NBS2017
NATURE-BASED SOLUTIONS
From innovation to common use

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Presidency of the Estonian Republic of the Council of the European Union

Nature-Based Solutions

From Innovation To Common-Use

eBOOK OF ABSTRACTS

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REPUBLIC OF ESTONIA
MINISTRY OF THE ENVIRONMENT

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Contents

Conference visual design: Skoop3 Stuudio Ltd.
Conference photographer: Martin Dremljuga
Editors: Galina Kapanen, Ivo Krustok, Tiiu Koff
Conference reporters: Agnes Anderson, Egert Vandel, Ingrid Hermet, Teele Kaljurand, Ivo Krustok, Martin Küttim, Elve Lode, Jaana Merisaar, Karen Silts, Jaanus Terasmaa, Piret Vacht, Kadri Vilumaa
Abstract book edition: Teele Kaljurand

The eBook of Abstracts is freely available to all visitors on the conference "Nature-based Solutions: From Innovation to Common-use" website www.nbs2017.eu

The NBS 2017 conference was livestreamed and can be viewed from this link:
https://livestream.com/accounts/12493954/events/7858087

For more information on EU policy on nature-based solutions, please visit this website:
https://ec.europa.eu/research/environment/index.cfm?pg=nbs

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Background

From 24 to 26 October 2017, the Estonian Presidency of the Council of the European Union hosted a high-level environmental conference „Nature-based Solutions: From innovation to Common Use ". More than 400 scientists, experts, policy makers and nature enthusiasts from around the world convened at Tallinn University to discuss how to best integrate solutions inspired by nature into urban environments and everyday life.

The conference featured several leading European policy makers and experts, including Siim Kiisler, Estonian Minister for the Environment, Kęstutis Navickas, Lithuanian Minister for the Environment, Stewart Maginnis, Global Director Nature-based Solutions Group with the International Union for Conservation of Nature (IUCN), Hans Bruyninckx, Executive Director of the European Environment Agency (EEA), Patrick Child and Joanna Drake, Deputy Director General in the European Commission, Lena Ek, President of Swedish forestry cooperative Södra, Marjolein Helder, CEO of Plant-E and member of the EU's High Level Group of Innovators, and many others.

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Estonian Ministry of the Environment

Kalev Sepp
Estonian University of Life Sciences

Victor Beumer
Deltares

EXECUTIVE SUMMARY

Main conclusions:

- Europe has the ability to become the leader in the field of nature-based solutions.
- Our focus must be on communication, collaboration and the exchange of best practices.
- Nature-based solutions need to be better integrated to policy frameworks.
- Concrete business models that are based on sound science and viable case studies need to be developed.
- International cooperation and creating the right possibilities for it are very important for the dissemination of the knowledge related to nature-based solutions.

Nature-based solutions (NBS) refer to the sustainable management and use of nature to address various environmental and social challenges. Examples of nature-based solutions include urban green spaces and wetlands, green walls and roofs, and permeable surfaces that help regulate temperatures, collect storm water, reduce air pollution, increase biodiversity, while also improving overall well-being.

Deputy Director General Patrick Child of the European Commission stated the importance of NBS in his keynote address: "NBS have the potential to link policies such as climate change mitigation and adaptation, disaster risk reduction, sustainable management of water resources and energy efficiency. At the same time, they enhance biodiversity, natural capital, low carbon economic development, social welfare and health." Utilizing nature-based solutions in a systemic manner can also contribute significantly to the achievement of the Sustainable Development Goals of Agenda 2030.

According to a recent Eurobarometer survey, 83% of Europeans are interested in the wider use of nature-based solutions. However, there is still much room for improvement with regard to public awareness about the potential applications and benefits offered by nature-based solutions.

Estonian Minister for the Environment, Siim Kiisler stressed in his opening remarks that if we want NBS to thrive, our focus must be on collaboration and the exchange of best practices. There is a need to reconnect with nature and understand the benefits this can offer. Highlighting best practices and using digital platforms were also deemed important priorities.

Hans Bruyninckx, Executive Director of the European Environment Agency (EEA), who opened the second day of the conference, stressed that we will need strong nature if we want strong NBS. To this end, it is important to approach nature systemically, i.e. preserving ecosystem health and biodiversity, while also restoring damaged ecosystems.

Europe has the ability to become the leader in the field of NBS, possessing the necessary knowledge base, best practices, and, most importantly, political will. However, in order to better promote NBS, suitable business models that are based on sound science and an evidence base for NBS need to be developed. This approach will enable attracting more investors and facilitating the dissemination of NBS across the world. Additionally, the mapping and assessment of ecosystem services must continue.

Many of the benefits of NBS cannot be monetized but can be expressed in non-monetary values. We overvalue financial capital and undervalue social and human capital. We have failed to value natural capital in a meaningful way and need to refocus. We need functioning ecosystems for functioning NBS.

Stewart Maginnis, the Global Director of Nature-based Solutions Group with the International Union for Conservation of Nature (IUCN), pointed out that the policy framework we have today is too fragmented to use the full potential of NBS. We have to make policies work together and create a standard to bring these solutions to scale.

Ultimately, nature-based solutions should not be considered as a magic cure-all that will solve our environmental problems. However, if used wisely, nature-based solutions have the potential to contribute significantly to the mitigation of adverse effects of climate change, while also increasing biodiversity, reducing pollution, especially in urban environments, and offering significant health benefits.

CONFERENCE OVERVIEW

The conference "Nature-based Solutions: From Innovation to Common-use", part of the official program of the Estonian Presidency of the Council of the European Union, was organized by the Estonian Ministry of the Environment in collaboration with Tallinn University, and the European Commission.

The goals of the conference were to serve as an important step in popularizing nature-based solutions across Europe and disseminate the discussions that took place to the Member States, the European Commission and other stakeholders involved in the development of NBS to help plan their future activities. The conference also aimed to highlight best practices to develop policies related to nature-based solutions.

The conference focused on five main topics: blue-green infrastructure in smart cities; integrated water management through natural systems; ICT as a supporting tool for nature based solutions and ecosystems; ecological restoration through eco-innovation; nature-based solutions in circular economy. In addition, special sessions on well-being and public engagement and linking NBS to sustainable development goals were held.

Cities and local governance

Currently, 73% of Europe's population lives in cities and this is increasing. Because of this, there is a high need for sustainable urbanization and growing cities are an opportunity for the development of NBS. Properly implemented NBS (such as through high-quality green spaces, green roofs and -walls) can increase citizens' health and well-being, reduce energy consumption, limit temperature increase in urban areas and help with water management.

What do the citizens want?

European citizens want NBS – a recent Eurobarometer poll showed 83% of Europeans were in favour of the EU promoting NBS across our continent, six out of ten citizens favour NBS over technological solutions and around half want to be involved directly if a NBS was implemented in their area

Moving forward

To increase the use of NBS, it is important to understand what we already have and how it can be improved by its addition. The local level is central as it allows for faster change. Tools such as green public procurement need to be available and well planned so they are used. Traditional solutions are easier to implement, as there is knowledge and markets available, but they are frequently not the sustainable choice.

The knowledge and cooperation of the community is also key. Co-creation between citizens and scientists can create a lot of value. More work needs to be done to highlight the importance of protecting our natural capital and the wide range of benefits it provides to citizens.

EU funding programs like LIFE and H2020 already support NBS. The Horizon 2020 program treats cities and urban areas as a priority and the work program for 2018-2020 includes further calls on NBS mainly in the area of sustainable urban development. The next calls for the LIFE programme will be opened in spring 2018. Regional funding can also benefit the development of NBS.

Natura 2000 sites should be more visible to citizens and managed in a way that their functional contribution to NBS is acknowledged. This is also relevant for urban regions, as 17% of Natura sites are located in these regions and 65% of EU citizens live in bike ride distance from Natura sites.

There is also a need for tools that help cities monitor the transition to sustainability and networks between cities that can help the implementation of NBS.

Future of NBS in the EU and the green economy

NBS require long-term investments, which need involvement from all the actors. Both public and private funding are needed. NBS can carry interesting investing opportunities but need to be treated like any other technology – their limits need to be recognized.

NBS creates synergies between policies and can be scalable and flexible. Today we are however nowhere close to harnessing their true potential. We have solutions at local level communities, but not at the global level.

Legislation

NBS needs to be included in legal instruments. Otherwise it will not work. Finland is a great example of this. The country has a sustainable development budget for the realization of the SDGs – it is probably the first country in the world with such a budget.

In the EU the nature legislation is functional, but we should focus on broader biodiversity. Currently we are protecting 18% of our terrestrial area, but it is uncertain how far this is protecting wider biodiversity. 2/3 of Europe's ecosystems are in unfavourable condition. There is progress but the essence is that we are still struggling to protect them in a fundamental way.

Natural capital is degrading in all areas in the world. In the EU we are good at eliminating pollution but for soil, biodiversity and climate change there is no systematic approach. We need a systemic framing to understand the broader picture. This is crucial for

harvesting the true potential of NBS as systemic approaches providing multiple benefits to multiple societal challenges.

Economy

Entrepreneurs are interested in NBS, but the problem is to shift from purely monetary benefits to a larger picture of benefits for the business case. There needs to be a shift in thinking - from monetary costs towards considering value.

Contemporary societies tend to overvalue financial capital and to undervalue social and human capital. They have indeed failed to value natural capital – there needs to be a refocus and a better consideration of natural capital.

Functioning ecosystems are needed for functioning NBS and the mapping and assessment of these services provide an important background for the analysis of NBS alternatives. The EnRoute project's experience from different EU urban areas can in this respect provide key insights, for instance on the use of indicators for measuring ecosystems' condition services - these can be used by NBS demonstration projects as input and inspiration when evaluating NBS effectiveness.

The business case for NBS has to be built based on concrete examples from R&I projects and initiatives at EU, national and local levels.

Research and development

International cooperation and creating the right possibilities for it are very important for the dissemination of the knowledge related to nature-based solutions. A lot of the research related to nature-based solutions still needs to be done as many of the potential benefits and drawbacks are yet to be scientifically proven.

The experience that some European research and development initiatives (such as Joint Programming Initiatives) have in terms of nature-based solutions can be better gathered and used.

Better communication

Behavioural changes are also needed. People are losing their connection with nature and this needs to be changed. They are interested in NBS but are unaware of the concept and don't know the benefits to their health, the environment and risk reduction. We need ways to measure and show these benefits through concrete examples.

Governments need to play a big role in this but citizen science is also becoming more important and the end user is becoming one of the key actors. Citizens want to be involved and can drive the process at local level.

In addition, media professionals need to be involved to raise public awareness through campaigns. Involving people with different cultural background can also help a lot as NBS can mean different things in different places.

CONFERENCE TOPICS

1. Blue-green infrastructure in smart-cities

Currently, 73% of Europe's population lives in cities and the number is increasing. Because of this, there is a growing need for sustainable urbanization. Urban areas can be enhanced with green rooftops and facades, grey infrastructure or brownfields can be turned into greenspaces, wetlands and more.

The session provided suggestions of answers to the following questions:

- How can NBS create cities with higher wellbeing and health for its citizens?
- How can blue-green infrastructure projects improve climate adaptation?
- What are the best policy practices in the implementation of NBS in cities and is there a need for an EU wide policy?
- How can NBS be best financed in local governance through business cases and how will the business cases change in the short-term future?

It is important to set measurable targets to monitor change through assessing and monitoring of NBS and blue-green infrastructure projects, including monetary benefits. The EKLIPSE Impact Assessment Framework was introduced. On the evaluation of impacts of existing "NBS" and "green and blue infrastructure" practices, interesting perspectives were brought by:

- a study from the University of Sheffield on cost-benefits analysis of NBS for a urban development with a private developer:
- an analysis from the H2020 funded project NATURVATION of more than 100 European cities, mapping the use and impact of NBS in 100 European cities to characterise existing practice;
- the feedback of the University of Bocconi (also part of a H2020 funded project on Nature Based Solutions in cities) on different practices of private public partnerships and the payment for ecosystem services they enable.

Urban planning dynamics should highlight NBS as solutions connected with social wellbeing as well as with cost effective solutions to achieve key human challenges like climate resilience.

Best practices of services provided by blue and green infrastructure and NBS as well as barriers were presented by key stakeholders on mainstreaming of NBS: the Water utility providers association "EurEau", Poland as a MS involved in NBS projects, as well as the "smart" city of Espoo, Finland.

The need for supporting policy as well as funding at the local, national and European scale was strongly urged. A presentation from a study by the Ecologic Institute, part of the H2020 funded Naturvation project, laid out what European and national policy frameworks should do to support nature-based solutions and green/blue infrastructure.

2. Integrated water management through natural systems

Commonly used water treatment solutions pose many challenges, such as the high demand for energy and the low success rate in removing some problematic pollutants. In addition, many urban areas offer very little resilience to flooding and high rainfall events. In extreme cases, current water treatment systems can fail. Many researchers and administrators are looking towards natural water management systems (wetlands, bio-retention systems, storage ponds etc) for answers to these issues and these have been successful in many cases.

The session highlighted the 'Building with Nature' innovation programme from the Netherlands. Building with Nature is a new approach to hydrological engineering, acknowledging the impact public infrastructure can have on the environment and utilizing the forces of nature instead of combating them, achieving different policy objectives to strengthen the economy, society, and nature.

Starting points are building with natural materials, and the use of forces and interaction with the natural system. For instance, the restoration of natural riverbanks may be a superior solution to river flooding than stone-covered dikes, benefiting nature and people. Runoff Attenuation Features (RAF) (raised bunds, leaky barriers and corner-of-field wetlands) were also discussed in the context of peri-urban environments. The presented UK case study suggests that RAFs could be beneficial for managing both local flood risk and diffuse pollution. Ponds also act as bio-filters lowering nutrient rates in streams.

3. ICT as a supporting tool for nature based solutions and ecosystems

Information and Communications Technology (ICT) solutions can have a strong supporting effect on NBS co-creation, implementation and monitoring. Examples of these include the use of Geographic Information Systems (GIS) for environmental data analysis; mobile phone apps for the monitoring, planning and better management of NBS, etc.

The wealth of initiatives on smart cities could provide tools and/or inspiration for the development of new tools for NBS (e.g. the Brazilian sustainable cities programme). There is a lot of environmental data available and through the right analysis, it can help inspire, develop and maintain NBS. ICT could also help measure the environmental impact of NBS compared to "traditional solutions", thus supporting their implementation.

In addition to this, ICT can play an important role in raising general awareness of NBS through citizen science projects and community led urban development. The sessions highlighted tools that were designed for better understanding ecosystem functions and services and to disseminate the results of research to a wider audience, to utilize available data, visualize and conceptualize natural processes and related problems and raise awareness.

Drone mapping was described as a tool for monitoring of mire ecosystems restoration. Plant communities with different plant cover and species composition reflect spectral bands in different rate and this information reflects state and disturbances of the mire ecosystems. Usage of drones gives higher resolution compared to other remote sensing options and is suitable for plant community level monitoring, but at the same time there is a trade-off between spatial resolution and mapping area.

City Enabler: Quite often, urban data is scattered and information systems are in closed platforms. City managers are not aware of the data already available and stakeholders have difficulties to exploit it. As a result, the potentially useful data to deploy NBS is not used. The tool City Enabler aims to help tackle this problem and integrates information from different open source databases and sensors, offering also quality checks. This allows citizens to participate in the co-creation of ideas for adopting NBS and their quality of life increases. At the same time, city planners and managers can save money and time, raise awareness of city services, find better ways to protect urban environment and reduce environmental risks, but also design new innovative nature based services.

It is clear that for setting conservation goals for each individual region, it is necessary to apply GIS-tools and remote sensing methods, enabling to link information from biodiversity databases with the local environmental conditions and landscape structure. Ongoing and

accelerating biodiversity decline indicates that the traditional approaches for conservation are not sufficient and new methods are needed. It was proposed to use a novel approach – everyman's nature conservation – involving ICT tools for engaging public into nature conservation and biodiversity enhancement activities.

In developing ICT, it is necessary to look at both ecological and social dimensions. In that case, the positive ecological dimension rests on ICT's potential to deliver greener products, optimize the ways of their delivery, and increase consumption efficiency through dematerialization, e-substitution, green marketing, ecological product life optimization, etc. The environmental potential offered by the ecological dimension will be fully utilized only under an optimized social dimension, which deals with the behavioral issues of consumption.

4. Ecological restoration through eco-innovation

Innovative solutions have spurred on human development from the very beginning. Unfortunately, this development has had many negative aspects on the environment. However, NBS can help restoring degraded ecosystems in a more sustainable way.

As it was stated during the session, biodiversity and related ecosystem services are threatened globally while actions that mitigate biodiversity loss have to be taken on locally. For that not only stakeholders, but each and every citizen is expected to participate in preservation and enhancement of biodiversity by making informed nature-friendly decisions in their everyday life. NBS are great help in achieving this goal, but are still scattered islands in a wide ocean of business-as-usual.

This parallel session introduced the benefits of native meadows that increase biodiversity and reduce need for mowing when compared to lawns. Benefits and difficulties of the creation and management of native meadow vegetation were discussed. Similar approach was introduced in restoration activities of floodplains in the Rhine river valley, where key element lays in restoring natural "sponge" functions of floodplains, which will help reduce water fluctuations and increase biodiversity. Network of EU countries under the BiodivERsA project offered innovative opportunities for the conservation and sustainable management of biodiversity, with nature-based solutions as core theme. Proposed initiative requires deep changes in the way we perform research, with reinforced relationships between scientists and research stakeholders, deeper collaboration between disciplines, enhanced international collaborations, and better policy relevance of research.

Several innovative technical approaches were introduced – designs via bio-inspiration and usage of natural material in urban planning, soil and water remediation and oil removal from sea water. In bio-inspirational solutions living organisms are the central components that deliver the desired process outcome (e.g. phytoremediation and mycoremediation in natural treatment systems). It was demonstrated that usage of gypsum in treatment of arable fields reduces efficiently phosphorus release (reduction about 50%) and erosion more cheaply than current measures in agriculture.

In urban environments, it was showed that usage of lightweight clay aggregates (LECA)-based green roof is capable to give better protection to the roof membrane and is suitable also in temperate climate. The key message of this session was, that for eco-innovation and NBS a change in mindset is needed in order to implement new technologies and involve every citizen.

Stakeholder engagement is key:

- influencing perceptions
- crossing sectoral borders to initiate dialogue on land change
- resolving differences in perspective

The sessions also called out for more systemic approaches in research.

5. Nature-based solutions in circular economy

Natural resources and solutions are the long-term basis of the circular economy. They need to be taken into account in all economic fields to close the loop of the entire value chain. NBS can support the move towards circular economy by demonstrating the use cases of systemic resource-efficient and cost-effective approaches. A second effect is the lower impact on biodiversity due to lesser resource use (raw materials, energy, water, air, land and products that are made of and depend upon ecosystems and their services). As nature operates in circular, closed loops, there is a lot to learn from it for industrial ecology and urban systems, using systems thinking lens. This means NBS can be an important inspiration for the development of the circular economy.

The discussion on the circular economy needs to move forward from materials and manufacturing into areas like land use where NBS can be applied. This needs to be done in a systemic way, addressing the whole ecosystem. It's essential to understand local context, not all solutions are applicable for all areas. Focus must be also on the usage of biodegradable materials - replacing artificial (plastic) materials with biodegradable materials, materials from nature with no negative impact to nature.

To accelerate growth, solutions should be supported by the government / EU when it is still innovative or when it concerns public benefits. This also means that the use of context sensitive solutions, replicability of ideas and co-operation is essential. Operating through Public Private Partnership gives better equality between social and economic value (based on Italy's experience), and therefore promotes the process of becoming 'common use'. Thorough analysis and surveys are essential - to map the general and specific knowledge about NBS, possible places of use and find replicable methods and long-term solutions.

De Ceuvel, a former shipyard in Amsterdam now serving as a global example for circular urban development, was highlighted as good example. De Ceuvel serves as a catalyst for change and empowers urban areas to be self-sufficient using decentralized technologies and full recycling of local resources. Dealing with challenges like a lack of financing and heavy soil pollution, De Ceuvel was forced to think outside of the box. As such, various nature-based solutions were implemented to recycle its water, nutrient, waste, and energy streams, and at the same time limit underground infrastructure and contact with the polluted top layer of the soil. These include the use of phytoremediation for the polluted ground, helophyte filters for decentralized greywater filtration, the conversion of urine into struvite for the fertilization of an aquaponics system, and the use of human faeces as compost for the phytoremediation garden. With nature-based solutions, the project highlights a low-cost and comprehensive application of technologies, to create a more circular urban metabolism in a way that brings value to the site and the surrounding area and community.

6. Well-being and Public Engagement

Ecosystem-based approaches are emerging R&I areas, involving very diverse cities, regions, and actors (scientists, NGOs, public authorities, landscape architects, engineering firms etc.), but the NBS concept is still not sufficiently known by markets, citizens and decision-makers as an alternative to other well-established technological and urbanistic developments. Green Infrastructure (GI)/NBS can give improved health and well-being – nature has the power to heal. However, studies and data related to asthma cases and healthcare use in areas with good accessibility to natural recreation areas are still controversial.

GI should be implemented through biophilic design, which means using nature in urban exterior and interior design, for example on rooftops. Benefits of rooftop gardens in hospitals and healthcare facilities included mental health, wellbeing and social activities of chronic patients (meditation spaces, family and visitors spaces, weddings), and faster rehabilitation processes.

GI gives not only positive social effect but also positive business effect. For example, increase in number of customers, better value property and improved business image, as well as a higher level of wellness and pro-environmental behaviour of staff. Urban NBS interventions in high street commercial areas were especially beneficial to "green" businesses, such as flower, leisure, organic food shops, outdoor bars and terraces, etc., and to large store buildings. Case studies with cost-benefit analysis and economic modelling are needed to optimise implementation of GI. Access to information is not enough, people's behaviour mechanisms and socio-economic factors are also important.

EU R&I initiatives and policies on Nature-Based Solutions must contemplate public engagement and stakeholders involvement, as 56% of European citizens would like to participate if a nature-based solution were implemented in their area, mostly by volunteering with their work (24%), sharing information or promoting the project (20%).

H2020 demo projects involving social actors demonstrate NBS' high potential for public engagement, co-design and co-creation, as well as for sustainable urban innovation. As the timescale and efforts necessary for sustainable innovation are underestimated by citizens and local authorities, longer-term scale, sustainable innovation visions, scenarios and tools are needed. Such developments should engage citizens and stakeholders in future-oriented systemic thinking and strategic co-creation of innovative NBS.

7. Linking nature-based solutions to sustainable development goals

SDGs). The NBS concept is just one tool among many in the move towards sustainability. It could however become a cross-cutting tool for implementing SDGs contributing to the alleviation of several problems at once.

Today many cases are very sector specific. For the successful implementation of NBS, sectors need to work together. Leaders (e.g. for cities, the Mayor) can be very important in this sense, looking at the bigger picture.

In the Naturvation project, the use and impact of NBS in 100 European cities were mapped. Most of the NBS in the database were also related to specific SDGs, which allows the user to search for cases related to specific SDGs.

There is still a need for indicators and analysis on how much different NBS contribute to which SDG.

Session conclusions:

- Public awareness needs to be strengthened: Urban people are often disconnected from nature and for the successful implementation of NBS. Awareness of NBS needs to be increased among professionals like engineers and architects. Instead of educating, co-designing, co-creating and co-implementing them, thus creating long-term ownership and sustainability
- At city scale, the mayor's lead is very important, otherwise experts stick to their sector-specific excellence. Give opportunities for NBS in cities, and then let people choose. E.g. making the infrastructure for cycling and let people try it out.
- NBS deployment not happening is related to incentives – many benefits of NBS cannot be monetized. Start with solutions that "show" fast results, so that people can see concrete outcomes and become allies in the development.
- SDGs should appear on the political agenda for elections. Mainstreaming of SDG works. Check whether NBS can be one of the many tools to implement SDGs, to feed into the political debates.
- Can we use the NBS to critically question current economic structures and logic? European leadership on NBS could be taken to the global level, e.g. presenting them at the High-level Political Forum on Sustainable Development (Heads of State discussing on policy lines for the SDGs).

