser, påverkan av uppfattningar och att tidigt definiera drift och underhåll, kostnader och ansvar.*

Tema 2 – Hur påverkar den täta staden gröna och blå lösningar?
Det krävs platseffektiva lösningar och detta måste med redan i den översiktliga planeringen för att inte bygga igen naturliga vattenvägar. Kraven ökar på dialog, samverkan och möjligheter att sätta värde på lösningarna.

Tema 3 – Nya risker och ny strategi i Köpenhamn – kan den appliceras på andra platser?
Det korta svaret är JA! Däremot krävs det alltid lokala anpassningar för att optimera enskilda lösningar. Ta fram och utnyttja modeller för vattnets väg och samverka med övriga aktörer.

Det finns många goda insikter och tankar från deltagarnas workshops och förhoppningsvis kan de inspirera till både goda lösningar och intressanta stipendieansökningar. Med denna sammanfattning som grund pågår också ett samarbete mellan LTH och SLU för att bygga upp gemensamma projekt och skapa en plattform för hållbar dagvattenhantering. En första målsättning är att få igång en blå och grön doktorand hos respektive part och ansökningsskrivandet är nu igång.

För er som inte var med, och naturligtvis även för er som var det, följer här de korta sammanfattningarna av föredragen. Håll tillgodo och låt er inspireras!

Anders Kristoffersson och Henrik Aspegren

REHABILITATION OF SMALL URBAN RIVERS AND FLOODING RISK MANAGEMENT IN ZURICH, SWITZERLAND

MARKUS ANTENER
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Abstract

The water evacuation plan for the city of zürich will be new calculated within the next five years. In case of flooding risk, the means that are going to be taken not only exist in ever bigger pipes. A new sustainable approach is required and it rests on the three pillars:

– *Rainwater has to be infiltrated* in the subsoil wherever possible and feasible. Only the rainwater from roofs is allowed to infiltrate in underground facilities, the other rainwater needs a treatment: mostly the passage through a humus soil.
– *Extraneous water is to be drained separately*, wherever possible in an open brook.
– According to the local situation, the City defines *maximum loads of rainwater* that is allowed to be drained into the sewer system. This requirement has to be reached by infiltration or retention. The easiest way to do so is to store the water on flat roofs, if possible on green roofs. Another easy way is to store the water in a pond which is only used during times with heavy rainfall.

If all these means are not enough to reach the aim of no flooding for a rainfall with the intensity of 1 in 10 years for sewers and 1 in 100 years for brooks and streams, new bigger sewers will be proposed.

Zürich has implemented a brook concept already 25 years ago. More than 21 km of brooks have been opened since or revitalised. The benefits are not only in 250 l/s less clean water flowing into the waste water treatment plant but also in better living conditions for the people in the city.

To start the sustainable approach, an adequate legislation is required. The water protection law of Switzerland requires, that

– Non-polluted waste water shall be infiltrated according to the instructions of the cantonal authorities.
– Non-polluted waste water with permanent flow shall not be passed through a central water purification system either directly or indirectly.
– Watercourses shall not be covered or brought underground.

Planning principles for the brooks:

– all the extraneous water occurring in the area should be connected up to the brooks or clean-water conduits where possible; this includes well water, seepage water and drainage water. It depends on the capacity of the brook whether roof water and other uncontaminated rainwater can be connected too.
– the new brooks are to serve as recreational areas. They have footpaths along their length and are equipped with play facilities for children.
– the new brooks are to be configured in as near to a natural state as possible; they should offer living space for native plants and animals and link together as many receiving waters and headwater areas as possible.
– If there is not enough space for a bank close to the natural state at least the bottom should provide a habitat for micro-organisms.
– as a general rule, the new brooks are only dimensioned to cope with three to five times the dry-weather flow. Any flow of water in excess of this is discharged into the existing combined-sewerage system.

– in order to avoid the loss of water into the subsoil and to prevent water from making its way into the sewers again via drainage lines or leaks, the new brooks are made seepage-proof with a layer of clay.

Maintenance is very important for the acceptance of brooks. The following aims have to be achieved:

– Secure the capacity of the brook by removing plants and dead wood, empty gravel traps, ect.
– Clean the brook. The first piece of rubbish is the worst: it attracts others. Wood can clock bar screens and lead to flooding.
– Achieve the ecological planning target: When you open a brook, you can only bring in the right subsoil. For the rest, only the maintenance over the years will contribute to the ecological target.

