Posters presented at the

COST Action CA17133 workshop

Implementing nature based solutions for creating a resourceful circular city

13-15 February 2019

Intentionally left blank

Imprint:

Proceedings of the COST Action CA17133 workshop Implementing nature based solutions for creating a resourceful circular city.
13-15 February 2019

Edited by Bernhard Pucher

University of Natural Resources and Life Sciences, Vienna
Department of Water, Atmosphere and environment
Institute of Sanitary Engineering and Water Pollution Control

Contact: ca17133@boku.ac.at

ACT4CITY, ARTIZEN and SCHOOL4CITY
Independent cultural actors towards sustainable cities

Duration: 2014-2019

Programmes: Creative Europe 2014, Balkans Arts and Culture Fund, The Deutsche Bundesstiftung Umwelt DBU, Europe for Citizens

Website: http://www.expeditio.org/

Abstract

Under this topic we present a series of projects seen as a continuous initiative, realized in order to encourage sustainable development and improve the understanding and application of sustainable cities concept, through awareness-raising, capacity building, artistic and advocacy actions, based on participatory approach and citizens' engagement. The activities were implemented in cooperation with numerous partners and stakeholders in Montenegro, Balkan and European countries, and funded under different grant schemes.
1) **European ARTIZEN Initiative** (2014-2016) was realized by Dédale, France; EXPEDITIO, Montenegro; Prostoroz, Slovenia; Idensitat, Spain; AltArt, Romania; Transforma, Portugal and funded by *Creative Europe 2014 - Smaller scale cooperation projects (COOP1)*.
2) **ACT4CITY - Independent cultural actors towards sustainable Balkan cities** (2015-2017) was realized by EXPEDITIO, Montenegro; Ministry of Space, Serbia; City Creative Network, Macedonia; Art Workshop Lazareti, Croatia and funded by the *Balkans Arts and Culture Fund.*
3)The (ongoing) project **SCHOOL4CITY - Bringing education about sustainable cities in Montenegrin schools (**2015-2019) was realized by EXPEDITIO, JAS - Jugend Architektur Stadt e.V. (Germany) and Bureau for Education Services of Montenegro, and funded by *The Deutsche Bundesstiftung Umwelt DBU*.
4) **New Ideas for Old Buildings** (2015-2017) was realized by the Municipality of Ajdovščina, Slovenia (lead); EXPEDITIO, Montenegro; Green Istria, Croatia; Institute for Spatial Policies (IPoP), Slovenia; Kitev, Germany; Municipality of Maribor, Slovenia; Municipality of Nikšić, Montenegro; MikroArt (Ministry of Space), Serbia; Municipality of Oberhausen, Germany; Urban Institute, Latvia, and funded by the Europe for Citizens.
The aim of the projects was to: reinforce cultural and creative players' role in the city making with citizens; promote the use of creative tools in shaping Balkan cities to be more sustainable; increase the involvement of citizens in making decisions related to public property management and sustainable urban development; improve the understanding and application of sustainable cities concept among the teachers and children in schools. The projects included different activities, implemented in active collaboration with different actors, including citizens and the civil society. The main activities and outcomes include: joint research on the role of creative sector in co-designing sustainable Balkan cities; organizing focus groups on the topic of sustainable cities, round tables for stakeholders and workshop for cultural actors focusing on Balkan cities sustainability issues; undertaking pilot activities aimed at linking artistic/creative interventions and sustainable cities concept, including a participatory theatre play "KoTo(R) o KOTORU"; organizing the conference "New Ideas For Old Buildings"; creating and obtaining accreditation for teachers training programs on sustainable cities in Montenegrin kindergartens, primary and high schools and producing teachers manuals; organizing training for trainers and workshops on "Sustainable cities" for teachers and conducting practical activities with children in pilot schools in Montenegro. We believe these activities have contributed to bringing citizens closer to sustainable cities concept and encouraged cooperation between different actors.

Contact person at the COST Action CA17133 Workshop Vienna:

- Aleksandra Kapetanović, NGO EXPEDITIO, Kotor Montenegro
- Dr Jelena Lazarević, University of Montenegro, Biotechnical Faculty

PROJECTS_ACT4CITY, ARTIZEN, SCHOOL4CITY, NEW IDEAS FOR OLD BUILDINGS

Independent cultural actors towards sustainable cities

<u>DURATION</u>: 2014-2019
<u>PROGRAMMES:</u> Creative Europe 2014, Balkans Arts and Culture Fund, The Deutsche Bundesstiftung Umwelt DBU, Europe for Citizens
<u>WEB:</u> http://www.expeditio.org/

Under the topic **Independent cultural actors towards sustainable cities** we present a series of projects seen as a continuous initiative, realized in order to encourage sustainable development and improve the understanding and application of sustainable cities concept, through awareness-raising, capacity building, artistic and advocacy actions, based on participatory approach and citizens' engagement. The activities were implemented in cooperation with numerous partners and stakeholders in Montenegro, Balkan and European countries, and funded under different grant schemes.

1. **European ARTIZEN Initiative (2014-2016)** was realized by Dédale, France; EXPEDITIO, Montenegro; Prostoroz, Slovenia; Idensitat, Spain; AltArt, Romania; Transforma, Portugal and funded by Creative Europe 2014 - Smaller scale cooperation projects (COOP1).
2. **ACT4CITY - Independent cultural actors towards sustainable Balkan cities (2015-2017)** was realized by EXPEDITIO, Montenegro; Ministry of Space, Serbia; City Creative Network, Macedonia; Art Workshop Lazareti, Croatia and funded by the Balkans Arts and Culture Fund.
3. **New Ideas for Old Buildings (2015-2017)** was realized by the Municipality of Ajdovščina, Slovenia (lead); EXPEDITIO, Montenegro; Green Istria, Croatia; Institute for Spatial Policies (IPoP), Slovenia; Kitev, Germany; Municipality of Maribor, Slovenia; Municipality of Nikšić, Montenegro; MikroArt (Ministry of Space), Serbia; Municipality of Oberhausen, Germany; Urban Institute, Latvia, and funded by the Europe for Citizens.
4. The (ongoing) project **SCHOOL4CITY - Bringing education about sustainable cities in Montenegrin schools (2015-2019)** was realized by EXPEDITIO, JAS - Jugend Architektur Stadt e.V. (Germany) and Bureau for Education Services of Montenegro, and funded by The Deutsche Bundesstiftung Umwelt DBU.


ARTIZEN / ACT4CITY

ARTIZEN / ACT4CITY


ARTIZEN / ACT4CITY


ARTIZEN / ACT4CITY

The aim of the projects

- reinforce cultural and creative players' role in the city making with citizens;
- promote the use of creative tools in shaping Balkan cities to be more sustainable;
- increase the involvement of citizens in making decisions related to public property management and sustainable urban development;
- improve the understanding and application of sustainable cities concept among the teachers and children in schools.
- The projects included different activities, implemented in active collaboration with different actors, including citizens and the civil society.

The main activities and outcomes

- Joint research on the role of creative sector in co-designing sustainable Balkan cities;
- Organizing focus groups on the topic of sustainable cities, round tables for stakeholders and workshop for cultural actors focusing on Balkan cities sustainability issues;
- Undertaking pilot activities aimed at linking artistic/creative interventions and sustainable cities concept, including a participatory theatre play "KoTo(R) o KOTORU";
- Organizing the conferences "New Ideas For Old Buildings";
- Creating and obtaining accreditation for teachers training programs on sustainable cities in Montenegrin kindergartens, primary and high schools and producing teachers manuals;
- organizing training for trainers and workshops on "Sustainable cities" for teachers and conducting practical activities with children in pilot schools in Montenegro.

We believe these activities have contributed to bringing citizens closer to sustainable cities concept and encouraged cooperation between different actors.


ARTIZEN / ACT4CITY


NEW IDEAS FOR OLD BUILDINGS

ARTIZEN / ACT4CITY


ACT4CITY

ACT4CITY


ACT4CITY


SCHOOL4CITY


SCHOOL4CITY


SCHOOL4CITY

SCHOOL4CITY


SCHOOL4CITY


SCHOOL4CITY

Contact persons at the COST Action CA17133 Workshop Vienna:
- Aleksandra Kapetanović, NGO EXPEDITIO, Kotor Montenegro
- Dr Jelena Lazarević, University of Montenegro, Biotechnical Faculty

ATMEnvPro

Advanced technologies for monitoring and environmental protection from the harmful chemical substances and radiation

Duration: 01/2011 – present

Programme: Integral and Interdisciplinary Research (project ID# III43009), Ministry of Education, Science and Technological Development of the Republic of Serbia. Project Coordinator: Prof Dr Antonije Onjia, Faculty of Technology and Metallurgy, University of Belgrade, Serbia.

Website: https://www.researchgate.net/project/III43009-Advanced-Technologies-for-Monitoring-and-Environmental-Protection-from-Chemical-Pollutants-and-Radioactive-Contamination

Subproject: Technologies for the production of composite materials based on unsaturated polyester resins/elastomers and non-metallic fractions of waste printed boards with additives for resistance to the combustion

Duration: 01/2018 – 01/2020

Programme: Innovation Research (project ID# 391-00-16/2017-16/11), Ministry of Education, Science and Technological Development of the Republic of Serbia. Project Coordinator: Prof Dr Aleksandar D. Marinković, Faculty of Technology and Metallurgy, University of Belgrade, Serbia.

Abstract

ATMEnvPro is set up in 2011. and coordinated through the 4 complementary and functionally dependent subprojects. The project was implemented using an integrated approach for monitoring and reducing pollution of the environment from the biochemical and radiological aspect, with the participation of over 80 researchers from 12 national institutions and with the support of 7 industrial participants interested in research results. The main scientific goals are devoted to environmental prevention and protection:

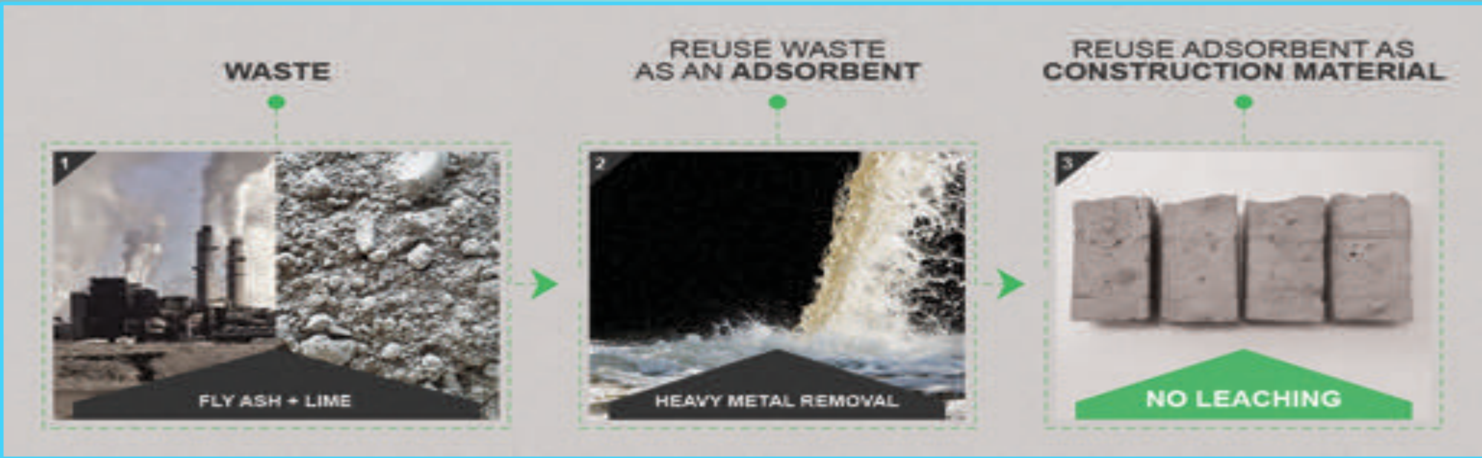
- developing, modifying and characterizing functional materials used in the removal and/or inactivation of disparate radio/bio/chemical pollutants (radionuclides, microbial cells, heavy metals and organic compounds) from aquatic and terrestrial media
- synthesizing and characterizing multifunctional hybrid materials through the (RE)Valorization/Use/Cycling of disparate waste source material (fly ash, PET, circuit boards, etc.) as combined adsorbents/catalysts in wastewater treatment and/or additives in construction material
- investigating the mechanisms of the adsorption/desorption processes onto pristine, modified and/or synthetic separation media, modelling of chemical/biochemical kinetics and thermodynamics, as well as determining their main influencing parameters.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Maja Đolić, Vinča Institute of Nuclear Sciences and Faculty of Technology and Metallurgy, University of Belgrade
- Mirjana Ćujić, Vinča Institute of Nuclear Sciences, University of Belgrade

THE REMOVAL OF As(V) IONS BY LIME MODIFIED FLY ASH AND REUSE OF THE EXHAUSTED ADSORBENT AS AN ADDITIVE FOR CONSTRUCTION MATERIAL

Milica Karanac, Maja Đolić, Đorđe Veljović, Vladana Rajaković-Ognjanović, Zlate Veličković, Vladimir Pavićević, Aleksandar Marinković



- Adsorption studies - Kinetic (pseudo-first, pseudo-second-order, second order model and diffusion models), Isotherm models (Langmuir, Freundlich, Temkin and Dubinin-Radushkevic), Thermodynamic
- The optimization of the synthesis and adsorption process - response surface method (RSM)
- γ spectrometry, X-ray diffraction (XRD), Brunauer–Emmett–Teller (BET), scanning electron microscopy (SEM), and Fourier transform infrared (FTIR) spectroscopy
- The granulometric and elemental analysis, point of zero charge (pH_{PZC}), the content of PAHs and PCBs
- Mechanical properties, Leaching test of construction material

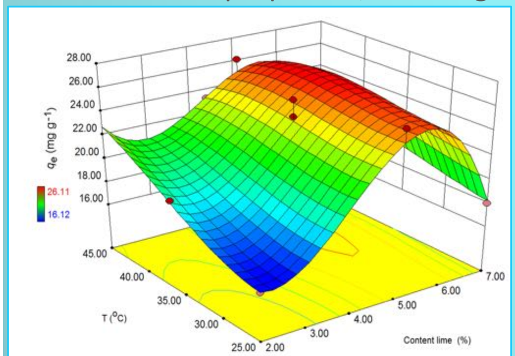


Fig. 1. The estimated surface plots based on the sorption capacity q_e (mg g^{-1}) for As(V) ions vs. T (°C) and lime content (%) for MFA

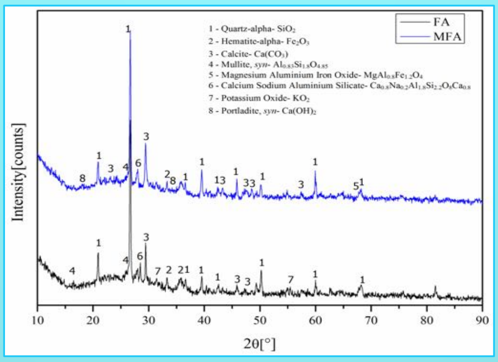


Fig. 2. The structural analysis and mineralogy profile of the FA and MFA

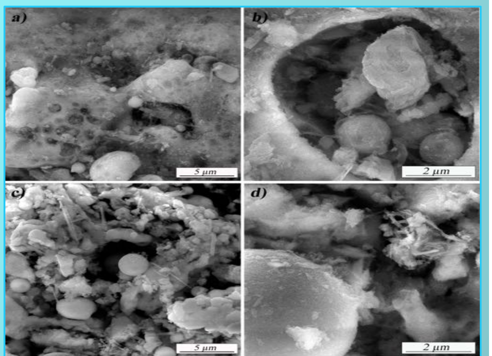


Fig. 3. SEM micrograph before (a) and (b) (FA), and after modification (c) and (d) (MFA)

C_i(As(V))=5 mg L^{-1}, pH_i = 7
q_e =35.40 mg g^{-1}

$\Delta G^o_{MFA/As(V)} < 0$
$\Delta H^o_{MFA/As(V)} > 0$

Kinetic data (MFA/As(V)) - pseudo-second-order equation and the Weber-Morris model

The results of flexural and tensile strength of studied construction material

Sample	Flexural strenght (MPa)	Compressive strenght (MPa)
1. CM-MFA	1.6	5.1
2. CM-MFA/As(V)	1.5	4.8

Results of TCLP testing of MFA/As(V) and CM-MFA/As(V)

Element	MFA/As(V)	CM-MFA/As(V)	Limited values
Sb	0.0099	0.0094	0.06
As	0.0687	0.0683	0.5
Cu	0.0835	0.449	2.0
Ba	0.434	0.3110	20
Zn	0.1930	0.0941	4.0
Cd	0.0072	0.0083	0.004
Cr	0.0150	0.0468	0.5
Ni	0.0594	0.0591	0.4
Pb	0.114	0.2019	0.5
Se	0.0159	0.0148	0.1

“two-in-one”-reuse fly ash

Acknowledgement
This work was supported by grants from the Ministry of Education, Science and Technological Development of the Republic of Serbia (TR34033 and III43009)

CarbonNextGen

Carbon Neutral Next Generation Wastewater Treatment Plants

KTH Kemiteknik

Duration: 07/2018-07/2020

Programme: Swedish Energy Agency and Re:source

Website: https://www.kth.se/ket/resource-recovery/aktiviteter-1.702492

Abstract

Socio-ecological sustainability is a key goal under SDGs for the 21st century and to accomplish it, transition into a circular economy, which includes waste minimisation through resource recovery, reuse and recycling but also waste to energy transformation, is imperative. Most EU countries are trying to increase the use of renewable feedstocks and organic waste through a transition into bio-based products, e.g. through the emissions trading system, policy objectives concerning energy security, stimulation of renewable transportation fuels at the EU level, and the CO2 pricing through tax or market mechanisms on fossil fuels to reach self-imposed Paris Agreement targets. Addressing this challenge demands the development of next generation carbon-neutral wastewater treatment (NGWT) technologies to turn these carbon-rich waste streams into new bio-based chemicals and materials instead of methane production.

The main purpose of the project is to develop and demonstrate a new approach in carbon neutral next generation wastewater concept. The overall aim of this project is to demonstrate a zero-waste strategy that turns two important municipal organic wastes into functional carbon sources, but also to develop new high-value products besides biofuel securing the optimal resource recovery of these organic wastes. This project will combine basic and applied approaches. The specific purpose to develop:

(1) Assessment of usage of short chain fatty acids (SCFAs) as carbon source in denitrification process,

(2) Production of polyhydroxyalkanoates (PHA), which is a main component of bioplastics, from SCFA-rich effluent stream by using semi-synthetic microbial community,

(3) Evaluation of the environmental sustainability of the entire processes and comparison to methane production.