Conference Program

Tuesday, 24th October. Side-events/meetings

08:30	**Registration**
9:00-17:00	**Green Spider Network** (on invitation)
9:30-13:30	**Joint Programming Initiative (JPI) workshop: Water, Oceans, Climate, FACCE, BiodivERsA, Urban**
10:00 – 12:00	**ThinkNature Forum** (on invitation)
11:20-11:50	**Coffee Break**
11:50-13:30	**JPI workshop** **Water, Oceans, Climate, FACCE, BiodivERsA, Urban**
09:30-17:00	**JRC (Joint Research Center), EnRoute: Mapping Urban Ecosystem Services as support of the impact - Evaluation of NBS** (on invitation)
10:00-17:00	**Local workshop: "NBS in Estonia"**
13:00-14:00	**Break / Lunch**
14:00-17:00	Forest-based Sector Technology Platform: Innovation in the forest-based sector, from idea to practice
14:00 – 14:30	ThinkNature: **Introduction TN, DG RTD & EASME, projects presenting the Taskforces** (on invitation)
14:30 – 19:00	ThinkNature **Taskforce : "Data Management and EU NBS Knowledge Repository"** (on invitation)
14:30 – 19:00	ThinkNature **Taskforce " NBS Impact Evaluation Framework version 2.0"** (on invitation)
14:30 – 19:00	ThinkNature **Taskforce "Governance, Business Models and Financial Mechanisms"** (on invitation)
14:00-17.00	**Deltares: NBS Products and Services for Flood Risk Reduction**

17:00-17:45	**Children's film contest winners ceremony**
17:45-20:30	**Documentary Film program**
19:00	**Welcome reception in the Museum of Estonian Architecture** (registration needed)

Wednesday, 25th October - NBS Governance and policy

08:30	**Registration**
09:30	**Welcome/Opening** • Siim Kiisler (Ministry of the Environment of Estonia) • Tarmo Soomere (President of the Estonian Academy of Sciences) • Katrin Niglas (Tallinn University)
09:45	**Keynote presentations** • Patrick Child (European Commission) • Joanna Drake (European Commission) • Lena Ek (Södra)
11:00	**Coffee**
11:30	**Panel discussion "Local governance in moving towards NBS"** Moderator: Tom Heap; **Panellists**: • Siim Kiisler (Minister of Environment of Estonia), • Lena Ek (Södra), • Joanna Drake (European Commission), • Kęstutis Navickas (Minister of Environment of Lithuania), • Eeva Furman (Finnish Environmental Institute SYKE)
12:40	**Lunch**
13:40	**EU Funded NBS Projects (EASME)** Julien Guerrier
13:55	**Enhancing resilience of urban ecosystems through green infrastructure (EnRoute)** Joachim Maes (Joint Research Centre)
14:05	**Panel discussion "Future of NBS in the EU"** Video Message from Adina-Ioana Vâlean Moderator: Tom Heap; **Panellists:**

	• Patrick Child (European Commission), • Stewart Maginnis (IUCN), • Marjolein Helder (Plant-E; European Innovation Council), • Vasco Ferreira Costa (Senior Investment Officer at Infrastructure Funds and Climate Action Division of the European Investment Bank), • Marina von Weissenberg (Ministerial Adviser for the Ministry of Environment of Finland)
15:15	**ThinkNature platform launch**
15:30	**Coffee**
16:10	**Parallel sessions 1**
Moderator David Zetland	**PS1. Blue-green infrastructure in smart cities** • **25.PS1.O1.** A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. Presenter: Davide Geneletti. Authors: Christopher M. Raymond, Niki Frantzeskaki, Nadja Kabisch, Pam Berry, Margaretha Breil, Mihai Razvan Nita, Davide Geneletti, Carlo Calfapietra. University of Trento, Italy. • **25.PS1.O2.** Comprehending the multiple 'values' of green infrastructure – Valuing nature-based solutions for urban water management from multiple perspectives. Presenter: Tom C. Wild. Authors: Tom C. Wild, John Henneberry, Lewis Gill. University of Sheffield, United Kingdom. • **25.PS1.O3.** A helping hand or a thorn in the foot? European and national policy frameworks to support nature-based solutions and green/blue infrastructure. Presenter: McKenna Davis. Authors: McKenna Davis, Katrina Abhold, Doris Knoblauch, Sandra Naumann. Ecologic Institute, Germany. • **25.PS1.O4.** Water services. Presenter and author: Bruno Tisserand. Author: Bruno Tisserand, Bertrand Vallet. EurEau.
Moderator Kalev Sepp	**PS3. ICT as a supporting tool for nature based solutions and ecosystems** • **25.PS3.O1.** Eco-innovation through public involvement: everyman's nature conservation. Presenter and author: Aveliina Helm. University of Tartu, Estonia • **25.PS3.O2.** Making Sense of Nature Based Solutions to different City Contexts through a Knowledge Platform. Presenter: Cristiano Cagnin. Authors: Cristiano Cagnin[1], Guilherme Wiedman[2]. [1]Center for Strategic Studies and Management; [2]Ministry of Science, Technology, Innovation and Communication. • **25.PS3.O3.** Enhancing Performance Management and Sustainable Development through e-government policies in Urban Areas A System Dynamics Approach. Presenter: Diego Navarra. Authors: Diego Navarra, Carmine Bianchi. Studio Navarra, United Kingdom.
Moderator Stewart Maginnis	**PS4. Ecological restoration through eco-innovation** • **25.PS4.O1.** Restoration of the sponge function in wetland soils as a measure for integrated river basin management in the Rhine catchment. Presenter: Eef Silver. Authors: E. Silver, W. van Deursen, E. Otterman, B. Roels, F. Zeitler. Wetlands International - European Association, The Netherlands. • **25.PS4.O2.** Biodiversity-enhancing solutions: combining ecological scientific knowledge with practical applications. Presenter and author: Mart Meriste. Nordic Botanical Ltd, Estonia.

	• **25.PS4.O3.** Nature-based solutions: Typology, and uptake in the BiodivERsA Strategic Research and Innovation Agenda for promoting eco-innovation. Presenter: Xavier LeRoux. Authors: Hilde Eggermont[1], Henrik Lange[2], Xavier LeRoux[3]. [1] Belgian Biodiversity Platform/Belgian Science Policy Office, Belgium; [2] Swedisch Environmental Protection Agency, Sweden; [3] Microbial Ecology Centre of Lyon, CNRS-INRA, Lyon, France.
Moderator Victor Beumer	**PS5. Nature-based solutions in circular economy** • **25.PS5.O1.** The social, technical and political dynamics of NBS in European cities. Presenter: Björn Wickenberg. Authors: Isabelle Anguelovski[1], Filka Sekulova[1], Kes Mccornnick[2], Björn Wickenberg[2]. [1] Universitat Autònoma de Barcelona; [2] Lund University. • **25.PS5.O2.** Wood-based sustainable fiber solutions for a sustainable planet. Presenters and authors: Marina Crnoja-Cosic, Berndt Köll. Lenzing AG, Global Business Management Industrial, Austria. • **25.PS5.O3.** Co-designing NBS for circular economy: practices and experiences in urban systems. Presenter: Marco Riva. Authors: Fabio Sgaragli, Marco Riva, Patrizia Saroglia. Fondazione Giacomo Brodolini, Italy. • **25.PS5.O4.** Nature Insurance Value: Assessment and Demonstration' (EU-H2020 NAIAD). Presenter:
Moderator Attila Katona	**PS6. Linking NBS to Sustainable Development Goals** 1. The 'big picture' of SDGs and NBS: significance in the global and European context. Presenter: Marco Fritz. European Commission. 2. The multiple connections between NBS and SDGs. Presenter: Eeva Furman. Finnish Environmental Institute SYKE. 3. Implementation mechanisms of SGDs from the NBS perspective, with some examples of alignment from a European database. Presenter: László Pintér. Central European University (Hungary). 4. Case examples of cities linking NBS in their urban areas to SDGs: Lisbon – Duarte d´Araújo Mata; Utrecht — Jeroen Schenkels.
	PS7. ThinkNature special session 1. EU project ThinkNature by Prof. Nikos Nikolaidis. 2. Destination Paradise. How NBS could contribute to developing sustainable cities. Holger Robrecht. Deputy Regional Director for Europe, ICLEI – International Council for Local Environmental Initiatives. 3. Nature Based Climate Adaptation as a driver or better cities. Alexandra Vindfeld-Hansen. SLA landscape Architects Copenhagen. 4. Climate resilient cities through nature based solutions. Constantinos Cartalis. NKUA, University of Athens, Dpt of Physics. 5. Prof. Denia Kolokotsa: the main conclusions from the 3 Taskforces in the EU projects clustering + short report from the communication meeting of the Green Spider Network.
17:40	**Posters/exhibition**
19:00	**Dinner**

Thursday, 26 October - NBS research and innovation

09:00	**Registration/Posters/Exhibition**
09:30	**Keynotes** • Hans Bruyninckx (European Environmental Agency) • Stewart Maginnis (IUCN – International Union for Conservation of Nature) • Shardul Agrawala (OECD – Organisation for Economic Co-operation and Development) • Cor Lamers (European Committee of Regions)
11:00	**Coffee**
11:30	**Panel discussion „Panel disussion "NBS in green economy"** Moderator: Tom Heap; Video message from Commissioner Karmenu Vella (European Commission) **Panelists:** • Birgit De Boissezon (European Commission), • Victor Beumer (Deltares), • David Zetland (Leiden University College), • André Movilla Mariño (Architect and Green City Foundation Supporter), • Kalev Sepp (Estonian University of Life Sciences)
13:00	**Lunch**
14:00	**Parallel sessions 2**
Moderator Marco Fritz	**PS1. Blue-green infrastructure in smart cities** • **26.PS1.O1.** Database of 1000 Nature-based solution from 100 European cities. Presenter: László Pintér . Authors: László Pintér [1], Dora Almassy[2]. [1]Central European University and IISD, Hungary; [2]Central European University, Hungary. • **26.PS1.O2.** Towards Smart Sustainable City as a Service: Case Espoo City, Finland. Presenter: Julia Nevmerzhitskaya. Authors: Päivi Sutinen[1], Julia Nevmerzhitskaya[2], Emma Terämä[3]. [1] Espoo city, Finland; [2] Laurea UAS, Finland; [3] Finnish Environment Institute, Finland. • **26.PS1.O3.** "Adopt a flowerbed" in Milan: payment for ecosystem services through civic engagement. Presenter: E. Croci. Authors: E. Croci, B. Lucchitta. IEFE – Bocconi University, Italy. • **26.PS1.O4.** From grey infrastructure to green – blue hybrids: why it happened and how it works in Polish cities? Presenter and author: Magdalena Glogowska. National Contact Point For Research Programmes of the EU, Institute of Fundamental Technological Research, Polish Academy of Sciences.
Moderator Victor Beumer	**PS2. Integrated water management through natural systems** • **26.PS2.O1.** Building with Nature: integrating ecosystem services into infrastructure. Presenters and authors: Rob Cornelissen and Egon Baldal. Ministry of Infrastructure and the Environment of the Netherlands.

	• **26.PS2.O2.** Evaluating performance and placement of nature based solutions in peri-urban environments for achieving multiple benefits. Presenter: Mark Wilkinson. Authors: Mark Wilkinson[1], Paul Quinn[2], Josie Geris[3], Marc Stutter[1], Caspar Hewett[2]. [1] James Hutton Institute, Aberdeen, United Kingdom; [2] School of Civil Engineering and Geosciences, Newcastle University, United Kingdom; [3] School of Geosciences, University of Aberdeen, United Kingdom. • **26.PS2.O3.** Potential implementation of a FWS system within an Italian natural wetland for the area restoration and maintenance. Presenter: Gianpaolo Sabia. Authors: Filippo Moretti[1], Gianpaolo Sabia[2], Luigi Pettab[2], Renato Ceccarellic[3]. [1] Italian National Agency for New Technologies, Energy and Sustainable Economic Development, ENEA, Agrifood Sustainability, Quality and Safety Laboratory BIOAG-SOQUAS, Italy; [2] Italian National Agency for New Technologies, Energy and Sustainable Economic Development, ENEA, Waste and Wastewaters Laboratory USER-R4R, Italy; [3] Independent Consultant, Italy. • **26.PS2.O4** Marker Wadden: adding value for nature. Building with and building for Nature in Lake Marken; construction of islands. Presenter and author: Sacha de Rijk. Deltares, The Netherlands.
Moderator Mattias Rennel	**PS3. ICT as a supporting tool for nature based solutions and ecosystems** • **26.PS3.O1.** Drone mapping as a tool for monitoring of mire ecosystems restoration. Presenter: Raimo Pajula. Authors: Raimo Pajula, Laimdota Truus, Kairi Sepp, Mati Ilomets. Tallinn University, Estonia. • **26.PS3.O2.** Nature-based solutions for coastal flood and erosion risk reduction using Earth Observation. Presenter: Daphne van der Wal. Authors: Daphne van der Wal[1], Iris Möller[2], Gloria Peralta[3], Edward P. Morris[3], Jasper Dijkstra[4], Albert Scrieciu[5], Ben Evans[2], Bas Oteman[1], Gerrit Hendriksen[4], Jesus Gomez-Enri[3], Javier Benevante[3], Geoff Smith[6], Tjeerd Bouma[1], Myra van der Meulen[4], Julia Vroom[4], Adrian Stanica[5], Bregje van Wesenbeeck[4], Mindert de Vries[4]. [1] NIOZ Royal Netherlands Institute for Sea Research, Dept of Estuarine and Delta Systems, and Utrecht University, Yerseke, The Netherlands; [2] Cabridge Coastal Research Unit, University of Cambridge, Cambridge, UK; [3] Department of Biology, University of Cadiz, Puerto Real, Spain; [4] Deltares, Delft, The Netherlands; [5] National Institute for Marine Geology and Geo-ecology (GeoEcoMar), Bucharest, Romania; [6] Specto Natura Ltd., Cambridge, United Kingdom. • **26.PS3.O3.** City Enabler: open technology giving awareness on data available in cities for NBS applications. Presenter: Giovanni Aiello. Authors: Giovanni Aiello, Marco Alessi, Lanfranco Marasso, Roberto Di Bernardo. Research and Development Laboratory Engineering Ingegneria Informatica SpA, Rome, Italy. • **26.PS3.O4.** Combining GIS environmental data analysis and expert knowledge in ecosystem services provision potential assessment. Presenter: Peter Bezák. Authors: Peter Bezák, Zita Izakovičová, Peter Mederly, Juraj Lieskovský. Institute of Landscape Ecology, Slovak Academy of Sciences, Slovakia.

Moderator Marjolein Helder	**PS4. Ecological restoration through eco-innovation** • **26.PS4.O1.** Nature-Based technologies for soil and water remediation: competitive opportunities in the environmental industry sector and integration into the urban landscape for the benefit of local communities. Presenter and author: Caroline Zaoui. Biomimicry, Belgium. • **26.PS4.O2.** Green roof as mitigating tool of environmental problems in cities: case studies from Estonia. Presenter: Alar Teemusk. Authors: Alar Teemusk, Ülo Mander, Ain Kull, Arno Kanal. Institute of Ecology and Earth Sciences, University of Tartu, Estonia. • **26.PS4.O3.** Gypsum – An eco-innovation for the Baltic Sea. Presenter: Eliisa Punttila. Authors: Markku Ollikainen[1], Petri Ekholm[2], Eliisa Punttila[1], Anna-Kaisa Kosenius[1], Samuli Puroila[1]. [1] University of Helsinki, Finland; [2] Finnish Environment Institute, Finland. • **26.PS4.O4.** Development of nature-based solutions for marine oil spill response actions. Presenter: Jaak Truu. Authors: Jaak Truu[1], Marika Truu[1], Kirsten Jorgensen[2], Anna Reunamo[2], Ossi Tonteri[2], Nga Dang[3], Tarmo Kõuts[4], Siim Pärt[4]. [1] Institute of Ecology and Earth Sciences, University of Tartu, Estonia; [2] Finnish Environment Institute, Marine Research Center, Finland; [3] Norut Northern Research Institute, Norway; [4] Marine Systems Institute, Tallinn University of Technology, Estonia.
Moderator Roman Zinchenko	**PS5. Nature-based solutions in circular economy** • **26.PS5.O1.** Why nature-based solutions and circular economics need each other in the built environment: the case of De Ceuvel. Presenter and author: Nadine Galle. Metabolic, The Netherlands. • **26.PS5.O2.** Economic value of urban nature: a meta-analysis. Presenter: Marija Bockarjova. Authors: Marija Bockarjova, Wouter Botzen. Utrecht University School of Economics, The Netherlands. • **26.PS5.O3.** Winery wastewater valorisation system based on constructed wetlands. Presenter: Rocio Pena. Authors: Rocio Pena[1], Ana Pascual[1], Juan A. Alvarez[1], Paula Villar[1], Luz P. Herrero[1], David de la Varga[2]. [1] Aimen, Polígono Industrial de Cataboi, Spain; [2] SEDAQUA, Spain. • **26.PS5.O4.** Nature-based solutions for valorization of Estonian black shale. Presenter: Anne Menert. Authors: Anne Menert[1, 2], Sirli Sipp Kulli[2], Triin Korb[1], Kaja Orupõld[3], Alar Teemusk[4], Maia Kivisaar[1]. [1] University of Tartu, Institute of Molecular and Cell Biology, Tartu, Estonia [2] BiotaTec Ltd, Tallinn, Estonia; [3] Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Tartu, Estonia; [4] University of Tartu, Institute of Ecology and Earth Sciences, Tartu, Estonia.
Moderator Steve Cinderby	**PS8. Well being and public engagement** • **26.PS8.O1.** How do urban nature based solutions foster human health and wellbeing? Presenter: Aino Rekola. Authors: Eeva Furman, Riikka Paloniemi, Aino Rekola, Eeva Primmer, Suvi Vikström, Maija Tiitu, Salla Rantala. Finnish Environment Institute (SYKE), Finland. • **26.PS8.O2.** Why we should prioritize green infrastructure within healthcare environments. Presenter and author: David Vernon Brasfield. Scandinavian Green Roof Association, World Green Infrastructure Network, Norway.

	• **26.PS8.03.** Public engagement for nature based solutions: citizens are on natures side. Presenter: Josefina Enfedaque. Authors: Josefina Enfedaque[1], Laurent Bontoux[2], Gilles Laroche[3]. [1] Sustainable Management of Natural Resources Unit. DG Research & Innovation, European Commission, Belgium; [2] Joint Research Centre, European Commission, Belgium; [3] Policy, Coordination and Communication Unit. DG Environment, European Commission, Belgium. • **26.PS8.04.** Co-benefits that urban green infrastructure can bring for businesses and workers wellbeing based on the project: http://bit.ly/2upxsaH. Presenter: Steve Cinderby. Authors: Steve Cinderby[1], Sue Bagwell[2]. [1] Stockholm Environment Institute, United Kingdom [2] Cities Institute, London Metropolitan University.
15:30	**EEA photo contest winners** Hans Bruyninckx (European Environmental Agency)
16:00	**Closing** • Tom Heap (conference Moderator) • Birgit De Boissezon (European Commission) • Tiit Land (Rector of Tallinn University)
16:30	**Coffee/Posters**
18:00-19:15	**Documentary Film program**

Speakers

Siim Kiisler

The Estonian Minister of the Environment

Siim Kiisler is Minister of the Environment of the Republic of Estonia as of 12 June 2017. He is a member of the Pro Patria and Res Publica Union. Siim Kiisler has been a member of the Riigikogu several times and from 2015-2017, he was the Chairman of the Constitutional Committee. He was the Minister of Regional Affairs (2008-2014), and from 2007-2008 he was Assistant Minister of the Ministry of Economic Affairs and Communications.

Tarmo Soomere

President of the Estonian Academy of Sciences

Mathematician and marine scientist, since 2014 the President of the Estonian Academy of Sciences. His scientific interests are mostly concentrated to the analysis and mitigation of marine hazards and preventive methods of coastal protection.

He has received twice the national science award and state decoration of 3rd class White Star order for developing coastal science in Estonia. A highly unusual distinction for a scientist came from society: he was declared the Person of the Year in Estonia 2005 by daily newspaper The Postman for his contribution to the forecast of a devastating storm.

Patrick Child

Depity Director General of DG Research and Innovation

Deputy Director General in DG RTD Research and Innovation, European Commission. Policy for management and implementation of the EU's €77bn research and innovation programme by the Commission services, executive agencies and other implementing bodies including legal aspects, IT systems, audit and business processes. Specific responsibility for research and innovation into clean energy technologies, and Commission representative and elected chair of the steering committee of Mission Innovation (a coalition of 23 countries committed to doubling research in clean energy by 2020).

Julien Guerrier

Director of the European Executive Agency for Small and Medium-sized Entreprises

Head of the European Executive Agency for Small and Medium-sized Entreprises (EASME). He has been working for more than 20 years at the European Commission, mainly on industrial policy, international trade negotiations and corporate management issues. As representative of the Commission, he managed the EU-Japan Centre for Industrial Cooperation in Tokyo. Before joining the Commission, he was at the French Ministry of Public Works and participated in an exchange of officials with the Japanese administration, where he worked for one year. Julien Guerrier graduated from Ecole Polytechnique and Ecole nationale des Ponts et Chaussées in France and holds an MBA in international business.

Katrin Niglas

Vice-Rector for Research, Tallinn University

As a vice-rector for research Katrin Niglas is responsible for the development of R&D and doctoral studies at Tallinn University. She has a PhD in educational sciences from Tallinn University and a MPhil form University of Cambridge. She has taken part in various research projects on the fields of education, social sciences and humanities as an expert in methodology and data analysis and her experience in collaboration with international academic colleagues is extensive. Katrin Niglas is a member of the editorial board of Journal of Mixed Methods Research as well as of International Journal of Multiple Research Approaches.

Tiit Land

Rector of Tallinn University

Tiit Land is the rector of Tallinn University, Estonia. He has MA in chemistry from Tartu University, Estonia and PhD in neurochemistry and neurotoxicology from Stockholm University, Sweden. He has been a researcher at the National Institutes of Health, USA between 1994-1999 and a researcher and lecturer at Stockholm University between 1999-2006. Then he was elected professor in chemistry at Tallinn University. Between 2008-2011 he worked as the Director of the Institute of Mathematics and Natural Sciences of Tallinn University. He was first elected as the rector of Tallinn University in 2011 and re-elected for the second term in 2016.

Marina von Weissenberg

Finnish Ministry of the Environment

Marina is working as Senior Ministerial Adviser at the Finnish Ministry of the Environment, Department of the Natural Environment/Biodiversity since 1996. Political scientist/international affairs, UNI degree and interested in social, political, human relations in her daily work. She is the National focal point (NFP) for the Convention on Biological Diversity (CBD) and its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) for Finland which means networking with different people and skills. CBD Bureau Member in 2000-2001.

Birgit De Boissezon

Senior Head of Unit at the European Commission - Sustainable Management of Natural Resources, Directorate Climate action and resource efficiency

Her Unit defines and implements, supported by Horizon 2020, objectives and priorities for nature-based solutions which increase economic, social and environmental resilience and improve risk management, to re-nature cities, adapt to climate change, restore biodiversity and ecosystems, and valorise cultural heritage. Earlier EC positions related to strategy and policy, planning and evaluation of EU research framework programmes (FP).

Kalev Sepp

Professor of Landscape Ecology and Environmental Protection at the Estonian University of Life Sciences

Kalev Sepp has studied human effects on agricultural landscapes and biological diversity. His studies focus on environmental status and protection as well as regional studies from a geographical point of view.

Lena Ek

Member of the Board of Mistra Geopolitics

Lena Ek was appointed Minister for the Environment in September 2011. She was a Member of the European Parliament from 2004–2011 as member of the Alliance of Liberals and Democrats for Europe (ALDE). Vice chair Committee of environment and agriculture, Swedish Parliament Oct 2014 – May 2015. Member Swedish Parliament Oct 2014–July 2015. Chairman of the Board of Södra from May 2015. Chairman of the Board of Forest-based Sector Technology Platform (FTP) from April 2016. Member of IVA's Forest Technology division from November 2016. Coordinator for the European Spallation Source (ESS) from December 2016. Member of the Board of Mistra Geopolitics from April 2017.

Joanna Drake

Deputy Director-General in DG Environment

Joanna Drake is the Deputy Director- General in charge of Coordination of Resource-efficiency policies and instruments in DG Environment (ENV). Between 2010 and 2015 she was the director, of SME's and Entrepreneurship in the DG Internal Market, Industry, Entrepreneurship and SMEs (GROW), managing a team of over 100 personnel and 5 units.

In 2015 she served as the Principal Adviser and Chair of Task Force on The Collaborative Economy, New Business Models And SME's in DG GROW.

Kęstutis Navickas

Minister of Environment of Republic of Lithuania

Kęstutis Navickas is the Minister of Environment of Republic of Lithuania. From 1998 to 2006 he served as the director of the Lithuanian Office of the Regional Environmental Centre for Central and Eastern Europe. Between 2006 and 2016 he was a sustainable development expert of the Baltic Environmental Forum.