Maintenance begins with the planning process. We have for each brook and each planned brook a folder with the maintenance principles, the tasks and the organisation, which has to fulfil the task.

Drainage planning for residential areas not only involves hydraulic calculations and the full-scale expansion of the sewer network. Instead, it has to start at the point where the waste water occurs whenever a new building project or a new residential district is planned.

CREATING HEALTHY CITIES WITH BLUE-GREEN INFRASTRUCTURE

Experiences from Portland, Oregon Usa

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Abstract

For several decades stormwater professionals in many countries have been struggling with how to better manage stormwater in their cities. Some of these professionals and many community members have worked to find ways to integrate stormwater management with urban design. Peter Stahre from Malmo Sweden was one of these professionals. His work has been a major influence in helping to shape the issues and design strategies. Peter and I met in Portland Oregon in 2002 when he was attending the 9th International Urban Drainage Conference. We immediately recognized that we were had similar challenges.

In 2006 Peter and I were participating in a project sponsored by Water Environment Research Federation and had a chance to discuss many things from sustainable stormwater to world religions. This paper will focus on the Water. At the last meeting we had Peter and I decided to write a book about our experiences. Peter fulfilled that promise and completed his work with the publication of "Blue-Green Fingerprints in the City of Malmo, Sweden." My book is still to be written.

In reading Peter's book I found myself re-visiting so many of the urban topics we often discussed. Some of the words of wisdom found in his book:

"The intention with this book is to describe Malmo's transition from traditional drainage in buried pipes towards a sustainable urban drainage in open systems."

"When you enter the path of sustainable urban drainage it will soon become obvious that the institutional barriers between the different stakeholders…often are unexpectedly high."

"…sustainable drainage facilities constitute an integrated part of the city…"

"The politicians, managers of different city departments and (city staff) must have the courage to withstand the critiques that inevitably come from the traditionalists ..."

The reference to city staff is my appendage to his statement. I think Peter would agree that staff must have the courage to move the concepts forward and develop them more. Four basic principles apply to the concept of "integrating stormwater with the urban fabric" a phrase that found favor in Portland back in the 1990s:

1. Change water conveyance to the surface rather than a dependence on pipes.
2. Capture rain/precipitation where it falls, prevent runoff and increase evapotranspiration.
3. Use surface vegetated facilities to capture, filter, evapotranspirate and infiltrate water.
4. Blend these approaches with the urban fabric and other city imperatives.

Blue-Green infrastructure approaches use vegetation as a primary component of the functional and aesthetic aspects of the urban stormwater design. These approaches have significant and multiple benefits. Techniques include; vegetated roofs and walls, trees, vegetated infiltration and flow through facilities, and reclaiming vegetated space by removal of impervious surfaces. In addition to stormwater management, some of the multiple functions that these techniques accomplish to help create healthier cities are:

1. Provide urban wildlife habitat
2. Provide urban insect habitat

3. Reduce air pollution
4. Reduce water pollution
5. Mitigate urban heat
6. Provide green spaces
7. Reduce grey infrastructure costs

The following is a modification of a few paragraphs I prepared in 2000 that seem as relevant today as then:

Blue-Green Infrastructure is aspects of the built environment that emulate nature's processes. Water is not a feature unto itself, but an integral element of the site and architecture. Watergardens are a synergetic result of landscape, biology, architecture and engineering. The principle of integrating water in urban design introduces water as a friendly companion, but always with attention to its potential power and negative aspects. Trees, plants and soil are employed to function with water in urban spaces previously not used for stormwater management. Application of this approach is not at the expense of our human habitat … but as enhancement of this habitat … earth, water, plants … all have an artful place with people in the urban context and improve livability. Documentation of tests, monitoring data, costs and observations show the viability of the techniques discussed.