By this way, this project will achieve a carbon neutral wastewater plants by closing loop.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Zeynep Cetecioglu-Gurol, Royal Institute of Technology-KTH

Carbon Neutral Next Generation Wastewater Treatment Plants

CarbonNextGen

Abstract

Socio-ecological sustainability is a key goal under SDGs for the 21st century and to accomplish it, transition into a circular economy, which includes waste minimisation through resource recovery, reuse and recycling but also waste to energy transformation, is imperative. Most EU countries are trying to increase the use of renewable feedstocks and organic waste through a transition into bio-based products, e.g. through the emissions trading system, policy objectives concerning energy security, stimulation of renewable transportation fuels at the EU level, and the CO2 pricing through tax or market mechanisms on fossil fuels to reach self-imposed Paris Agreement targets. Addressing this challenge demands the development of next generation carbon-neutral wastewater treatment (NGWT) technologies to turn these carbon-rich waste streams into new bio-based chemicals and materials instead of methane production.

The main purpose of the project is to develop and demonstrate a new approach in carbon neutral next generation wastewater concept. The overall aim of this project is to demonstrate a zero-waste strategy that turns two important municipal organic wastes into functional carbon sources, but also to develop new high-value products besides biofuel securing the optimal resource recovery of these organic wastes. This project will combine basic and applied approaches. The specific purpose to develop:

(1) Assessment of usage of short chain fatty acids (SCFAs) as carbon source in denitrification process,

(2) Production of polyhydroxyalkanoates (PHA), which is a main component of bioplastics, from SCFA-rich effluent stream by using semi-synthetic microbial community,

(3) Evaluation of the environmental sustainability of the entire processes and comparison to methane production.

By this way, this project will achieve a carbon neutral wastewater plants by closing loop.

Preliminary Lab-Scale Application

- Primary sewage sludge (PS) from Hammarby Sjöstadsverk
- Organic wastes (OW) from Himmerfjärden WWTP (SYVAB)
- OW consisted of alcohol and soda beverage, food, dairy, fruit, fat and oil wastes.
- Seed sludge is digested sludge taken from a full-scale anaerobic digestor (Henriksdal WWTP, Stockholm, Sweden)

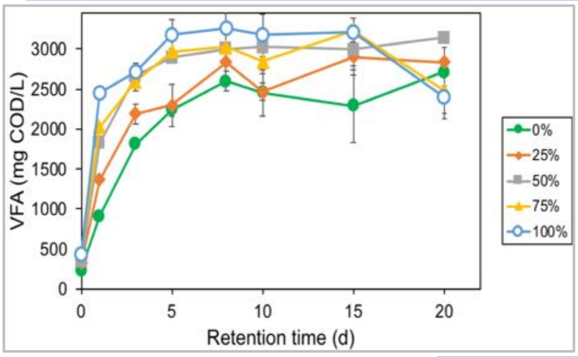
Parameters[a]	Primary sludge	Organic waste	Seed sludge
pH	5.9	4.1	7.0
TS	28.5±2.5	54.3±6.3	20.6±0.4
VS	25.2±2.2	47.8±6.2	13.4±0.1
Total COD	43.2±10	148.4±4.2	24.2±2.8
Soluble COD	2.2±0.1	77.2±11	1.6±0.01
Total VFA	0.76±0.1	2.39±0.1	0.26±0.01
Total Nitrogen	0.58	2.6	1.3±0.1

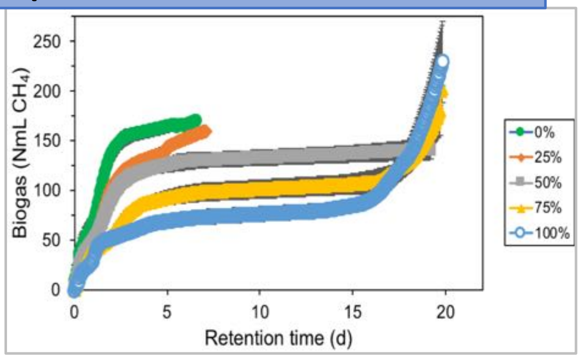
Experimental Design

- Co-digestion of PS and OW
- Initial total chemical oxygen demand (COD) of substrate each 15 g/L
- Volatile solid of seed sludge (inoculum) = 7.5 g/L
- Batch experiments were done in triplicate
- Temperature maintained at 37°C and pH 5 and 10
- Different PS:OW ratios in terms of COD

Description	Ratio (PS:OW)
Mono digestion of PS	1:0
Co-digestion	4:3
Co-digestion	1:1
Co-digestion	1:4
Mono digestion of FW	0:1

Results- pH5





0% - Only Sewage sludge
100%- Only organic waste

Contact Person: Zeynep Cetecioglu-Gurol
E-mail: zeynepcg@kth.se
Researchgate: https://www.researchgate.net/profile/Zeynep_Cetecioglu
Linkedin: https://www.linkedin.com/in/zeynep-cetecioglu-gurol-a2092247/
Twitter: @Bio_conversion

CITYFOOD

Smart integrated multitrophic city food production systems –a water and energy saving approach for global urbanisation

Duration: 05/2018-04/2021

Programme: SUGI-FWE Nexus (JPI Urban Europe)

Website: https://jpi-urbaneurope.eu/project/cityfood/

Abstract

Feeding rapidly growing urban populations is a global challenge, which strains the Food-Water-Energy Nexus through increasing water and energy demands and environmental pollution. CITYFOOD provides innovative solutions to this daunting environmental challenge by integrating aqua-agriculture (IAAC) systems into cities on a broader scale. IAAC multitrophic food production systems optimise flows of food, water, energy, and waste while minimising resource needs, thus contributing to sustainable urban infrastructure.

CITYFOOD's multidisciplinary experts from food science, ecology, modelling, and urban planning will expand the knowledge and applicability of this innovative solution. Computer models will help to optimise the environmental, economic, and social benefits of the IAAC technology. Real-world experiments in Living Labs will synthesise all three FWE sectors and illustrate the integrated system for multiple stakeholders. Urban planning approaches and sample case studies will help to develop comprehensive implementation strategies in a variety of urban contexts. Finally, existing knowledge and project results from modelling, Living Labs, and conceptual planning will be disseminated by different project activities and made publicly accessible through an integrated Knowledge Base.

CITYFOOD connects diverse countries and contexts, each with their own challenges, within the framework set by the Belmont Forum and European Union 2020 strategies for sustainable and resilient cities.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Gösta Baganz, IGB Berlin Germany
- Hendrik Monsees, IGB Berlin Germany
- Siv Lene Gangenes Skar, NIBIO, Norway

CITYFOOD

Project no. 730254

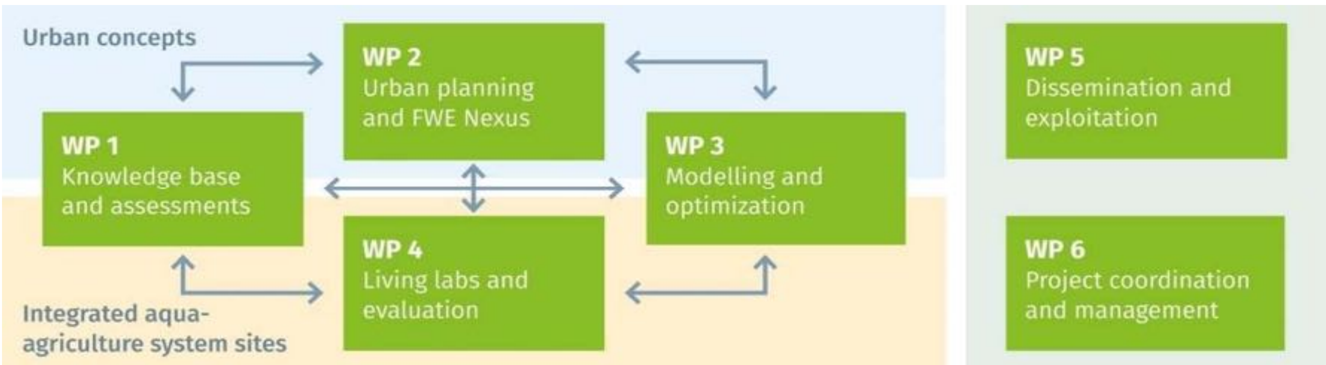
Smart integrated multitrophic city food production systems – a water and energy saving approach for global urbanisation

Leibniz-Institute of Freshwater Ecology and Inland Fisheries

CITYFOOD

General description
Feeding rapidly growing urban populations is a global challenge, which strains the Food-Water-Energy Nexus through increasing water and energy demands and environmental pollution. CITYFOOD provides innovative solutions to this daunting environmental challenge by integrating aqua-agriculture (IAAC) systems into urban areas.

- **Food**
  fish & plants, protein shift
- **Water**
  reuse, waste reduction
- **Energy**
  saving, urban ressources



IGB Leibniz-Institute of Freshwater Ecology and Inland Fisheries · NIBIO Norwegian Institute of Bioeconomy Research · Wageningen University & Research · unesp Universidade Estadual Paulista "Júlio de Mesquita Filho" · University of Gothenburg · University of Washington

Project Information
Duration: 2018 – 2021
Internet: cityfood.igb-berlin.de
Contact: Werner Kloas, Daniela Baganz
Budget: 1.876.956 (Requested funds in EUR)

Sustainable Urbanisation Global Initiative (SUGI) FOOD-WATER-ENERGY NEXUS · BELMONT FORUM · URBAN EUROPE · European Commission

CPUL City Actions

Continuous Productive Urban Landscape:

Designing urban agriculture for sustainable cities

Duration: since 1998, ongoing

Programme: -

Website: http://snua-book.com/wp/

Abstract

Context:

Since about 20 years, this project explores the role and value of urban agriculture and other urban food system components in urban design and architecture considering not only their spatial, but also their environmental and socio-economic effects. This work has seen a tremendous shift in interest, practice and policy over those years. Having started in the UK around the year 2000, initiatives (and initiative) have now spread widely in Europe.

Objectives:

The design concept *CPUL* and the *CPUL City Actions* enable a coherent discourse about integrating urban agriculture into cities – like a „second nature". The current objective is different from about 15 years ago when thinking and action around the themes of food and the city were still disconnected. Currently, CPUL-related work contributes to embedding food, urban agriculture and sustainable food system activities long-term into urban planning and support policy making to this effect.

Process:

In phase 1 (roughly 1998 – 2007), CPUL's main aim was to make a "case for urban agriculture" convincing various stakeholders that food must be an issue in the designing and planning of cities. In phase 2 (roughly 2008 – 2016), the concept was tested in various life projects, mainly in the UK and Germany. Since around 2017, the project has entered phase 3. Its accumulated theoretical knowledge and practical experience is now being employed by municipalities to explore actual food-related implementations.

Outcomes:

Urban agriculture, urban food, urban food system(s) have moved from a fringe interest to the centre of attention. *CPUL* has been at the forefront of this „movement" being used by different stakeholders in several countries and cited as influential by practitioners, activists, councillors, urban farmers and policy makers. Live and research projects have advanced from experimental to economically-viable, from domestic and neighbourhood scale to infrastructural and systemic.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Katrin Bohn, University of Brighton

CPUL City Actions

Continuous Productive Urban Landscape (CPUL): Designing urban agriculture for sustainable cities

Applying the CPUL Concept: Feasibility study for the Council of Middlesrbough, UK, testing the integration of (food-)productive urban landscapes, Bohn&Viljoen 2011

Context:

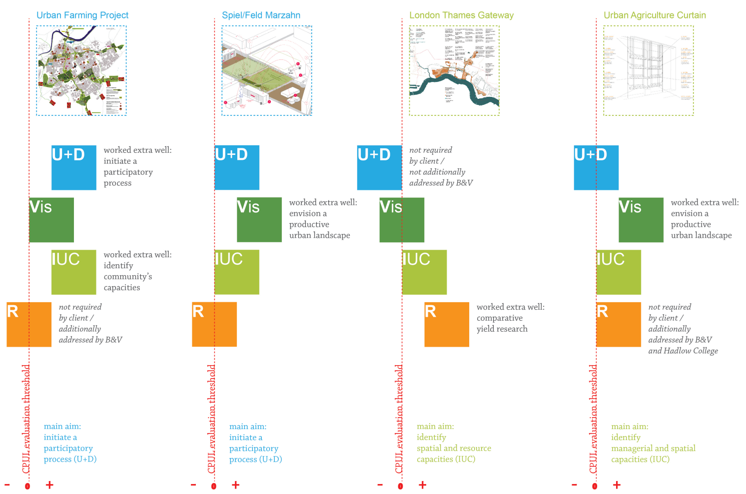
Since about 20 years, this project explores the role and value of urban agriculture and other urban food system components in urban design and architecture considering not only their spatial, but also their environmental and socio-economic effects. This work has seen a tremendous shift in interest, practice and policy over those years. Having started in the UK around the year 2000, initiatives (and initiative) have now spread widely in Europe.

Objectives:

The design concept CPUL and the CPUL City Actions enable a coherent discourse about integrating urban agriculture into cities – like a „second nature“. The current objective is different from about 15 years ago when thinking and action around the themes of food and the city were still disconnected. Currently, CPUL-related work contributes to embedding food, urban agriculture and sustainable food system activities long-term into urban planning and support policy making to this effect.

Process:

In phase 1 (roughly 1998 – 2007), CPUL's main aim was to make a "case for urban agriculture" convincing various stakeholders that food must be an issue in the designing and planning of cities. In phase 2 (roughly 2008 – 2016), the concept was tested in various life projects, mainly in the UK and Germany. Since around 2017, the project has entered phase 3. Its accumulated theoretical knowledge and practical experience is now being employed by municipalities to explore actual food-related implementations.



The CPUL City Actions: Visualisation of applying the CPUL City Actions toolkit in the assessment of urban agriculture projects, Bohn&ViljoenArchitects, 2014

Outcomes:

Urban agriculture, urban food, urban food system(s) have moved from a fringe interest to the centre of attention. CPUL has been at the forefront of this „movement“ being used by different stakeholders in several countries and cited as influencial by practitioners, activists, councillors, urban farmers and policy makers. Live and research projects have advanced from experimental to economically-viable, from domestic and neighbourhood scale to infrastructural and systemic.

Scale (e.g. supply chain level, stage, process, unit)	Timeframe	Assessment methodologies used (e.g. LCA, LCC, CBA etc.)	Key performance indicators considered					Identified barriers and drivers (type)	ICT solutions and tools	Citizens satisfaction & Engagement methodology
			Inventory based	Economic/Cost	Environmental	Social	Policy			
City-wide; Urban-rural nexus; Neighbour-hood; Domestic	1998 -	CPUL City Actions	X	x	X	X	x	t.b.a.	Websites; Mappings; Digital visuali-sations	Partici-patory design; Co-design; Lectures; Teaching, Exhibi-tions; Publica-tions; Live projects

London CPUL: Early visualisations (CPUL City Action „Visualising Change“) of what a (food-)productive landscape would be like, Bohn&Viljoen, 2002

prepared for:

COST EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Circular City circular-city.eu

prepared by:

University of Brighton

BOHNANDVILJOEN ARCHITECTS

Dynamic models for NBS

Quantitative evaluation of the socio-economic impact of NBS

Abstract

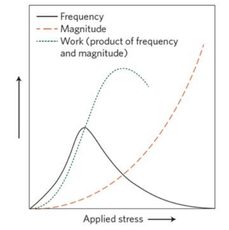
The net two-way interaction between man and the environment may yet be sustainable or unsustainable. A new model reproduces major features of nonlinear dynamic systems where feedbacks may cause divergence from equilibrium and shift. Specifically, the model reproduces the dynamics of wealth, population density and environmental resources.
Systems where environmental resources are steady and systems where humans use and replenish environmental pools of resources (in a predator-breeder-prey dynamics), both may evolve in time toward land abandonment or socio-ecological development. The initial conditions in the (*wealth, population density, environmental resources)* plane are either a prelude of a catastrophic shift or a sufficient starting condition for further development.
Neglecting the link between human development and environmental dynamics and assuming that anthropogenic environmental changes are negligible, underestimates the risk of a catastrophic shift of the whole system.
The main dependent variables represent the three dimension of sustainable development, and thus, the model which reproduces and forecasts their dynamics, provides quantitative design criteria for NBS and may be used to increase society awareness and orient political decision in unsteady scenarios.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Nadia Ursino, University of Padova, Italy (Urban hydrologist)

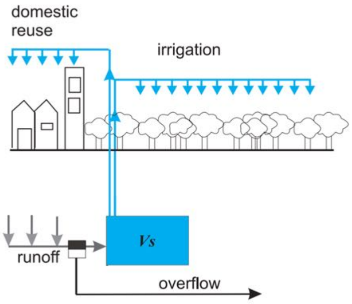
Quantitative evaluation of the socio-economic impact of NBS

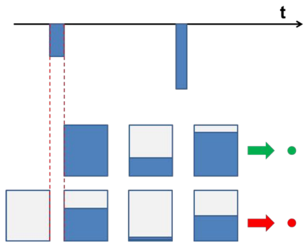
Nadia Ursino
University of Padova, Italy



The catastrophic impacts of humans thus tend to increase with time and concomitant increases in population

The net two-way interaction between man and the environment may yet be sustainable or unsustainable. A new model reproduces major features of nonlinear dynamic systems where feedbacks may cause divergence from equilibrium and catastrophic shift.





Probability analysis (PA) provides efficiency (*E*) and demand ratio (*DR*)of water harvesting systems and confirmes the existence of Low Deand Scenarios.

$$a = \frac{V_s \zeta}{\phi S}$$

$$b = \frac{\lambda V_s}{Q_0}$$

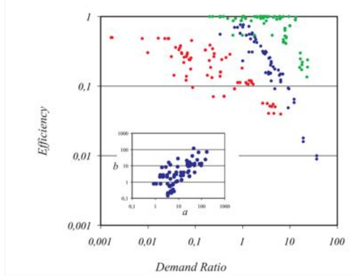
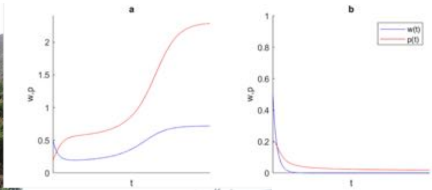
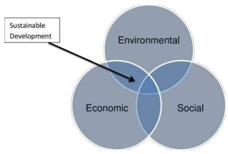


Figure 3. Efficiency vs- Demand Ratio. Blue: data taken from literature [14]. Red: Efficiency *E* and Demand Ratio *DR* are estimated under the most conservative assumptions. Green: Efficiency *E'* and Demand Ratio *DR'* are estimated under the least conservative assumptions. Inset: corresponding *a* and *b*, estimated from literature data.