Marjolein Helder

Member of the High Level Group for the European Innovation Council

Marjolein Helder, MSc. PhD. graduated from Wageningen University, the Netherlands, as a PhD in Environmental Technology, November 2012. She did research into a technology to produce electricity from living plants. She founded the spin-off company Plant-e to bring the unique and innovative technology from her research to the market. Marjolein is part of the High Level Group for the European Innovation Council and member of the board of directors of housing corporation Idealis. She is a well-trained and regularly hired speaker for a multitude of events, including different TEDx events, where she brings across the message of sustainable electricity from living plants with great enthusiasm.

Vasco Ferreira Costa

Senior Investment Officer at Infrastructure Funds and Climate Action Division of the European Investment Bank

Vasco Ferreira Costa is the Senior Investment Officer at Infrastructure Funds and Climate Action Division of the European Investment Bank. He has more than 15 years' experience in Impact Finance, including leading roles in investment origination and risk management. He's currently working on the implementation of the Natural Capital Financing Facility, a joint EIB - European Commission Investment Program using market-based instruments for financing the conservation, restoration, management and enhancement of natural capital. Vasco has extensive experience in financing environmental and economic sustainable projects in Europe, including natural capital, urban regeneration infrastructure projects, research and innovation, and microfinance.

Hans Bruyninckx

Executive Director of the European Environment Agency

Keynote presentation pdf

Dr Hans Bruyninckx became the Executive Director of the European Environment Agency on 1 June 2013. In 1996 he completed a PhD in international environmental politics at Colorado State University and since 2010 headed the HIVA Research Institute in Leuven which specialises in policy research. Over the last 20 years, he has conducted research in more than a dozen countries, in areas including environmental politics, climate change, and sustainable development.

Shardul Agrawala

Head of the Environment and Economy Integration Division at the OECD Environment Directorate

Keynote presentation pdf

Shardul Agrawala is Head of the Environment and Economy Integration Division at the OECD Environment Directorate. In this capacity, Dr. Agrawala leads the Directorate's work on economic-environmental modelling, empirical analysis of environmental policies, trade and environment, and on resource productivity and waste. At the OECD since 2002, Dr. Agrawala has previously served as Senior Advisor to the OECD Secretary General, Coordinator of the OECD-wide initiative on New Approaches to Economic Challenges, Acting Head of the Climate Change Biodiversity and Development Division, and Senior Economist Climate Change. Dr. Agrawala has published extensively on climate change. He has led teams of international experts as Co-ordinating Lead Author (CLA) for chapters of the Fourth and Fifth Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC).

Cor Lamers

Chair of the ENVE committee of the European Committee of the Regions (CoR)

Cor Lamers is the Chair of the ENVE Commission in the Committee of Regions - Commission for Environment, Climate Change and Energy and a Mayor of Schiedam in the Netherlands. He has been a very active member within the CoR with the expertise mainly in environment especially air quality, but also in climate change and energy. He was rapporteur on two opinions concerning air quality: the Clean Air Policy Package (2014) and the review of EU air quality and emissions policy (2012). Together with the CoR President, he will lead a delegation of 20 local and regional political leaders to the COP23 meeting in Bonn.

Victor Beumer

Deltares

Victor Beumer got his PhD in Landscape Ecology at the Utrecht University (NL) in 2008. Since then he has been working at Deltares (NL). Deltares is an independent knowledge institute with approximately 850 professionals working on water, subsurface and infrastructure. Victor has been working on nature-based solutions, building with nature or green infrastructure with a focus on water-related benefits where he is much active within the scope of implementation. Last 5 years he has been focusing on urban areas. For the EU Water platform (WssTP) he chairs the working group on Green Infrastructures.

David Zetland

Assistant professor at Leiden University College

David Zetland is an assistant professor at Leiden University College, where he teaches on the commons and environmental economics. Since receiving his PhD in Agricultural and Resource Economics from UC Davis in 2008, he has held positions in the US, Canada, Saudi Arabia and the Netherlands. He blogs on water, economics and politics at aguanomics.com, has written two books (The End of Abundance and Living with Water Scarcity) and has published numerous academic and popular articles. David is now running a project -- Life Plus 2 Meters -- to help the public understand how climate change might affect their lives.

André Movilla Mariño

Spanish architect and urban planner, AKKA Architects

In the pursuit of solutions for today´s global challenges, he arrived to AKKA Architects, international office based in Amsterdam, almost two years ago to expand his knowledge and achieve stronger skills in participatory processes with communities by designing spaces and contexts to foster interactions, innovation, and creativity in a scale range that goes from products to furniture, to interiors, to buildings to urban interventions.

Eeva Furman

Director for the Environmental Policy Centre at the Finnish Environment

Professor Eeva Furman has been researching and developing governance of environmental and sustainable development for more than 20 years. She was the coordinator of the EU-project OpenNESS (Operationalisation of Ecosystem Services and Natural Capital concepts) where approaches, tools and a web based platform were developed by using 27 place based cases studies. Much attention was paid on nature based solutions. She has also been involved in various national projects on nature based solutions. Presently Furman is occupied on issues around the UN Agenda2030 as she is part of the writing team of 15 experts who produce the UN global sustainable development report for 2019.

Stewart Maginnis

Global Director of the Nature-based Solutions Group in IUCN

Keynote presentation pdf

Stewart Maginnis is the Global Director of IUCN's Nature-based Solutions Group and the Director of IUCN's Global Forest and Climate Change Programme, with overall responsibility for IUCN's work on Ecosystem Management, Forests, Water, Marine & Polar, Gender, Social Policy, Economics, and Business & Biodiversity. He is also the Secretariat focal point for the IUCN Commission on Environmental, Economic and Social Policy (CEESP). Stewart has 30 years of broad experience in the area of natural resource management, biodiversity conservation and sustainable development. He has also taken in a leadership role in defining and promoting the concept of nature-based solutions and he and his team are currently working on the development of practical guidance and standards for NBS approaches that can be operationalized at scale.

PLENARY SESSIONS

LOCAL GOVERNANCE IN MOVING TOWARDS NATURE-BASED SOLUTIONS

Wednesday 25 October

Siim Kiisler, Minister of Envrionment of Estonia

In July 2017, the informal meeting of EU environmental ministers was held in Tallinn. One of the main topics was urban sustainability. It was stressed, that it is important to focus on developing and restoring biodiversity and nature in cities. But we need to focus on adjusting and improving the infrastructure we have as well. It was highlighted that we need platforms to share knowledge between different cities. ThinkNature and EnRoute are examples of such innovative platforms.

On local authority level, cities need to be practical because the legislation concerning public procurement is very strict. It is not always easy to bring new ideas to life. Controversially, 14% of European GDP is spent on public procurement. Due to that, it is important that public sector leads the way in using NBS. That includes changing information and experience with private sector.

A good example from Estonia is CITYNTEL smart street light solution that uses real time traffic and weather information for regulating public led-lights. This solution helps government save costs on energy and maintenance. Also, smart solutions help us to monitor our impacts to environment.

Conferences like NBS 2017 are also very valuable, as they allow for experience and knowledge transfer and help stakeholders meet new contacts.

Lena Ek, Södra

In urban areas, it is important to think about the kinds of surfaces we have and what impact they have on the environment. The era of hard cover has faded out and it's time for NBS. Related to that, it is essential to rethink how we use our drinking and grey water.

One important environmental problem is microplastic pollution in different water bodies and soil. This issue need addressing as quickly as possible.

Change in transportation is also needed. Controversially, we don't need new highways and roundabouts to decrease the number of people killed in traffic. Instead we need change in fuels that transport uses, because premature death due to air pollution is bigger problem. One solution is to use liquid biofuels and change the public procurement regarding transportation.

Another problem is overuse of antibiotics in our food. That is why we are getting resistant to common medicine and we can´t anymore cure diseases as easily.

In many cases local level smart and practical thinking goes sometimes much faster and further than legislation can.

Joanna Drake, European Commission

Solutions in local level can work faster and are more visible, but we have to work together as partnership to make a full impact. Therefore, in EU level we can do as much.

In Europe urbanization is an ongoing process and that is why we need to create healthy, inspirational and resilient living environments. It is important to build cities for people who want to live in healthy way near green areas.

We have grassroots initiatives happening in cities, like green roofs and urban farming. Public authorities need to engage even more people and raise their awareness about the benefits of green cities. Also, inclusive framework is needed for active citizens to improve the quality of life in cities.

Natura 2000 sites need to be more visible, functional and well managed for local citizens. Only then can these areas be source and example for NBS. People in EU live quite close to nature, specifically to protected areas and therefore we have the responsibility to take appropriate care of them and use them to improve our health.

Sadly, there isn't enough mapping how these areas can provide services for that particular urban area. EU project EnRoute tries to change the situation and maps the services provided by green areas. In order to make local level initiatives happen, holistic approach is needed.

Kęstutis Navickas, Minister of Environment of Lithuania

Can nature be part of the city? NBS are solutions based on nature experience. We should not forget about nature when we think about future developments.

NatureFrame is a planning an approach at municipal level that aims to create areas and green corridors for wildlife. It includes compensation methods when nature is harmed. The main point of this kind of approach is that nature is not an obstacle but opportunity in cities.

It has been carried out in Lithuanian city of Vilnius. These kind of green areas are not only esthetical, they provide a learning tool for students and have social aspects.

Eeva Furman, Finnish Environmental Institute SYKE

Local level solutions are crucial for successful NBS. Thereby, it is important to keep in mind that NBS are solutions for societal problems, including biodiversity loss, climate change, but also refugee problems. Therefore, interdisciplinary and transdisciplinary research about the topic is needed and it has to base on actual cases.

Behavioural studies have an important role in this research. It is important to know how people make decisions. That is why we need to study human brain and find out how and why humans consume. This can help us find ways to change current behaviors and move towards sustainability. Additionally, we have to include NBS to the

big picture. Sustainability of NBS solutions are crucial because this is not always the case.

Green infrastructure alone is not enough; we need to know how we can make people use it actively for better health. In fact, municipalities can support that kind on research.

PLENARY SESSIONS

FUTURE OF NATURE-BASED SOLUTIONS IN THE EUROPEAN UNION

Wednesday 25 October

Stewart Maginnis, IUCN

The Millennium Ecosystem Assessment presented the concept of nature-based solutions (NBS) for the first time. Global importance of biodiversity isn't only about the rare and endangered, natural and untouched places. It is about the common and well-known communities as well. No matter where we live, we are dependent on nature. It reveals itself in different ways: we have to protect what we already have, for example clean drinking water.

New societal and economic opportunities can improve restoring and integrating nature to our society and economy. That inspired IUCN to build NBS as a second complimentary pillar of our global conservation work. That helps to address key societal challenges we are facing today.

How do we see NBS evolving over the next decade?

1. There is still long way to go until NBS becomes common national policy, but we should feel encouraged.
2. NBS is one of a few options that is available for long-term solutions.
3. The biggest challenge in implementing NBS may not be the need for financial support. Instead, the need for sufficiently integrated and joined up policy frameworks by which NBS can effectively be delivered.

NBS are unique because they can deliver several key benefits. For that, supportive sector policies need to be implemented.

The biggest change has to be made by environmental management and protection workers, because they need to contribute concrete outcomes for different problems. There is also need for more research, for example in collaboration with other technologies and approaches. We must avoid over claiming these solutions and keep in mind the limitations.

Marjolein Helder, Plant-E; European Innovation Council

We need to work with nature, rather than against it. To implement NBS we need more entrepreneurs to get involved. Unfortunately, there is a tendency to think that nature can't generate any money. It's wrong to concentrate only on making money. Such thinking represents everything wrong with the system. Instead, we should ask, what is the added, societal and natural value.

Main points to take into account:

1. We should look at businesses from a multidisciplinary point (nature is more than money).

2. We should see the added value of nature, also the societal aspect and calculate price considering these factors.
3. We should stop assuming that entrepreneurs aren't interested, because they are. But the current system isn't.
4. We should be encouraged.

Vasco Ferreira Costa, Senior Investment Officer at Infrastructure Funds and Climate Action Division of the European Investment Bank

Long term investment in NBS needs a new and holistic approach. It requires an active involvement from all the stakeholders and greater interaction between disciplines and sectors. It needs to be supported by research, evidence and knowledge. Public funds and grants can't alone close the funding gap, both public and private funding is needed.

European Investment Bank invests 80 billion a year with the focus on environment and climate innovation and infrastructure. NBS are already used in many of our client's projects, like urban regeneration, circular economy and timberland funds. The bank is currently implementing the natural capital financing facility, which is brought to life with collaboration with European Commission. It aims to demonstrate investors the attractiveness of financing natural capital.

Current experience shows the need for much closer collaboration of finance providers and clients. We need suitable financing methods to promote long-term sustainability of the projects. Technical assistants play major role in supporting capacity of promoters to develop integrated solutions or to monitor impacts.

NBS carry interesting investment opportunities, including the potential to bring the much-needed attention to biodiversity protection and ecosystem services concept. We need better and faster ways to invest more. Education, awareness and knowledge sharing, like this conference are fundamental for engaging more people and at the same time find ways to invest more.

Marina von Weissenberg, Ministerial Adviser for the Ministry of Environment of Finland

We are facing serious environmental problems. For tackling these issues, we need radical social and behavioural changes. I believe that NBS provide opportunities to integrate biodiversity in different sectors, now and in the future. People's connection to nature plays essential role in that. Sadly, we are losing it all over the world. EU work in financial means has had a positive impact on NBS, including programmes and initiatives like LIFE and BiodivERsA.

NBS needs to be included into the legal framework. If it's voluntary it can't work. Collaboration between different organizations needs to be included to halt the

biodiversity loss by 2020 and beyond. Mainstreaming NBS in different policies is crucial and that is why we need to reach out more.

Procedures and mechanisms to fill the voids between different sectors and scales, also science and policy have to be implemented. Need for adapting governance, what makes use of new scientific knowledge is needed. Also, the national action plan for sustainable development helps to achieve the goals. Whole budget needs to be focused on sustainable development.

It is crucial to raise the public awareness. In that, synergies between different actors is important. Human well-being can and must be improved by nature, especially in urban areas.

Conclusion: The need to integrate NBS to our local policies is very important and has multiple benefits.

Patrick Child, European Commission

Europe is in unique leader position regarding NBS, we have the vision and leading political influence, projects and technology.

The main question is how can we make it into commercial success? Convincing business cases are needed, of course we have to show benefits besides economical ones. We should target NBS implemented by Europe to the global market.

PLENARY SESSIONS

NATURE-BASED SOLUTIONS IN GREEN ECONOMY

THURSDAY 26 October

Victor Beumer, Urban Water and Subsurface Management at Deltares

If we want to take nature-based solutions (NBS) to common use, we need valid business cases. So far most of the business cases are based on the novelty of NBS, but the more we make NBS 'common use' the less we can rely on current available budgets. Another point is that we cannot apply the same tools and approaches to different types of NBS. We regard two different groups of NBS: ones that are existing nature areas with their ecosystem services (ES) and ones that are designed and constructed to deliver certain ES.

The group of designed and constructed NBS contains two subgroups:

1. High-tech NBS or hybrid solutions. They are a combination of the so-called hard solution and green solution. In these cases, nature is dependent on the hard structure, for example 'green roofs'. They are 'half-way' to common use.
2. Ecosystem-based NBS. They are restored or reinstalled (parts of) ecosystems, for example 'urban parks' and 'functional wetlands'. These solutions are the most complex, because they are dependent on local flows (hydrology, ecology, etc.). Therefore, it is difficult to develop a common use implementation.

The most NBS-related start-up companies are on hybrid or high-tech NBS, but how can we achieve this for ecosystem-based NBS too?

To illustrate this Victor used Marker Wadden (lake archipelago to catch sediments) as an example. Its main ES (corresponding to the initial ambitions of the project) are maximized, while its secondary services are optimized (they are not allowed to negatively affect the main ES). Here, the main ES form the basis for the overall business case, while the secondary ES can form sub-business cases. This amplifies the need for clear understanding of synergies and trade-offs between ES. If previous is kept in mind, then common use of ecosystem-based NBS is within reach (https://www.deltares.nl/en/blog/the-implementation-of-complex-nature-based-solutions-in-cities/).

David Zetland, Assistant professor at Leiden University College

Not NBS but human caused problems.

Anthropocene is the new era where humans are changing the world. It started with exploitation and usage of fossil fuels and it has become the main problem. We are gone beyond the natural capability and are struggling to find NBS to ease the problems.

Environmental problems that we are faced today are not recent. Controversially, the solution to that isn't more industry. We don't need more cars in the cities, we need less people. We don't need more fertilization, we need more conservation of soil. We don't need to reduce carbon, we need to restore forests. Industry is not the solution, in fact, there are barriers for reducing industry. For example, nature is a common, that meaning we all share it. Industry is a private enterprise that can profit from abuse of nature. Sadly, most of the people are either too dumb, too pore or too ignorant for being engaged to this topic.

Solutions:

1. We should do no harm: we should end common agricultural policy.
2. We should force the industry to protect the commons: carbon tax.
3. We need to think about the small cost of doing the right thing: carbon tax would raise the price of gasoline by six cents per liter.

We should stop talking about NBS and instead stop human caused problems.

Andre Movilla Marino, Architect and a Green City Foundation Supporter

Relationship between ecology (home knowledge) and economy (home management) is important. If we want to manage something, we need to know about it. Economy can't survive on unhealthy ecology.

Economy is the consequence of ecology. Before every new project like urban planning, it is essential to study the site first. Architecture as a service can provide people with spaces that foster interactions and provide context for collaboration and learning.

Collaborative process between different agents is important, we can't solve environmental problems alone, common goal is needed. Environmental problems are solved in complex way and in most cases, you can address different problems at the same time. Therefore, diversification plays a key role in it, because there are no ecosystems that can survive alone. We need to take into account the intelligence of the users (they are the experts), honesty of behaviour (can become a pattern) and quality of time.

Learning and doing is a circular process. Designing the future is not a possibility, it is a responsibility. Yesterday's answers are not relevant today, we have to keep on searching.

Birgit De Boissezon, Head of Unit "Sustainable Management of Natural Resources"

Main points: Different concepts of circular economy, urban innovation and NBS and how to change the society.

Circular economy has different elements: no waste, best use of resources, resilience but also element of sharing and network economy. In sharing economy, exchange is made among different stakeholders in various ways, similarly to an ecosystem. Due to that, many actors like researchers, public authorities, artists, NGOs, civil societies and citizens take active part in innovation. By co-design, co-implementation and co-evaluation different NBS are brought to life.

Citizen-science is a concept where usual people take the central role. That way, citizens become the main actors and demand products that they really need (designing

upstream). Also, public engagement in valuing different capitals is important. Indeed, we have to invite all the actors to find the best and most sustainable solution.

Kalev Sepp, Professor of Landscape Ecology and Environmental Protection at the Estonian University of Life Sciences

Inspiration and support from nature can stimulate scientific innovation and support green economy. However, future research of NBS effectiveness is needed. We need complex studies how to use different approaches together. Lack of an interdisciplinary view in these studies is a problem to solve. In addition, it is important to consider the socio-economical part of these solutions.

Obstacles and changes of NBS:

Long-term and short-term benefits. Politicians have short-term objectives. Fear of unknowingness: we can build green wall/roof but the benefits for the biodiversity in long-term are still unknown. In addition, we have an administrative infrastructure; people are making decisions for us and in many cases growth obsession is still dominating.

It takes long time to get new and innovative ideas to policies. We need to think how to reach the public and implement the new concepts. In the same time, the question is how to choose the best NBS to fit the cities development goals.

Take-away message: We need more different research and increased awareness from the stakeholders. Also, legal financial framework to support the new ideas.

PARALLEL SESSIONS

ORAL PRESENTATIONS

Session 1. Blue-Green Infrastructure in smart cities

Wednesday 25 October

25.PS1.O1

A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas

Christopher M. Raymond, Niki Frantzeskaki, Nadja Kabisch, Pam Berry, Margaretha Breil, Mihai Razvan Nita, Davide Geneletti, Carlo Calfapietra
University of Trento, Italy.
davide.geneletti@unitn.it
Presentation pdf

To address challenges associated with climate resilience, health and well-being in urban areas, current policy platforms are shifting their focus from ecosystem-based to nature-based solutions (NBS), broadly defined as solutions to societal challenges that are inspired and supported by nature. NBS result in the provision of co-benefits, such as the improvement of place attractiveness, of health and quality of life, and creation of green jobs. Few frameworks exist for acknowledging and assessing the value of such co-benefits of NBS and to guide cross-sectoral project and policy design and implementation. In this paper, we firstly developed a holistic framework for assessing co-benefits (and costs) of NBS across elements of socio-cultural and socio-economic systems, biodiversity, ecosystems and climate. The framework was guided by a review of over 1700 documents from science and practice within and across 10 societal challenges relevant to cities globally. We found that NBS can have environmental, social and economic co-benefits and/or costs both within and across these 10 societal challenges. On that base, we develop and propose a seven-stage process for situating co-benefit assessment within policy and project implementation. The seven stages include: 1) identify problem or opportunity; 2) select and assess NBS and related actions; 3) design NBS implementation processes; 4) implement NBS; 5) frequently engage stakeholders and communicate co-benefits; 6) transfer and upscale NBS; and 7) monitor and evaluate co-benefits across all stages. We conclude that the developed framework together with the seven-stage co-benefit assessment process represent a valuable tool for guiding thinking and identifying the multiple values of NBS implementation.

25.PS1.O2

Comprehending the multiple 'values' of green infrastructure – Valuing nature-based solutions for urban water management from multiple perspectives

Tom C. Wild, John Henneberry, Lewis Gill
University of Sheffield, England.
t.wild@sheffield.ac.uk
Presentation pdf

The valuation of urban water management practices and associated nature-based solutions (NBS) is highly contested, and is becoming increasingly important to cities seeking to increase their resilience to climate change whilst at the same time facing budgetary pressures. Different conceptions of 'values' exist, each being accompanied by a set of potential measures ranging from calculative practices (closely linked to established market valuation techniques) – through to holistic assessments that seek to address wider concerns of sustainability. Each has the potential to offer important insights that often go well beyond questions of balancing the costs and benefits of the schemes concerned. However, the need to address – and go beyond – economic considerations presents policy-makers, practitioners and researchers with difficult methodological, ethical and practical challenges, especially when considered without the benefit of a broader theoretical framework or in the absence of well-established tools (as might apply within more traditional infrastructural planning contexts, such as the analysis of transport interventions). Drawing on empirical studies undertaken in Sheffield over a period of 10 years, and delivered in partnership with several other European cities and regions, we compare and examine different attempts to evaluate the benefits of urban greening options and future development scenarios. Comparing these different approaches to the valuation of nature-based solutions alongside other, more conventional forms of infrastructure – and indeed integrating both 'green and grey' interventions within a broader framework of infrastructures – throws up some surprising results and conclusions, as well as providing important sign-posts for future research in this rapidly emerging field.

25.PS1.O3

A helping hand or a thorn in the foot? European and national policy frameworks to support nature-based solutions and green/blue infrastructure

McKenna Davis, Katrina Abhold, Doris Knoblauch, Sandra Naumann
Ecologic Institute, Germany.
mckenna.davis@ecologic.eu
Presentation pdf

Nature-based solutions (NBS) as well as green and blue infrastructure (GBI) are gaining increasing importance worldwide - particularly in cities - due to their potential to address multiple societal challenges, while also delivering economic and environmental benefits. Policy frameworks are a crucial aspect in determining the extent of their uptake, as these can either foster or hinder implementation. As such, the H2020 research project NATURVATION aims to assess this potential for NBS/GBI support through an analysis of EU and national policy instruments. As there is not a legal initiative at EU level requiring Member States to invest in such solutions, the review targets a range of EU and national sectoral policies across six Member States. The review focuses on the explicit and implicit use of NBS/GBI (and related) terms, the societal challenges targeted by the NBS/GBI, the type of interventions and examples of NBS/GBI pursued, as well as the degree and nature of support for NBS/GBI (e.g. legislative, financial or regulatory, information provision, or capacity development). Preliminary results indicate that NBS are often in-directly addressed by policy instruments through the related concepts of ecosystem-based management/approaches and green (and blue) infrastructure. Moreover, EU policies focus strongly on the management/maintenance and restoration of existing ecosystems, rather than emphasizing the creation of new green spaces. The final report will further highlight gaps in the current EU and select national policy frameworks, as well as potential opportunities for increasing future NBS/GBI policy support at the national and EU levels as a tool for addressing a range of urban challenges.