Urban development provides the essentials of human community life. Usually within this human community exists some degree of nature. These human essentials are, to a large extent, forms of impervious surfaces and pipes. Stormwater runoff, the physical phase of precipitation after it falls in the urban community, is almost foreign to many natural environments. The cause of this runoff comes from the impervious surfaces needed within the urban community. To reverse, mitigate or eliminate the negative effects of stormwater runoff new ways of designing or retro-designing the urban community are being explored and tested. Many of these new ideas are actually modern applications of age-old approaches, which for some reason had faded away. Maybe the resurgent interest in bringing aspects of nature back into the community is caused by some of the federal laws governing water, air and threatened species. Certainly within the Pacific Northwest water and nature are synonymous with salmon and forests. And, what is becoming apparent is the building blocks of nature are also the building blocks of a healthy urban community. These new ideas begin to take shape in the form of urban design techniques: methods of integrating water with land and vegetation. Watergardens are an aesthetic and cost effective approach to design with water.

In Portland ideas that re-green or mitigate the effects of impervious surfaces are being developed. These approaches include development of a healthy *urban* forest, re-vegetation and preservation of riparian corridors and habitat, identification and removal of un-necessary impervious surfaces, improved street designs to reduce environmental impacts, improved zoning codes to reduce hard surfaces, and identification and implementation of green/sustainable building and site design practices.

The physical characteristics of impervious surfaces are essentially – rooftops and pavement. These surfaces are at best environmental dead zones, but are certainly not benign as they have other than direct water impacts such as contributing to urban heat island conditions, smog, loss of wildlife and habitat, increased carbon dioxide, and reduced oxygen and photosynthesis.

So what is the paradigm that best describes these new ideas or approaches? Simply stated it is the careful integration of water with site and architectural design. The applications of design elements allow the urban hydrology to better mimic nature. The design elements are those usually within the landscape architects purview, including soil, plants/trees, rock and wood with water added. These principles are universal and can be applied to any region. The success of projects in Portland and many other communities is proof that ecological design not only benefits the environment of humans and wildlife but it often costs less to implement and sustain. It is no easy task however; many institutional barriers and professional mindsets must be overcome. Design, research, demonstration projects and education are all key elements in helping to bring these and other new approaches to the professional community.

ACHIEVING EVEN MORE SUSTAINABLE URBAN DRAINAGE

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Abstract

This paper presents the case for a more integrated approach to be taken for sustainable drainage (SUDS) to become more accepted. Much progress has been made in the implementation of SUDS but barriers still exist. The current situation in a number of countries is reviewed, the potential for future progress is examined particularly focusing on the possibility of an Ecosystem Services approach being used to integrate different environmental and other agendas thus better accounting for people's needs.

Responses to a wide range of environmental drivers include the introduction of policies on sustainable drainage, appropriate legislation, setting up stakeholder groups, and encouraging partnership working. The principal European legislation driving SUDS are the Water Framework and Floods Directives and their respective National Legislations.

Further responses have been to implement revised physical drainage measures (SUDS) – swales, permeable surfaces, basins, ponds, wetlands. An impressive body of evidence has now been assembled throughout Europe to show that SUDS perform as expected provided they are conceived well and maintained properly.

However, many barriers to progress still exist; at the construction stage where developers pay for all new developments and most re-developments; SUDS require changes in maintenance responsibilities and maintenance costs but these activities, frequencies and costs are not well understood; Planning paradigms also require to change from established hierarchies often led by a demand for formal recreation and play provision. A further barrier is the conservatism and inertia of regulations and practises which take time to implement.

The question of where progress past these barriers will come from needs to be addressed since the barriers to more sustainable drainage are high. Before SUDS can develop further, greater integration is necessary and purely engineering solutions are unlikely to be productive. Multiple benefits over and above the drainage function need to be clear and the whole life costs need to be properly recognised.

One area where multiple benefits are possible is urban regeneration frequently in the form of social and housing improvements. Highways improvements can also provide opportunity, particularly in providing emergency flow routes. A better re-allocation and multi-functional use of open space in both of these types of developments is possible.

Simplistic tools are now available for jointly considering recreational space for flood water using the assumption that recreational space can be used for avoidance of flooding. This properly addresses the multi-functional rather than the multiple benefit use of open space but it does provide a basis of a common language for engineers and planners who need to integrate water and spatial planning. It may not be the best solution but it does move the agenda towards sustainability by addressing flow and quality in the language of the specialist who has only a marginal interest in drainage.

However a far better approach will be to address the many non-functional benefits which derive from efficient places to control water flow. These include health and well-being deriving from living in pleasant places to take exercise and breath fresh air and the inclusion of art works close to watercourses telling the 'story of the water'. Education and training can also benefit from better access to water and improved natural habitats. Many schools see the advantage of access to ponds and wildlife.