Sytems where environmental resources are steady and systems where humans use and replenish environmental pools of resources (in a **predator-prey -breeder** dynamics), both may evolve in time toward land abandonment or socio-ecological development. The initial conditions in the (***wealth, population density, environmental resources***) plane are either a prelude of a catastrophic shift or a sufficient starting condition for further development.

Neglecting the link between human development and environmental dynamics and assuming that anthropogenic environmental changes are negligible, underestimates the risk of a catastrophic shift of the whole system.

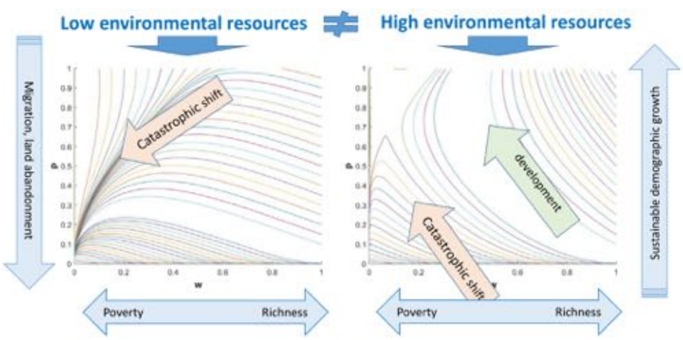
Dynamic models of socio-ecological systems predict catastrophic shifts following unsustainable development

Nadia Ursino
University of Padova, Dept. IMAGE, Italy

New interdisciplinary tools for sustainable development are expected to bridge across disciplines, to guide political decisions, and raise public awareness. A minimal socio-ecological model has been formulated to describe the co-evolution of economy, environment and society. The dynamics of wealth and population is simulated under two contrasting assumptions. The first is that the anthropogenic development produces negligible changes of the environmental conditions (blind land management). The second is that population and environmental resources change according to a predator/breeder-prey dynamic at comparable time scales (conscious land management). The model predicts catastrophic shift to migration and land abandonment or patterns of sustainable development, depending on the initial state of the socio-ecological system and investment in sustainable development actions. Man determines the fate of the system acting as predator or breeder of environmental resources. The evolution, fate and the risk of a catastrophic shift of the socio-ecological system are discussed.

- The link between socio-environmental dynamics and economic growth may be modelled.
- Dynamic models predict migration and land abandonment or sustainable development.
- Resources, politics and awareness affect socio-environmental dynamics.
- The system fate in the Anthropocene can be understood as prey-predator/breeder.
- The prey-predator/breeder model may aid decision making in favor of sustainability.

Abraha Atsbeha, Ethiopia



EdiCitNet

Integrating Edible City Solutions for social resilient and sustainably productive cities

Duration: 01/09/2018-30/08/2023

Programme: H2020: Smart and Sustainable Cities; Call topic: Nature-based solutions for inclusive urban regeneration;

Website (in elaboration): https://cordis.europa.eu/project/rcn/216082/factsheet/de

Abstract

The systemic use of urban landscapes for food production is a major step towards more sustainable, livable and healthier cities. A multitude of initiatives around the World, however fragmented, are prospering, forming a global movement of Edible Cities. Their products, activities and services – the Edible City Solutions (ECS) - empower local communities to overcome social problems by their inclusive and participatory dynamics and to create new green businesses and jobs, and thereby generating local economic growth and fostering social cohesion.

EdiCitNet will leverage the substantial benefits that ECS effect today at local level and catalyse their replication at the EU scale - and world-wide by launching a fully open and participatory network of cities, empowering their inhabitants by a common methodology:

a) to systematically explore the wealth and diversity of existing ECS,

b) to adapt, plan and implement successfully proven ECS in their specific urban context.

To make this happen, EdiCitNet will close knowledge gaps in the effective implementation of ECS and their transformation into sustainable, innovative business models. This new insight will feed into a openly shared and globally accessible knowledge base and methodology to enable sustainable and evidence-based integration of ECS into the long-term urban planning of cities covering a large spectrum of urban, climatic, social, environmental and cultural contexts. 5 Front Runner Cities (FRC), Rotterdam, Oslo, Andernach, Heidelberg and Havana, supported by a highly interdisciplinary consortium of city authorities, SME, NGOs and academia, will demonstrate their unique experience with own Living Labs and transfer their knowledge to 7 dedicated Follower Cities (FC), i.e., Berlin, Sant Feliu de Llobregat, Letchworth, Sempeter pri Gorici, Carthage, Lomé, Wenquan and Montevideo, determined to replicate ECS for the benefit of their inhabitants. The carefully selected group of FRC and FC allows to study and monitor implementation in large variety of environments and also ensures truly global outreach with city partners based in Central America, Africa and East Asia.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Nataša Atanasova University of Ljubljana
- Eric Mino, SEMIDE – EMWIS (Euro-Mediterranean Information System on know-how in the Water sector)
- Gianluigi Buttiglieri, Catalan Institute for Water Research - ICRA

Edible Cities Network: Integrating Edible City Solutions for socially resilient & sustainably productive cities

Edible Cities Network

Social cohesion and Climate resilience in Urban densed areas

EdiCitNet - 5 years H2020 project started on Sept. 2018 – 35 partners - 12.79 M€

We are „Demonstrating innovative nature-based solutions in cities for inclusive urban regeneration, addressing societal challenges such as mass urbanization, social inequality and climate change. "

PI Dr. Ina Säumel , HU Berlin - . EdiCitNet coordinator

5 EdiCitNet Front Runner Cities:

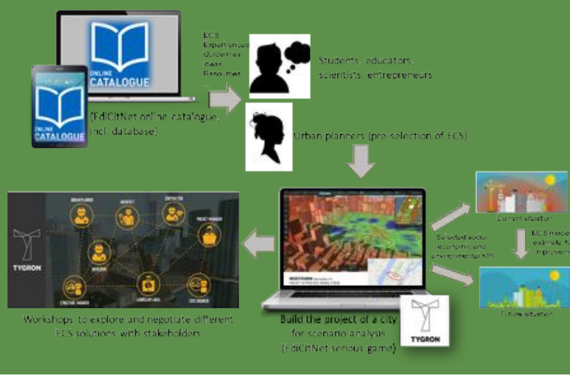
Rotterdam (Netherlands)
Andernach (Germany)
Oslo (Norway)
Havana (Cuba)
Heidelberg (Germany)

8 EdiCitNet Follower Cities:

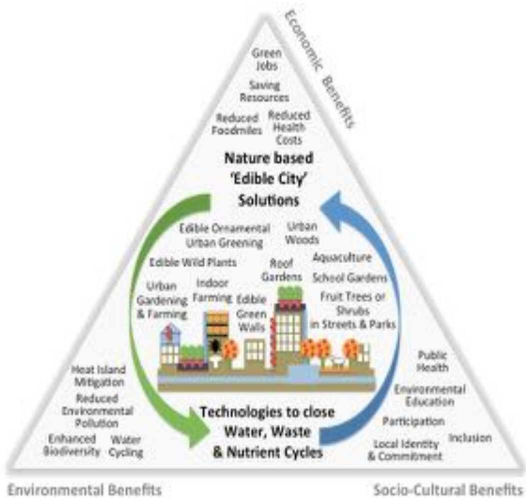
Berlin (Germany)
Sant de Feliu de Llobregat (Spain)
Sempeter pri Gorici (Slowenia)
Letchworth (UK)
Montevideo (Uruguay)
Carthage (Tunisia)
Lomé (Togo)
Suzhou (China)

Main Objectives

- Paradigm shift towards re-use oriented, cross-sectoral management of natural resources in cities,
- Social cohesion, to enhance human health and wellbeing,
- Improving overall ecosystem services,
- Growth in local green economy, creating new and sustainable businesses and jobs,
- Measurable and truly systemic improvement in participating Front Runner Cities and Follower Cities far beyond the consortium.



Living labs expected transformation



Edible City Solutions (ECS) for urban regeneration

Focus on urban productive landscapes including wide range of urban farming, building integrated farming, agro-forestry, aquaculture, biomass production for energy among other productive and ornamental purposes and services combined with closed loop systems for sustainable water, nutrient and waste management

ICRA Catalan Institute for Water Research

SEMIDE EMWIS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776665.

HUMBOLDT-UNIVERSITÄT ZU BERLIN

EmiSure

Nature-based solutions for micropollutant removal from municipal wastewater

Duration: 01/01/2017 – 31/06/2020

Programme: EmiSure Project (Interreg V A)

Website: http://www.interreg-gr.eu/wp-content/uploads/2018/12/EmiSûre_FR_Description.pdf

Abstract

The study focus consists in the development of soil-filter installations named Constructed Wetlands as tertiary treatment for micropollutant removal in medium-sized WWTPs on the Sure river. For this, 27 compounds have been selected taking into account those known to be excreted in the highest amount (in the case of pharmaceuticals: antibiotics, beta blocker, cytostatics etc), those known with the highest eco-toxicity (i.e. cytostatics), those known to be under observation (i.e. Glyphosate, Erythromycin) or with legal obligations (i.e. Diclofenac, Isoproturon, Diuron).

In the pilot scale, six planted (i.e. Phragmites australis and Iris pseudacorus) lysimeters have been fed with synthetic wastewater three times a day with a relaxation time of 7.5 hrs, resulting an hydraulic load of 100 L/m2d (lately increased to HL of 150 L/m2d. After reaching steady-state conditions, the downward wetlands were spiked with target micropollutants over five months. Removal rates of the individual compounds have been evaluated with respect to substrate and its physical parameters, together with operational conditions (i.e. hydraulic load, time of operation and treated wastewater). The established nitrification process and the acclimatization of bacteria has been observed by the measurement of macropollutants (i.e. NH4, TN, NO3) and consumed dissolve oxygen. Several removal mechanisms were detected (phytodegradation, biodegradation, sorption and photodegradation). Among all of these mechanisms, sorption seems to be the one with the biggest impact.

The most promising adsorbing materials will be performed in an intermediate test in the treatment plant of Reisdorf, Luxembourg (i.e. 4000 PE) in order to see the effect of real matrix.

The knowledge gained from these lab scale studies together will be then used to design and dimension a full scale wetland to be installed in the WWTP of Echternach, Luxembourg (i.e. 20000 PE) and subsequently for decision policy support in the Greater Region.

Contact person(s) at the EmiSure Project (Interreg V A):

- Joachim Hansen, Chair of Urban Water Management, University of Luxembourg, Luxembourg
- Hana Brunhoferova, Urban Water Management Group, University of Luxembourg, Luxembourg
- Silvia Venditti, Urban Water Management Group, University of Luxembourg, Luxembourg

Nature-based solutions for micropollutant removal from municipal wastewater

Joachim Hansen, Hana Brunhoferova, Silvia Venditti*

*Urban Water Management Group, Université du Luxembourg, Campus Kirchberg 6, rue Coudenhove-Kalergi, L-1359 Luxembourg

INTRODUCTION

Micropollutant compounds (namely pesticides, herbicides and pharmaceuticals) may constitute a danger towards water systems. These micropollutants in general originate from urban environments, arrive in the wastewater catchment and its connected treatment system and may finally reach the water bodies. Due to numerous investigations of the international scientific community, the European Commission decided to impose limitations on their discharged concentrations and just recently included 6 pharmaceuticals in a so called watch list (Commission Implementing decision (EU) 2015/495 of 20 March 2015).
Conventional wastewater treatment plants (WWTPs) are not designed for removing persistent micropollutants and thus they have to be upgraded with state of art technologies (Ozonation, UV irradiation, etc.). Vertical Flow Constructed Wetland could be potentially a good alternative for small and medium sized WWTPs. In this research 27 xenobiotics are undergoing an investigation towards their removal potential in wetland system environment. The goal of the project is to select the best substrate and then to transfer the result into the medium sized WWTP (4500 – 10 000 PE) on the Sure river, which is, due to its geographical position, a relevant border in-between Germany and Luxembourg.

CONTEXT

The EmiSure Project (Interreg V A) aims to develop suitable strategies to reduce the emission of micropollutants in the German-Luxembourgish watersystems.

Duration of the Project: 01/01/2017 – 31/06/2020

Partners of the Projects:

- ***Lead***: Syndicat Intercommunal de Dépollution des Eaux résiduaires du Nord (SIDEN), (GDL)
- Technische Universität Kaiserslautern (RLP)
- Universität Luxembourg (GDL)
- Syndicat Intercommunal de Dépollution des eaux résiduaires de l'Est (SIDEST) (GDL)
- Land Rheinland-Pfalz, vertreten durch das Ministerium für Umwelt, Landwirtschaft, Ernährung,Weinbau und Forsten (RLP)
- Ministère du Développement durable et des Infrastructures, Administration de la gestion de l'eau (GDL)
- Entsorgungsverband Saar (EVS) (SL)

Figure 1 – Geography of the Sure river

ORGANISATION BACKGROUND

The Urban Water Management Group at University of Luxembourg will be deeply active in the project bringing knowledge on the fate of micropollutants in urban cycle together with strong engineering process expertise's.

The used methodology aims to answer the questions:

- Is a wetland a suitable tertiary technology for the removal of micropollutants?
- How the design parameters influence its performance?

To this end the following steps have been foreseen:

- **Status-quo** analysis on micropollutant emissions in the River Sure as reference case for the Great Region.
- **LAB SCALE TESTS** (with synthetic wastewater)
  Design of lysimeters: dimension, hydraulic, type of soils and/or plants
  Evaluation of different soil filters in terms of micro-pollutants removal

  MAIN OUTPUT: Selection of the most promising adsorbing material in order to design full scale lysimeters to be installed in Reisdorf
- **FULL SCALE TESTS** (with real wastewater effluent)
  Installation and monitoring of lysimeters in Reisdorf
  Installation and monitoring of soil filter conteinairezed in Echternach

  MAIN OUTPUT: feasibility of soil filters for the removal of micropollutants, development of different scenarios to decrease emissions

METHODOLOGY

The **methodology** aims to select the best substrate (i.e. biocoal towards zeolite) in the removal of selected micropollutants spiked in synthetic wastewater by testing vertical-flow lab scale-wetlands (Figure 2). The lab scale-wetlands have been fed with synthetic wastewater three times a day with a relaxation time of 7.5 h, resulting in an hydraulic load of 100 L/m^{2}d. Each wetland is planted with plants well applied in common wetland configurations, *Phragmites australis* and *Iris pseudacorusm*, combining the benefit to have long and short routes respectively. To simulate photodegradation, UV lamps were installed to provide 8 hours per day of light (i.e. from 10 to 18 o'clock).

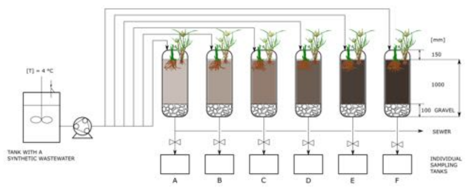


Figure 2 – Schematic of the EmiSure installation

Main substrates (i.e. biocoal and zeolite) were mixed with a sand that serves as support according to the following composition: Sand 100 % (Column A), Biocoal 30 % and Sand (Column B), Activated Biocoal 15 % and Sand (Column C), Activated Biocoal 30 % and Sand (Column D), Zeolite 15 % and Sand (Column E) and Zeolite 30 % and Sand (Column F). Micropollutants were chosen considering those known to be excreted in the highest amount (in the case of pharmaceuticals), with the highest eco-toxicity, under legal obligation, under observation or potentially present in the wastewater treatment plants discharging in the Sure river (Table 1).

Group	Substance	CAS number	Use	Chemical formula
Pharmaceuticals	Atenolol	29122-68-7	Beta Blocker	$C_{14}H_{22}N_2O_3$
	Bezafibrate	41859-67-0	Lipid regulator	$C_{19}H_{20}ClNO_4$
	Carbamazepine	298-46-4	Psychiatric drug	$C_{15}H_{12}N_2O$
	Clarythromycin	81103-11-9	Antibiotic	$C_{38}H_{69}NO_{13}$
	Ciprofloxacin	85721-33-1	Antibiotic	$C_{17}H_{18}FN_3O_3$
	Cyclophosphamide	50-18-0	Cytostatic	$C_7H_{15}Cl_2N_2O_2P$
	Diclofenac	15307-86-5	Anti inflammatory	$C_{14}H_{11}Cl_2NO_2$
	Erithromycin	114-07-8	Antibiotic	$C_{37}H_{67}NO_{13}$
	Ketoprofen	22071-15-4	Anti inflammatory	$C_{16}H_{14}O_3$
	Lidocaine	137-58-6	Anesthetic	$C_{14}H_{22}N_2O$
	Metoprolol	51384-51-1	Beta Blocker	$C_{15}H_{25}NO_3$
	Propanolol	525-66-6	Beta Blocker	$C_{16}H_{21}NO_2$
	N-acetyl sulfamethoxazole	21312-10-7	Metabolite of Sulfamethoxazole	$C_{12}H_{13}N_3O_4S$
	Sulfamethoxazole	723-46-6	Antibiotic	$C_{10}H_{11}N_3O_3S$
Pesticides/Herbicides	Carbendazim	10605-21-7	Fungicide	$C_9H_9N_3O_2$
	Deet	134-62-3	Insect repellent	$C_{12}H_{17}NO$
	Diuron	330-54-1	Herbicide	$C_9H_{10}Cl_2N_2O$
	Isoproturon	34123-59-6	Herbicide	$C_{12}H_{18}N_2O$
	Terbutryn	886-50-0	Herbicide	$C_{10}H_{19}N_5S$
	Mecoprop	7085-19-0	Herbicide	$C_{10}H_{11}ClO_3$
	Tolyltriazole	29385-43-1	Fertilizer	$C_7H_7N_3$
	Glyphosate	1071-83-6	Herbicide	C3H8NO5P
	AMPA (Aminomethylphosphonic acid)	1066-51-9	Primary degradation product of Glyphosate	CH_6NO_3P
Fluorosurfactants	Perfluorooctanesulfonic acid (PFOS)	1763-23-1	Surfactant	$C_8HF_{17}O_3S$
	Perfluorooctanoic acid (PFOA)	335-67-1	Surfactant	$C_8HF_{15}O_2$
Corrosion inhibitor	Benzotriazole	95-14-7	Corrosion inhibitor/Antiviral	$C_6H_5N_3$
Flame retardant	Tris(2-chloroisopropyl)phosphate	13674-84-5	Flame retardant	$C_6H_{12}Cl_3O_4P$

Table 1 – Tested micropollutants

RESULTS AND CONCLUSIONS

With the operation of the vertical-flow lab scale-wetlands the following preliminary conclusions were stated:

- Stable conditions and a good quality of the effluents were observed almost independently from the substrate used.
- All the substrates performed well in the removal of the COD while saturation of TN was reached after 112 days of operation (results not disclosed).
- TP is well removed with the only exception of biocoal. Activated biocoal performs good because the activation is executed by fermentation, thus bacteria may use the TP present in the biocoal as substrate for their growth.
- During the first 130 days of spike, most of micropollutants were eliminated with high removal rates independently from the substrate demonstrating that sorption mechanism is dominant at this stage of the test.
- Sand, activated biocoal and zeolite seem to be finally the most promising substrate to use for the following full scale test.