Water services

Bertrand Vallet[1], Bruno Tisserand[2]
[1] *EurEau Policy officer, Belgium;*
[2] *EurEau Policy officer, France.*
bruno.tisserand@eureau.org
Presentation pdf

Water services are responsible for the urban drainage of cities. With the increase of impervious areas, the run-off management is becoming both a security, environmental and health issue in Europe. With the effect of climate change increasing the frequency of extreme rain-events, the need for effective and future-proof run-off management will become more and more urgent. Recent flooding events in major towns and regions (Copenhagen 2011, Croatia 2015) have caused significant economic and environmental damage and triggered the development of strategies to reduce the risk of such events in the future. Building on a thorough analysis of the needs and the establishment of effective governance structures, changes in the water infrastructure can be designed.

Increasing retention capacity with grey infrastructures is not always the most sustainable option. Decision makers will thus have to combine green-blue infrastructures with the optimisation of the already existing grey infrastructures in order to have a sustainable run-off management at city level. In this context, NBS are the key tool to reduce the run-off peaks by allowing natural retention and avoiding overflowing of sewers during heavy rain events. As they are often made up of parks and green areas in cities, they also contribute to improving the well-being of citizens. Combining NBS with real-time control of the sewer is currently developed in Europe and in the world to optimise the retention capacity of sewers. Local policy and urban or river basin management plans encompassing the implementation of such solutions will lead to move forward cities towards sustainability by minimising their impact on the Environment during rain events. EurEau will present some European best practices case-studies from its members to illustrate this vision.

Thursday 26 October

26.PS1.O1

Database of 1000 Nature-based solution from 100 European cities

László Pintér[1], Dora Almassy[2]
[1] *Central European University and IISD, Hungary;*
[2] *Central European University, Hungary.*
PinterL@ceu.edu

Nature-based solutions (NBS) hold significant promise in enabling the urban transition to sustainability and meeting sustainable development goals. They have the potential to provide multiple benefits across a range of sustainability challenges facing cities – such as managing flooding, supporting improved health outcomes or creating places for social interaction and recreation. The Horizon 2020, EU Framework Programme funded NATURVATION project seeks to assess the performance of NBS through examining the services that NBS provides, their value and benefit, their scope in terms of the constituents (and potentially ecosystems) through which these are realised as well as the dynamics and the politics of these interventions.

Work Package 2 of NATURVATION seeks to advance the state of the art beyond the analysis of individual cases of NBS by undertaking a uniquely comprehensive survey of NBS in European cities. The resulting database will detail the type, form, function, governance, impact and distribution of NBS in 100 European cities. By choosing a representative sample of cities covered by Eurostat's Urban Audit (http://bit.ly/2pZNhiD), the database will provide a tool to assess the key characteristics of urban NBS; the relation between urban NBS and economic development, social inclusion & health; and the types of innovation that support the uptake of NBS in different European contexts.

The first findings from the database will be summarized in a report, analysing the basic profiles of NBS across Europe and presented in an interactive, open-access online database. Both outputs will be available in November 2017. The database will also provide a basis in subsequent stages of NATURVATION for analysing the socio-economic and the innovation patterns of NBS, support case study selection for an in-depth, internationally comparative analysis to identify the innovation potential of NBS and provide insights into the barriers facing NBS innovation.

26.PS1.O2

Towards Smart Sustainable City as a Service: Case Espoo City, Finland

Emba Päivi Sutinen[1], Julia Nevmerzhitskaya[2], Dr Emma Terämä[3]
[1] *Espoo city, Finland;*
[2] *Laurea UAS, Finland;*
[3] *Finnish Environment Institute, Finland.*
julia.nevmerzhitskaya@laurea.fi
Presentation pdf

Nature based solutions (NBS) can address a variety of socioeconomic (inequality, health, job creation, business models) and environmental (climate change, GHG emissions, resource use) challenges. However, the evidence on measurable impacts is still fragmented, and benefits are often hard to evaluate due to a lack of practical models for integrating NBS in urban planning and development. It is also vital to provide easy-to-implement and easy-to-replicate models for integrating NBS in sustainable city development, especially from an innovation system and policy development point of view. Another challenge is related to the fact that the term Smart Sustainable Cities, is often understood in the context of ICT solutions as enabling sustainable goals, rather than through the various roles of nature in generating and sustaining the smart city.

In this paper we present a conceptual model of "Nature-Based Smart City" founded on a City as a Service framework consisting of four interconnected elements:

1. City as an Open Innovation and Experimentation Platform
2. City with nature-based solutions supporting both natural and business innovation ecosystems
3. City as a Living Lab - Co-creation with Citizens and local Stakeholders
4. City as Enabler and an Orchestrator for Business Innovations - City - customer, action and knowledge based city management

Based on the case study of Espoo - deploying nature-based solutions in creating a City as a Service we illustrate how the Nature-Based Smart City model can be deployed in cities, and propose a framework of indicators for multi-level impact assessment of the effectiveness of the model. We draw upon recommendations from both city planning and sustainable urban development realms, and provide recommendations on reconciling existing frameworks for best use for assessing nature based solutions.

26.PS1.O3

"Adopt a flowerbed" in Milan: payment for ecosystem services through civic engagement

Croci E., Lucchitta B.
IEFE – Bocconi University, Italy.
edoardo.croci@unibocconi.it
Presentation pdf

Cities have taken the lead in showing that investing in nature can provide substantial social, economic and environmental benefits, designing policies and actions to enhance urban green spaces. The promotion of market based instruments for conservation, such as Payments for Ecosystem Services (PES) schemes, allows long term protection and valorisation of urban nature.

The project "Adopt a flowerbed" launched by Milan Municipality in 2005 is an example of a PES scheme implemented at the urban level. Milan Municipality designed two contract typologies in order to finance urban green areas management through sponsorships and stakeholder engagement. 451 contracts with private stakeholders have been signed for a total of 225,860 m^2 of green spaces allocated to private management. The success of the initiative is evidenced by the fact that in the last 10 years the contracts increased by 350% and by the variety of stakeholders involved. In fact contracts were signed by: citizens (80); universities (4); private companies (155); residents (171); associations and cooperatives (41).

The paper focuses on the analysis of the initiative and highlights which are the strengths and weaknesses of the business models adopted to manage urban green spaces and which is the potential of PES schemes in involving citizens and private entities in the protection and enhancement of urban ecosystem services. Futhermore the paper takes into consideration which transformations are in act in the areas interested by the initiative. In particular the effect of the initiative on communities and the regeneration process trigged are investigated.

26.PS1.O4

From grey infrastructure to green – blue hybrids: why it happened and how it works in Polish cities?

Magdalena Glogowska
National Contact Point for Research Programmes of the EU, Institute of Fundamental Technological Research – Polish Academy of Sciences, Poland.
magdalena.glogowska@kpk.gov.pl

The effects of climate change, especially the rise of temperature, frequency and intensity of extreme phenomena, taking place in the last few decades, tend to deepen and therefore they have become a matter of interest to governments and the international community. The results of scientific research clearly indicate that phenomena caused by climate change are a threat to the social and economic development of many countries in the world, including Poland. Therefore, efforts to adapt to the effects of climate change should be taken in parallel with actions carried out by Poland with regard to limiting greenhouse gas emissions. As adaptation to climate change is highly local, and its effectiveness depends on local institutions through which incentives for individual and collective actions are structured the implementation of adaptation actions involve in particular local governments. At the local level a large part of adaptation actions indicated in national adaptation strategies will be implemented. A particular role in the implementation of adaptation measures will fall on cities in which the adverse effects of climate change are accumulated.

For the last decade Polish cities achieved an impressive progress in implementing blue and green infrastructure. The Blue-Green Network (Zalewski et al. 2012) is a project embedded in the context of the region's natural system that integrates and extends previous planning documents concerning the natural elements and elements of green architecture in Lodz. The system of rivers and adjacent green areas creates the basis for a functional, economical, logical and user-friendly arrangement of urban space that provides multiple benefits to Lodz residents. Lodz is also participating in INASOUL project (Innovative NAture-based SOlutions for Urban resilience and welL-being). City of Wroclaw is one of the frontrunners in a GROW GREEN project (Green Cities for Climate and Water Resilience, Sustainable Economic Growth, Healthy Citizens and Environment). City of Poznan participates in CONNECTING (COproductioN with NaturE for City Transitioning, INnovation and Governance) project. Many other Polish cities invest their own resources to make a shift from grey infrstructure to blue and green hybrids.

Session 2. Integrated water management through natural systems

Thursday 26 October

26.PS2.O1

Building with Nature: integrating ecosystem services into infrastructure

Rob Cornelissen
Ministry of Infrastructure and the Environment of the Netherlands, The Netherlands.
Rob.Cornelissen@minienm.nl
Presentation pdf

By 2050, an expected 80% of the world's population will live in urban areas, mainly situated along coasts, deltas and rivers. Increasing pressure from all involved stakeholders on the available land and water puts a continuing need for optimalisation of the physical water conditions, while anticipation is needed in response to the challenges created by climate change and sea level rise. This means an increasing demand will be put on the innovative abilities of hydrological engineering and water management.

Building with Nature is a new approach to hydrological engineering, acknowledging the impact public infrastructure can have on the environment and utilising the forces of nature instead of combating them, achieving different policy objectives to strengthen the economy, society, and nature. As starting points it takes the building with natural materials, and the use of forces and interactions with the natural system. For instance, the restoration of natural riverbanks may be a superior solution to river flooding than stone-covered dikes, benefiting nature and people.

Finding effective solutions in this way is therefore not just a task for engineers, but also for ecologists and economists, working in close collaboration. In the Netherlands, partners from governments, companies, research institutes and NGOs carry out the Building with Nature innovation programme in the Ecoshape consortium. Together, they develop and spread knowledge about this design philosophy. New engineering solutions are being tested in practice by Ecoshape through pilot projects in diverse conditions, in the Netherlands and other countries. In doing so knowledge is being gained about the systems involved, so it can be made applicable for other locations with comparable systems. Still emerging and in need to be put into use in untested conditions, Building with Nature is proving itself to be a successful engineering method, answering the demands of our changing world.

26.PS2.O2

Evaluating performance and placement of nature based solutions in peri-urban environments for achieving multiple benefits

Mark Wilkinson[1], Paul Quinn[2], Josie Geris[3], Marc Stutter[1], Caspar Hewett[2]
[1] *James Hutton Institute, Aberdeen, United Kingdom;*
[2] *School of Civil Engineering and Geosciences, Newcastle University, Newcastle upon Tyne, United Kingdom;*
[3] *School of Geosciences, University of Aberdeen, Aberdeen, United Kingdom.*
mark.wilkinson@hutton.ac.uk

Peri-urban environments are increasingly being developed, typically from intensively farmed landscapes. Changes to these landscapes can result in increased flood risk, poorer water quality, and increased sediment delivery. Within this context, Nature Based Solutions (NBS) have the potential to make significant contributions to achieving EU water policy objectives. Here we focus specifically on measures which disconnect overland flow, such as raised bunds, leaky barriers and corner-of-field wetlands (collectively known as Runoff Attenuation Features (RAFs)). The functioning of RAFs has so far predominantly been explored in rural landscapes. Here we aim to improve understanding of how RAFs can address water quantity and quality issues in complex peri-urban environments. RAFs seek to optimise the use of space and could be a cost effective addition to existing Green Infrastructure. Using evidence from several case study catchments across the UK, we specifically i) assess the performance of different RAFs locally in rural catchments and ii) explore the issue of placement and upscaling in peri-urban environments.

Empirical evidence from rural UK case study catchments suggests that RAFs could be beneficial for managing both local flood risk and diffuse pollution; in some cases reducing flood peak flows by 30%. RAFs typically remain empty for most of the year without impacting on farming practices. They hold storm water in the order of 100-5000m^3, drain quickly (~1day), and some may capture sediment up to ~1 tonne following intense storm events. To explore the performance of RAFs in urbanising landscapes, we monitored the spatio-temporal character of natural flow pathways and associated water quality and quantity in an actively urbanising catchment in NE Scotland. Results indicate a need to implement both rural and urban NBS measures utilising a catchment-based treatment train approach to address multiple issues in peri-urban areas. This could support the design of NBS during urban planning.

26.PS2.O3

Potential implementation of a FWS system within an Italian natural wetland for the area restoration and maintenance

Filippo Moretti[1], Gianpaolo Sabia[2], Luigi Pettab[2], Renato Ceccarellic[3]
[1] Italian National Agency for New Technologies, Energy and Sustainable Economic Development, ENEA, Agrifood Sustainability, Quality and Safety Laboratory BIOAG-SOQUAS, Italy;
[2] Italian National Agency for New Technologies, Energy and Sustainable Economic Development, ENEA, Waste and Wastewaters Laboratory USER-R4R, Italy;
[3] Independent Consultant, Italy.
gianpaolo.sabia@enea.it
Presentation pdf

Wetlands are highly productive and biologically rich ecosystems which guarantee a variety of ecosystem services, such as water purification, flood regulation, erosion control, coastline protection, sediment and nutrient transport. Moreover, these systems create aesthetically appealing spaces and wildlife habitats offering recreational, educational, and research opportunities.

The study was focused on the analysis of the environmental state of a 16 ha extended Italian natural wetland, located on the northern coast line of Lazio region. In order to control the water level, the local controlling Authority provides a regular freshwater supply from the Tiber river generating substantial additional costs. The survey regarded a preliminary site analysis aimed at investigating site-specific environmental conditions such as climate conditions, water balance and potential source of contaminations. A yearly monitoring campaign in 10 different sampling stations was carried out in order to evaluate the wetland water quality. The collected data were processed by means multivariate statistical techniques allowing to define the spatial and temporal variations of the water quality, highlighting the sites and the periods of major wetland sensitivity to pollutants loads. A water deficit as well as a major wetland sensitivity respect to nutrient loads, mainly nitrogen compounds, was verified during warmer seasons (June-September). The implementation of a free water system receiving the effluent from a local urban wastewater treatment plant was assessed in the view of re-using local water resources and restoring the water balance avoiding any environmental impacts. The wetland auto-depurative capacity was quantified by applying common empirical plug's flow models showing as the limiting conditions would be related to the ammonia parameter during the colder seasons. By deriving the maximum capacity of the systems to receive pollution loads, the study showed that

the use of local reclaimed water resource may allow the wetland water balance restoration among other environmental and economic benefits.

This work was developed as a pilot action of Water-DROP project, funded in the framework of the EU ENPI CBC Mediterranean Sea Basin Programme. It is coordinated by ENEA and has the collaboration of 9 cross-country partners and 3 associates from Italy, Cyprus, Spain, Lebanon, Palestine and Jordan.

26.PS2.O4

Marker Wadden: adding value for nature. Building with and building for Nature in Lake Marken; construction of islands

Sacha de Rijk
Deltares, The Netherlands.
sacha.derijk@deltares.nl

Lake Marken is the site of a unique construction project, called Marker Wadden. Sand, clay and silt from the lake itself are combined to form a new archipelago, improving the water quality and offering habitats for birds, fish, plants and shellfish. The islands will form a wetland, comparable with the Wadden Sea, but without tides because the lake Marken is not connected with the sea anymore. People also benefit from this nature reserve: the first and largest island will be accessible to nature lovers and water sports enthusiasts.

Lake Marken is a 700 km2 lake in the central Netherlands, a shallow lake at some 3 to 5 m in depth. Lake Marken used to be part of the Zuiderzee, a saltwater inlet of the North Sea that was dammed off by the Closure Dike in 1932, turning the Zuiderzee into the freshwater lake IJssel. The subsequent further anthropogenic impacts has disrupted the ecosystem significantly, e.g., changed the system into a freshwater lake, altered water quality (nutrients and turbidity) and reduced bird populations. Lake Marken is now used as a freshwater reservoir and a buffer against floodwaters and droughts. It has some recreational assets as well. Ecological value is however, low. There is a lack of natural habitats for flora and fauna, such as banks, land-water transitions and shallow zones. A known problem found at more impacted water systems, both in the Netherlands and in the rest of the world.

During the development of Marker Wadden (ongoing since 2016), nature based solutions are applied and monitored. The Marker Wadden can be considered as a Living Lab where partners are invited to learn by investing in the research program with the goal of improving knowledge on building with sand, clay and silt. To facilitate the Living Lab idea a joint Research Program has been developed in cooperation with the Society for preservation of nature monuments in the Netherlands, governmental organisations, private companies, universities and knowledge institutes. The research focuses on three themes:

- Building with sediment: how to build a strong base for an island using thin silt or thin clay?

- Developing ecosystems with value: How can Marker Wadden contribute to increasing the food supply and food quality for birds and fish?
- From idea to construction and management: Which steps are needed? How do you organise the decision-making process?

The obtained knowledge can be used for other purposes, such as dyke improvement, combating erosion or the construction of residential islands. This presentation will show progress of the construction project, a few very first results of the research and will invite partners to join the living lab Marker Wadden.

Session 3. ICT as a supporting tool for nature based solutions and ecosystems

Wednesday 25 October

25.PS3.O1

Eco-innovation through public involvement: everyman's nature conservation

Aveliina Helm
University of Tartu, Institute of Ecology and Earth Sciences, Estonia.
aveliina.helm@ut.ee
Presentation pdf

Climate change, decline of biodiversity and loss of vital ecosystem services pose serious threats to human well-being and rapid actions are needed for ensuring sustainable world. Ongoing and accelerating biodiversity decline indicates that the traditional approaches for conservation have not sufficient. All around Europe, landscapes outside conservation areas are turning into "green deserts" – areas that do not support most of the native biodiversity historically characteristic to the particular region. Spatially isolated nature conservation areas are often not able to support viable populations of species and provide sufficient connectivity for biota of different habitats. Thus, it is important to create and sustain conditions for biodiversity also outside conservation areas. Here, I propose a novel approach – everyman's nature conservation – involving ICT tools for engaging general public into nature conservation and biodiversity enhancement activities. Everyman's nature conservation is a concept that integrates local and regional conservation goals into planning of landscapes, gardens, urban areas, construction sites, mining areas, and agricultural fields.

First, everyman's conservation involves active promotion of biodiversity and its value among general public. Secondly, in order to succeed, application of everyman's conservation methods need to include science-based background information about the local and regional conservation goals and biodiversity conditions. For setting conservation goals for each individual region, landscape, city or garden, it is necessary to apply GIS-tools and remote sensing methods, enabling to link information from biodiversity databases with the local environmental conditions and landscape structure. In my talk, I'll introduce examples from real landscapes to show how ICT tools can be used to set goals for more efficient conservation of biodiversity and related ecosystem services.

If applied, everyman's conservation can considerably improve our ability to conserve nature and preserve ecosystem services by making our landscapes and cities greener and more biodiversity-friendly.

25.PS3.O2

Making Sense of Nature Based Solutions to different City Contexts through a Knowledge Platform

Cristiano Cagnin[1], Guilherme Wiedman[2]
[1] *Center for Strategic Studies and Management (CGEE), Brazil.;*
[2] *Ministry of Science, Technology, Innovation and Communication (MSTIC, Brazil).*
ccagnin@cgee.org.br
Presentation pdf

Sustainable urbanization is a major global challenge that requires novel ways to address current and future city problems, which are often dealt with through compartmentalised and silo decision making processes at all government levels. This article describes the experience of a public policy pilot designed to introduce the New Urban Agenda into the National Research and Innovation Strategy in Brazil. A variety of issues ranging from public transportation, new building materials, sustainable energy systems and sanitation, among others, were addressed through horizontal public policy with particular attention to the systemic interactions involved across the challenges addressed and their likely solutions. Nature Based Solutions proved to be an elegant pathway to address a number of city challenges according to different city typologies. The main focus has been on knowledge production and sharing, with careful observation of nature dynamics, thus providing the appropriate mind-set to perform the needed paradigm change for transitioning to more sustainable ways of living. With the use of state of the art digital technology and big data processing, a knowledge platform for collaborative work named Sustainable City Innovation Observatory (SCIO) presents itself as an important ally for municipalities as well as national and regional governments to face the major challenges of our fast growing cities in a contextualised way.

25.PS3.O3

Enhancing Performance Management and Sustainable Development through e-government policies in Urban Areas A System Dynamics Approach

Diego Navarra, Carmine Bianchi
Studio Navarra, United Kingdom.
diego@studionavarra.co.uk
For presentation please contact the author

This paper tackles a very controversial topic in the application of system dynamics for the evaluation of territorial policies and urban governance, in terms of sustainable development. The goal is to illustrate how system dynamics modeling can be used in territorial governance and e-government policy design as an innovative methodology to frame sustainable performance in urban areas. A 'dynamic' performance management approach is proposed and applied to the specific field of study as an aid to support territorial analysis and planning, policy design and the assessment of policy outcomes. Topics such as renewable energy, efficiency, the design and exploitation of urban energy, water and waste management infrastructure and the alignment of different stakeholders provide relevant fields of study for the analysis of this paper. Specifically, we reflect upon the way in which insight system dynamics conceptual models, based on exemplary case-studies, can be used to outline performance drivers and end-result measures and link them with strategic resources in a feedback analysis. This approach fosters a common shared view among different policy makers and therefore may help them to highlight new ways to enable sustainable development in urban areas.

Thursday 26 October

26.PS3.O1

Drone mapping as a tool for monitoring of mire ecosystems restoration

Raimo Pajula, Laimdota Truus, Kairi Sepp, Mati Ilomets
Tallinn University, Estonia.
raimo.pajula@tlu.ee
Presentation pdf

Mire ecosystems are globally important for their unique species and habitats and specific ecosystems services – water cycle regulation and carbon sequestration. Mires are largely disturbed by human activities like drainage, agriculture, forestry, peat cutting and urbanisation. Therefore, the conservation and restoration of mire ecosystems is highly actual.

Life project *Peat Restore* (2016-2020) established aimed to restore mire ecosystems and natural carbon balance. In Estonia Läänemaa-Suursoo project site (area 3343 ha) selected to restore mire water regime and carbon balance. We included drone mapping to the restoration project for following tasks: a) to map plant communities over the study area; to interpolate carbon balance over the area; to detect changes in plant communities and relate these to the changes in carbon balance.

Ca 70 permanent plots (each contain three 2x2 m reveals) established for on-site mire plant communities monitoring and carbon fluxes measurements. Borders of permanent plots marked by 10 cm wide tape to visualize plots for drone mapping. Two different drone platforms are in use: a) *DJI Phantom 4 pro* with standard RGB camera; b) *SenseFly eBee* with *Parrot Sequoia* multispectral camera (4 spectral bands: green, red, red edge, near infrared). Automatic pre-planned flight missions used for both drone flights. For *eBee* drone *eMotion AG* software and for *Phantom 4 pro* drone *Pix4Dcapture* app used for flight missions planning. Captured images processed with *Pix4D mapper* software to generate high-resolution (pixel size 2 to 5 cm) georeferenced aerial photo mosaics and multispectral index maps.

Plant communities with different plant cover and species composition reflects spectral bands in different rate. Therefore vegetation spectral indices carry information about mire plant communities and can reflect state and disturbances of the mire ecosystems. First results indicate that normalized difference vegetation index (NDVI) reflect well density of mire communities grass layer. Sphagnum-dominated communities are characterized by relatively low NDVI values compared with sedge-dominated communities.

26.PS3.O2

Nature-based solutions for coastal flood and erosion risk reduction using Earth Observation

Daphne van der Wal[1], Iris Möller[2], Gloria Peralta[3], Edward P. Morris[3], Jasper Dijkstra[4], Albert Scrieciu[5], Ben Evans[2], Bas Oteman[1], Gerrit Hendriksen[4], Jesus Gomez-Enri[3], Javier Benevante[3], Geoff Smith[6], Tjeerd Bouma[1], Myra van der Meulen[4], Julia Vroom[4], Adrian Stanica[5], Bregje van Wesenbeeck[4], Mindert de Vries[4]
[1] IOZ Royal Netherlands Institute for Sea Research, Dept of Estuarine and Delta Systems, and Utrecht University, Yerseke, The Netherlands;
[2] Cambridge Coastal Research Unit, University of Cambridge, Cambridge, United Kingdom;
[3] Department of Biology, University of Cadiz, Puerto Real, Spain;
[4] Deltares, Delft, The Netherlandas;
[5] National Institute for Marine Geology and Geo-ecology (GeoEcoMar), Bucharest, Romania;
[6] Specto Natura Ltd., Cambridge, United Kingdom.
daphne.van.der.wal@nioz.nl

Vegetated foreshores offer benefits for coastal defence, as they attenuate waves, enhance sedimentation and reduce erosion. They have become increasingly recognized as cost-effective nature-based solutions to reduce risks of coastal flooding and erosion. Yet so far, assessments and practical tools that deal with the spatial complexity, heterogeneity and stability of foreshores are lacking.