The authors argue that an Ecosystem Services approach could be used to bring together these multiple benefits within a sustainable drainage system (SUDS) or group of SUDS. Ecosystem Services (ES) are those provided by the natural environment that benefit people and are categorised into four services – Supporting, Provisioning, Regulating and Cultural services. The Millennium Ecosystem Assessment promotes an ES approach to assessing environmental benefits and provides the basis of a methodology for applying an ES approach to different habitat types and zones.

This paper poses the question whether the same approach might be used for SUDS. The position of Regulating services is clear and Cultural services are also highly valid. It may be that a full accounting of these two categories would be sufficient to embrace the value of SUDS and allow the amenity term in the SUDS triangle to be replaced. However, their roles and applications will need to be identified and evaluated as will the value of Supporting and Provisioning services.

An ES approach should provide the means to quantify amenity and close the SUDS triangle. There is wide agreement that valuation is needed – but it is complex since there are many qualitative as well as quantitative aspects to include, and 'double counting' of benefits and values across categories is also a risk. The debate is still on-going with no single approach but good progress has been made in the UK National Ecosystem Assessment.

From a planning perspective, fully integrating drainage and 'space for water' into the urban landscape and architecture taking appropriate value of all has many benefits. Urban ES tools are needed, particularly for planners. One possibility is the very simple 40/60 rule in which an additional 40 % of each housing area is required for additional services.

The technical development of sustainable drainage has progressed but sustainability is not yet assured. The barriers identified fifteen years ago are still present and although everyone knows what they are, these barriers are now preventing further progress. SUDS are not just technical but must involve people and the environment and further changes in thinking are required. Changes to how peoples value their area need to be accounted for including changes to integrated thinking to achieve multiple benefits and this will mean better evaluation of the secondary services provided by SUDS. This would be possible with a tool for assessing the urban ecosystem services of SUDS which should mirror the tools used for the quantity and quality of runoff from developments.

RISK OF ROOT INTRUSION BY TREE AND SHRUB SPECIES INTO SEWER PIPES IN SWEDISH URBAN AREAS

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Abstract

Tree roots that grow into underground sewage and drainage pipelines are increasingly becoming a problem for society, both economically and in terms of risks to health. Malfunctioning wastewater and stormwater pipelines as a result of clogging by tree roots can cause flooding. Clogged drainage pipes can have serious consequences in terms of damp and mould damage to property.

In 2007 data regarding sewage pipes and CCTV-inspections of the sewage pipe interior, a total of 1 113 sewage pipes with 3 417 root intrusions, was collected from the three cities; Malmö, Skövde and Katrineholm. In 2008 additional data was collected consisting of an inventory of 4 590 trees in the same three cities, and CCTV inspections in a fourth city, Växjö. Another 74 778 inventoried trees and 23 312 registered trees were collected from the participating cities' databases. These trees were geographically distributed throughout the cities. Overall this constitutes a database of 102 680 trees.

By using the collected data, analysis showed that PVC-pipes have less root intrusions penetrating through the joints than pipes made of other materials. However, PVC-pipes have more root intrusions per meter pipe. This is probably due to roots entering the pipes through service connections and at the transition between PVC and other materials. A further reason for why PVC has less root intrusions that have penetrated through the joints compared to concrete pipes can also be that they are affected by the joint frequency which is significantly lower in the PVC pipes.

The investigation has shown that the minimum distance of three meters that was previously recommended in order to reduce the risk of root intrusion is insufficient. Our results indicate that a high number of trees at a distance of between 3 and 7 meters from pipes have contributed to root intrusions, and it is thereby suggested that the previous recommendations should be revised. This will create challenges for the landscapers, but it is of great importance if the numbers of root intrusions are to be reduced in the future.

The species that have been regarded as having a high or low risk of giving rise to root intrusions has previously been listed. This project provides a new such list. In this list both willow, poplar/aspen, roses and thuja occurs. It is thereby clear that even shrubs can cause root intrusions. The species that occur with a higher frequency close to root intrusions are also interestingly, not only willow, poplar/aspen. In addition it seems that the species that are frequent in surrounding root intrusions are not the same as those investigated in the cities. In light of these results, previous recommendations must be taken with some caution.