References

Lessons learned from European Experiences and presentation of case studies"(15 pages) In "Hospital wastewater: Characteristics, Management, Treatment and Environmental risks", Editor: P. Verlicchi, The Handbook of Environmental Chemistry, 60, Springer 2017

Barraud, O., Tchuinte; Thibault Stalder, PhD; Silvia Venditti, PhD; Antoinette Ngandjio, PhD; Christophe Dagot, PhD; Marie-Cécile Ploy, PharmD, PhD; Characterization of class 3 integrons with oxacillinase gene cassettes in hospital sewage and sludge samples from France and Luxembourg. International Journal of Antimicrobial Agents (2016).

Klepiszewski, K., Venditti, S., Köhler, C.,Tracer tests and uncertainty propagation to design monitoring setups in view of pharmaceutical mass flow analyses in sewer systems. Water Research (April, 2016).

Patent: System for removing micropollutants from wastewater: the device itself and the associated methods for wastewater treatment. Europe Lu92857, Filed October 22, 2015.

ESTIMUM

Ecosystem Service Toolbox developed from multi-scale Integrated Modelling of Urban Metabolism

Duration: 01/2017-12/2020

Programme: Grant agreement ID: C16/SR/11311935

- FNR CORE 2016 (https://www.fnr.lu/funding-instruments/core/)
- Domain of application: Sustainable Resource Management in Luxembourg
- Thematic research priority: Spatial and Urban Development

Website: https://www.list.lu/en/research/project/estimum/

Abstract

While no consensus exists on best practices for urban metabolism (UM) sustainability assessment, urban designers, planners and policy makers need more understanding and support instruments to predict changes in cities and implement the most effective and sustainable solutions to improve the welfare of citizens. To address this gap, ESTIMUM aims to develop an integrated spatially-explicit operational tool for simulating the value change (both monetary and physical) of ecosystem services over time at multiple urban scales, which runs on different scenarios of urban metabolism and implementation of nature-based solutions in cities. Such a tool is built using a System Dynamics rationale, and is suited to characterise the complex relationships between biosphere and technosphere components in urban regions (assumed to represent dynamic UM patterns). While the former are components of urban ecosystems (stocks and flows of biotic and abiotic elements, semi-natural systems and areas, etc.), the latter are stocks and flows of infrastructure and commodities (goods and services produced, transformed and consumed in the city), mainly associated with life cycle product and input-output economic sectorial datasets. Such an integrated structure is created to provide a complete windows on the intra- and inter-linkages among the components of a city (both man-made and natural ones), disclosing metabolic pathways and allowing to trace the inputs and outputs of the urban system in relation with the surrounding environment, at multiple scales (city > region > country > Earth).

The main output of ESTIMUM will be a toolbox for the valuation of ecosystem service trade-offs (e.g. air purification, noise reduction, urban cooling, runoff mitigation, food provision) in urban regions, called MIMES-TUM: Multiscale Integrated Model of Ecosystem Services Tailored for Urban Metabolism. This would become an instrument for scenario analysis of urban metabolism able to forecast the environmental, physical and socio-economic benefits and costs of solutions to enhance the supply of ecosystem services in cities. Three cities are put forward to test the robustness of MIMES-TUM and its relevance for Luxembourg, which is considered a showcase for Europe: namely, Esch-sur-Alzette (located in the South of Luxembourg) is taken as a demonstrator and compared with Lisbon (Portugal) and Siena (Italy). Hence, different strategies of urban metabolism (in terms of production/consumption of goods and services in the city, which link to environmental and socio-economic impact pathways) and urban land uses can be assessed. Because the proposed simulation framework evaluates changes in urban ecosystem service trends over time and different uses of land, a special focus is on improving the urban biodiversity and management of green spaces, while at the same time fostering the implementation of nature-based solutions in the cities.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Benedetto Rugani & Javier Babí Almenar, LIST, Luxembourg

TÉCNICO LISBOA

INDACO2 INDicators, Assessments and CO_2

AFORDable Futures LLC

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY LIST

ESTIMUM

Ecosystem Service Toolbox developed from multi-scale Integrated Modelling of Urban Metabolism

Rationale

While no consensus exists on best **practices for urban metabolism (UM) sustainability assessment**, urban designers, planners and policy makers need **more understanding and support instruments to predict changes in cities** and implement the most effective and **sustainable solutions to improve the welfare of citizens**

Objectives

✓ to develop a novel methodological approach for setting up an **integrated spatially-explicit operational tool** for simulating the value change (both monetary and physical) of **ecosystem services over time at multiple urban scales**

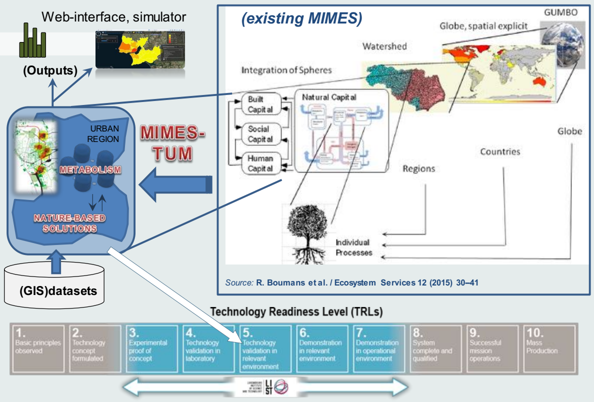
✓ to implement **scenarios of UM and implementation of nature-based solutions for 3 European cities**, offering a toolbox for the valuation of ecosystem service trade-offs (e.g. air purification, noise reduction, urban cooling, runoff mitigation, food provision) in urban regions, called **MIMES-TUM: Multiscale Integrated Model of Ecosystem Services Tailored for Urban Metabolism**

Innovation

✓ MIMES-TUM, embedded in iGuess® 3.0, is built using a **System Dynamics** rationale, and is suited to characterise the **complex relationships between biosphere and technosphere** components in urban regions (assumed to represent dynamic UM patterns)

✓ MIMES-TUM will be validated in test-bed conditions by **urban planners** and **decision-makers in Luxembourg and outside**; more than 10 different stakeholders, among which **key-players and managers in urban metabolism**, **ecosystem services and sustainable urban planning** feed the model with expert inputs

Interoperable Smart City and Region architecture based on the iGuess software framework (left);
Web interface prototype of the Smart City and Region Urban Metabolism Platform (right)



www.list.lu/en/research/project/estimum/

Jan'17 ➔ Dec'19

Luxembourg National Research Fund

FNR CORE 2016
(C16/SR/11311935)

Impact

✓ ESTIMUM offers an **unprecedented monitoring, simulation and management tool** to support sustainable urban planning policies through prospective assessments and trade-offs analyses

✓ **Urban planners from Esch-sur-Alzette, Siena and Lisbon**, as project stakeholders collaborating in the MIMES-TUM development, will receive a free licence for using a beta-version of the toolbox to support their decision-making process over the near future

✓ ESTIMUM contributes to **meeting national research and policy targets** oriented towards a conceptual construction, organisation and practical use of urban space and the enhancement of quality of life , fostering the **long-term socio-economic and environmental development in Luxembourg** and in the other pilot cities through the use of green urban space and infrastructure

Luxembourg Institute of Science and Technology

5, avenue des Hauts-Fourneaux
L-4362 Esch/Alzette

phone: (+352) 275 888 - 1
fax: (+352) 275 885

Contact: Benedetto Rugani (PI)
benedetto.rugani@list.lu
LIST.lu

Consortium:
- Luxembourg Institute of Science and Technology (LU)_contracting partner
- Instituto Superior Técnico Lisboa (PT)_non-contracting partner
- INDACO2 s.r.l. (IT)_sub-contracting partner
- AFORDable Futures LLC (USA)_sub-contracting partner
- >10 experts from partner cities and the scientific community_advisory board

FramWat

Framework for improving water balance and nutrient mitigation by applying small water retention measures

Duration: 07/2017 - 06/2020

Programme: Interreg CENTRAL EUROPE

Website: https://www.interreg-central.eu/Content.Node/FramWat.html

Abstract

The good ecological status of surface water in EU in 2015 has improved by 10 % since 2009. However, there is still a lot of work to be done in order to achieve a better status of fauna and flora, as well as favourable hydrological and chemical characteristics. Various types of measures listed under the name Natural (Small) Water Retention Measures (N(S)WRM) can have significant positive effects on solving environmental problems such as hydrological extremes, nutrients' transport and decreased biodiversity. FramWat will follow on previous developments in identifying new, innovative solutions in a systematic way and since the management of rivers do not observe national boundaries, a collective response and transnational integrated approach is needed.

Firstly, a valorisation method will be developed for identifying locations in a river basin where N(S)WRM are needed. It will be based on multi-criteria analysis of topographic, hydrological, meteorological and economic data. A GIS software will be used, which will enable the users to populate it with their data and after calculations, will review the resulting maps and statistics.

Secondly, innovative methods and tools (e.g. decision support system) will be developed for river basin authorities to evaluate the cumulative effectiveness of the system of N(S)WRM at river basin scale, as they influence processes in a synergic way.

The final step will be a preparation of Guidelines which will provide decision makers with policy options and cost analysis for implementation of N(S)WRMs. FramWat will support bottom up dialogue with all stakeholders and look for the positive implementation of solutions that mitigate negative effects of floods and droughts and prevent water pollution to preserve natural heritage in Central Europe. The development of systematic approach trough transnational cooperation will strengthen the N(S)WRM planning process and serve as an instrument to fulfil the WFD obligations (3rd RBMP).

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Sabina Bokal, Global Water Partnership CEE, (project partner and WP leader)

Global Water Partnership
Central and Eastern Europe

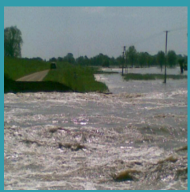
SMALL RETENTION - BIG DEAL

Towards Integrated Water Resource Management

The Global Water Partnership's vision is for a water secure world. Our mission is to support the sustainable development and management of water resources at all levels. Integrated approach to managing the world's water resources is the best way to pursue this vision.

Human activities and climate change have caused an increase in the frequency of extreme climate events, including floods and droughts. At the same time, there is a clear need to mitigates the negative impacts of fluctuating water availability on human economic activities and the environment.

Too much **Too little** **Too dirty**



Benefits of Small Water Retention Measures

RETENTION CAPACITY: Improving the natural retention capacity with green infrastructure will contribute to an increased water that can be naturally stored in the environment, and used for alimentation of water courses during droughts as well the water retention capacity of a catchment which can accelerate water runoff from the catchment.

CONSERVATION OF THE ECOSYSTEM: Satisfying the needs of water dependent forest and swamp ecosystems, as well as the improvement of the state of environment as a result of elevation of groundwater tables.

IMPROVEMENT OF BIODIVERSITY: improvement of biodiversity of agricultural landscape by the restoration of wetlands, small ponds, creation of natural aquatic fauna and flora enclaves, creation of human friendly micro climate.

IMPROVEMENT OF THE QUANTITATIVE STATUS OF GROUNDWATER: Increase of groundwater aquifers alimentation causes the increase of groundwater resources.

IMPROVEMENT OF WATER QUALITY: Protection of surface water quality, retention of suspended matter, cleaning of rainwater from nutrients (nitrogen and phosphorous), in particularly from diffuse pollution.

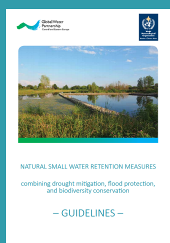
ECONOMIC ASPECT: for example, water reservoirs can be used as water intakes for firefighters, bathing resorts, fish ponds and water intakes for irrigation or watering holes for wild animals.

Integrated Drought Managment Programme in Central and Eastern Europe

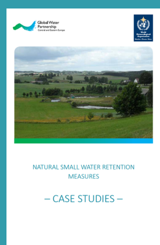
Integrated Drought Management Programme

Main outcomes of IDMP's demonstration project on Natural Small Water Retention Measures

Tools for planning and assessing the different types of NSWRMs



Collection of best practices, experiences and lessons learnt from the region



Attractive products to increase the understanding of NSWRMs

Since 2013, Global Water Partnership Central and Eastern Europe (GWP CEE) implements Integrated Drought Management Programme (IDMP CEE); a regional programme of the global IDMP coordinated jointly by World Metrological Organisation (WMO) and the Global Water Partnership (GWP).

The main focus of the IDMP CEE is improved preparedness for drought risk management and enhanced cooperation of key actors (operational services, decision making institutions, end users) on national and regional level for integrated drought management approach.

NWRMs can improve the water holding potential of landscapes and increase resilience against the effects of climate change. Floodwater, for example, stored by NSWRMs is an important source of water for ecosystems, agriculture and forestry during drought in river basins.

FramWat project

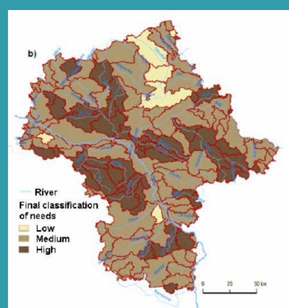
Interreg CENTRAL EUROPE
FramWat

The FramWat project aims to strengthen the common regional framework for flood, drought and pollution mitigation by increasing the buffer capacity of the landscape. This will be done by the systematic use of natural (small) water retention measures (N[S]WRM). Partners will develop methods that translate existing knowledge about the N(S)WRM approach into river basin management practice.

This will result in improved water balance, decreased sediment transport and enhanced nutrient re-circulation. The project will provide decision makers with appropriate tools for incorporating N(S)WRM into the next cycle of river basin management plans (RBMPs). It will also promote and offer guidance on the horizontal integration of different planning frameworks.

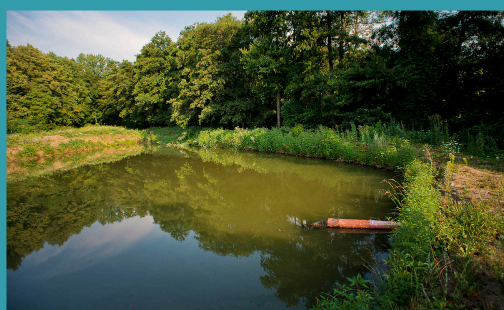
Main outputs of FramWat project

- GIS tool for the identification of areas, which are most suitable for the NSWRMs.
- Guidelines on how to assess the effectiveness of the system of measures in the river basin.
- Guidelines to improve water balance and nutrient mitigation by applying system of N(S)WRMs with Action Plans for selected river basins



Source: Tyszewski et al. 2008





Lucerne University of Applied Sciences and Arts
HOCHSCHULE LUZERN
Technik & Architektur

Forces on overgrown rope facades

Forces in overgrown rope facades and structures - experimental investigation and development of a load model and design concept

Duration: 04/2016-12/2021

Programme: Innosuisse

Website: https://www.hslu.ch/de-ch/hochschule-luzern/forschung/projekte/detail/?pid=3507

Abstract

The aim of the research project is to analyse forces in overgrown rope facades and structures due to wind, snow, plant weight and plant growth using a specially constructed test stand (see fig. 1). A load model and design concept is developed from the collected data. With this concept, the cables, the anchoring and the building structure can then be dimensioned in the projection of greened rope facades.

Figure 1: Test stand for overgrown rope facades

The wind forces on a building are measured at the maximum wind speed that occurs once every 50 years. The probability is small that this wind speed will occur once during the test period. Therefore, it is not possible to determine the wind forces at the test stand. In the master thesis of Kilian Arnold first tests were carried out to determine the wind load on overgrown rope facades in a wind tunnel. The results of this study are very promising and further wind tunnel experiments on other plants of overgrown rope facades are planned in 2020.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Kilian Arnold, Hochschule Luzern, Switzerland

Wind forces on overgrown rope facades

MSc. Kilian Arnold (kilian.arnold@hslu.ch)

Institute of Civil Engineering, CC Building Envelope

Lucerne University of Applied Sciences and Arts
HOCHSCHULE LUZERN
Engineering and Architecture

Problem statement

In order to increase greenery in cities, the greening of building surfaces is an obvious option. The greening of facades saves surface and reduces the energy demand of buildings. However, the implementation raises some questions, such as the handling of wind loads.

Procedure Methodology

In this work, the flow resistances of five typical plants from soil-bound vegetation variants for overgrown rope facades were measured and statistically evaluated in a turbulent wind tunnel . For this purpose, a prototype of a turbulent wind tunnel (see Fig 1-3) was developed, which simulates the gusts of the natural wind flow.

Result

The forces at the maximum speeds of the gust are decisive. Therefore the wind load determinations for plants must be carried out in a turbulent wind tunnel. The statistical 95% fractile value is formed from the measured forces and robustly extrapolated to prevailing maximum speeds according to the Swiss standard SIA (see diagram 1&2). The extrapolated curves are converted from speed to dynamic pressure (see diagram 3). In the wind load calculation according to SIA 261, the wind loads can be then calculated with the aid of the adapted formula 1. The drag coefficient for this calculation can be taken from diagram 3.

$$F_w = \eta_d \cdot c_w \cdot A \cdot q_p$$

Formula 1: The flow resistance calculation formula $F_w=c_w \cdot A \cdot \rho \cdot v^2/2$ is converted to dynamic pressure by $v^2=2 \cdot q_p/\rho$ and adapted with the conversion factor η_d for the vegetation intensity.

The results in Diagram 1&2 follow the differential equation according to Formula 2. Formula 2 is derived and verified on the basis of the measurements. The parabolic course of the curves in Diagram 1&2 is verified using the measurement results and the differential equation.

$$F_w = F'_w \cdot \frac{e}{4} \cdot \hat{v}$$

Formula 2: Differential equation derived from the measurements.

A first approach to a relationship is derived from the experimental results and the equation in formula 3. If formula 3 can be validated, the forces may be calculated without measurements on the basis of the characteristic length L_c. Possible characteristic length see in fig. 4.

$$F_w = e \cdot \hat{v} \cdot \left(\frac{\hat{v}}{L_c} + 1 \right)$$

Formula 3: Approach of a new equation for wind load determination by implementing the characteristic length L_c.