As part of the EU FP7 SPACE funded project FAST (Foreshore Assessment using Space Technology; *www.fast-space-project.eu/)* an Open Source Copernicus downstream service (MI-SAFE viewer, *fast.openearth.eu/*) is developed that combines Earth Observation (EO) information, field observations, and numerical models to demonstrate the protective value of wetlands worldwide.

Maps of foreshore characteristics developed within FAST are based on satellite data from the Copernicus programme, such as Sentinel-2 and third party missions such as Landsat. At eight pilot sites across Europe (Spain, United Kingdom, Netherlands, and Romania), intensive field work was carried out to assess vegetation, waves, elevation and sediment properties to calibrate and/or validate the satellite retrievals, to study foreshore functioning and to obtain generic relationships between foreshore characteristics and flood risk mitigation properties, which were then used to predict wave attenuation over foreshores using the X-BEACH suite.

MI-SAFE provides services at three levels. The open access Educational level includes broad global data developed within FAST, or available from other sources, and provides crude predictions of potential wave attenuation over foreshores. The open access Expert level includes high resolution earth observation derived maps, field surveys and modeling output at the pilot sites. The Advanced level includes tailor-made solutions (such as training, development of new functionalities, or studies for specific sites), offered upon request in consultation between the user and the consortium.

In this presentation, we give an overview of the MI-SAFE package, elucidate the science behind the products as obtained within the FAST project, and showcase applications.

26.PS3.O3

City Enabler: open technology giving awareness on data available in cities for NBS applications

Giovanni Aiello, Marco Alessi, Lanfranco Marasso, Roberto Di Bernardo
Research and Development Laboratory Engineering Ingegneria Informatica SpA Rome, Italy.
{giovanni.aiello, marco.alessi, lanfranco.marasso, roberto.dibernardo}@eng.it
Presentation pdf

At urban scale, different actors (Public and private entities as well as citizens) are providing useful data (e.g. air quality, mobility, education) that actually are usable through heterogeneous technologies, legacy systems, IoT devices, thus acting as siloes.

This way to "manage" data, (sometimes) jointly with the lack of awareness by the city about the real availability of such scattered data at the urban environment, may prevent a holistic data analysis and related urban planning decision making.

The solution called City Enabler (CE), here below described, is powered by FIWARE (the European Open Service Platform) and co-funded by EIT Digital. The CE is able to detect a number of available data sources in the City, to federate the metadata providing a single layer of open APIs, and to give added value to the data through innovative and reusable map based urban services.

An application foreseen for the CE is to experiment and validate NBS instead of traditional solutions in order to face complex challenges to meet objectives regarding city sustainability (e.g. social, economic, environmental). Here, the CE can support the measurement of the impact of NBS compared to "traditional solutions", thus pushing for their further implementation and diffusion and raising in the meanwhile the general awareness of NBS through citizen science projects and community led urban development.

The CE allows to get an integrated and geo-spatial urban knowledge base collecting data, providing a set of tools to "predict through location" (so supporting an evidence based policy making process) and to easily develop innovative map based urban services relying on the data collected (so supporting co-creation process in urban ecosystem). The City Enabler intends to overcome several cons of existing solutions available, providing the following advantages: a) Data driven solution; b) Openness (no vendor lock-in); c)Portability (no city lock-in); d) Focused on Data discovery, integration; e) Apply data economy model.

26.PS3.O4

Combining GIS environmental data analysis and expert knowledge in ecosystem services provision potential assessment

Peter Bezák, Zita Izakovičová, Peter Mederly, Juraj Lieskovský, *et al.*
Institute of Landscape Ecology, Slovak Academy of Sciences, Slovakia.
peter.bezak@savba.sk
Presentation pdf

Case study research in Slovakia focused on ecosystem services (ES) assessment in the context of landscape and spatial planning was conducted in scope of EU FP7 project OpenNESS. The study was performed in town Trnava and its functional zone, which comprises of 15 municipalities. Key stakeholders selected ten the most important ES for the study area for further detailed analysis using Geographic Information Systems (GIS) and by engaging key stakeholders. They covered all main ES categories; provisioning, regulating and cultural ES. GreenFrame was one of the methods used in the case study, which utilises an extensive set of spatial datasets of environment quality grouped into themes combined with both scientific experts' and local actors' scorings (Kopperoinen et al. 2014). Gathered 14 GIS themes covered all aspects of environment, from abiotic conditions through quality of green-blue areas to polluted areas. 25 stakeholders evaluated through the questionnaire positive/negative/neutral impact of the themes to provision each of listed ES. Summarised evaluation matrix provided median scores further used as weights in weighted raster overlay of information about environment quality obtained from GIS layers. The GreenFrame is able to assess spatial variation in ES provision potential of green infrastructure in planning process. Based on combination of many datasets and given scores, processed by using GIS, the GreenFrame precisely identifies quality of environment in spatial scale and thus can better inform decision-makers on current/future needs in landscape planning.

Session 4. Ecological restoration through eco-innovation

Wednesday 25 October

Restoration of the sponge function in wetland soils as a measure for integrated river basin management in the Rhine catchment

E. Silver, W. van Deursen, E. Otterman, B. Roels, F. Zeitler
Wetlands International - European Association, The Netherlands.
Eef.Silver@wetlands.org
Presentation pdf

Urbanisation and agriculture in the Rhine basin have driven loss of water storage capacity in floodplains. Changing precipitation patterns are expected to lead to increased peak flows as well as critically low water levels. Restoration of the sponge function in wetland soils at the foot of U-shaped valleys in the Middle Rhine, where much precipitation occurs, can be a nature-based solution that can help offset flood risks with potential impacts from local to basin scale. This can help deliver multiple policy objectives and societal benefits. An analysis of costs, impacts and stakeholders, commissioned by Wetlands International and WWF, provides insights to the 'soft challenges' to nature-based river management, i.e. the opportunities and obstacles to initiation of wetland restoration in an urbanized basin in Europe. We conclude that realising this nature-based solution heavily depends on right timing, right place, and right people and cannot be regarded as business as usual yet. The study demonstrates that the most suitable way forward to achieve implementation is equivocal, and that stakeholder engagement is key. Opinions differ on the scale of impact that can be achieved across the basin and highlight the need for better transboundary engagement to resolve differences in perspective and sharing of knowledge. A pilot scheme could fulfil the request to deliver proof of hypothesis of a locally implemented measure, but securing support and resources for a pilot is a challenge in itself without the proof. Generating stakeholder sympathy and influencing perceptions are crucial aspects to create awareness of the overlooked place and role water has in our landscape. In addition, crossing sectoral borders and recognizing the interlinkage between cultural traditions and land use is a prerequisite to initiate dialogue on land use change. Altogether, sponge restoration should be understood as one nature-based option in the toolbox for integrated river basin management.

25.PS4.O2

Biodiversity-enhancing solutions: combining ecological scientific knowledge with practical applications

Mart Meriste
Nordic Botanical Ltd, Estonia.
mart@nordicbotanical.eu
Presentation pdf

Biodiversity and related ecosystem services are threatened globally while actions that mitigate biodiversity loss have to be taken locally. There are many citizens who are willing to contribute to nature conservation and preservation of biodiversity. However, they mostly lack the knowledge about actions that most effectively benefit biodiversity of the particular region.

Within the concept of everyman's nature conservation, each citizen is expected to participate in preservation and enhancement of biodiversity by making informed nature-friendly decisions in their everyday life. Here, we introduce practical nature conservation solutions that can be applied by citizens themselves. For granting maximal outcome, it is important, that the solutions would stem from ecological theory and local environmental conditions. Examples of applications that can be applied depending on the region and citizen involve implementation of biodiversity-supporting elements by agricultural producers and hobby farmers; creation of wildflower meadows consisting of native species with local genotypes for preservation of pollinators and threatened grassland species; facilitation of active dispersal of native seeds in the landscape for enhancing plant dispersal, improving habitat connectivity and maintaining genetic diversity; use of native threatened plant species in gardening and urban greening to increase, as well as coherent planning of constructions and infrastructure by preserving and facilitating biodiversity. Above all, increase of knowledge of biodiversity benefits and encouragement of people to implement practical solutions are key factors for success of nature conservation.

25.PS4.O3

Nature-based solutions: Typology, and uptake in the BiodivERsA Strategic Research and Innovation Agenda for promoting eco-innovation

Hilde Eggermont[1], Henrik Lange[2], Xavier LeRoux[3]
[1] *Belgian Biodiversity Platform/Belgian Science Policy Office, Belgium;*
[2] *Swedisch Environmental Protection Agency, Sweden;*
[3] *Microbial Ecology Centre of Lyon, CNRS-INRA, Lyon, France.*
xavierleroux@hotmail.fr

BiodivERsA (funded under the Horizon2020 ERA-NET COFUND scheme) is a network of national and regional funding organisations promoting pan-European research on biodiversity, ecosystem services and nature-based solutions. By pulling capacity and resources from 21 European countries both across the mainland and overseas, the network offers innovative opportunities for the conservation and sustainable management of biodiversity, with nature-based solutions as core theme in BiodivERsA's Strategic and Research Innovation Agenda. Indeed, research programmers and funders should now promote 'research supporting solutions' in complement to 'research raising the alarm of loss of biodiversity'. This requires deep changes in the way we perform research, with reinforced relationships between scientists and research stakeholders, deeper collaborations between disciplines, enhanced international collaborations, and better policy relevance of research. Profound changes in the way research programmers and funders design, implement and evaluate their research programmes, and increased support for cross-sectoral and cross-border research, will also be vital.

During this talk, we will first present the typology of nature-based solutions we co-developed with various stakeholders (scientists, policy makers, non-governmental organizations, research programmers and funders). We will subsequently explain how BiodivERsA NBS-related activities contribute to this promising field of research in the context of its Strategic Research and Innovation Agenda and Implementation plan. In particular, we will provide concrete examples of activities developed to promote research on ecological restoration through eco-innovation, and to reinforce stakeholder engagement in this research domain.

Thursday 26 October

26.PS4.O1

Nature-Based technologies for soil and water remediation: competitive opportunities in the environmental industry sector and integration into the urban landscape for the benefit of local communities

Caroline Zaoui
Biomimicry Belgium, Belgium.
c.zaoui@biomimicrybe.org
Presentation pdf

Past decades of industrialization have indebted Europe with a wide array of pollutants emitted to air, water and soil. Regarding soil pollution in Europe, 3.5 million sites are potentially contaminated, of which 0.5 million have already been identified as needing remediation. While 15% of the overall identified sites have already been treated to date, the management of contaminated land in Europe costs an estimated 6.5 billion Euro per year, thus constituting a major financial burden for the companies and public institutions involved. Similarly, land use conversion from farmland pastures and forests to mining and construction sites have lead to water pollution. As a consequence, nearly half of Europe's rivers and lakes are still being polluted, while groundwater is being contaminated with emerging recalcitrant pollutants from the pharmaceutical and agro-chemical industries.

Searching for competitive and restorative ways to tackle soil and water pollution, nature constitutes a vast, largely unexplored library of efficient designs, materials, processes and strategies that have been time-tested through natural selection. Bio-inspiration, or also called biomimicry is an innovation method that translates natural designs and strategies in order to solve human challenges in an environmentally-friendly and regenerative manner. Notably, a category of the innovations designed via bio-inspiration consists of "bio-assisted" solutions. In such solutions, living organisms are the central components that deliver the desired process outcome. In that respect, those solutions fall within the NBS definition.
Thus, in an effort to promote the implementation of nature-based solutions within the environmental sector, this presentation aims at introducing the most promising and validated bio-assisted clean-technologies for soil and water remediation. Bio-engineered natural treatment systems such as phytoremediation, mycoremediation will be presented through their technical, competitive attractiveness, as well as for their implications within circular economy/industrial ecology schemes, both at the scales of the environmental sector and urban- and citizens-oriented initiatives.

26.PS4.O2

Green roof as mitigating tool of environmental problems in cities: case studies from Estonia

Alar Teemusk, Ülo Mander, Ain Kull, Arno Kanal
Department of Geography, Institute of Ecology and Earth Sciences, University of Tartu, Estonia.
alar.teemusk@ut.ee

In modern cities concrete dominates over green areas but planted roofs (called also green roofs) are innovative and efficient method to increase greenery in cities. In Estonia, we have studied how green roofs could improve the quality of the urban environment in temperate zone conditions. Temperature and water regime and also greenhouse gas fluxes are the main topics which have been investigated within last 12 years. Our results show that lightweight clay aggregates (LECA)-based (so-called extensive) green roof is capable to protect the roof membrane from extreme temperatures both in seasonal and daily scale. The difference between temperature amplitude under the substrate layers of the planted roofs and the surfaces of the conventional roofs was in summer on average 20°C. The studied green roof effectively retained light rain thus contributing both to regulation of air humidity and reduced rainwater discharge. In the case of heavy rainstorm the green roof was able to delay the runoff for up to half an hour but not fully retain it – the measured runoff volume was the same as that of the reference roof. The observation of snow cover melting showed that snow cover melted quickly, but nevertheless the green roof prolonged the snow melt water runoff to a longer period compared with the reference roof. The quality of the runoff water varied depending on the type and intensity of the runoff and the pollutants accumulated (mainly dry deposition) on the roof. Greenhouse gas measurements showed that CO_2 flux from green roofs increased following the gradient from artificial to natural composition of the substrate and plant coverage. Green roofs acted effectively as sinks for CH_4, and in general there was no significant effect on N_2O.

26.PS4.O3

Gypsum – An eco-innovation for the Baltic Sea

Markku Ollikainen[1], Petri Ekholm[2], Eliisa Punttila[1], Anna-Kaisa Kosenius[1], Samuli Puroila[1]
[1] *University of Helsinki, Finland;*
[2] *Finnish Environment Institute, Finland.*
eliisa.punttila@helsinki.fi
Presentation pdf

Gypsum ($CaSO_4 \cdot 2H_2O$) is a natural mineral formed in prehistoric oceanic sediments. It is also produced in huge amounts as a by-product in several industrial processes. Although gypsum was used for soil improvement already by ancient Greeks, its use in agriculture is relatively rare. As an innovative solution supporting circular economy, pure gypsum can be used in agricultural water protection.

Recent studies suggest that gypsum treatment of arable fields reduces efficiently phosphorus release and erosion. Gypsum may reduce about 50% of total phosphorus release and more cheaply than current measures in agriculture. Given that point sources have considerably reduced their nutrient loads to the Baltic Sea, gypsum provides agriculture the same possibility and the Baltic Sea a chance to improve.

University of Helsinki and the Finnish Environmental Institute examine gypsum treatment of arable fields in a large-scale experiment. The experiment is funded by the EU Interreg Central Baltic programme (project NutriTrade) and the Finnish Ministry of the Environment (project SAVE). We examine gypsum treatment as an eco-innovation comprising practical experience, social acceptance as well as environmental and economic performance.

The experiment started in autumn 2016 involving 55 farmers and covering more than 1500 ha of land area treated with gypsum. We monitor continuously water quality, examine the impacts on aquatic biota and analyse the impacts on soil and crops. Also, we collect experiences from farmers and the whole supply chain.

Jointly with our stakeholders we refine the eco-innovation of gypsum treatment for the Finnish agriculture. We will provide a measure which is well-functioning, safe, adaptable for different types of farms, easy to implement and effective in diverse conditions. Furthermore, we are keen in helping others to use gypsum. Gypsum treatment may suite well for Sweden, Denmark and Poland.

26.PS4.O4

Development of nature-based solutions for marine oil spill response actions

Jaak Truu[1], Marika Truu[1], Kirsten Jorgensen[2], Anna Reunamo[2], Ossi Tonteri[2], Nga Dang[3], Tarmo Kõuts[4], Siim Pärt[4]
[1] *Institute of Ecology and Earth Sciences, University of Tartu, Estonia;*
[2] *Finnish Environment Institute, Marine Research Center, Finland;*
[3] *Norut Northern Research Institute, Norway;*
[4] *Marine Systems Institute, Tallinn University of Technology, Estonia.*
jaak.truu@ut.ee
Presentation pdf

The main aim of the Horizon 2020 project GRACE is to explore the true environmental impacts and benefits of a suite of marine oil spill response technologies in the cold climate and ice-infested areas in the northern Atlantic Ocean and the Baltic Sea. The oil spill response methods assessed during this project include mechanical collection of oil in water and below ice, in situ burning, use of chemical dispersants, natural biodegradation and combinations of these. Natural processes, such as microbial degradation, play a major role in oil removal from sea water. During the project the biodegradation rates of different oil fractions in seawater and sediments are determined, and this data is related to environmental parameters and dispersant application. In addition, key bacterial species and metabolic pathways responsible for the degradation of different oil fractions in different compartments (aerobic and anaerobic water and sediments) of the Baltic Sea and the Northern Atlantic are determined. Based on results of meta-analysis of obtained omics data sets, public data and modeling, metagenomics prediction platform for inferring oil biodegradation capacity in marine environment is established. Another key issue for the development of nature-based solutions for the oil spill response actions is on-line detection and monitoring of oil spills *in situ* at sea. During the project, methods to observe and predict the oil distribution are improved, both developing sensors as well usage of different observation platforms, like ships of opportunity, autonomous buoys, moving vehicles as well drones. Important task is also development of smart data transfer into operational oil spill response systems improving situational awareness of these, achieving new level decision support expert system.

Session 5. Nature-based solutions in circular economy

Wednesday 25 October

25.PS5.O1

The social, technical and political dynamics of NBS in European cities

Isabelle Anguelovski[1], Filka Sekulova[1], Kes Mccornnick[2], Björn Wickenberg[2]
[1] *Universitat Autònoma de Barcelona, Spain*;
[2] *Lund University, Sweden*.
fisekulova@gmail.com
Presentation pdf

While the social, environmental, and economic benefits of Nature-Based Solutions (NBS) and their contribution to an urban transition to sustainability are well known, more research needs to be conducted on the governance mechanisms and innovation tools that can allow for their strategic, widespread, and equitable rolling out through urban areas. Here we present our case study research on the social, technical and political dynamics of NBS in European cities and our methodology for understanding how innovation trajectories, structural conditions, governance modes, business models, civic engagement, and inclusion processes play a role in the diffusion and wider uptake of NBS. Through a comparative qualitative approach and a transdisciplinary design, we are learning about the experience of cities and the conditions that structure, enable, or constrain the systemic integration of NBS through municipal policies and planning instruments.

Some of our key research questions are: What are the logics, expectations and visions through (and with) which NBS are being promoted? What are the institutional arrangements and forms of civil engagement that facilitate the emergence and implementation of NBS? What type of challenges do they face throughout time, (e.g. critical junctures or decisions), and how these influence the trajectory of NBS and what are the enabling and obstructing factors? Situating NBS in the emergence of new discourses on urban transition to sustainability in what sense can we think of NBS as technical, social, policy, cultural, or financial innovations? Finally, we also explore how NBS relate and depend upon other fields such as mobility, sustainable buildings, energy.

Some preliminary findings on the questions listed above will be presented, as emerging from our research in Barcelona, Gyor, Leipzig, Malmo, Newcastle and Utrecht based on a sample of 18 NBS (including green corridors, urban parks, protected areas, community growing spaces, green roofs, restoration of river beds and water permeable surfaces).

25.PS5.O2

Wood-based sustainable fiber solutions for a sustainable planet

Marina Crnoja-Cosic, Berndt Köll
Lenzing AG, Global Business Management Industrial, Austria.
n.gratzl@lenzing.com
Presentation pdf

Cellulose, the most abundant polymer on this planet, plays a key role in the global fiber market. Austria headquartered Lenzing AG developed a process to transform wood based precursor material into a fiber with multiple end-uses. Lenzing fibre products are part of the natural cellulose cycle.

One outstanding trait of our products is that they are highly compostable and fully biodegradable. Along with classic uses in the textile industry, Lenzing fibres are also convincing choices for the products in technical applications. One of these applications is the use of Lenzing Fibres for biodegradable packaging for fruit and vegetables.

Agro twines produced from Lenzing wood based fibres, main for green-house use can be tailored to keep the required strength during the growth period of the plant, but being compostable after harvesting. With this unique feature it is possible to substitute plastic twines and wire twines.

25.PS5.O3

Co-designing NBS for circular economy: practices and experiences in urban systems

Fabio Sgaragli, Marco Riva, Patrizia Saroglia
Fondazione Giacomo Brodolini, Italy.
saroglia@fondazionebrodolini.eu
Presentation pdf

Circular economy is an opportunity for both economic development and environmental sustainability. NBS are the building blocks of circular economy, making consumption patterns more sustainable thus encouraging the development of new economic activities. As cities are increasingly seen as complex adaptive systems where infrastructures and communities interact as interdependent components, the talk will explore the dynamics of positive re-enforcing feedback loops where citizens' behavioral patterns influence the adoption of NBS and the creation of new economic value chains at the local level. Examples from cities around the world will provide evidence supporting the argument.

25.PS5.O4

Nature Insurance value: Assessment and Demonstration NAIAD project

Laura Vay
NAIAD Project Manager
lvay@icatalist.eu

NAIAD aims to operationalise the insurance value of ecosystems to reduce the human and economic cost of risks associated with water (floods and drought) by developing and testing - with key insurers and municipalities - the concepts, tools, applications and instruments (business models) necessary for its mainstreaming. We will do this in detail for 8 demonstration sites (DEMOs) throughout Europe and develop tools and methods applicable and transferable across all of Europe. The assumption is that Natural Assurance Schemes can reduce risk, especially to drought and flooding, and this risk reduction can be assessed and incorporated within insurance schemes. NAIAD´s conceptual frame is based on three pillars: (i) to help build a resilience approach to risk management through nature based solutions, (ii) the operationalisation and testing of scientific methods using a source-to-sea in DEMOs, (iii) the uptake of nature based solutions that are cost-effective and provide environmental, social and economic benefits. Trans-disciplinarity and stakeholder engagement are at the core of NAIAD for two reasons: first, because the conceptual and assessment methodologies combine physical, social and cultural and economic aspects, integrated into tools and methods but second, and most importantly "road tested" and validated with the stakeholders and end users themselves at the DEMOs. NAIAD will contribute to providing a robust framework for assessing insurance value for ecosystem services by (i) enabling full operationalisation through improved understanding of ecosystem functionality and its insurance value at a broad range of scales in both urban and rural context; (ii) making explicit the links between ecosystem values and social risk perception; and (iii) the application of developed methods and tools in water management by relevant stakeholders, especially businesses, public authorities and utilities.

Thursday 26 October

26.PS5.O1

Why nature-based solutions and circular economics need each other in the built environment: the case of De Ceuvel

Nadine Galle
Sustainability Consultant and Researcher, Metabolic, The Netherlands.
nadine@metabolic.nl
Presentation pdf

Near the center of Amsterdam lies Buiksloterham, a typical post-industrial area characterized by polluted land and sparse populations. The district is rapidly transitioning to mixed-usage, with a particular focus on circular urban development. To guide this unique planning process, a vision and action plan was created to provide a tangible interpretation of the circular economy, where planning for circular urban metabolisms can be applied in practice. The first pioneer in Buiksloterham was De Ceuvel, a former shipyard in Amsterdam now serving as a global example for circular urban development. De Ceuvel serves as a catalyst for change and empowers urban areas to be self-sufficient through the use of decentralized technologies and full recycling of local resources. The site is now populated by 17 upcycled houseboats that were eco-retrofitted to enable each boat to collect and filter water, collect and process nutrients, and generate and save energy. The boats were placed on land, are surrounded by tall plants, and house the offices of 30 entrepreneurs from the sustainability and creative sectors. Dealing with challenges like a lack of financing and heavy soil pollution, De Ceuvel was forced to think outside of the box. As such, various nature-based solutions were implemented to recycle its water, nutrient, waste, and energy streams, and at the same time limit underground infrastructure and contact with the polluted top layer of the soil. These include the use of phytoremediation for the polluted ground, helophyte filters for decentralised greywater filtration, the conversion of urine into struvite for the fertilisation of an aquaponics system, and the use of human feces as compost for the phytoremediation garden. Through the use of nature-based solutions, the project showcases a low-cost and comprehensive application of technologies, to create a more circular urban metabolism in a way that brings value to the site and the surrounding area and community.