STORMWATER MANAGEMENT IN COLD CLIMATES (SWM-CC)

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Abstract

This presentation deals with stormwater management in cold climate. Cold climate makes the hydrological circle more complicated, and consequently the stormwater management, compared with warmer climate.

According to Smith (1996) cold climate regions are, where the mean temperatures for one month of the year are below +1ºC and snow may stay on the ground for a period. The cold climate (CC) regions stretch from the Bering Sea through Alaska, Canada, Northern USA, Greenland, Iceland, Scandinavia, northern Europe and the Baltic countries, most of the former Soviet Union, Northern China and Northern Japan. Ca. 1.2 billion people live in these regions.

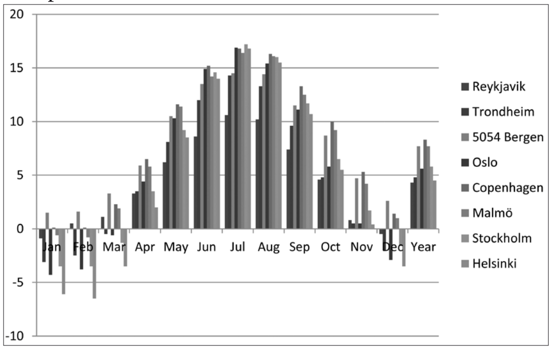
The climate is often harsh, cold, snowy and windy, resulting in difficulties in stormwater management and urban runoff. The temperature may range from –50ºC to as high as +40ºC, a range on 90ºC, i.e. in Karasjok, Norway between –51.4 ºC to +32,4 ºC, a range on 83,4ºC, and in Røros, Norway between –50,4 ºC to +30,7 ºC, a range on 81,1ºC. The diagram is showing the average monthly temperatures in some Nordic cities.

The low temperatures and the snow cover cause problems due to frozen ground, snow cover, snow redistribution, rain-on-snow, and melting. Problems are also due to frost heave and freezing in pipes, ice on ground, clogged gutters and inlets, icing in manholes and storm sewers, and ice in watercourses.

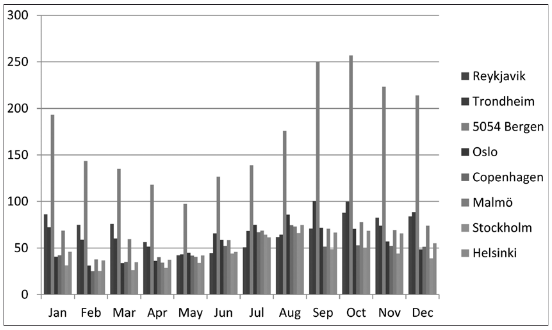
The urban water systems must be able to handle these conditions and the focus has to be on methods and technologies that are appropriate for cold climate.

Long term urban hydrological data with high resolution i.e. minutes, through the winter are rare in cold climate regions.

Temperature



Precititaion



Pollutants can be harmful to the urban water environment. These pollutants are often traffic related such as salt (NaCL), used for traffic safety, heavy metals because for corrosion and organic micro pollutants from poor burning of fuel and substances from winter tires, asphalts etc. They have often diffuse sources and are difficult to remove before discharge.

Stormwater systems must be protected against damage by freezing using natural or artificial insulation or heating. Their construction and management becomes expensive.

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THORBJÖRN ANDERSSON
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Abstract

Stormwater management is not only an issue of technical concern. To use stormwater as a quality is also a way to enhance our understanding of the biological systems that we all are part of. In the discussion about stormwater, we must hold as a point of departure not only to manufacture technical systems but also to create experiential values in our environment.

As for a future quest, this paper will argue that we must break down the centralized infrastructural systems that we have created in the post war years and exchange it to local systems. If we see the stormwater management issues as merely environmental techniques, we will run the risk of working with solutions instead of ideas.

A local, natural, stormwater system means that we bring back the water to the soil for the benefit of soil moisture, air humidity and the well-being of the vegetation as well as for the people instead of being a burden for the community treatment plants.

The lecture will focus on a recently inaugurated plaza in Malmö, Hyllie plaza. In this project, we have seen all the environmental factors as assetts and brought them together into a complete biological system. In Hyllie Plaza, stormwater drains, air channels, vegetation, structural soils, irrigation systems, pavements and light effects all interact to give urban quality to be enjoyed by the people that use the plaza.