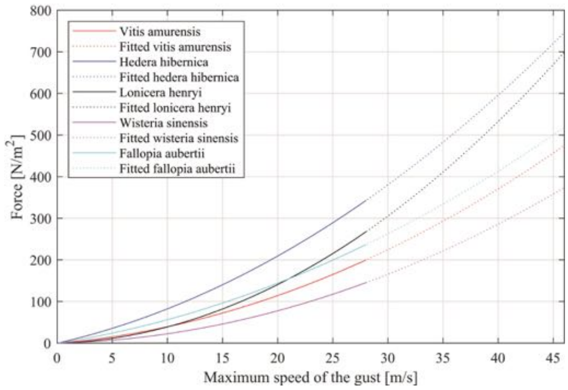


Diagram 1: Wind forces in turbulent air flow

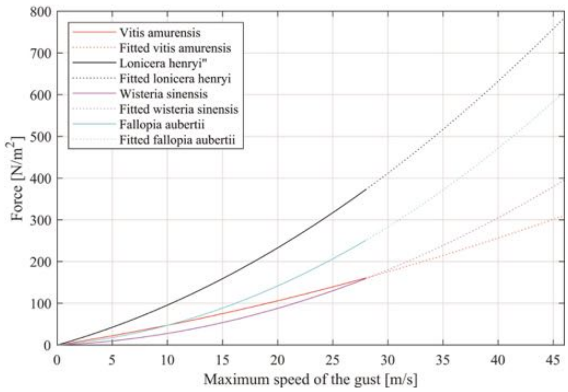


Diagram 2: Wind forces in the turbulent rainy air flow

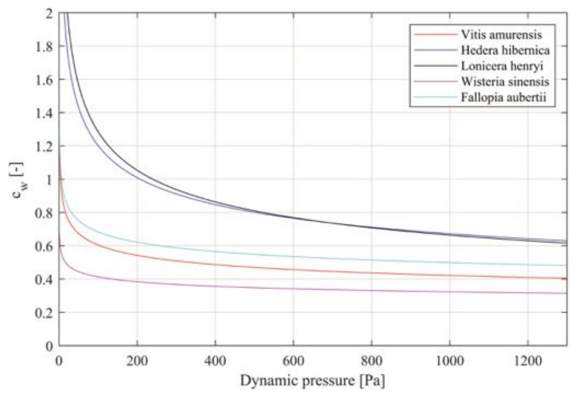


Diagram 3: Drag coefficients as a function of dynamic pressure

Outlook

The approach to this relationship will be checked on other plant types of overgrown rope facades through further wind tunnel experiments in 2020. If the experiments of this connection are successful, the wind forces for all plants of overgrown rope facades can be determined by measuring the characteristic length L_c. The construction for the climbing plants can be dimensioned on the basis of the determined wind loads.

Fig. 1: Plant wisteria sinensis in the wind tunnel: left at 0 m/s, middle and right at 27 m/s maximum speed of the gust.

Fig. 2: Turbulence generation through a uniaxially rotating active grid.

Fig. 3: First prototype of a fully turbulent wind tunnel at the Lucerne University of Applied Sciences and Arts.

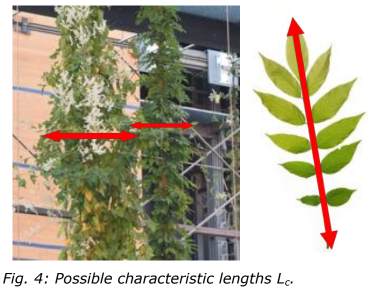


Fig. 4: Possible characteristic lengths L_c.

GEOFOOD

Geothermal energy for circular food production

Duration: 05/2018-04/2021

Programme: Geothermica Project no. 170169-44011

Website: https://geofoodproject.eu

Abstract

The GEOFOOD project showcases the opportunities of direct use of geothermal energy to increase food production in highly productive circular systems. A research plant in the Netherlands and a demonstration plant in Iceland will be built and run during the project period. These plants will be used to validate mathematical models which will predict the best combinations of steps in a thermal treatment train depending on climatic conditions. The model will also be used to design systems using geothermal heat in Slovenia. Also, in close collaboration between the multidisciplinary consortium members, knowledge sharing and B2B activities will be done to foster the inclusion of the GEOFOOD technology to existing and upcoming geothermal heat installations. The GEOFOOD consortium will also put emphasis on dissemination of the results focusing on geothermal areas in Europe and worldwide. The dissemination and communication will cover technological, economic and social aspects of the sustainable models developed in GEOFOOD.

The objectives and challenges are to:

1) Generate predictive models to design thermal treatment trains based on circular food production systems to maximize heat extraction from geothermal heat installations.

2) Design, build and run a research plant and a demonstration plant, in the Netherlands and Iceland respectively, which will use existing low temperature (<150°C at 1 km depth in Iceland / <80°C at about 2 km depth in The Netherlands) geothermal energy wells for innovative heat extraction using circular food production.

3) Provide a demonstration design of geothermal energy use for future food production in Slovenia.

4) Optimize key processes of the respective plants, including energy storage, heating and cooling cycles, in order to achieve a more efficient use of energy through the year.

5) Close the nutrient and water cycles within the systems.

6) Disseminate the results to other geothermal areas in Europe and worldwide as a way to foster the adoption of the technology.

Contact persons at the COST Action CA17133 Workshop Vienna:

- Ragnheidur Thorarinsdottir, Samraekt, Iceland, Coordinator
- Maja Turnsek, University of Maribor, Slovenia

GEOFOOD

GEOTHERMICA PROJECT NO. 170169-44011

Geothermal energy for circular food production

The GEOFOOD project showcases the opportunities of direct use of geothermal energy to increase food production in highly productive circular systems. A research plant in the Netherlands and a demonstration plant in Iceland will be built and run during the project period. These plants will be used to validate mathematical models which will predict the best combinations of steps in a thermal treatment train depending on climatic conditions. Also, in close collaboration between the multidisciplinary consortium members, knowledge sharing and B2B activities will be done to foster the inclusion of the GEOFOOD technology to existing and upcoming geothermal heat installations. The dissemination and communication will cover technological, economic and social aspects of the sustainable models developed in GEOFOOD.

The objectives and challenges

1) Generate predictive models to design thermal treatment trains based on circular food production systems to maximize heat extraction from geothermal heat installations.

2) Design, build and run a research plant and a demonstration plant, in the Netherlands and Iceland respectively, which will use existing low temperature (<150° C at 1 km depth in Iceland / <80°C at about 2 km depth in The Netherlands) geothermal energy wells for innovative heat extraction using circular food production.

3) Provide a demonstration design of geothermal energy use for future food production in Slovenia.

4) Optimize key processes of the respective plants, including energy storage, heating and cooling cycles, in order to achieve a more efficient use of energy through the year.

5) Close the nutrient and water cycles within the systems.

6) Disseminate the results to other geothermal areas in Europe and worldwide as a way to foster the adoption of the technology.

Acknowledgement

The Geofood project is supported through the ERANET Cofund GEOTHERMICA project (Project no. 731117), from the the European Commission, The Research Council in Iceland (Rannis), Netherlands Enterprise Agency (RVO) and the Ministry of Infrastructure in Slovenia. The consortium partners include Wageningen University & Research, LandIng Aquaculture, Ammerlaan (Netherlands), University of Iceland, Samraekt (Iceland), University of Maribor and the Municipality of Brezice (Slovenia).

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA INFRASTRUKTURO

OBČINA BREŽICE

Univerza v Mariboru

Rijksdienst voor Ondernemend Nederland

LandIngAquaculture

WAGENINGEN UNIVERSITY & RESEARCH

Ammerlaan The Green Innovator

Co-funded by the European Union

GEOTHERMICA

rannís

SAMRÆKT

www.geofoodproject.eu

Green Cadaster

RFQ 23/2018 for Inventorization of Trees as part of the Skopje Green Cadaster – Phase II

Град Скопје

Duration: 09/2018-12/2018

Programme: "ICT for urban resilience"

Website: http://gis.skopje.gov.mk/zk/

Abstract

In the last two years, UNDP and the City of Skopje are implementing the project: "ICT for urban resilience". The main project objective is to build disaster and climate resilience by increasing institutional capacity, mobilizing knowledge and transferring appropriate best practice Innovation technologies. Within this project, Skopje Green Cadaster was established, as one of the instruments for improvement of the public greenery management practices, and ultimately as shall contribution to the urban resilience of the City of Skopje.

The objective of this assignment is to carry out an inventorization of 20,000 trees on selected territory of the City of Skopje within the Skopje Green Cadaster, by entering the attributes for each of the registered tree.
During the implementation of the assignment, the Contractor will closely cooperate and coordinate with UNDP (Project Manager) and the representatives from the City of Skopje (Environment Department, ICT Department, as well as PE Parkovi and Zelenilo).

With qualitative analysis of the data, as well as the experience from the field, the future barriers and challenges of the urban greenery were identified and determined. The collected data can be used in the further analysis and research regarding the beneficiaries and best practice nature-based solutions related to the urban greenery for better future of Skopje.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Vladimir Stojanovski, Project Coordinator, PhD Student.
- Ivan Minchev, Faculty of Forestry in Skopje, Ss Cyril and Methodius University in Skopje (Department for Soil and Water), Macedonia
- Bojan Simovski, Faculty of Forestry in Skopje, Ss Cyril and Methodius University in Skopje, (Department of Botany and Dendrology), Macedonia
- Blagij Nikolov, Master Student at Faculty of Forestry in Skopje, Ss Cyril and Methodius University in Skopje, Macedonia.

Project: RFQ 23/2018 Skopje Green Cadaster – Phase II – Tree Inventory

Stojanovski, V., Simovski, B., Minchev, I., Nikolov, B.,

Град Скопје

Introduction

Role of Urban Greenery (UG)

- The impact of UG on human health and the welfare of society,
- Creating a microclimate (shade, shadow),
- Increasing relative humidity,
- Reduction of T and wind speed,
- Filtration of dust particles and aerosols,
- Reduce noise,
- UG and water absorption,
- Heat islands and UG,
- Planned deployment energy saving 20-50%.

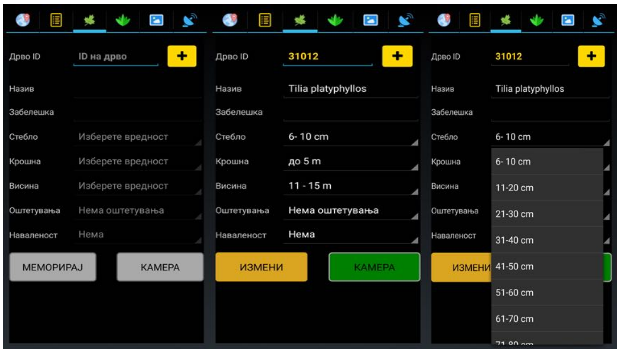
Methods

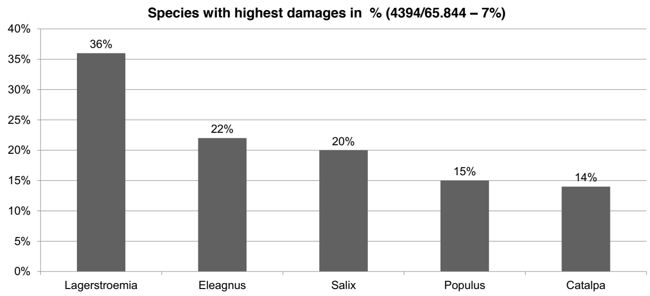
- Period October – November 2018,
- 7 teams (3x2 и 4x1),
- Application on smart phones,
- IT sector city of Skopje,
- Weather conditions,
- Control,
- Location 10/11 Municipalities in Skopje,
- UG under jurisdiction of city of Skopje,
- Necessary pre-knowledge
- ~170 species.

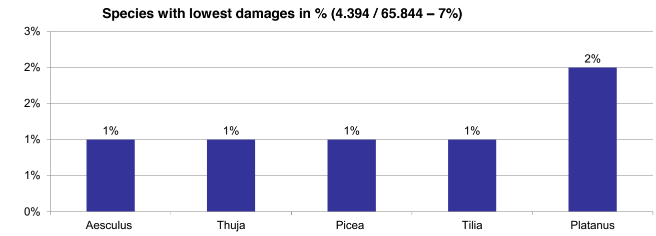
Conclusions

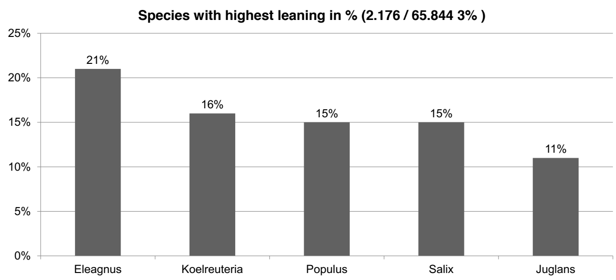
- Green Cadaster posses big potential of opportunities
- Biodiversity
  - Wide range of species
  - Invasive, allergens
- Species selection
  - Location
  - Purpose
- Ecological adaptability
  - Synchronization
  - Harmonization
- Other possibilities – citizens and city needs

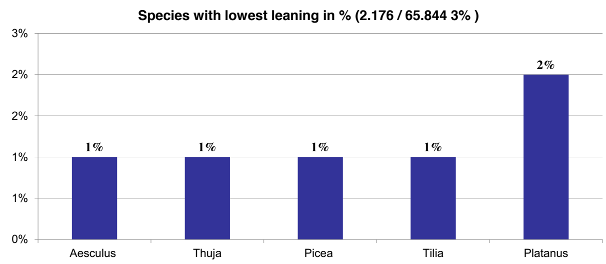
Results











Green INSTRUCT

GREEN INTEGRATED STRUCTURAL ELEMENTS FOR RETROFITTING AND NEW CONSTRUCTION OF BUILDINGS

Duration: Start 9/2016, duration 42 month

Programme: HORIZON2020 EEB-04-2016

Grant Agreement Number: 723825

Website: www.greeninstruct.eu

Abstract

Plants have numerous positive effects on humans and urban microclimate, removing toxic or harmful substances like volatile organic compounds (VOCs) from the surrounding air, reducing air pollution and contributing to the mitigation of the urban heat island effects. The integration of plants in building facades will provide further benefits such as additional insulation and noise reduction.

Green INSTRUCT undertakes the design and manufacture of a prefabricated modular wall panel made from construction and demolition waste (CDW) such as concrete, gypsum, wood, polymers, bricks, tiles, clay, textiles, glass and aluminium (over 70% of net weight), with incorporated green wall technology for the treatment of grey and storm water.

The vertical green-wall, under development by alchemia-nova, enables the cleansing of waste waters within a vertical flow system as a result of microbial activity within the root-zones of selected plants. The plants are bedded in an anorganic substrate, mixed with reclaimed fibres from construction and demolition waste (CDW), building on the phytotechnological potential shown in the demEAUmed project.

New value chains, CO_2 savings, energy savings and higher resource efficiency will ultimately contribute to a resource-efficient and climate-change-resilient economy.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Johannes Kisser, alchemia-nova research & innovation gemeinnützige GmbH, Austria
- Helene Pattermann, alchemia-nova GmbH, Austria

Green Integrated Structural Elements for Retrofitting and Construction of Buildings

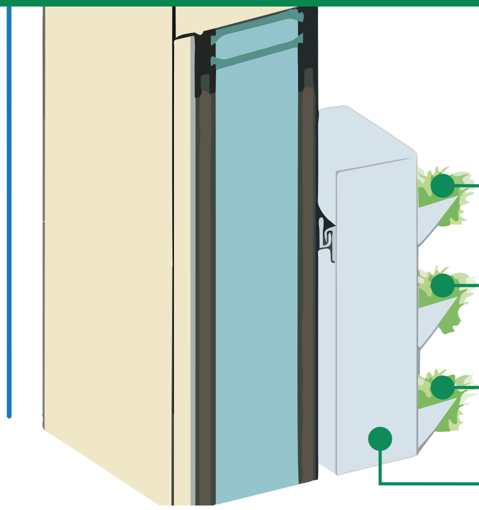
Topic: H2020-EEB-2016-2017 - Type of Action: RIA - Grant agreement no: 723825

Johannes Kisser, Heinz Gattringer, Carmen Zehetbauer, Gianluca Vassallo, Francesco Menconi, Ines Kantauer

www.alchemia-nova.net, office@alchemia-nova.net

Prefabricated modular wall panel made from Construction and Demolition Waste (CDW) (over 70% of net weight) incorporates Green Wall technology for the treatment of grey & storm water plus multiple functionalities and benefits.