26.PS5.O2

Economic value of urban nature: a meta-analysis

Marija Bockarjova[1], Wouten Botzen[1,2]
[1] *Utrecht University School of Economics, Department of Economics, The Netherlands;*
[2] *Vrije Universiteit Amsterdam, Institute for Environmental Studies, The Netherlands.*
m.bockarjova@uu.nl
Presentation pdf

Nature-based solutions (NBS) that are positive responses to societal challenges, can be employed in urban context to simultaneously meet environmental, social and economic objectives. However, applicability of NBS into practice is often hampered. Difficulties are associated with valuing nature in monetary terms because nature and its attributes and services are not goods that are directly traded in the market. Hence, benefits provided by NBS are difficult to assess and to compare to other project costs and benefits and can thus lead to underprovision of nature in urban areas. Therefore, there is a need for estimating these values through statistical inference. However, traditional primary valuation may not always be pursued because they are costly, time-consuming or impossible due to a lack of data. Benefit transfer method is often applied as a second-best strategy. Meta-analysis is one of the techniques a that lends itself as a suitable basis for benefit transfer and can thus help estimate values applied for assessments of NBS in urban planning projects.

In this study, we have built upon the meta-analysis of open space in cities by Brander and Koetse (2011) and extended it in a number of ways to make it suitable for valuing NBS. First, we have extended the database of primary studies which has increased the statistical power of obtained estimates, and has allowed us to include additional explanatory variables relevant to NBS analysis, such as type of site, landscape, ecosystem services and urban challenges. The control variables include methodological, regional and socio-economic characteristics of study and study area. Two separate analyses were conducted, due to methodological differences between the stated preference and revealed preference studies. Results are discussed focusing on relevance for urban planning.

This research is carried out as part of H2020 NATURVATION project.

26.PS5.O3

Winery wastewater valorisation system based on constructed wetlands

Rocio Pena[1], Ana Pascual[1], Juan A. Alvarez[1], Paula Villar[1], Luz P. Herrero[1] and David de la Varga[2]
[1] *Aimen, Spain;*
[2] *SEDAQUA, Spain.*
rpena@aimen.es
Presentation pdf

In the framework of WETWINE project, funded by the 2015 Interreg Sudoe Programme, a natural-based technology for wastewater treatment will be validated. This project will be carried on South-West Europe (Portugal, Spain, and South of France) were wine sector has a great economic impact.

WETWINE aims to valorise wastewater from wineries recovering irrigation water and fertilizer to be used in vineyard. Therefore, a circular economy approach is proposed in this project. Although, winery wastewater characteristics depends on its activity and the products obtained, its treatment problems are similar. That is why a common technology could be applied. However, it is necessary to adapt the design and operation strategies to each winery as they will have different production processes. Furthermore, it must be taken into account than wineries have significant differences in wastewater production (flow and organic load) during the year.

WETWINE valorisation system is a combination of subsurface flow constructed wetlands (SSCW), considered natural-based technologies. First, it is a pre-treatment anaerobic unit: HUSB reactor (hydrolytic upflow sludge blanket). In HUSB reactor, wastewater solids are retained and hydrolysed with an efficiency of 70-80%. Upflow water will be treated in a combination of vertical and horizontal SSCW. SSCW are planted with reeds. The outlet flow is suitable for vineyard irrigation fulfilling current FAO specifications and wastewater reuse regulations. Solids from HUSB bottom will be treated in a sludge treatment wetland in order to dewater and stabilise the anaerobic sludge and to formulate an organic fertilizer.

WETWINE system is being validated at demo-scale in a Spanish winery (Bodega Santiago Ruiz, Pontevedra, Spain) for 2 years, in order to check operation conditions in different seasons, especially in grape harvest time, when higher organic and flow rates are expected.

26.PS5.O4

Nature-based solutions for valorization of Estonian black shale

Anne Menert[1,2], Sirli Sipp Kulli[2], Triin Korb[1], Kaja Orupõld[3], Alar Teemusk[4], Maia Kivisaar[1]

[1] University of Tartu, Institute of Molecular and Cell Biology, Tartu, Estonia;

[2] BiotaTec Ltd, Tallinn, Estonia;

[3] Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences,Tartu, Estonia;

[4] University of Tartu, Institute of Ecology and Earth Sciences, Tartu, Estonia.

Presentation pdf

Session 6. Linking NBS to Sustainable Development Goals

Wednesday 25th October

The 'big picture' of SDGs and NBS: significance in the global and European context

Marco Fritz
European Commission DG Research and Innovation.
Presentation pdf

The multiple connections between NBS and SDGs

Eeva Furman
Finnish Environment Institute (SYKE), Finland.
Presentation pdf

Implementation mechanisms of SGDs from the NBS perspective, with some examples of alignment from a European database

László Pintér
Central European University, Hungary.
Presentation pdf

Case examples of cities linking NBS in their urban areas to SDGs:

a. Nature-based solutions in Lisbon

Duarte d´Araújo Mata
Lisbon Municipality, Portugal.
Presentation pdf

b. Utrecht

Jeroen Schenkels
Utrecht Municipality, The Netherlands.
Presentation pdf

Session 8. Well-being and public engagement

Thursday 26 October

26.PS8.O1

How do urban nature based solutions foster human health and wellbeing?

Eeva Furman, Riikka Paloniemi, Aino Rekola, Eeva Primmer, Suvi Vikström, Maija Tiitu, Salla Rantala
Finnish Environment Institute (SYKE), Finland.
eeva.furman@ymparisto.fi

Ecosystem services are important for human societies. The contribution of ecosystem services to human wellbeing is particularly important in urban areas where nature is scarce. As urbanization proceeds, humans are faced with health risks caused by urban lifestyles and environment. These include mental and physical illnesses: eg. depression, vascular diseases, allergies and obesity.

Nature based solutions (NBS) are operationalized ecosystem services which can be fostered by planning and governance to the benefit of urban inhabitants. In Finland there will be new opportunities opened up for promoting NBS and investing on them up due to the major regional governance reform underway.

In the future, municipalities in Finland will no longer be responsible for producing healthcare. Even so, municipalities will have an interest to foster people's wellbeing to have them stay and pay their taxes. As the spatial planning monopoly is to be held by municipalities, the planners will be in a key role in supporting inhabitants' health with NBS in the form of GBI. When wisely planned, NBS will support financially also the new regional governance body responsible for healthcare. NBS could be cheaper than medication and simultaneously leading to a healthier population that needs less medical care.

We show that NBS which base on GBI are cost-effective and could play a major role in health of urban people. We suggest that instead of looking at individual illnesses and ways to treat them, societies should focus on fostering good health by using preventive measures and influencing lifestyles and environment. This requires however a systemic approach acknowledging the complex interconnections between green and blue infrastructure (GBI) and human health and integrating these perspectives into the governance at all sectors and levels. Besides systemic NBS approach we suggest that assessment tools such as GIS analyses combined with health statistics should be developed and used.

26.PS8.O2

Why we should prioritize green infrastructure within healthcare environments

David Vernon Brasfield
Chairperson, Scandinavian Green Roof Association, Board Member World Green Infrastructure Network, Norway.
davbra@sunnaas.no
Presentation pdf

The benefits to healing processes from contact with nature are well documented and will be briefly discussed. Healthcare institutions should develop buildings, grounds and local nature amenities that harness the wide scope of green infrastructure benefits.

Healthcare facility and hospital design in previous decades focused on medical processes inside of buildings, and overlooked important physiological and psychological processes supported by beautiful landscapes. Investments in green infrastructure will give economic and sustainability paybacks expected from improved stormwater management and long term climate resilience, and simultaneously yield positive healthcare outcomes, reduced length of patient stays and patient satisfaction.

The pleasures of watching carp swimming in a pond, the sound of falling water or bird song, of being able to pick and eat apples or blueberries from the hospital grounds or to simply contemplate within a natural setting, all have measurable impacts on patients' well-being, stress levels and body chemistry. Hospital stays often involve coping with trauma and loss. Institutionalization in an unfamiliar built environment induces stress, especially after an accident or serious diagnosis. The environment of care can include nature based amenities that alleviate stress.

Hospital facilities are critical infrastructure covering extensive and often urban areas. There is a tremendous untapped potential for value creation in innovative green development and stewardship of hospital grounds. We need to start thinking of both hospital grounds and indoor spaces as areas where ecosystem services can be delivered to patients, visitors, staff and the local community.

The health sector should be viewed by proponents of NBS as a strategic starting point for implementing NBS in the built environment. Recent Hospital projects in Scandinavia will be shown that exemplify the role nature based solutions can play in healthcare design.

26.PS8.O3

Public Engagement for Nature-Based Solutions: Citizens are on Nature's Side

Josefina Enfedaque[1], Laurent Bontoux[2], Gilles Laroche[3]
[1] Policy Officer.Public Engagement in Nature-Based Solutions and Outreach. Sustainable Management of Natural Resources Unit. DG Research & Innovation, European Commission, CDMA 3/55, 1049 Brussels, Belgium;
[2] Policy Analyst. Foresight and Behavioural Insights Unit. Joint Research Centre, European Commission, CDMA 4/16, 1049 Brussels, Belgium;
[3] Head of Policy, Coordination and Communication Unit. DG Environment, European Commission, BU-9 06/190, 1049 Brussels, Belgium.
josefina.enfedaque@ec.europa.eu

The EU Research and Innovation policy agenda on Nature-Based Solutions (NBS) aims to position Europe as leader in 'Innovating with Nature' for more sustainable, resilient societies. Ecosystem-based approaches are emerging R&I areas, involving very diverse cities, regions, and actors (scientists, NGOs, public authorities, landscape architects, engineering firms etc), but the NBS concept is still not sufficiently known by markets, citizens and decision-makers as an alternative to other well-established technological and urbanistic developments.

Nevertheless, NBS have a high potential for public engagement, co-design and co-creation, as well as for sustainable urban innovation. Recent Eurobarometer studies show that more than eight in ten Europeans (83%) are in favour of the EU promoting nature-based solutions; 60% of Europeans favour nature-based solutions over purely technological ones; 56% would participate if a nature-based solution were implemented in their area, mostly by volunteering with their work (24%), sharing information or promoting the project (20%).

For the first time, thanks to the planned investment of 300 million euro in NBS-related R&I, a growing network of cities share NBS knowledge and experiences. Horizon 2020 funds big demonstration projects with broad NBS stakeholder involvement (www.think-nature.eu). NBS case studies are described and analysed www.oppla.eu/nbs/case-studies. EU projects do involve social actors, but often the timescale and efforts necessary for sustainable innovation are underestimated by citizens and local authorities. At the same time, sustainable innovation visions, scenarios and tools are developed by other EU research projects involving citizens (www.casi2020.eu, www.cimulact.eu).

A hands-on Scenario Exploration session with the Joint Research Centre's award-winning Scenario Exploration System (SES) https://ec.europa.eu/jrc/en/research/foresight/ses is proposed to help engage citizens and stakeholders in future-oriented systemic thinking and strategic co-creation of innovative NBS. Multiple NBS scenarios could be developed to explore the impact of local NBS initiatives with citizens and other stakeholders all over Europe, culminating in the EU Green Week 2018.

26.PS8.O4

Co-benefits that urban green infrastructure can bring for businesses and workers wellbeing

Steve Cinderby[1], Sue Bagwell[2]
[1] *Stockholm Environment Institute, United Kingdom;*
[2] *Cities Institute, London Metropolitan University, United Kingdom.*
steve.cinderby@york.ac.uk
Presentation pdf

based on the project: Exploring the co-benefits of urban green infrastructure improvements for businesses and workers wellbeing http://bit.ly/2upxsaH

POSTER PRESENTATIONS

Session 1. Blue-green infrastructure in smart cities

CitAgra – The Compact City with Integrated Agriculture and Ecology

Tomasz Jeleński
Cracow University of Technology, Poland.
tjelenski@pk.edu.pl
Poster presentation

The growing problem of urban sprawl – low-density, fragmented, and car-dependent development on greenfields – is increasingly serious for both Europe and the rest of the world. It brings with it a number of negative consequences for human health, well-being, social and economic performance, and negative ecological impacts, including emissions contributing to climate change. Therefore, in order to improve urban quality of life and address the "20-20-20 strategy" global objectives, we propose a series of pilot projects that introduce significant planning, managerial and technology initiatives combined to enhanced cooperation of the European citizens with experts. We will bring together experts from complementary fields to introduce a feasible model of "compact cities" integrating nature-based urbanism. Among other innovative tools and strategies, it will include Agrarian Urbanism, Transect-Based Planning, Lean Urbanism and Placemaking (all recent but proven methodologies for developing more compact, resource-efficient cities.) In this project, the "nature-based solutions" would be applied both within the public space and urban agriculture systems to improve impact on quality of life. This outcome will be assessed for its impacts on GHG reductions, sustainable development, and "cities for all" as outlined in the New Urban Agenda, the Sustainable Development Goals, and COP21. In this sense, CitAgra would leverage the new UN agendas by making the project a form of pilot implementation of these agendas. By leveraging European expertise and experience, we can provide benefits for other parts of the world confronting related challenges.

NBS in smart city planning for healthy and live able cities

Mari Carmen Garcia Mateo
Sustainability Strategist Advisor, Architect, Urban Planner.
maricarmengarcia.archt@gmail.com
Poster presentation

Cities investing in Nature-based solutions and Inclusive Urbanism in a participatory and pedagogical way of thinking are starting to highlight the benefits of that approach; such as enhancing human well-being, social cohesion, education and health in a safe environment and with a landscape and a harmonious public space and sustainable works; they create and share opportunities for green employment, about the urban space with and for citizenship, so that the present step to the city of the sustainable and smart cities of the future is underway.

The debate on urbanization and Sustainable Urban growth is complex and fragmented in everyday government policies. By 2050 is expected that cities will have to accommodate 36 million new urban citizens. Cities should aim to cooperate and develop new innovative solutions, enhance innovation through new competitive, economy efficient natured based-solutions promoting the investing in green solutions instead of grey infrastructure. Make NBS a global investing market, as role model in Europe and Worldwide.

Cities by using nature-based solutions such as creating urban gardens, community gardens, green recreational areas to play sports or do activities, and other actions are linked to improving quality of life for its citizens. Through innovative Nature Based-Solution applies in Cities, they will enhance inclusive urban regeneration for sustainable urbanization and urban development. Therefore Cities will contribute to improve the environmental, social and economic dimension providing the way towards a more resource efficient, competitive and green economy.

The global collaborations and the fact that urbanization has become a global sustainability challenge. If we design and create living solutions enhancing sustainability urbanization through nature-based solutions we will improve the resilience of ecosystems service and the environment as well as stimulate green economic growth, making Cities more attractive to live in, and enhancing well-being of his citizens

26.PS1.P3

A cross-scalar environmental strategy: the urban green infrastructure

Valentina Dessi
Politecnico di Milano, Dept DAStU, Italy.
valentina.dessi@polimi.it
Poster presentation

The paper proposes a transcalary glance at the city and the possible strategies that are consistent with the city's various scales, urban, district and community scales, to address emerging environmental and social issues.

The element that is likely to meet the requirements of the three urban scales at the same time is the green infrastructure (GI) that contributes to limiting climate change and its effects, while at the same time satisfying the need for citizens to re-establish that alliance with nature that the city for years has severely damaged.

Only in this way, we can improve liveability conditions and at the same time give a significant environmental contribution. The example shown is an opportunity to observe how a GI design is a process that necessarily starts from the urban scale, but is defined and perfected when it comes down to the microscale, where dimensional ratio of the streets and orientation as well as shadows at different times of the day can be considered, and where design solutions and materials choices can be adequately defined.

In Italy, particularly in Milan, among the few projects of urban greenways, it is worth mentioning the Green Rays project, 8 cycle-pedestrian routes for a total of 72 km and 50000 new trees to be planted.

After 10 years only a small part of the project was realized, but it was still an opportunity to make reflections and focus on small parts of the structure and propose a project strategy for urban greenways taking into account some urban configurations in the green rays defined according to the different orientations and morphologies (H/D dimensional ratios of 0.5, 0.9 and 0.36).

From this point the best combinations of vegetation and paving materials were evaluated, in order to improve the thermal comfort conditions for the users and give, due to the distribution of the green structure at urban level, a significant contribution to the heat island reduction and run-off, in case of excessive rains.

26.PS1.P4

Scientifically grounded urban greening as a nature based solution for controlling the quality of urban environment

Lilit R. Khachatryan, Hasmik A. Hovhannisyan, Gayane S. Nersisyan
Center for Ecological-Noosphere Studies of the National Academy of Sciences RA, Armenia.
lilit.khachatryan@cens.am
Poster presentation

The goal of this research was to develop a complex program of scientifically grounded urban greening of Armenia's cities to assure ecological tolerance, longevity, high biodiversity and a functional use of urban forests. The article provides results on the status of green infrastructure of Yerevan – the capital city of Armenia. The research included a study of levels and character of pollution of different environmental compartments, a functional predestination of selected sites, diversity of urban trees and urban shrubs in Yerevan, assessment of condition and ecological tolerance of urban plants.

The obtained research results underpinned both selection of tree and shrub species ecologically tolerant to Yerevan conditions and development of the assortment of plants for each district of the city with regard for the level and character of pollution, natural and climatic conditions and a functional predestination of the areas.

Finally, a complex program of urban greening was developed which comprised:

- Functional zonation of sites,
- Geochemical assessment of sites, indication of dominating toxicants,
- The obtained data mapping,
- Data acquisition on diversity and distribution of species of urban trees and urban shrubs,
- Assessment of condition of trees and shrubs involved in urban green infrastructure,
- Development of a set of ecologically tolerant urban plant species with good filtration properties,
- The monitoring of urban green belts.

The scientifically grounded urban greening allows us to find new nature based solutions for efficiently controlling the quality of urban environment as proved on the example of city of Yerevan.

26.PS1.P5

Nature-based solutions to the environmental challenges of Romania's cities

Cristian Ioja, Mihai Nita, Alina Hossu, Diana Onose, Denisa Badiu
University of Bucharest, Center for Environmental Research and Impact Studies, Romania.
cristian.ioja@geo.unibuc.ro

The integration of nature-based solutions (NBS) in urban planning is critical to successfully tackle cities' current societal challenges. Limited research has been conducted on the concept of nature-based solutions and it is still unclear under which forms these are used in policy and practice.

Our study aims to explore to what extent the projects, developed to implement the environmental goals proposed in the environmental action plans, rely on nature based solutions. We considered Bucharest, Romania's capital and largest city as a case study. An in-depth analysis of 5 projects that ended not later than 2015 and interviews with relevant stakeholders revealed information that highlighted which types of nature-based solutions were used in such projects as well as what favored or hindered their implementation. Our results show that NBS projects addressing the increase of green infrastructure were the most common, while those related to water management, urban agriculture and biodiversity are neglected. It seems that country's financial and economic challenges shape the design and implementation of such projects. This study offers important information on the nature-based solutions taken as well as on benefits and barriers to their implementation.

Participative ecosystem services assessment as a contribution to sustainable urban planning and decision-making (case study Trnava, Slovakia)

Peter Mederly, Anna Dobrucká, Peter Bezák, Zita Izakovičová, Peter Verweij, Michiel van Eupen, Michal Ševčík, František Petrovič
Institute of Landscape Ecology of Slovak Academy of Sciences, Slovakia.
pmederly@ufk.sk

Main objective of research (conducted within EU FP7 project OpenNESS) was to test an innovative approach for implementation of ecosystem services (ES) concept in the urban planning and decision making in Slovakia. This was achieved by integrated research approach with the use of GIS data on urban blue-green areas, Quick-Scan decision tool and active stakeholder involvement in the urban area of Trnava. The valuation model was formulated based on bio-physical data (structure and functions of urban open spaces) leading to detailed land use maps further used for assessment. Group of ES experts, urban planners and decision-makers prioritised particular ES for their following detailed assessment and they ranked importance of input variables. Eight ES were evaluated, i.e. biomass for food production, air and water quality regulation, micro-climate regulation, flood protection, biodiversity maintenance, recreation and intellectual interactions. After interpretation of ES supply, these results were confronted with demand for ES groups, representing mainly be demographic data or spatial data on socio-economic variables. The final assessment of (im)balance between ES supply and demand in the urban area was calculated for each ES category. The same procedure was also applied for assessment of functional zones of the existing urban plan for the next 25 years. The limits and advantages of used approach were retroactively evaluated by the stakeholders. Except for identification of critical zones in the urban area with low provision of current or planned ES, whole procedure can also contribute in proposing a meaningful way for ES assessment as a part of participative planning process for sustainable use and management of natural capital in the urban areas.

26.PS1.P7

Advancing urban NBS green/blue assessment

Peter Olsson[1], Helena Hansson[1], Clara Veerkamp[2], al Schipper[2], Ton Dassen[2], Anton van Hoorn[2], Amanda Nordin[1], Tanya Lazarova[2], Katarina Hedlund[1]
[1] Centre for Environmental and Climate Research, Lund University, Sölvegatan 37, 223 62 Lund, Sweden;
[2] PBL Netherlands Environmental Assessment Agency, Postbus 30314, 2500 GH The Hague, Netherlands.

As part of the Naturvation project[1] we are aiming at producing an easy to use and highly accessible tool to capture NBS values that can be used in the day to day urban practice, anywhere in Europe. Within the Naturvation project, the evidence base of NBS from the economic, social-cultural and biophysical and ecological perspective was mapped. We have reviewed the scientific literature on biophysical and ecological service in the urban environment provided by green and blue infrastructure. The result is partly available online as the Ecosystem Service Quantification Database[2] (ESQD). We are currently reviewing models and frameworks that can be used to assess ecosystem services of NBS in the urban environment. Based on the result of these reviews and as well stakeholder interactions we will in the coming year create and develop the novel NBS assessment framework for urban environments.

26.PS1.P8

Designing of methods for sustainable functioning of Blue-space areas in Europe

Ingmar Ott[1], Ronald Laarmaa[1], Katrin Saar[1], Himansu Sekhar Mishra[2], Mart Külvik[2], Peeter Vassiljev[2], Jekaterina Balicka[2], Friedrich Kuhlmann[2], Gloria Niin[2], Simon Bell[2]
[1] Estonian University of Life Sciences (EMÜ), Institute of Environmental and Agricultural Sciences (PKI). Centre for Limnology, Estonia;
[2] EMÜ PKI. Department of Landscape Architecture, Estonia.
ingmar.ott@emu.ee

The majority of the European population lives in an urban environment. Historically these areas are located in the vicinity of inland waterbodies and coastal areas due to the opportunities provided by the water environment. Natural waterbodies can provide services and resources for habitants to be used. The affect of bluespaces on health promotion is investigated in the EU Horizon 2020 research and innovation program Project BlueHealth (grant agreement No 666773). The ecological status of bluespaces is also being considered, thus the question is how can waterbodies be used while maintaining their good ecological quality and make bluespaces more attractive to humans.

In order to design attractive and sustainable bluespace areas, we started to work out assessment methods (BlueHealth environmental assessment tool – BEAT). Part of the BEAT addresses aquatic ecology and includes a calculation of the conditions of the waterbody as a result. The tool for water ecosystem aspects is divided into three waterbody types. In each type four aspects are considered: substrate, human impact, ecosystem services, abiotic and ecological aspects.

Assessment of the substrate evaluates whether it is natural or the substrate indicates human impact. The aspect of human impact evaluates human activity near the bluespace that can have negative influence. Ecosystem services aspect divides indicators into three groups: provisioning, regulating and maintaining, and cultural services. The main idea of the aquatic ecology tool is that good ecological condition of bluespace provides a better living environment for people.

To understand the links between human health, design and quality of bluespace we compiled a database of designed bluespace projects around the world. This review (170 projects) helped to identify the key factors which make bluespaces successful, also to develop guidelines. The main goal of project BlueHealth is to collect the positive examples and implement those in favor of human well-being.

26.PS1.P9

Strategic urban regeneration for (out-in) door environment, social and economic quality: from 70 real performances projects, the scale of the neighborhood and the building

A. Battisti[1], M. Santamouris[2] and V. Dessi[3]
[1] *Department of Planning, Design and Technology of Architecture, Sapienza University, Rome (Italy);*
[2] *Faculty of the Built Environment, University of New South Wales, Sydney (Australia);*
[3] *Department of Architecture and Urban Study, Polytechnic University, Milan (Italy).*

This contribution focuses on the concept of sustainable urban quality in terms of adaption to the complexities of the economic, social and environmental problems we face, with measures related to microclimatic improvement and thermal comfort intimately linked to the site as an indispensable condition for deployment of urban vitality. In this perspective, it outlines the strategic actions of 70 requalification interventions made over the last decades, as a scalar holistic solution that fits in the public space and single building in different geographic contexts, mostly European. Obtaining quantitative and qualitative positive results both from the point of view of the reduction of CO2 emissions and the heat island effect (UHI) elements responsible for the overheating in urban areas. These dynamic processes consist of a combination of cooling systems (fountains, sprinklers and water-curtains), the vegetation that plays a key role in the fight for the air temperature mitigation, the artificial elements of solar radiation control, the elements that favor the socialization (sitting), slow mobility support, the use of 'cool' materials with excellent thermal performance, energy efficiency and renewable energy. The primary aim is to provide design archive to facilitate choices made under different application modes associated with economically reduced costs.