Internal Panel



Green Wall

Management of grey- and stormwater
40% less water used in the building

Cooling effect
15l/m^2 evaporation

Fixing potential
500g CO_2/m^2*a

Recycled Aluminium Frame

External Panel

aesthetics
biodiversity
greywater management
acoustic insulation
microclimatic benefits
absorbtion of solar radiation

KEY DATA

4 meters
of flow height required to treat greywater in a single pass (only pump once)

23 to 25m^2
of façade area necessary to treat 1 m^3 of greywater

1,6 m^2
of panel area per inhabitant (assuming 70 l greywater / person / day)

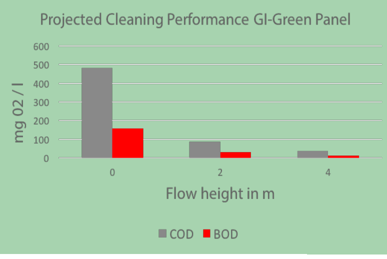
3 kg/m^2
biomass

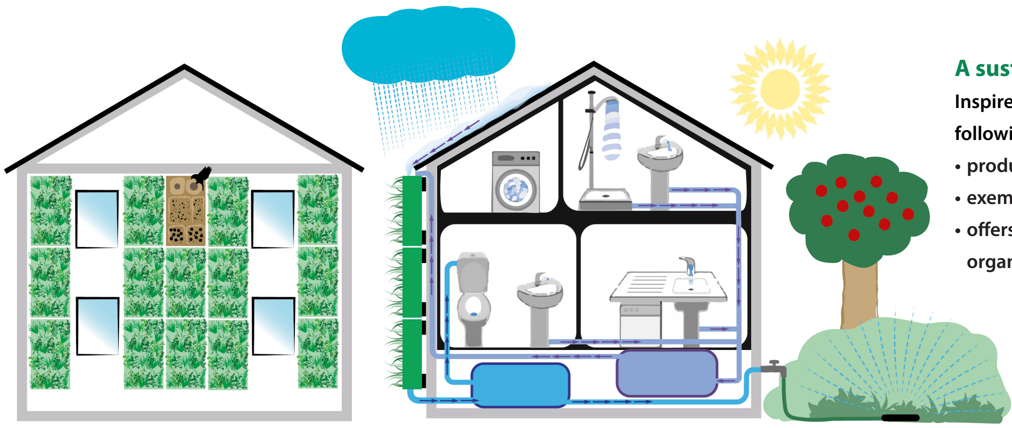
500 g/m^2*a
CO_2 sequestration

75 kg/m^2
weight

Green Wall technology specifications

- Living plants are included in the external prefabricated facade panel
- Plant based grey- and stormwater treatment can be done by channeling the water inside the panel in hollow structures filled with substrate also partly derived from CDW (construction and demolition waste)
- The treated water can be used as service water in flushing toilets, watering green areas or for cleaning purposes
- A certain amount of water will be evaporated through the plants, which have positive effects on the microclimate (mitigation of the urban heat island effect)
- Robust local adapted plants that inscrease biodiversity and side benefits used
- Sensor integration and smart automation
- Combination with urban farming is possible





A sustainable building:

Inspired by the Cradle to Cradle® movement (McDonough/Braungart), following vision by R&D efforts of Green INSTRUCT:

- **produces resources (clean water, clean air, food)**
- **exemplary use of recycled resources**
- **offers proper living environment & foundation for people and other organisms**

www.greeninstruct.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723825

Green technologies

Closing material flows by wastewater treatment with green technologies

Duration: 05/2017-04/2020

Programme: Slovenian Research Agency

Website: Project description in SICRIS database

Abstract

Nowadays water, energy, food and adequate infrastructures are advancing technologically, but they are functioning in a linear and disconnected way (extract-use-dispose). Re-use of resources (water, nutrients) by recycling wastewater (WW) results in “closing material flows”, which leads to sustainable WW management. Resource recovery technologies or Green technologies (GreenT) enable the recovery of nutrients from WW and reuse of treated water; however, most of GreenT are still looking for improvements in their performance and economic feasibility.

The aim of the project is the performance evaluation of a closed material flow concept by three GreenT at two scales a) lab-scale, and b) pilot-scale at demo center located at central wastewater treatment plant (WWTP) in Ajdovščina, Slovenia (45°52'32"N 13°54'20"E). The three tested GreenT are 1) algae-based technology (ABT) with the production of algae biomass and water for irrigation; 2) constructed wetland (CW) with the production of water for irrigation; and 3) evapotranspirative willow system (EWS) with zero outflow for wood biomass production. The algae biomass from ABT can be used for bio fertilisers, biofuels, biogas, feed, bioplastics, extraction of high value components; from EWS the wood biomass can be used for energy production and the media as fertilizer. The final products from GreenT enable closing the water and material flows of WW; however, they may contain micropollutants like pharmaceuticals, industrial chemicals, microplastics, pesticides etc. which may affect human health and environment. Because the conventional WWTPs are not designed for removing micropollutants, their removal and fate in the GreenT are of great interest. In this project, two selected groups of micropollutants are monitored, namely bisphenol A (BPA) and its alternatives as emerging industrial chemicals and neonicotinoids as a new class of insecticides.

The final products of GreenT are going to be tested for agricultural use in pot and lysimeter experiments. In this way, the valuable results will be obtained on how potentially hazard compounds and nutrients from municipal WW and environmental and health risk can be managed in water and nutrient reuse. For selected GreenT an extensive database to support decisions about their applications will be elaborated. The project focuses on water and biomass quality, water and nutrient balance, and its optimisation. With the project we also aim to increase awareness regarding limited phosphorus reserves and knowledge of efficient closed material flows in the context of ecosystem services which is currently low and consequently there is low acceptance of resource-oriented technologies.

Contact persons at the COST Action CA17133 Workshop Vienna:

- Tjaša Griessler Bulc, University of Ljubljana, Faculty of Health Sciences, Slovenia, Coordinator
- Nataša Atanasova, University of Ljubljana, Faculty for Civil and Geodetic Engineering, Slovenia
- Darja Istenič, University of Ljubljana, Faculty of Health Sciences, Slovenia

Closing Material Flows by Wastewater Treatment with Green Technologies

University of Ljubljana

T. Griessler Bulc[1,3,*], D. Istenič[1,*], F. Prosenc[1], D. Škufca[2], E. Heath[2], N. Atanasova[3,*], A. Krivograd Klemenčič[3], M. Pintar[4], V. Zupanc[4]

Jožef Stefan Institute

**Contact persons at the COST Action CA17133 Workshop Vienna*

(1) University of Ljubljana, Faculty of Health Sciences, Ljubljana, Slovenia (2) Jožef Stefan Institute, Department of Environmental Sciences, Ljubljana, Slovenia, (3) University of Ljubljana, Faculty of Civil and Geodetic Engineering, Ljubljana, Slovenia, (4) University of Ljubljana, Biotechnical Faculty, Ljubljana, Slovenia

Reuse of treated wastewater = an alternative for water and nutrient shortage

Wastewater (WW) → WWTP → Treated WW → Irrigation

Major advantages of reuse:
- Lower demand on potable water supply
- Lower consumption of synthetic fertilizer
- Soil enrichment

BUT...

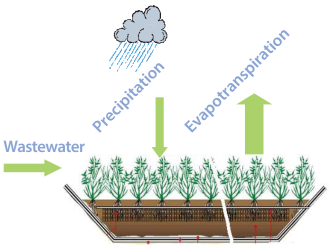
To avoid any health and/or environmental hazard, WW should be controlled and treated before reuse.

DEMO CENTRE

All three systems fed with mechanically pretreated municipal WW.

3 Evapotranspirative willow system (EWS)

No outflow, production of wood biomass



Cross-section through a willow system & water balance. Source: H. Brix, 2011.

Experimental EWS willow system with 9 test beds for evaluation of biomass production & water use in 3 different willow clones: 'V 160' (*S. alba*), 'V 052' (*S. alba* var. *calva* × *S. alba*), 'V 093' (*S. alba* × *S. alba* var. *vitellina*) × *S. alba*. The wood biomass can be used for energy production and the media as fertilizer.

1 Constructed wetland (CW)

Production of water for irrigation

Installation of impermeable liner and gravel into a CW with two parallel vertical beds & a horizontal bed. Photo: SintezaLinning Ltd.

Operational CW planted with common reed *Phragmites australis*.

Outflow from CW, used for irrigation. Photo: I. Ameršek.

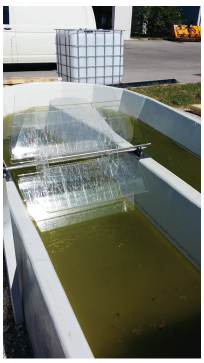
LYSIMETERS

Test field with 25 lysimeters for irrigation with treated WW from CW and ABT.

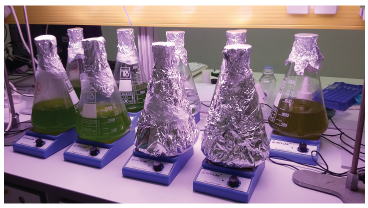
A lysimeter is a device for measurements of evapotranspiration and the quantity and quality of water that percolates through the soil. Each lysimeter has one plant and an individual irrigation and drainage system.

2 Algae-based technologies (ABT)

Production of algal biomass and water for irrigation



Raceway algae pond for WW treatment, inoculated with *Chlorella vulgaris* & opened for inoculation with naturally present microorganisms.



Lab experiments for removal of bisphenol (BP) mixture with *C. vulgaris*. BPA, used in the production of polycarbonate plastics and epoxy resins, is a recognised endocrine-disrupting chemical. It is slowly replaced by bisphenol analogues, BPS and BPF, which have not yet been extensively studied.

The algae biomass from ABT can be used for bio fertilisers, biofuels, biogas, feed, bioplastics, extraction of high value components.

LAB STUDIES

arrs
SLOVENIAN RESEARCH AGENCY

Acknowledgements

Project financed by the Slovenian Research Agency, research core funding No. P3-0388: Improved treatment and monitoring of Water Framework Directive priority pollutants (ID L1-7544), Closing material flows by wastewater treatment with green technologies (ID J2-8162), and Development and efficiency of zero emission evapotranspiration system for closing material loops of wastewater (ID Z2-6751).

Growing with green ambition

Enhancing Resilience in Ecosystem Services and Green Infrastructure of Urban Areas

Duration: 04/2016-02/2019

Programme: EnRoute – JRC and Programme BG03 "Biodiversity and ecosystems", FM EEA 2004-2009

Website: http://www.oppla.eu/enroute; www.tunesinurb.org

Abstract

The knowledge about urban green infrastructure (UGI) is important for maintaining the quality of life in urban regions. The perspective of rapid urban sprawl generates a need of establishment and use of adequate system for monitoring the condition of the urban ecosystems and green spaces. To present results of the assessment of UGI of Karlovo city (BG) and Provided Ecosystem services (ES) highlighting their importance within the local policy context.

The aim of these research studies is creating a national system for urban areas and their ecosystem services through the application of set of indicators for assessment and mapping with a view to better understanding and implementation of sectoral policies.

The implemented activities contributed with a developed understanding how human activities influence functional and structural processes in these specific ecosystems through assessment of current ecosystem conditions and how this impacts the supply of ecosystem services in all urban ecosystems at national level. This understanding (typology of urban ecosystems and functional urban areas, their state and potential to provide ES) is mapped using GIS and the final products were maps, assessment reports and user-friendly ecosystem-based information system for target groups and stakeholders. Outputs of project contributes to understanding the values societies place on urbanized ecosystems as this will be key to promoting the preservation/restoration of the valuable habitat spaces within the urban areas.

The in-depth analysis of the urban ecosystems and green spaces dynamics within the landscape system as well as mapping and assessment of selected ecosystem services allowed to identify the drivers and barriers influencing adaptive green spaces management and governance. As a final result mapping and assessment of ecosystem services provided by urban and peri-urban green spaces was demonstrated and accepted as a policy support system and relevant decision support tools by the city authorities.

The data derived by combining a set of methodologies and by integrating remote sensing methods with in-situ observations, give solid, up-to-date and comprehensive information about the health status of the urban green infrastructure. Therefore, the need to introduce and to implement the ecosystem services concept into the municipal development plans and into the relevant policy for agriculture, forestry, climate change and strategies to mitigate the unfavorable impact of the natural hazards, becomes present and requires better communication and fostering of the scientifically based decisions for GI management across Europe.

A step beyond – developing target values for ES and accounting.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Miglena Zhiyanski, FRI-BAS, Bulgaria

Growing with Green Ambition – Enhancing Resilience in Ecosystem Services and Green infrastructure of Urban Areas (TUNESinURB and Karlovo City-lab)

Miglena Zhiyanski

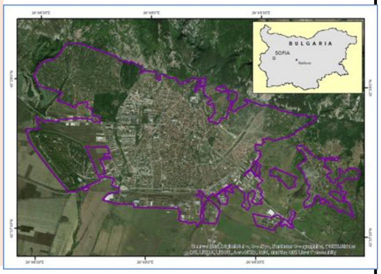
Forest Research Institute – Bulgarian Academy of Sciences, zhiyanski@abv.bg

Policy questions: Karlovo is a small city, rich of surrounding natural forests, but a low level of urban green spaces. 1. Are green spaces in Karlovo and the region healthy enough to continue supplying ecosystem services?

- Which are the areas where the urban landscape should be gentrified by green spaces and
- How should the green spaces be maintained to have the greatest impact on human well-being and the environment?

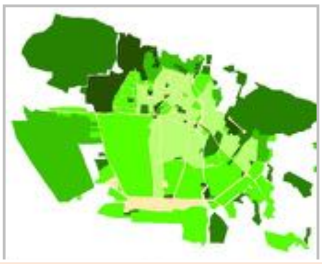
2. What are the potential effects, both positive and negative ones, of UGI and ecosystem services on agricultural and climate policy as well as disaster risk reduction at local and regional level in Karlovo?

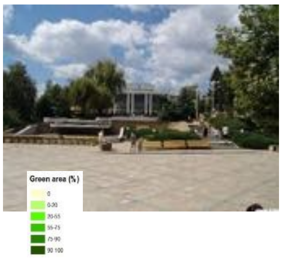
- Which territories can benefit most of such activities for development?
- How can urban green spaces contribute to the improvement of welfare in urban regions (e.g. by creating or restoring urban and peri-urban forest parks, multiple-use, etc.)?

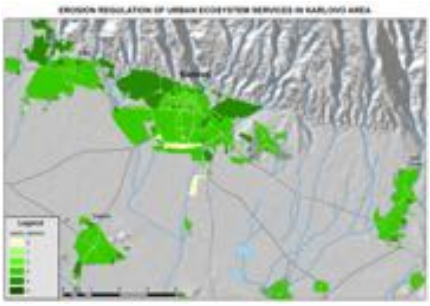


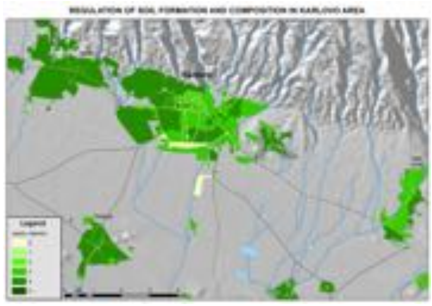
Process: The **scientific phase** was initiated by the researchers and was based on compilation of available information and data from different projects (Nedkov et al., 2018; Yaneva et al., 2018; Dimitrov et al., 2018; Zhiyanski et al., 2017, MetEcosMap , TUNESinURB , ESMERALDA) as well as of the results obtained due to performed original research. The assessment of ecosystem condition in urban ecosystems and green infrastructure of the city is measured by a set of indicators, which are organised in a system based on the concept of ecosystem integrity. Then the assessment of the key elements of green infrastructure condition in Karlovo was performed through an integrated application of in-situ observation and remote sensing using Unmanned Aerial Vehicle (UAV) technology (Dimitrov et al., 2018). The final step of the scientific phase was the assessment of selected ecosystem services provided by green infrastructure in Karlovo at local and regional levels. **The administrative phase** was realized in close cooperation with the local authorities and aimed at providing direct assistance in defining measures to improve the condition of green spaces and to undertake assessment and mapping of some ecosystem services in the spatial planning.

Local scale mapping and assessment: FUAs and GI

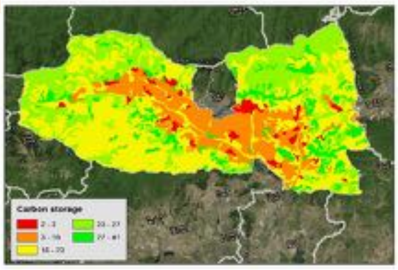


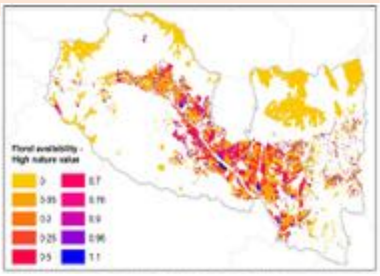






Regional scale mapping and assessment:
Map of the capacity of the ecosystems to provide climate regulation for Karlovo Municipality - InVEST model
Map of the pollination capacity of Agriculture lands in Karlovo Municipality – ESTIMAP model





Policy relevance: MAES outcomes are used as a new decision support tools for integrated green spaces allocation and management at the local and regional levels. The results were a basis to promote adaptive forms of management and governance, whilst an inductive type of urban green spaces decision making is reported as one of the main products of the use of such instruments.

The in-depth analysis of the urban ecosystems and green spaces dynamics within the landscape system as well as mapping and assessment of selected ecosystem services allowed to identify the drivers and barriers influencing adaptive green spaces management and governance. As a final result mapping and assessment of ecosystem services provided by urban and peri-urban green spaces was demonstrated and accepted as a policy support system and relevant decision support tools by the city authorities.

Conclusions:
The data derived by combining a set of methodologies and by integrating remote sensing methods with in-situ observations, give solid, up-to-date and comprehensive information about the health status of the urban green infrastructure. Therefore, the need to introduce and to implement the ecosystem services concept into the municipal development plans and into the relevant policy for agriculture, forestry, climate change and strategies to mitigate the unfavorable impact of the natural hazards, becomes present and requires better communication and fostering of the scientifically based decisions for GI management across Europe.

A step beyond – developing target values for ES and accounting

Contact: miglena.zhiyanski@gmail.com; www.fri.bas.en

Acknowledgments: the work is realized part of the results are due to the implementation the project "Toward better UNderstanding the Ecosystem Services in URBan environments through assessment and mapping" (TUNESinURB), Programme BG03, funded under the FM of EEA 2009-2014 www.tunesinurb.org and EnRoute Project – JRC www.oppla.eu/enroute in collaboration with Stoyan Nedkov, Ivo Ihtimanski, Rositsa Yaneva

HIDPROTEC

Analysis and Protein Hydrolysis of Fish Bones for Human Food

Duration: 11/2017- 05/2018

Programme: SUGI-FWE Nexus (JPI Urban Europe)

Website: http://www.geruc.es/index.php?option=com_k2&view=item&id=255:added-value-protein-from-animal-by-products-not-intended-for-human-consumption&Itemid=876&lang=en

Abstract

The project arises with the collaboration of HADELCA SL, a company located in the north of Spain focused on the valorization of fish residues of the canning industry together with the Green Engineering & Resources (GER) research group of the University of Cantabria.

A primary objective of the HDPROTEC project is the optimization of the protein enzymatic hydrolysis production of value added products (such as proteins, oil, amino acids, minerals, enzymes, bioactive peptides, collagen and gelatine) from Animal by-products (ABPs) which are not intended for human consumption. Characterization of the enzymatic hydrolysates by Gel Permeation Chromatography (GPC) technique will be carried out in the R&D laboratories of the GER group as a fundamental task of the project.

Apart from the enzymatic hydrolysis of the fishbones, heads and discards, the use of fishbones ashes as phosphorous donor for struvite precipitation using seawater and human urine was conducted.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Tamara Llano Astuy, University of Cantabria, Spain.

NUTRIENTS RECOVERY FROM HUMAN URINE USING SEAWATER AND FISHBONES AS A RESOURCEFUL CIRCULAR CITY MODEL

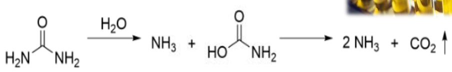
Llano, T., Sánchez-Lázaro, M., Santos, J., Andrés A.

Green Engineering and Resources group. Department Chemistry and Process and Resource Engineering. University of Cantabria. Santander, Spain.