26.PS1.P10

Set of indicators to monitor NBS in urban environment – case of Tbilisi

George Gotsiridze, Tamar Bakuradze, Tinatin Khimshiashvili[2], Mamuka Gvilava[1]
[1] *GIS and RS Consulting Center GeoGraphic, Georgia;*
[2] *Georgian Association of Landscape Architects (GALA), Georgia.*
mgvilava@geographic.ge
Poster presentation

Within the framework of developing Urban Renovation Conception for Historic Parts of Tbilisi (Georgia), spatially explicit multicriteria analysis was undertaken, overlaying social, economic, transportation, heritage, hazards, other urban variables in an integral manner. Specific attention was paid to environmental variables. Objective of this part of the wider study was to derive spatially explicit indicators and indices for natural and environmental parameters, so that urban renovation in historic parts of Tbilisi could proceed with due monitoring against core set of indicators.

As the first step, baseline environmental conditions were assessed through SWOT analysis. This allowed an elaboration of strategic issues, goals, objectives and actions for urban nature and environment sector, summarising results into logical framework table.

Another outcome of the analysis was a set of key parameters for urban environment, which could serve as sustainability indicators. The following indicators were selected for further spatial analysis: green Environment, Noise, Ventilation, Temperature, Air quality and Built-up intensity (integral index, derived from these indicators was abbreviated as ENVTAB). Selected variables were scrutinised with regard to environmental issues, identified key policy documents, such as Environmental Strategy for Tbilisi 2015-2020.

Datasets of variable quality were available for normalisation into five discrete levels: 0, ±1, ±2. Some datasets (such as temperature, green spaces) can be determined through remote sensing (Landsat, Sentinel); some can be comprehensively extracted from cadastral data (built-up intensity defined via building footprints and heights); while some others were based on expert knowledge (ventilation, noise). Integral index was derived through Delphi scoring, presenting results in traffic light colours of green, yellow and red, with final thresholds validated by experts.

Results served to demonstrate the feasibility of monitoring NBS application outcomes for Tbilisi in both space and time. Quality of indicators can gradually be improved as better *in-* and *ex-situ* datasets become available.

Recommended next step is to develop a geospatial survey tool, asking citizens of Tbilisi, rather than experts, to vote on what they think about the quality of environment in their immediate surroundings and sharing as a feedback ENVTAB maps with aggregated public opinion.

26.PS1.P11

From green infrastructures to urban regulating services: a framework for planning

Chiara Cortinovis, Davide Geneletti
Department of Civil, Environmental and Mechanical Engineering, University of Trento, Italy.
chiara.cortinovis@unitn.it

Regulating ecosystem services are linked to some of the most pressing urban challenges, from climate change resilience to citizens' health and wellbeing. To be effective, nature-based solutions aimed at increasing the provision of urban regulating services by enhancing urban blue-green infrastructures need to be integrated in current planning practices. However, such integration is made difficult by the complexity of the mechanisms underpinning service provision, and by the large amount of data and information required for the assessment.

Using results distilled from a wide scientific literature, the study introduces a framework to guide planning interventions on urban blue-green infrastructures. The framework identifies the key elements that determine the spatial distribution of regulating services and related benefits within the city, and describes their interactions in the process of service provision and use. The framework is applied to the spatial analysis of seven urban regulating services: micro-climate regulation, air purification, noise reduction, run-off mitigation and flood protection, waste treatment, moderation of extremes events, and carbon sequestration. The analysis shows the key properties of urban blue-green infrastructures related to the different services, and the presence of thresholds and non-linearities in the supply. Further, it identifies the different components of the demand, their spatial distribution within the city, and the different typologies and scales of relation between blue-green infrastructures and the areas benefitting from their services. Finally, it highlights the role of environmental conditions and of their variability in space and time.

The potential of ICT and digital applications in providing data to describe each of the components involved is discussed, including systems for environmental monitoring, GIS applications related to blue-green infrastructures, and innovative systems for measuring demand and use of urban regulating services. Application cases from Italian cities exemplify the use of the framework and the integration of data in real-world blue-green

26.PS1.P12

Nordic urban planning: holistic approach for extreme weather

Nils Kändler[1], Ivar Annus[1], Minna Keinänen-Toivola[2], Janis Rubulis[3]
[1] Tallinn University of Technology, Ehitajate tee 5, Tallinn 19086, Estonia;
[2] Satakunta University of Applied Sciences, Tiedepuisto 3, Pori 28600, Finland;
[3] Riga Technical University, Kalku Street 1, LV-1658 Riga, Latvia.

In this study urban drainage modelling is coupled with a traditional spatial planning approach to create innovative Extreme Weather Layer (EWL). EWL will be embedded into existing urban general development plan bringing modelling into city planning. One of the effects of climate change on urban areas in Northern Europe is the increase of storm water peak intensities during a rainfall. Current stormwater collection and runoff systems in these areas are not designed to cope with such extreme weather events (EWE). Intense rainfall will cause the urban drainage system to become surcharged and consequently trigger pluvial floods. Many recent studies (e.g. Kluck et al., 2010; Maksimovic et al., 2001) have shown that accurate stormwater inundation models covering both underground structures and overland flow play a crucial role in the process of finding better measures to increase resilience in urban areas. Resilience is one of the key terms to make urban areas more climate proof (Bruijn et al. 2017; Dong et al. 2017). The developed Extreme Weather Layer comprises information how changes in runoff from any plot affect the downhill areas and from the other hand how EWE e.g. floods, affect a plot. For covering the complexity of the real system, surrounding water bodies (ditches, rivers, sea) will be taken into account with all range of threshold conditions. The EWL will enable to have all the interactions and counteractions of water related EWE in one graphical layer, which will give planners solid base to determine the measures for any area to increase resilience and thus alleviate the impact of climate change.

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26.PS1.P13

Green INSTRUCT – Green Integrated Structural Elements for Retrofitting and New Construction of Buildings

C. Zehetbauer[2], H. Gattringer[1], A. Zraunig[2], J. Kisser[2], M. Radtke[3]
[1] *Blue carex phytotechnologies GmbH;*
[2] *Alchemia-nova GmbH;*
[3] *Radtke Biotechnik.*

Building envelops are of critical importance in regard to the ecological footprint of buildings, during the material production phase as well as in the operational phase of buildings. Construction and demolition waste (CDW) has become a serious problem due to the accompanying environmental pollution. In the EU, CDW accounts for approximately 25-30% of all waste generated. This holds a great potential for recycling and re-use. The *Green INSTRUCT* project will develop a structural prefabricated building block, which will consist of more than 70% of CDW in weight and provide state of the art insulation and comfort parameters. New value chains will be created. CO_2 savings, energy savings and higher resource efficiency will ultimately contribute to a resource-efficient and climate change resilient economy.
The integration of plants in the façade (living façade) adds ecosystem-services to the building and brings numerous positive effects for humans and urban microclimate: Plants mitigate urban heat island effects, remove toxic or harmful substances like volatile organic compounds (VOCs) from the surrounding air, provide significant noise reduction and provide additional insulation for the building.
The living facade developed by alchemia-nova in *Green INSTRUCT* will furthermore add the service of greywater and stormwater treatment and re-use to the above-mentioned benefits. Senors will be integrated to assure high quality of water, to automatise the flow and to show the control online.
The general phytotechnological feasibility of purifying water in a vertical wetland structure has been demonstrated in the FP7-project demEAUmed (Grant agreement No. 619116). In *Green INSTRUCT,* microbial activity, established in the root zone of suitable green plants, ensures water purification within a vertical flow inside of modular façade panels. The treated water may be used for irrigation, toilet flushes, washing machines and similar purposes and therefore contributes to significant water savings. The panel's target areas of application are primarily façades of buildings in water scarce regions and in dense urban locations suffering from urban heat island effects.

26.PS1.P14

The Green Wall Analysis: Vertical Gardens Changing our Lives; the View from Limassol, Cyprus

Joanna Sophocleous, Julia Georgi
Neapolis University Pafos, Cyprus.
j.georgi@nup.ac.cy

Poster presentation

Urbanization causes an enormous impact on the environment which leads to an urban jungle, a concrete chaos, substituting forests and decreasing natural vegetation. As a result of this change, numerous factors such as economical, ecological, social, psychological and most importantly environmental, emerge to the surface.

The quality of life in such areas is constantly shifting negatively, for any living organism including humans. An innovating and efficient way of 'attacking' issues of urban life, which have been also embraced by other developed countries, is the implementation of Vertical gardens as a Natural Based Solution.

Living walls have demonstrated the ability to transform any area into a more sufficiently functioning ecosystem and act as a natural based solution.

Therefore, in this paper, Vertical gardens were analyzed and assessed thoroughly, in order to acquire a general perspective of their functions, abilities, operations, benefits and risks, impacts and the process behind how they offer a higher quality of living.

Furthermore, all of these aspects were analyzed in regards to the city of Limassol, on the island of Cyprus. The suggested implementation in Limassol will be conducted, starting with the selection of a specific case study area, discovering the bare facades within the area and analyzing their quantitative characteristics. Afterwards the determination of the application site and the strategic design will be introduced, with recognition and analysis of the study area. The integration and site analysis are imminent, followed by sun, shade and ventilation conditions of the building chosen. The proposal for implementation introduced with the main design idea, with the analysis and the imprinting of the proposal. The system and plant species was selected and introduced, along with an assessment of the proposed implementation and finally a conclusion is enclosed.

Session 2. Integrated water management through natural systems

26.PS2.P1

Building resilience in natural capital to reduce disaster risks and adapt to climate change: a case of wetlands in the eastern Free State; South Africa

Johanes A. Belle[1], Nacelle Collins[2], Andries Jordaan[3]
[1] University of the Free State, Disaster Management Training and Education Centre for Africa, Bloemfontein, South Africa;
[2] Free State Department of Environmental Affairs, Bloemfontein, South Africa;
[3] University of the Free State, Disaster Management Training and Education Centre for Africa, Bloemfontein, South Africa.
Belleja@ufs.ac.za

A strong mix of the eight community capitals reduce vulnerability and build resilience. Wetlands are a form of natural capital which provide many services that improve on the welbeing of the community. Unfortunately many wetlands have been degraded before their values and functions were realised. Using a system thing appraoach and a mixed research method, this article collected primary data from 176 respondents using semi-structured questionnaires. Besides, 21 wetlands were observed using field observation data sheet while interviews were conducted with 31 environmental, disaster and climate change specialists. Lastly secondary data were obtained from the South Africa Weather Service on two important climate parameters. All these data were used to investigate the vulnerability and functions of wetlands in the eastern Free State of South Africa. The main findings were that wetlands especially those in communal land were still very vulnerable partly due to ignorance of wetland values and functions. The dominant function of the wetlands in the study area was agriculture (both crop production and grazing). However these wetlands perform other functions that support the welbeing and safety of the local community. Despites these valuable functions, wetland degradation is still going on and the management is still predominantly reactive. The main recommendation therefore was a proposed integrated management framework that build wetland resilience to the changing environment characterised by increasing extreme weather events and disaster risks exacerbated by negtive impacts of climate change.

26.PS2.P3

PANORAMA - Solutions for a Healthy Planet

Christian Neumann
GRID-Arendal, Germany.
christian.neumann@grida.no

PANORAMA – Solutions for a Healthy Planet is a partnership initiative to document and promote examples of inspiring, replicable solutions across a range of conservation and sustainable development topics, enabling peer-to-peer and cross-sectoral learning and inspiration. PANORAMA allows practitioners to share and reflect on their stories, increase recognition for successful work, and learn together with their peers how similar challenges have been addressed around the globe.

Currently, the (http://panorama.solutions/en) platform hosts 313 solutions from over 280 solution providers who represent NGOs, government institutions, academia, international organizations, foundations and the private sector.

Solutions, per our definition:

- respond to challenges to sustainable development and human wellbeing and contribute to maintaining or improving the health of biodiversity and ecosystems, helping to achieve the Agenda 2030 SDGs and CBD Aichi Targets;
- are effective and have been implemented with a demonstrated positive impact for nature conservation and/or sustainable development;
- consist of elements that can be replicated or upscaled in other geographic, social or sectorial contexts.

Our unique approach promotes examples of where nature-based solutions are proven to ensure sustainable marine and coastal development, biodiversity conservation and climate change adaption. The partnership has started as a joint venture by the Blue Solutions and Panorama initiatives, focusing on marine and coastal and Protected Area solutions, and financed by the German BMUB and the Global Environment Facility, respectively. Today, the range of thematic communities also includes ecosystem-based adaptation, has concrete plans for expansion to agriculture and to forest management, and is welcoming new thematic communities and partners.

Our portfolio includes solutions relevant for smart cities, integrated water management, ecological restoration and circular economy. We offer a unique partnership and platform for cross-sector knowledge sharing that supports adaptation, replication and upscaling of successes, and inspires collaborative action.

26.PS2.P4

The Building with Nature (BwN)

Egon A. Baldal
Rijkswaterstaat (Agency for Public Works and Water management), Ministry of Infrastructure and the Environment, The Netherlands.
egon.Baldal@rws.nl

The most serious threat facing the North Sea Region (NSR) is climate change; increasing flood and coastal erosion risk from storm surges in coastal and estuarine areas and heavy rain causing flooding of rivers and lakes inland.

The Building with Nature (BwN) project demonstrates BwN solutions that utilize natural processes to deliver flood risk and coastal erosion management whilst enhancing ecosystem services. However, the performance of BwN solutions is uncertain and hampers wider uptake across NSR. A common transnational evidence base is needed to justify investments and optimize the effectiveness of BwN solutions (EC, 2015). The overall objective of the BwN project is to make coasts, estuaries and catchments of the NSR more adaptable and resilient to the effects of climate change. BwN will demonstrate BwN-based climate change adaptation solutions at 7 coastal target sites in NL, D, DK, SE (sand nourishment at North Sea Coasts and Wadden Sea barrier islands) and at 6 catchment scale sites in B, NL, SE, SCO (e.g. river restoration)

BwN creates joint transnational monitoring programmes, uses state-of-the-art analysis methods, develops improved designs and business cases. The laboratories generate the evidence-base to incorporate BwN in national policy and investment programmes of each of the NSR countries (worth >€200M/y). BwN gathers (national) governments that manage most of the North Sea coast, Wadden Sea and river basins and thus provide critical mass for major uptake.

26.PS2.P5

vertECO – building-integrated constructed vertical ecosystem for biological water treatment

H. Gattringer[1], J. Edlinger[1], A. Zraunig[2], J. Kisser[2], M. Radtke[3]
[1] *Blue carex phytotechnologies GmbH;*
[2] *Alchemia-nova GmbH;*
[3] *Radtke Biotechnik.*

The Vertical Ecosystem® (vertECO®) combines aesthetics and benefits of a typical greenwall with the water treating capacity of constructed wetlands. The underlying principle is the employment of certain plant species in a special sequence in combination with microbial activity for purification of polluted water. The hydroponic installation has different connected vertical stages with an actively aerated root zone. This way a compact ecosystem with its useful ecosystem services can be integrated into buildings e.g. tourist facilities and enable recycling and preservation of water.
The technology is suitable to treat greywater (effluents from shower, lavatories and kitchens) and can lead to water savings of 50% by recycling non-fecal waters. Over a period of 3 years intensive tests and monitoring at a pilot demonstration unit installed at Hotel Samba in Lloret de Mar, showed a pollution removal of 90% or higher in the most relevant physical and chemical water quality parameters. Even micropollutant removal (pharmaceuticals, endocrine disruptors) was notably high. The effluent water from vertECO can be used to flush toilets, for laundry, to water green areas or can be used for ground-water recharge. Energy consumption is very low with less than 1,5 kWh of electricity per m^3 of treated water and no chemicals or consumables are needed.
Additional benefit of the easy to maintain unit is the pleasing green aesthetic which can be used effectively for interior and exterior design. Particularly locations with high traffic of visitors (hotels, shopping centers, sport-centers) can benefit from the clear green image, which transmits a message of sustainability to guests, clients and co-workers, while microclimatic effects can also be obtained.

Session 3. ICT as a supporting tool for nature based solutions and ecosystems

25.PS3.P2

Remote sensing and GIS based methods of assessing the ecological state of urban environment (a case: the city of Yerevan)

G. Tepanosyan, V. Muradyan, Sh., A. Saghatelyan
Center for Ecological-Noosphere Studies NAS RA, Armenia.
garik.tepanosyan@cens.am

Improving cities resilience and reducing their vulnerability to a broad range of natural and man-made risks need solutions to each components based on geospatial databases and technologies.

Due to the high degree of complexity of urban issues, GIS and remote sensing (RS) technologies have long been used to facilitate scientists to assess the overall state of urban environment, to manage the urban infrastructures and improve the efficiency and rationality of its spatial management. A necessary prerequisite for the improvement of urban environment is rationality of its spatial management – the optimal division of urban spaces by their functional predestination. One of approaches aimed to this is functional zonation of the city – a spatial management of basic types of activities – labour, household, recreational.

Using RS data VHR QuickBird optical images the territory of the city of Yerevan was classified depending on the type of the activities of the population, which predetermine industrial, inhabited,recreation zones with their morphotypes. The map of functional zonation of the city allowed us to indicate the optimal level of distribution of ecologically unfavourable, neutral and favourable plots on the territory of Yerevan.

On the next stage the RS technics were used to study the ecological state of ecologically favorable plots. This study investigated whether it is possible, using WorldView-2 data and in the context of an urban park, to map canopy stress assumed to be associated with vehicle pollution. A small urban park in Yerevan, was studied using biogeochemical analysis of the tree canopy, field spectral reflectance measurements of tree leaves, simulated WorldView-2 multispectral data generated from the leaf spectra, and two summer images of real WorldView-2 data. High correlation between spectral reflectance values and leaves' heavy metal pollution levels was detected, which confirmed the importance of creating GIS and RS enabled pollution control and monitoring system.

26.PS3.P1

Prioritising urban restoration options through multicriteria assessment of ecosystem services

Davide Geneletti, Linda Zardo, Chiara Cortinovis, Blal Adem Esmail
Department of Civil, Environmental and Mechanical Engineering, University of Trento, Italy.
davide.geneletti@unitn.it

In this case-study research, we aim at identifying priorities for the redevelopment of brownfield sites in an urban context. First, we identify possible redevelopment scenarios by simulating different types of greening interventions in brownfield sites using a Geographical Information System (GIS). Second, we modelled the spatial distribution of ecosystem services provided by these redevelopment scenarios. The following ecosystem services were considered: cooling capacity, air filtration, water storage, habitat provision, noise reduction and recreation opportunities. State-of-the-art GIS modelling tools were used for the different services. Third, we quantified the beneficiaries of these services, and their vulnerability. Fourthly, all the information was combined using spatial multicriteria analysis to identify the types and location of interventions that provide the highest benefits to citizens, considering different perspectives (ie assigning different priorities to different types of benefits). The results helped to answer questions such as: which brownfield can be more effectively transformed through greening actions? Which level of performance of the new green areas is required to increase the wellbeing of the surrounding inhabitants? In which area the same investment is expected to obtain the biggest gain?

Session 4. Ecological restoration through eco-innovation

26.PS4.P1

Sustainable renovation as a part in process of forming modern organic city

Tarmo A. Elvisto
Centre for Sustainable Renovation, Estonia.
info@renoveeri.net

The method of sustainable renovation we started to develop and use since 2001, renovating together with Swedish specialists one neglected and amortized wooden house in Tallinn's suburb Kalamaja. Today this district Kalamaja is one of the fanciest districts in whole Estonia. Not suburb but mileu valuable district, where there is now biggest rise in real estate prices and biggest pressure for new buildings development. Developing the sustainable renovation method and using our experiences we have a mission which good be valuable for others as well.

The Information Centre for Sustainable Renovation (SRIK), in Tallinn was formed in 2001. People who want to keep old values, traditions, to protect natural old living surroundings and living spaces making them the same time modern and comfortable are working together. Architects, restores, house owners and people who are interested about culture and ecology are working together with sustainable renovation method with different projects. We started in Tallinn, but by the need we helped local communities also to organise similar centres in other towns in Estonia. Most active and well known are centres in Tartu and Paide.

Sustainable renovation as a method could be most effective and powerful together with using ecological materials and with right regulations and good promotion. This way it makes for local community's great potential to achieve effect in 5 different areas.

Specifically we could make effect in cultural, ecological, social, economic and philosophical field. Also we could develop building reconstruction area itself and help to keep traditional building skills and valuable historical buildings. This is our experience which could be interesting and valuable for all Europe.

1. Old historical, very often neglected areas could rise to new life as so called milieu valuables districts and stay organically part of our town development processes. We can't look them only as history and tourism attraction but more as organic part in modern city planning. This is valuable resource what we need to not only keep but well develop. But we can't allow losing their organic nature. That is very important and here the method of sustainable renovation could have important role.

2. Method of sustainable renovation is not something old fashion but more as a modern challenge and opportunity for keeping interesting old houses in right way, to value their differences and their organic nature.

3. Ways to use and develop sustainable renovation as a one important method in suburbs revitalization processes and also for single historical houses.

4. Training courses, lectures, seminars, fairs and other common work as a powerful tool in new local communities' movement and also in heritage protection.

5. New innovative tools and techniques we need to take in use in sustainable renovation process. Why and how is it possible to connect new technologies as sustainable energy producing etc. to the process? New are not only technical tools and systems but also project management tools we need to use to make sustainable renovation economically effective. We need to learn better handle risks which are connected with uncertainties which are hidden in old buildings constructions and technologies which we can't always predict and foresee.

6. Co-operation with EU partners to get ideas and enhance opportunities for all.

And last but not least sustainable renovation as method gives us good practical solutions to help to solve nowadays big tasks about energy efficiency and reduction of CO 2.

We have 17 years experience developing sustainable renovation as method and we got good opportunities to develop and practice via several EU supported projects and we would like to share our experiences.

26.PS4.P3

Ecological restoration of abandoned extracted peatlands

Edgar Karofeld, Kai Vellak
Institute of Ecology and Earth Sciences, University of Tartu, Estonia.
edgar.karofeld@ut.ee

Because of long time peat production there is ca 9400 ha of abandoned extracted peatlands in Estonia, abandoned mostly during Soviet period. Their area will increase in coming decades as the current production sites on ca 20.3 thousand ha will be closed. Drained and poorly vegetated extracted peatlands are a threat to the environment locally and also globally, being a substantial source of greenhouse gas emissions. Because of their large area, deep drainage, lack of viable propagules and unfavorable environmental conditions their spontaneous re-vegetation is very slow process. Therefore, ecological restoration of extracted peatlands towards self-sustainable ecosystems is crucial. We initiated studies to test methods for ecological restoration of extracted peatlands in Estonian conditions. By the end of 5th growing season since restoration following “ The moss layer transfer method” the mean plant cover has reached 67.6%, majority of it (63.7%) is formed by Sphagnum mosses. From Sphagna biggest mean cover had *S. fuscum* and *S. rubellum*. Latter species shows also biggest cover increase in years. The length increment of three main species (*S. fuscum*, *S.rubellum* and *S. magellanicum*) on restored peatland, especially on area with lower water table, was still smaller than on natural bogs. We revealed the role of surface preparation, water table depth and spreading density of Sphagnum fragments on the re-vegetation. We also studied the effect of changed mineral content and moisture conditions. Results showed that application of oil-shale ash with straw mulch, as well mulch alone, promote re-vegetation in extracted peatlands (mean plant cover 57% and 40% on 5th year, correspondingly), as compared to plots with oil-shale ash alone (4%) and control plots without treatment (2 %). For better results it is always important to involve in restoration specialists with good knowledge of mire ecology and plant species auto ecology.