INTRODUCTION

Human urine is responsible of most of the macro-nutrients in urban wastewater: 85-90 % N; 50-80 % P; 80-90 % K. Such compounds **cause environmental problems such as eutrofization**.

After storage, Nitrogen is present as amoniacal form by means of the urealysis reaction:



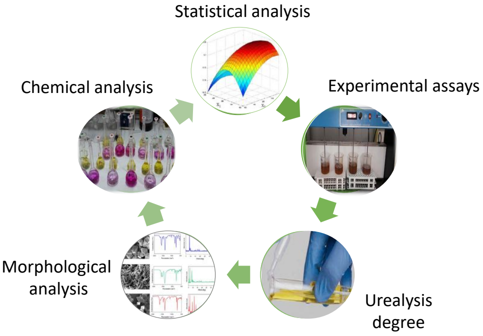
$$NH_3 + H_2O \rightleftharpoons NH_4OH \leftrightharpoons NH_4^+ + OH^-$$

Struvite is a slow-release fertilizer composed by equimolar amounts of NH_4^+, PO_4^{3-} and Mg^{2+} by the folowing reaction: $Mg^{2+} + NH_4^+ + PO_4^{3-} + 6H_2O \rightarrow MgNH_4PO_4 \cdot 6H_2O$

Cost of high-grade **Mg compounds contribute up to 75 %** of overall production **cots of struvite**, limiting large-scale use economically nonviable .

The aim of this research is to study recover urine macronutrients using sea water as alternative Mg source and fish bones as additional phosphorous contributor, by statistically analyse the main variables affecting struvite precipitation.

METHODOLOGY



Four scenarios were developed using Stat Graphics software:

1. Using 25 % hydrolysed urine
2. Using 50 % hydrolysed urine
3. Using 100 % hydrolysed urine
4. Using 100 % hydrolysed and fishbones

Mg:P ratio and pH were selected as **inlet parameters**

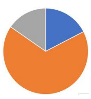
Amount of precipitate, Phosphorous recovery and Nitrogen recovery were selected as **response variables**

- Phosphorous content by UV-Vis analysis
- Functional groups by FTIR analysis
- Nitrogen content by vapour distillation
- Morphology analysis by SEM-EDX analysis

RESULTS

SCENARIO 1: 25 % HU

Mg:P	pH	Precip (g)	P.recu (%)
0.25	10	0.1236	96.99
0.25	6	0.0178	85.35
1.75	10	0.1615	99.62
1.75	6	0.0215	93.98
1	8	0.072	87.39
1	8	0.0094	92.01
1	8	0.0091	89.86



SCENARIO 3: 100 % HU

Mg:P	pH	Precip (g)	P.recu (%)
0.25	10	0.1034	29.50
0.25	6	0.0825	20.14
1.75	10	0.3286	97.07
1.75	6	0.4077	97.85
1	8	0.2904	94.02
1	8	0.2994	93.24
1	8	0.3	93.47

SCENARIO 2: 50 % HU

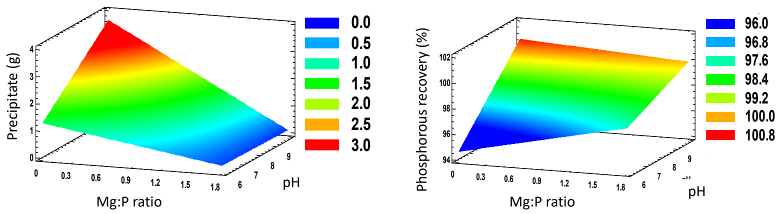
50% Ureolysed Urine			
Mg:P	pH	Precip (g)	P.recu (%)
0.25	10	0.3504	85.96
0.25	6	0.2028	83.61
1.75	10	0.5429	99.41
1.75	6	0.1605	79.98
1	8	0.3998	98.36
1	8	0.38998	98.60
1	8	0.3506	98.68

SCENARIO 4: 100 % HU & FB

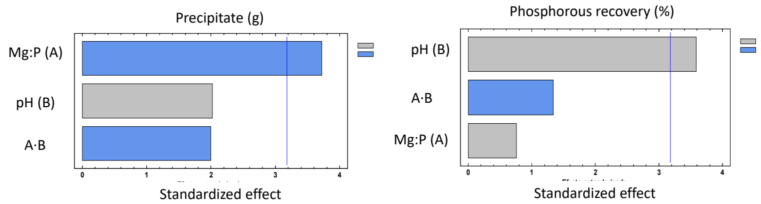
Mg:P	pH	Precip (g)	P.recu (%)
0.25	10	3.49028	99.92
0.25	6	1.4083	94.38
1.75	10	0.5258	99.27
1.75	6	0.5159	96.74
1	8	0.8446	99.07
1	8	0.7669	99.15
1	8	0.7915	98.97

$N\text{-}NH_3$ Non amoniacal N PO_4^{3-}

RESPONSE SURFACE ANALYSIS (RSA) OF THE FOUR SCENARIOS

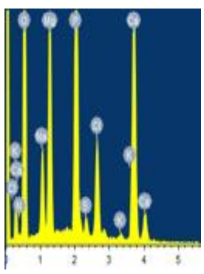


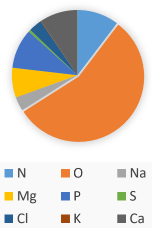
PARETO ANALYSIS OF THE FOUR SCENARIOS



CRYSTAL SIZE (SEM ANALYSIS)

ELEMENTAL COMPOSITION (EDX ANALYSIS)





MAIN CONCLUSIONS

- Struvite-based fertilizer precipitation is feasible, recovering urine macronutrients by using seawater and fishbones as magnesium and hosphorous alternative sources, making the process cost-effective.
- The statistical analysis showed that Mg:P ratio affected more in the amount of precipitate whereas the pH strongly affected to the Phosphorous recovery.
- Mathematical modelling was done giving R2 factors between 69,12 and 97,67 %
- Major crystal sizes were obtained in the fourth scenario (L > 150 µm)
- EDX analysis showed that precipitate consist of O (55.6 %), N (10.3 %), P (9.8 %) and Mg (7.4 %) demonstrating that struvite has been formed.
- As future work, a geochemical model analysis will be developed to analyses the equilibrium reactions.

Highway Draingarden®

Street runoff control with Draingarden® substrate and functional greening

Duration: 08/2017-10/2018

Programme: Feasibility Study (FFG**)**

Website: https://www.alchemia-nova.net/projects/draingarden/

Abstract

The permanent growth of urbanization poses new challenges for urban water management. Because of climate change, the number and intensity of heavy precipitation events is increasing, pushing drainage and sewer systems to their limits. Vegetative filtration systems as Draingarden® are important elements of green infrastructure and have been demonstrated to be effective on management of quantity and quality of storm water. The filter substrate within, in combination with the proper vegetation play a key role in the performance of the system, reducing runoff peaks and volumes and improving water quality.

Within the project Highway Draingarden the substrate Draingarden® was tested in combination with selected plants regarding to salt and heavy metal accumulation. The substrate is characterized by the capacity to store water and to dispense the humidity over a longer period to plants and soil organisms, as well as to remove most of runoff contaminants to a wide extent. The selected plants on the other hand accumulate additionally part of contaminants (heavy metals). The goal of this project was to perform a feasibility study on performance of the mentioned vegetative filtration system for purification of highway runoffs on-site.

Results show the capability of two plant species to accumulate metals/salt on-site. The proposed vegetative filtering system, combining the Draingarden® substrate with the two successfully tested plant species, can extend significantly the lifespan of the system, regarding to heavy metal removal.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Johannes Kisser, Helene Pattermann, alchemia-nova (Circular Economy), Austria
- Roza Allabashi, BOKU University (Sanitary Engineering), Austria

The institution alchemia-nova provides the research of an effective plant consortium.

The Institute for Sanitary Engineering and Water Pollution Control (BOKU) brings in expertise on evaluation of the substrate in regard of groundwater protection.

Drain Garden®
Intelligentes Regenwassermanagement

Highway Draingarden

Street runoff control with Draingarden® substrate and functional greening
Feasibility Study (FFG) Project Number 862321

Contracting authority:
Zenebio GmbH: Raimund Seidl, Anton Rath
Scientific consortium:
alchemia-nova GmbH: Theresa Heitzlhofer, Heinz Gattringer, Andrea Zraunig, Johannes Kisser
University of Natural Resources and Life Sciences Vienna: Roza Allabashi, Thomas Ertl

Fig. 1: experimental set-up at Obergrafendorf

Introduction:

The permanent growth of urbanisation poses new challenges for urban water management. Because of climate change, the number and intensity of heavy precipitation events is increasing, pushing drainage and sewer systems to their limits. Vegetative filtration systems as Draingarden®, are important elements of green infrastructure and have been demonstrated to be effective on management of quantity and quality of storm water. The filter substrate within, in combination with the proper vegetation play a key role in the performance of the system, reducing runoff peaks and volumes and improving water quality.
Within the project Highway Draingarden the substrate Draingarden® was tested in combination with selected plants in relationship to salt and heavy metal accumulation. The substrate is characterised by the capacity to store water and to make it available to plants and soil organisms over longer periods, as well as to retain most runoff contaminants. The selected plants can accumulate additionally some contaminants (heavy metals). The goal of this project was to perform a feasibility study on performance of the mentioned vegetative filtration system for purification of highway runoffs on-site.

Materials and Methods:

The experimental set-up at the BOKU test site in Groß Enzersdorf (Lower Austria) consists of seven IBC units with 1m³ capacity filled with Draingarden® substrate. Six selected plant species (***Carex acuta, Plantago maritima, Cyperus longus, Elymus arenarius, Spartina pectinate, Cochlearia danica)*** were planted in different combinations in six containers and one was left as control with no plants and were irrigated with water spiked with heavy metals (Cu and Zn) and salt (NaCl), at representative levels for highway runoffs. The road runoff was taken in winter season at highway junction Inzersdorf (Lower Austria), to ensure a salt content representative for winter season. Plants were selected according to earlier research results (Bergwerk Pflanze, GrecoMet) as well as to literature references. During and after the five months of experimental work, water, substrate and plant samples were collected and analysed according to standardised methods (ISO, EN, DIN). Plants were harvested, and processed using standardised method according to Zhao et al. (1994)[1], and analysed using ICP-MS, ICP-OES, photometric methods. Water samples were analysed for pH, conductivity, heavy metals (ICP-MS) and anions/cations (IC). For investigation of accumulation of contaminants in substrates at the end of experimental period, water eluates were generated from substrates and analysed. Corresponding accumulation factor is calculated in comparison to content in the substrate bevor use and the control reference.

Fig. 2: Experimental set-up at BOKU test site Groß Enzersdorf

In a second experimental set-up substrate and functional plants were set up along 300 meters of a busy road at Obergrafendorf (Lower Austria) to investigate resistance against vegetation pressure from naturally growing plants. (Fig.1)

	Plant species
Reference	*not vegetated*
Box 1-3	*Cyperus longus*
	Spartina pectinata
	Elymus arenarius
Box 4-6	*Cochlearia danica*
	Plantago maritima
	Carex acuta

Results:

Results confirmed again the high potential of the system for water retention and capability to remove heavy metals from road runoff. Especially two plant species (***Elymus arenarius, Cyperus longus***) show a good capability to accumulate metals (Zn, Cu) and even a moderate amount of salt on-site.

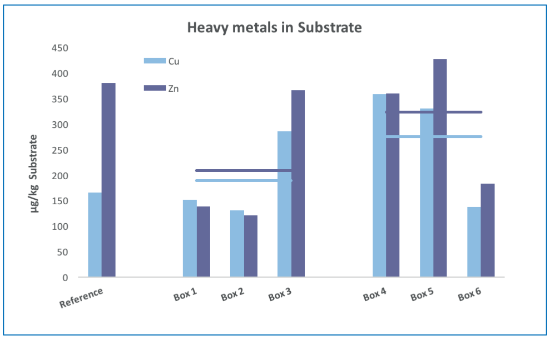


Fig. 3: Comparison of heavy metal uptake in substrate of vegetated (box 1-6) and not vegetated (reference) units. Horizontal lines mark average.

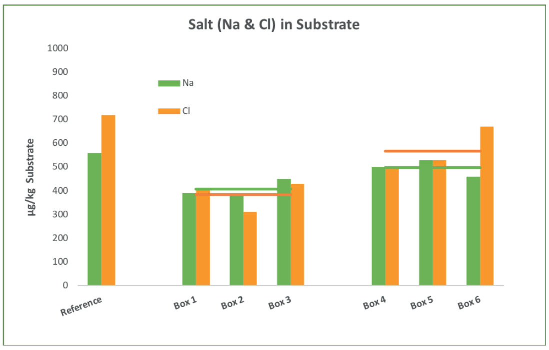


Fig. 4: Comparison of salt uptake in substrate of vegetated (box 1-6) and not vegetated (reference) units. Horizontal lines mark average.

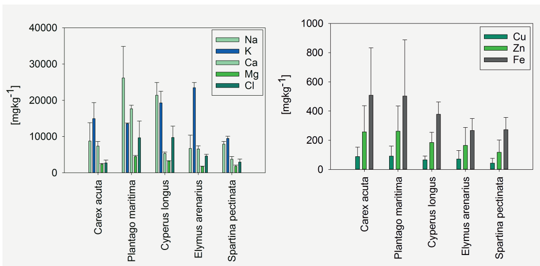


Fig. 5: Salt and metal uptake in the biomass of the tested plant species

	Na kg/ha	K kg/ha	Ca kg/ha	Mg kg/ha	Cl kg/ha	Cu kg/ha	Zn kg/ha	Fe kg/ha
Carex acuta	22,13	37,67	18,61	6,01	6,83	0,22	0,65	1,28
Plantago maritima	84,84	43,94	57,31	14,54	31,37	0,30	0,85	1,72
Cyperus longus	105,97	95,56	26,33	16,02	48,12	0,32	0,91	1,87
Elymus arenarius	123,33	432,12	120,62	31,60	84,79	1,32	3,02	4,91
Spartina pectinata	25,57	30,67	12,07	5,92	9,57	0,14	0,38	0,88

Table 1: Output in kg/ha yield of target pollutants considering biomass growth and accunulation rates

Conclusion:

Two plants were identified as especially efficient in removing heavy metals from road runoffs: ***Elymus arenarius*** and ***Cyperus longus (see Table 1).*** The proposed vegetative filtering system, combining the Draingarden® substrate with the two successfully tested plant species, can extend significantly the lifespan of the system in regards to heavy metal removal. The remediation success of the salt accumulation in the substrate by plants is limited. Multi-year deep rooting plants may be more successful, as well as possibly different varieties that could be tested. These findings indicate that salt used as deicing agent turns out to be a major challenge for using nature-based solutions for street runoff purification. Work is in progress to evaluate use of more ecofriendly solutions as deicing agents.
The Draingarden® system in combination with high biomass plants evidenced a significant capability to evapotranspirate large quantities of water while the substrate stores peak runoff volumes. This would greatly reduce the need for water management and treatment infrastructure along roads.

[1] Zhao, F., McGrath, S.P., Crosland, A.R., 1994. Comparison of three wet digestion methods for the determination of plant sulphur by inductively coupled plasma atomic emission spectroscopy (ICP-AES). Commun. Soil Sci. Plant Anal. 25, 407–418. doi:10.1080/00103629409369047

alchemia nova
institute for innovative phytochemistry & closed loop processes

BOKU SIG
University of Natural Resources and Life Sciences, Vienna
Institute of Sanitary Engineering and Water Pollution Control

FFG Forschung wirkt.

HOUSEFUL

Innovative circular solutions and services for new business opportunities in the EU housing sector

Duration: 01/05/2018-10/2022

Programme: Horizon 2020 research and Innovation programme

Website: http://houseful.eu/

Abstract

The housing sector is a major contributor to the global problems of resource depletion and climate change, representing one of the highest consumption sectors at EU level: 50% of all extracted materials, 40% of final energy consumption, 33% of water consumption, with a resultant 33% of all produced waste. The lock-in to the linear business models of today is causing many environmental problems and is one of the major barriers in transition towards a circular economy.

HOUSEFUL project proposes an innovative paradigm shift towards a circular economy for the housing sector by demonstrating the feasibility of an integrated systemic service composed of 11 circular solutions.

HOUSEFUL will introduce solutions to become more resource efficient throughout the lifecycle of a building taking into account an integrated circular approach where energy, materials, waste and water aspects are considered. This approach fosters new forms of co-creation, increasing the collaboration among stakeholders of the housing value chain to develop new circular solutions and services. HOUSEFUL concept will be demonstrated at large-scale across 4 demo-sites in Austria and Spain, adapting the concept to different scenarios, including social housing buildings.