26.PS4.P4

Integrating principles of Circular Economy into the concept of modern sanitary landfills to reduce methane emissions

Mait Kriipsalu, Kaja Orupõld, Kaur-Mikk Pehme, Valdo Kuusemets
Estonian University of Life Sciences, Estonia.
valdo.kuusemets@emu.ee

Sanitary landfills are waste disposal sites where waste is isolated from the environment until it is safe. Emission of greenhouse gases has to be minimised by collecting it and using for energy production or by flaring. Both methods, however, are not feasible in low gas production phases, or in landfills where waste with low organic content is disposed of. Also, five sanitary landfills in Estonia which are equipped with gas collection systems, are disposing waste with low organic content and are already experiencing gas deficit. This is a result of remarkable achievements in reducing disposal of municipal organic waste. In near future the methane content in Estonian landfill gas will drop below the level where active gas collection and flaring are unfeasible. Alternatively, methane can be oxidized in-situ by methanotrophic bacteria in biologically active landfill top cover. The bacteria use CH_4 as carbon and energy source, and degrades it into CO_2 and water. This approach has been used in some dumps in Estonia, e.g. in Kudjape and Sillamäe. The research demonstrates negligibly low methane emissions through such cover layer in both landfills. The results suggest that various waste fractions, including fine fraction from mechanical-biological treatment of waste and also from Landfill Mining may be well suitable as a functional final or intermediate cover material for operational sanitary landfills. Extracting cover material from previously disposed landfill cells would change the concept of sanitary landfilling. It would allow nature-targeted innovation in favour of Circular Economy using waste as the resource for reducing methane emission. Landfill operators will gain multiple benefits: a) reduce greenhouse gases by using lowest grade waste-derived materials, instead of using costly synthetic cover layers or wasting natural mineral materials, b) save energy and maintenance cost, and c) contribute to ecosystems restoration.

26.PS4.P5

The re-vegetation of ash-treated Puhatu cutaway peatland

Leno Kuura[1], Katri Ots[1], Mall Orru[2,3]
[1] *Department of Silviculture, Estonian University of Life Sciences, Estonia;*
[2] *Institute of Geology, Tallinn University of Technology, Estonia;*
[3] *Geological Survey of Estonia, Estonia.*
leno.kuura@student.emu.ee

Vegetation on cutaway peatlands is not restored for a very long period of time because the original vegetation has been destroyed and the conditions for the germination of seeds and growth of plants are unfavourable. Re-vegetation on those areas depends from different factors: water regime and time since the last peat harvesting, moisture conditions, the depth of residual peat, wind erosion, frost heaving, and/or specific residual peat chemistry. There is also influence of microtopography and distance to the nearest neighbouring seed source habitats. The conditions of the abandoned peat production fields in Estonia vary largely; however, in general the re-vegetation is poor: only up to 20% of the area of the cutaway peat fields is covered by plants. Wood ash and/or oil shale ash were applied non-vegetated cutaway Puhatu peatland manually in June 2011 using a square system (1 m^2 area around the plant). The amount of applied ashes was 0.8–1.8 kg ash per square. The experimental field consisted of five blocks, and each of them was divided into three plots of size 10 m × 20 m. Inventory of the bottom (bryophytes) and field layer (vascular plants) vegetation was done in 2016 by estimating the percentage coverage and biomass of each species. The results show that the re-vegetation of a cutaway peatland was significantly accelerated by ash application: five years after wood ash and/or oil shale ash application increased significantly the occurrence of vascular plants and moss species compared with control area (unfertilized area). Dominated species are *Tussilago farfara*, *Chamaenerion angustifolium*, *Phragmites australis* and fire-favoring moss species like *Ceratodon purpureus*. Protected species like *Epipactis palustris* was observed also. The ecological restoration of cutaway peatlands by using of nutrient rich ashes contributes to the re-vegetation and sustainable circulation of mineral nutrients, which improves also the growth of trees.

26.PS4.P6

Sphagnum growth as the indicator for carbon fluxes on restored milled peatlands

Anna-Helena Purre, Raimo Pajula, Mati Ilomets
Tallinn University, Estonia.
annahele@tlu.ee
Poster presentation

Peat is an important land resource in Northern Europe, it is mainly used for horticulture and energy. Estonia has about 10 000 ha of abandoned milled peatlands, from which, only less than 200 hectares have been restored. Carbon is bind in the mires, so the peat is accumulating. But in drained and excavated peatlands, peat layer is decomposing and large quantities of carbon are released into atmosphere. Peatland restoration aims to mitigate these negative effects and turn milled peatland from carbon sources back to carbon sinks. The main aim of this study is to analyse the connections between vegetation and carbon fluxes on restored milled peatlands to see, if these areas are carbon sinks or sources.

Carbon fluxes (net ecosystem exchange, respiration and photosynthesis) were measured during two vegetation seasons (2015 and 2016) on two sites, where restoration activities had been carried out (Viru (restored 2008) and Hara (restored 2012)). In 2016, vegetation cover was analysed and plant samples for biomass and production (bryophytes) were collected.

Viru and Hara southern field, where Sphagnum production and biomass was lower (or in some plots absent), were small carbon sources (less than 10 mg CO_2-C m^{-2} day on average). In Hara site's northern part, Sphagnum production was higher and the area was carbon sink on one year, but small source in 2015. This is probably the result of varying environmental conditions. Between the years differences were also observed in respiration in the Viru site. As larger Sphagnum production increased the carbon binding function in the restored peatlands, the monitoring of the Sphagnum cover and production could be the simple indicator if the area is carbon sink or source.

26.PS4.P7

Working with nature (not against it) – Nature-Based Solutions in Slovakia

Simona Stasova
Ministry of Environment of the Slovak Republic, Slovakia.
simona.stasova@enviro.gov.sk

The concept of Nature-Based Solutions (NBS), one of the recent contributions to the environmental and ecosystem services discourse, has relatively quickly found its way into science, policy and practice. The NBS concept has been recognized at the European level and also integrated into the new framework programme for research and innovation, 'Horizon 2020'. The aim of the presentation would be to explore in more detail the national context of the NBS, specifically the Slovak example, and present its application into policy and practice in Slovakia. Firstly, the general overview of the situation regarding NBS will be presented, including the understanding of the concept in Slovakia, its integration into relevant strategies, implementation and problems encountered. Then, based on ongoing and past projects, positive examples and best practices in the field of NBS will be highlighted as well as lessons learned that will help to illustrate the present situation in Slovakia. Thirdly, the presentation will reflect upon the plans for the future and niches in which this concept could be effectively applied. We will end by considering links of the NBS concept to other relevant policies and strategies, examining possible synergies and relevant partners, and drawing conclusions.

26.PS4.P8

The Sequencing of Prokaryotic Microbiomes of Estonian Coastal Soils Affected by Crude Oil Contamination – a Diagnostic Tool for Coastal Ecosystem Health Assessment

Margaret Hook, Maarja Mirjam Rajasaar, Kairi Koort
School of Natural Sciences and Health, Tallinn University, Tallinn.
kairi.koort@gmail.com

Crude oil contaminated soils are one of the most biochemically studied soil ecosystems due to their characteristic metabolic capabilities and the potential for applications in bioremediation. Despite the collective efforts to characterise these dynamic systems our understanding of the genomic composition and functional properties of the soil microbiome is very limited. In this study, we focused on identifying the presence of oil-degrading bacteria after 2, 8 and 17 years of three crude oil affected coastal areas in Estonia. In order to assess the current state of the ecosystem health we used high-throughput 16S microbiome sequencing to investigate whether the presence and detected abundance of oil-degrading bacteria in the microbial communities is correlated with the temporal distance from the crude oil pollution event. The bioinformatic analysis of the sequencing data reveals that the coastal soil microbiome is highly diverse in its composition - hierarchical clustering of the microbial sequencing data revealed patterns between the extent of and the time distance from the oil spill. The microbial communities in two of the very heavily contaminated coastal areas were dominated by *Proteobacteria* which have a key role in oil degradation. The number and abundance of oil-degrading bacterial species was in correlation with the extent of oil contamination and negatively correlated with the time-distance from the pollution event. This suggest that natural biodegradation is facilitated by these bacteria and temporal monitoring of the composition of these bacterial communities in parallel with chemical investigation gives us valuable information about the health of the ecosystem. The characterization of the dynamics of these microbial communities and computational modeling of the system would provide invaluable input for the design of man-mediated applications of bacterial bioremediation of crude oil polluted coastal areas in the future.

26.PS4.P9

Manipulating below ground diversity for above ground diversity: the application of arbuscular mycorrhizal fungi in vegetation restoration

Tanel Vahter, Maarja Öpik
Department of botany, Institute of Ecology and Earth Sciences, University of Tartu, Estonia.
tvahter@ut.ee

The loss and fragmentation of habitats is one of the main drivers of deteriorating ecosystem functioning and services. This has induced a growing need for conservation and increasingly more – restoration. A central part of land-ecosystems is soil biota with arbuscular mycorrhizal (AM) fungi being a key constituent. As ubiquitous plant symbionts, AM fungi have a global impact on carbon sequestration and nutrient cycling, soil formation, erosion and leaching processes, therefore influencing all spheres of earth. In soils where disturbance has lead to the loss of soil cover or a drastic change in plant community composition, the absence of suitable AM fungal symbionts can lead to slow post-restoration plant community recovery with negative implications on ecosystem functioning for decades. Because of this, the manipulation of soil AM fungal composition for restoring plant communities is a highly promising perspective.

To test the applicability of this idea, we have set up field inoculation experiments in three ecosystem restoration scenarios in Estonia: restoration of alvar grassland vegetation following clearing; restoration of wooded meadow vegetation following clearing; restoration of vegetation cover in depleted oil shale quarries. Native soils and plant seeds were collected from target ecosystems in a good state and trap cultures were set up to obtain bulk inoculums. These inoculums were used with native plant seeds in 18 restoration sites across Estonia. The experiment will be monitored for the desired effect and temporal changes in above and belowground diversity, giving valuable insights into the practical implication of AM fungi for ecosystem restoration. An overview of the hypotheses, methodology and practical boundaries of this experiment will be given, highlighting knowledge gaps and their possible solutions.

Session 5. Nature-based solutions in circular economy

25.PS5.P1

Analysing the multifunctional role of green infrastructure in an urbanised environment

Mario V Balzan
Institute of Applied Sciences, Malta College of Arts, Science and Technology (MCAST), Malta.
mario.balzan@mcast.edu.mt

Throughout history cities have grown and prospered by interdependency on rural environments and ecosystems providing services and goods to human societies and economies. These ecosystem services, or the direct contributions that ecosystems make to human well-being, include improved local climate regulation, flood control, access to food, availability of recreational spaces, and reduced health problems associated with urban living such as through exposure to excess noise and air pollution. Urbanisation, is today a major driver of land use change and, is expected to cause spatial shifts in the capacity of ecosystems to provide these services and in the demand for these services by beneficiaries.

This work assesses the capacity of ecosystems to provide ecosystem services in the small island state of Malta, and the actual use *(flow)* of these services by the local population. We utilise different available datasets, statistical models and indicators based on direct measurements. Individual indicators were mapped to visualise and compare their spatial patterns across the case study area. Subsequently, an analysis of associations between these services is carried out. Results obtained here indicate an important contribution of rural landscapes and green urban areas to human well-being and several significant synergistic interactions between ES capacity and flow was associated with these environments, thus indicating high landscape multifunctionality. In contrast, predominantly urban areas tend to be characterised with a low ecosystem capacity and ES flow, suggesting that ES delivery in the landscapes of the study area is determined by land use intensity. The relevance of these results to urban and landscape planning that promotes the use of nature-based solutions for achieving sustainable growth and socio-economic goals is discussed further.

26.PS5.P1

The Namibian BioEconomy: Commercialization of the !Nara (*Acanthosicyos horridus)*

Anne Heeren
LUH Hanover/UNAM Windhoek, Germany.
Anne-Heeren@web.de

The commercial utilization of bio-based resources is the central premise of today's development policy-making. The BioEconomy concept is being promoted as a 'catalyst for sustainable development'. The vision is created to build 'Sustainable Global BioEconomies' to address the overexploitation of natural resources, poverty, climate change and economic crisis. The basic principle of BioEconomy approaches is the commercial utilization of 'natural systems'. In order to adequately address current challenges faced by society, a re-structuring and critical assessment of existing economic approaches and its relation to 'Nature' is required.

Despite the fact that at the G*lobal Bioeconomy Summit* (2015) it was acknowledged that "there is not one bioeconomy but many", still an instrumental understanding of 'Nature' is dominating the debate: mainly 'Nature' is being constructed as a 'productive asset' which needs to be employed by technological means. Alternative perceptions of 'Nature' may not become easily integrated.

In the present paper I will explore the creation of 'Global Sustainable BioEconomies' at the example of the commercialization of the !Nara (*Acanthosicyos horridus*) in Namibia. The !Nara plant, endemic plant to the Namib desert, is closely intertwined with the Topnaar people. The plant serves not only as a source of income and nutrition, but as well is a vital part of the Topnaar traditional culture. Different value chains have been set-up: Trade in !Nara pips and more recently the use of the !Nara oil in the food and cosmetic industry.
There is a need to conduct a theoretically-based deconstruction of the 'selling nature to save it logic' in order to draw attention upon the underlying power asymmetries and hierarchies structuring the commercial use of bio-based resources.

26.PS5.P3

Designing a circular mountain economy based on industrial hemp

Tobias Luthe
Systemic Design Lab, ETH Zurich, Switzerland;USI University of Lugano, Switzerland; MonViso Institute, Ostana, Italy.
luthet@ethz.ch

Mountain regions are most vulnerable to environmental and demographic change while suffering from political and economic neglect. Their economy depends on single industry sectors, like agro-forestry, mining, or tourism. The revival of mountain economies demands the development of a more resilient economic model that is more adaptive and innovative to prepare for and respond to change. Such a more resilient economy is based on higher connectivity between different economic sectors, mimicking natural systems that function in circular ways where no waste exists, but outputs from one process are new inputs for another one. The development of a circular economy in mountain regions requires sophisticated tools and motivating illustrations to overcome jealousy and lack of collaborative will.

Cannabis (hemp) is amongst the oldest cultivated plants with a worldwide history of agricultural use. In mountain regions, the traditional mountain economy used to be based on industrial hemp. Hemp grows basically anywhere, produces fast biomass, improves the soil by loosening it with its deep root system, does not require pesticides, the fibers of the sheath can be used to produce fabric and clothing, the stems can be mixed with lime stone as a building material, the seeds can be used to produce oils for the kitchen and for 3D printing of organic plastic. Unfortunately, hemp faced a cruel devastating lobbyism by the tobacco and cotton industry, and as a result was forbidden to grow. In the last years though, society is re-discovering this plant and its genius capacity to power an entire economy.

We illustrate the potential to use the hemp cycle for designing a circular economy in the mountain community of Ostana, Piedmont, Italy, to connect agriculture, forestry, architecture, construction, gastronomy, tourism and textiles for building economic, social and ecological synergies as the trigger of a local, circular economy.

26.PS5.P4

Foodweb management as a multi-purpose nature based restoration and management of temperate eutrophic water bodies

Ilkka Sammalkorpi
Finnish Environmental Institute, Finland.
ilkka.sammalkorpi@ymparisto.fi

Benthivorous and planktivorous cyprinids benefit from eutrophication, maintain internal phosphorus loading, turbid water and blooms of potentially toxic cyanobacteria, suppress the food resources and biodiversity of waterfowl and their high biomass is of low commercial value. Fish removal or foodweb management/biomanipulation targeted on cyprinids is a cost effective measure of high potential importance in restoration and management of temperate water bodies. It can improve the ecological status and value of fish stocks of eutrophic lakes and maintain the impact of restoration or prevent deterioration from good status – but is not an alternative to measures reducing the diffuse external loading tackled e.g. in agricultural policy which affect at a slower pace. Fish removal can also restore or maintain favorable conservation status in lakes and wetlands protected in Natura 2000 for breeding or migrating waterfowl. It has been carried out in Finnish lakes since the 1990´s by gear developed especially for removal of cyprinids and adjusting fishing effort to the seasonal behavior of the target species. In successful cases, the biomass removed has been up to c. 200-600 kg/ha/a in large vs. small lakes and long term removal up to 70 kg/ha/a in larger lakes. 28 % of the commercial catch from Finnish lakes was from biomanipulation in 2014. Nutrients are removed in fish biomass and the price paid to fishermen (< 1€/kg of fish f.w. ≈ 75-100 €/kg P) makes fish removal cost effective compared with the average cost of reducing agricultural phosphorus loading. Linking improving ecological status of lakes by biomanipulation with blue bioeconomy has created new local entrepreneurship in food industry can make fish removal close to self-supported action.

Session 8. Human health and wellbeing

26.PS8.P1

Enriched Green Exercise Interventions: An innovative approach to nature-based solutions for Well-being

Tadhg MacIntyre[2], Aoife Donnelly[1], Juergen Beckmann[3]
[1] *University of Limerick, United Kingdom;*
[2] *Dublin Institute of Technology,United Kingdom;*
[3] *Technische Universität Münche, Germany.*
tadhg.macintyre@ul.ie

Engagement with nature through green exercise (i.e. physical activity in natural settings) is one possible solution to several societal challenges. We suggest that green exercise augmented with attentional and emotional engagement can optimise the human-nature interaction to create synergistic benefits for mental well-being, cognitive function and health. This has particular consequences for those in cities who are typically are more restricted in their access to natural spaces. Optimising any human-nature interactions is a priority for urban dwellers and the consequences of this engagement are manifold with direct implications for self-regulation, resilience and future implementation intentions. We propose an intervention model which proposes the provision of online information in advance of activity to *prime participants* prior to green exercise (with key local information on their natural environment), creating conditions for *flow* during exercise and employing post-activity 'nature savouring' tasks. To facilitate flow, participants will be trained to regulate the intensity of their physical effort to facilitate attention to natural stimuli rather than the sensation of effort. Additionally, savouring, a form of emotion regulation used to prolong and enhance positive emotional experiences, can be prompted by images of their nature experience with instructions delivered on mobile devices. Passmore and Holder (2016) reported that a two-week nature savouring intervention increased positive affect and prosocial orientation among a 'nature' group when compared to controls. Savouring offers a pathway for participants to recall, the positive emotions of their nature experience over a long duration and provides them with a skill of emotional regulation to enhance their well-being. Evidence is emerging from across Europe from transdisciplinary research perspectives to demonstrate the predictable positive effects of green exercise on well-being and mental health, and the wider co-benefits in terms of pro-social behavior and environmental awareness and social capital which are of benefits to individuals, communities and cities.

26.PS8.P2

Social indicators of Nature-based Solutions

János Balázs Kocsis[1], Flóra Szkordilisz[2]
[1] *Associate professor, Budapest University of Technology and Economics and Corvinus University of Budapest; senior researcher, Hungarian Urban Knowledge Centre;*
[2] *Managing director, Hungarian Urban Knowledge Centre.*
f.szkordilisz@mut.hu

The concept of Nature-based Solutions (NbSs) is a new approach for answering urban challenges. As Nature-based solutions – besides ensuring innovative solutions for many of environmental, climatic problems – it also delivers, whatever the solution might aim, social benefits.

The fate, sustainability and liveability of our towns and cities have become focal points of researches and actions recently as younger generations tend to more and more favour central areas to suburbs. Besides, 'traditional' problems such as social exclusion, segregation, high density, lack of services, high cost of living, alienating and dysfunctioning public spaces still persist parallel to the tensions evoked by present and forecast technological changes and transformations.

In this paper, we sum up our findings delivered in Horizon 2020 project Nature4Cities. We analyse the impact and effectiveness of NbSs on the above mentioned social problems. Our hypothesis is, that the implementation of Nature-based solutions always has a certain effect on the life of city dwellers in some ways. Our question we try to answer is however, the measure of these effects. That is why we set up a range of social (besides environmental and economic) indicators to measure the impact of NbSs and to further urban planners' knowledge on social effects of NbSs.

This project has received funding from the European Union's Horizon 2020 research and innovation programme.

26.PS8.P3

Socio-Ecological Conditions of Nature-Based Solutions: Learning From Estonian History

Timo Assmuth
Finnish Environment Institute/Environmental Policy Center and University of Helsinki.
timo.assmuth@ymparisto.fi

History is a great teacher also of Nature-Based Solutions (NBS). Their potential as well as their limitations can be better understood when considering earlier experiences. Along with ecological factors, social conditions are central. In Estonia, the development of NBS is influenced and informed by the past interactions notably between the Baltic German elites, the peasant populations and the Russian overlords.

The nature-based largely circular economy of a manor near Viljandi in SW Estonia during the long 19th Century (c. 1760 to 1920) is used as a case. The materials are retrieved from literature, especially Hein (2013).

The NBS in this manor included management of forests for water-driven sawmill timber and firewood also for industry; distillation of corn and potatoes to vodka and cultivation of tobacco as cash crops; rearing of merino sheep for wool, imported cattle for meat and dairy and fish in ponds, coupled with harvesting of forage plants (also innovative use of Chinese alfalfa); utilization of springs for drinking water and use of ice for refrigeration; construction of extensive parks and gardens; combined utilization, admiration, study and artistic representation of nature.

The physical processes of the agroforestry system were natural but shaped my man. The system boundaries were confined to the farm, but affected by regional markets. Importantly, this circular economy was based on manual labor of peasants, whose conditions were harsh though gradually improved. Decisions were made and profits reaped predominantly by the owners. Some sustainability was achieved e.g. by famine preparedness. Peasant rights were improved formally but not always in practice. During the first independence the manor was transformed to public dairy/food technology school, and this continued although inefficiently during Soviet rule.

Traditional agroforestry-animal husbandry fueled by renewable energy, increasing information, power balances and social norms provided a basis for economy. NBS were used in various ways, also innovative and integrated. Yet, social and thus more genuine sustainability was limited by non-democratic governance. NBS alleviated some of these social problems, but essentially the conditions of an adaptive and just system was political. If losing sight of these aspects, also present and future NBS attempts may go astray.

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26.PS8.P4

Holistic and diverse approaches to health, and Nature-Based Solutions

Timo Assmuth
Finnish Environment Institute/Environmental Policy Center and University of Helsinki, Finland.
timo.assmuth@ymparisto.fi

Converging and diverging takes on health. There is convergence of notions of the health of organisms – humans, domestic/lab and wild animals, plants, microbiota, communities, ecosystems[1]. This is linked to integrative approaches like Ecosystem health, Eco-Health and One Health. Health is increasingly seen as a general generative process[2]. On the other hand, diversity is evident e.g. in structured[3] or extended[4] One Health. Some of this diversity will pass but some persist, also as checks on indiscriminate holism[5]. The context dependency of generalization thus needs to be unpacked. Here, approaches to health are examined with regard to their implications for Nature-based Solutions (NBS) - and vice versa - with particular reference to the following crucial but under-research and poorly accounted-for human aspects:

- *Psychological:* Expert judgement is constrained by affect, cultures and core beliefs[6]. Such factors are especially important in health care as emotions are strong, and influence e.g. the choices of which organisms to protect and how risks and benefits of nature or of interventions are balanced. A key question is how perceptions and motivations are linked to the needed neutral reflection. *litical:* Without attention to inequities and power, solutions aiming at health or environmental care may be mis-focused, inefficient and even harmful. This is not merely a coordination task e.g. by Health in All Policies or mainstreaming of environmental policy. Knowledge of biophysical and technical aspects of health needs to be aligned with those of political aspects.

- *Philosophical:* One Health and eco-health pose questions of ontology, epistemology and ethics. This involves questions like which entities to protect; what constitutes their health; what interference is justified; can biophilic synergies be found, e.g. in reconciling eradication of pathogens and pests and the use of domestic animals with the protection of all life.

ALTER-Net (Europe's Ecosystem Research Network) has launched a small AHIA, *Marrying One Health with EcoHealth: Inclusive Nature-Based Solutions and Action*

Research Directions. Key contexts, goals and contents of the project are described in short.

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26.PS8.P5

How good is geochemistry of Estonian curative mud?

Galina Kapanen[1, 2], Jaanus Terasmaa[1, 2], Agáta Marzecová [1]
[1] The Centre of Excellence in Health Promotion and Rehabilitation (TERE KK); Haapsalu, Estonia;
[2] Institute of Ecology, School of Natural Sciences and Health, Tallinn University, Estonia.
galina.kapanen@tlu.ee

Estonia has long term traditions in using fine-grained sediments (muds) for cosmetic and medical purposes, but more precise information about their characteristics is lacking. At present, five deposit areas, containing about 174 320 tons of healing mud, are in active use. However, the mud resources are underutilized if compared to their earlier use during the early 20th century. This study aims the assessment of lithology, geochemistry and organic matter compounds of Estonian curative mud deposits. We reviewed the regional history of curative mud and the *existing scientific rationale* for the public and commercial applications of mud for healing purposes. The theoretical overview was then illustrated with two selected case studies: (1) we mapped spatial distribution of organic matter and heavy metals (Cu, Cr, Sr, Pb, Cd, Zn, and Ni) the surface sediments in the Estonian deposits of curative mud, and (2) the average concentrations of selected heavy metal in all Estonian curative mud deposits were compared against the Estonian and international reference values for soils and sediments, to provide insights in the current pollution levels. The thermo-gravimetric analysis and energy-dispersive X-ray fluorescence spectrometry were used. In assessing the ecosystem services of curative mud in Estonia, the main challenge is in finding the relevant indicators for evaluating ecosystem stability in time using bio-geo-chemical innovative method.

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