HOUSEFUL solutions will be evaluated from an environmental (Life Cycle Assessment), economic (Life Cycle Cost) and social (Social Assessment) point of view. The results obtained will be used to define an integrated HOUSEFUL service which will be driven and promoted through a SaaS (Software as a Service). The SaaS will integrate a Circularity Tool to quantify the circularity level of buildings and will include different circular solutions to be offered as services, encouraging the housing value chain to redesign traditional business models towards circular ones. 10 EU follower buildings will be engaged with the support of a Collaborative Community of Housing Experts to replicate HOUSEFUL results and maximize the impact of the project.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

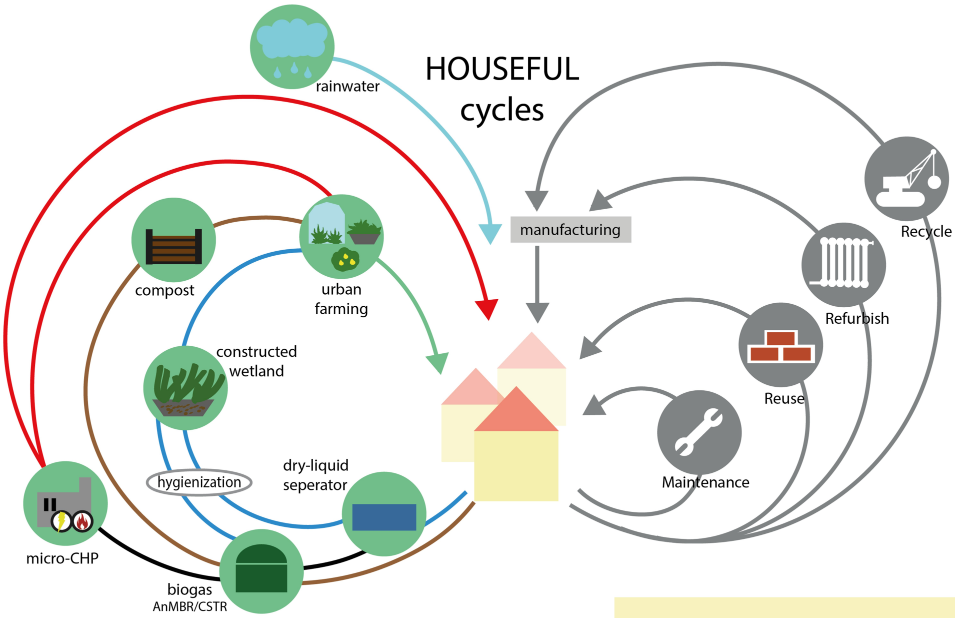
- Johannes Kisser, alchemia-nova research & innovation gemeinnützige GmbH, Austria
- Helene Pattermann, alchemia-nova GmbH, Austria

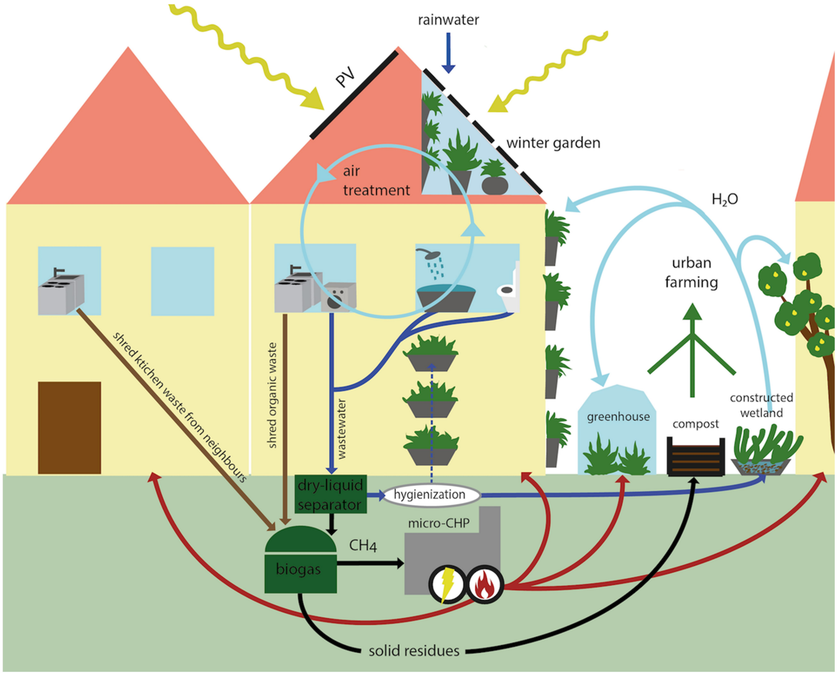
www.houseful.eu

HOUSEFUL

alchemia nova
institute for innovative phytochemistry & closed loop processes

Innovative circular solutions and services for new business opportunities in the EU housing sector





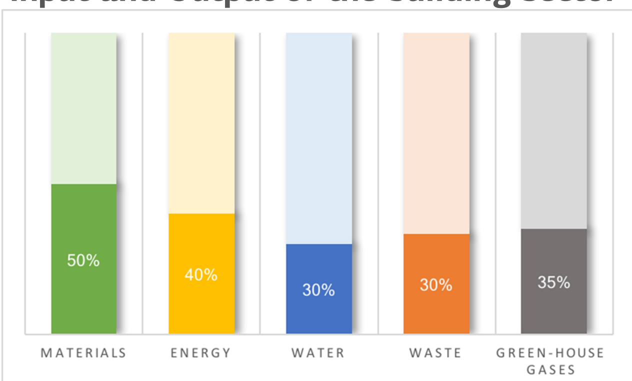
Technical solutions

- Separation of liquids/solids from waste-water
- Treatment of liquids in NBS
- Production and storage of biogas
- Air treatment in winter-garden
- Material passport & BIM
- Materials upcycling
- Nutrient-rich waste-water for green-house
- Compost cultivator
- Sourcing second hand circular building materials
- Energy efficient façades & roofs
- Energy production in buildings

Objectives

- Circular management
- Resource recovery
- Efficient use of water, waste, energy and material resources
- Replication as Circular Economy Business Opportunities

Input and Output of the building sector



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776708

www.alchemia-nova.net

HYDROUSA

Demonstration of water loops with innovative regenerative business models for the Mediterranean region

Duration: 01/2009-05/2017

Program: EU Innovation project submitted and approved under call topic CIRC-02-2016-2017 (Water in the context of the circular economy) (Grant Agreement No. 776643)

Website: http://www.hydrousa.org/

Abstract

Water management in Mediterranean islands is currently fragmented and there are several barriers, which need to be overcome in order to close water loops and contribute towards the environmental and economic development of these regions. Mediterranean islands, in particular, face significant challenges in terms of water management and conservation. Water reserves are scarce, while the high touristic activities during the summer months stress the limited water reserves. To overcome these challenges, a new HORIZON 2020 project, HYDROUSA is set to launch in July 2018 to reimagine a water resilient economy, mitigate climate change and reform the agro-food system.

HYDROUSA aims to provide innovative solutions for Mediterranean islands in terms of water/wastewater treatment and management, which will close the water loops and will also boost their agricultural and energy profile. HYDROUSA goes beyond the current water and wastewater management practices by adopting innovative, nature-based water management solutions for different types of water characterized by low energy footprint. Clear water loops will be demonstrated, recovering added value products, while integrating and interacting with the local market. These technologies will be demonstrated at six demonstration sites at full scale in three Mediterranean islands (Lesvos, Mykonos and Tinos) whereas the transferability of HYDROUSA solutions will be assessed in 25 early adopter cases in Mediterranean coastal areas and islands and at several water-stressed rural or peri-urban non-Mediterranean areas.

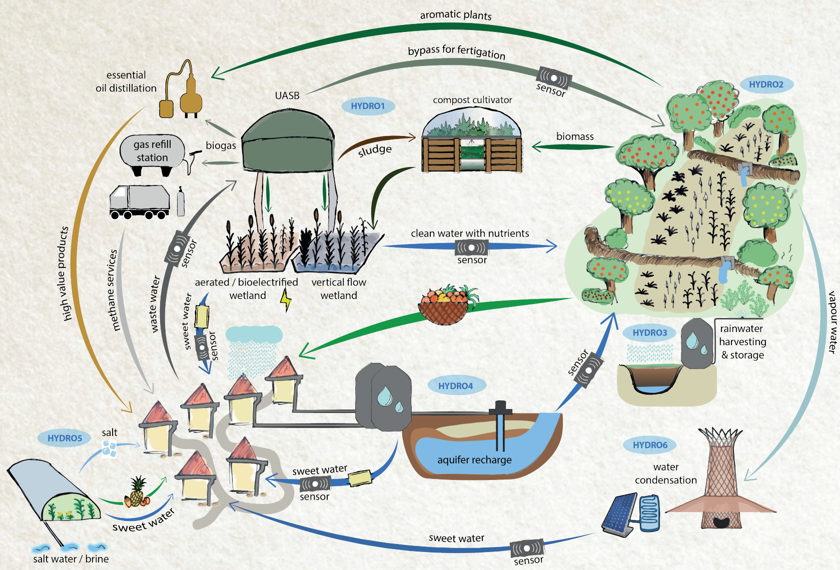
The additional services that will be provided with the innovative approaches will lead to a win-win situation for the economy, the environment, and the community. Comprehensive business models will be developed to demonstrate the economic viability of the aforementioned technologies and services as well as the resulting economic benefits from the recovered materials and energy. HYDROUSA will not only develop and demonstrate innovative water services, but will revolutionize the water value chains in Mediterranean areas from water use up to sewage treatment and reuse. It will change the human water cycle by valorizing non-conventional water resources, which are currently not being exploited. The consortium of the HYDROUSA project consists of 27 high competent organizations involved in water management, agricultural activities, ICT and, business/marketing, dissemination/ communication spanning throughout the whole water supply chain. The project is led and coordinated by National Technical University of Athens, (NTUA).

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Fabio Masi, IRIDRA, Italy, representative of IRIDRA, one of the HYDROUSA partner
- Johannes Kisser, ALCHEMIA NOVA, Austria, one of the HYDROUSA partner
- Helene Pattermann, ALCHEMIA NOVA, Austria, one of the HYDROUSA partner

HYDROUSA

Demonstration of water loops with innovative regenerative business models for the Mediterranean region



HYDROUSA revolutionises water value chains in Mediterranean areas and beyond, from water abstraction to sewage treatment and reuse. HYDROUSA water loops work with water from non-conventional sources including **wastewater**, **rainwater**, **seawater**, **groundwater** and **vapour water**, all resulting in recovered and marketable products.
HYDROUSA will demonstrate at large scale the feasibility and sustainability of innovative, **low-cost water treatment** technologies to **recover freshwater**, **nutrients** and **energy** from wastewater, **salt** and freshwater from seawater, and freshwater from atmospheric water vapour. **Water conservation** solutions include **aquifer storage** combined with **fertigation** and sustainable agricultural practices in **agroforestry** setups. HYDROUSA combines **traditional skilled workmanship with modern ICT** integration in beautiful and smart automation systems. The solutions are demonstrated on **3 major touristic islands in Greece**.
Technical and financial deployment plans will be established for **replication in additional 25 locations worldwide**. The proposed HYDROUSA solutions show massive potential to change the way humans interact with water, food and energy.

HYDROUSA's Regenerative Model

Build a Water-Resilient Economy

- Create Jobs
- Build Green Infrastructures
- Market Development

Mitigate Climate Change

- Sequester Carbon
- Rebuild Flourishing Ecosystems
- Turn a Problem into a Solution

Reimagine the Food System

- Rearrange Local Food Production
- Zero km Farming
- Establish Diversity as Commons

Water categories	HYDROUSA systems	Recovered products	Marketed products
Rainwater	Harvesting	Water for domestic use	Service water & Drinking water
Groundwater	Recharge & storage	Irrigation water	Mediterranean crops
Wastewater	UASB & wetlands	Fertigation liquid Biogas Water for reuse	Plant-based products Methane gas Service water
Water vapour	Vapour condensation	Drinking water	Drinking water
Seawater	Tropical greenhouse	Irrigation water Salt	Tropical fruits Edible salt

NATIONAL TECHNICAL UNIVERSITY OF ATHENS · alchemia nova · Brunel University London · MUNICIPALITY OF MYKONOS · SEMIDE EMWIS · Heliopolis University · iSiS · IRIDRA · Planet · WssTP · ICRA · ASA Azienda Servizi Ambientali SpA · AGENSO · Radtke Biotechnik · TINOS ECO LODGE · IMPACT HUB Athens · CWP Catalan Water Partnership · Delaros Environmental Management · BIOVERSUM · plenum sustainability · change · impact · MINAVRA TECHNIKI AE CONSTRUCTIONS · Lesvos · Δήμος Τήνου · aeris · SATISTICA · MEMIRA GENESIS

This project has received funding from the European Union's Horizon 2020 research & innovation programme under grant agreement no 776643

IRIDRA Srl

The Water Park of Gorla Maggiore (Italy): an urban park becoming place for nature-based solutions and ecosystem services

Duration: 01/2009-05/2017

Programme: Realization costs covered by Lombardy Region; monitoring costs covered by the OpenNESS project (European Union's Seventh Programme for research)

Website: http://www.openness-project.eu/node/41; https://oppla.eu/casestudy/17252

Abstract

The Gorla Water Park is placed in proximity of the Gorla Maggiore town, sited in the North of Milan, in Lombardy Region. The park hosts a neo-ecosystem built on the shore of the Olona River in an area previously used for poplar plantation. The whole area surface is about 3 ha and includes, excluding the are designed for public fruition, a flood prevention area (1 ha) and the pollutant removal area (0.4 ha of Phragmites reed bed + 0.3 ha of natural like multispecies wetland).

The project aimed to integrate multi-functional ecosystem services within a park dedicated to citizen leisure. Thanks to the use of nature-based solutions, the Gorla Water Park provides the following ecosystem services:

- Leisure and education: promote enjoyment of the area by the local population;
- Pollution control: reduce pollution load discharged to Olona river by a Combined Sewer Overflow (CSO);
- Flood prevention: store rainwater and regulate flow discharge to the river;
- Biodiversity (bird species richness): increase habitat availability for water birds.

The Gorla Water Park was designed by IRIDRA Srl and realized in 2012. After that, the Gorla Water Park became one of the 27 case studies of the OpenNESS project (Operationalisation of Natural Capital and Ecosystem Services). The ecosystem services evaluation was done by the Joint Research Centre and IRIDRA, both partners of the project. The investment costs for the Gorla Water Park Green Infrastructure were comparable with those of the Grey Infrastructure alternative (first flush basin plus dry detention basin). On the other hands, the multiple advantages given by Green Infrastructure resulted undoubtedly higher in comparison with the Grey solution, thanks to the multiple ecosystem services put into action.

The Gorla Water Park was awarded in Italy in 2017 with a mention in the "Sustainable Development Award" (Premio per lo Sviluppo Sostenibile) in the sector of "Water Management". Recognized as case-study of high value by several international web-site databases (e.g. OPPLA, Naturvation), the results from the monitoring of the Gorla Water Park were published in several papers of high-ranked peer-review journals (e.g., Ecological Engineering, Ecosystem Services, Journal of Hydrology).

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Fabio Masi, IRIDRA Srl, Italy, Technical Director of IRIDRA and Vice-President of Global Wetland Technology (GWT)
- Giulio Conte, IRIDRA Srl, Italy, IRIDRA partner involved in OpenNESS project

The Water Park of Gorla Maggiore (Italy): an urban park becoming place for nature-based solutions and ecosystem services

Fabio Masi, IRIDRA Srl, Italy, Technical Director of IRIDRA and Vice-President of Global Wetland Technology
Giulio Conte, IRIDRA Srl, Italy, IRIDRA partner involved in OpenNESS project

THE GORLA WATER PARK

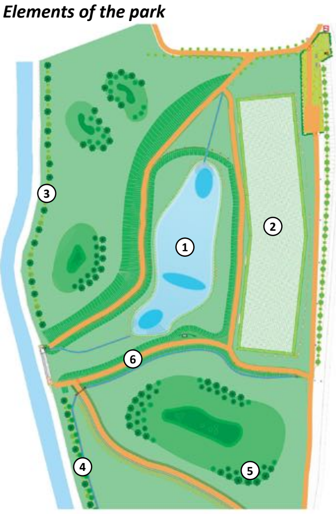
The **Gorla Water Park** is placed in proximity of the Gorla Maggiore town, sited in the North of Milan, in Lombardy Region. The park hosts a neo-ecosystem built on the shore of the Olona River in an area previously used for poplar plantation. The whole area surface is about 3 ha and includes, excluding the are designed for public fruition, a flood prevention area (1 ha) and the pollutant removal area (0.4 ha of Phragmites reed bed + 0.3 ha of natural like multispecies wetland).

The project aimed to integrate multi-functional ecosystem services within a park dedicated to citizen leisure. Thanks to the use of nature-based solutions, the Gorla Water Park provides the following **ecosystem services**:

- Leisure and education: promote enjoyment of the area by the local population;
- Pollution control: reduce pollution load discharged to Olona river by a Combined Sewer Overflow (CSO);
- Flood prevention: store rainwater and regulate flow discharge to the river;
- Biodiversity (bird species richness): increase habitat availability for water birds.

The Gorla Water Park was designed by IRIDRA Srl and realized in 2012. After that, it became one of the 27 case studies of the **OpenNESS project.** It was awarded in Italy in 2017 with a mention in the **"Sustainable Development Award"** (Premio per lo Sviluppo Sostenibile) in the sector of "Water Management".

Elements of the park



1. Naturalistic wetland (FWS)
2. Nature-based solutions for improvement of water quality conveyed towards the naturalistic wetland
3. Row of trees
4. Buffer strip
5. Small copse
6. Bicycle and pedestrian lanes

Localization

Pictures

Naturalistic wetland

ECOSYSTEM SERVICES EVALUATION

The following **alternatives** were defined:

0) The previous situation (*doing nothing*): a poplar plantation

1) The standard solution (*grey infrastructure*): an underground first-flush tank and an open-air dry detention pond

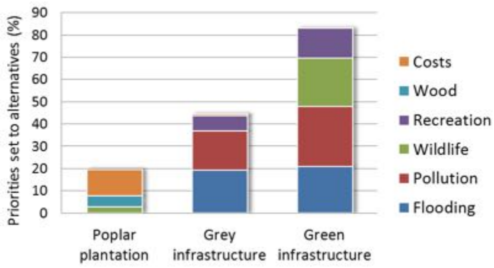
2) The nature-based solution (*green infrastructure*): constructed wetlands for water pollution control

The three alternatives were evaluated on the basis of the **ecosystem services** provided by each of them (that is, the benefits they offer to humans) and their investment and management costs.

A **multi-criteria analysis** run in the case study integrated the quantification of costs and benefits under each alternative with the opinion of different stakeholders, in order to select the optimal management option.

The **stakeholders** were represented by the Case Study Advisory Board and included members of public institutions at different levels (managers), the municipality and local associations (local stakeholders), and technical experts.

The **results** revealed that the existing green infrastructure or nature-based solution of Gorla Maggiore can accomplish the same functions of a conventional grey infrastructure with similar costs. The performance of the green infrastructure is analogous or even better than the grey infrastructure for water purification and flood protection. Moreover, the green infrastructure offers additional benefits such as habitats to support biodiversity and green areas for recreation.



IRIDRA's REFERENCES

The IRIDRA's authors are highlighted in bold

Barton, D.N., Kelemen, E., Dick, J., Martin-Lopez, B., Gómez-Baggethun, E., Jacobs, S., Hendriks, C.M.A., Termansen, M., García-Llorente, M., Primmer, E., ... **Masi, F.**, ... and Dunford, R., 2018. (Dis) integrated valuation–Assessing the information gaps in ecosystem service appraisals for governance support. *Ecosystem Services,* 29, pp.529-541.

Dunford, R., Harrison, P., Smith, A., Dick, J., Barton, D.N., Martin-Lopez, B., Kelemen, E., Jacobs, S., Saarikoski, H., Turkelboom, F., Verheyden, W., ..., **Conte, G.**, ..., and Yli-Pelkonen V. 2018. Integrating methods for ecosystem service assessment: experiences from real world situations. *Ecosystem Services*, 29, pp.499-514.

Rizzo, A., **Bresciani, R.**, **Masi, F.**, Boano, F., Revelli, R. and Ridolfi, L., 2018. Flood reduction as an ecosystem service of constructed wetlands for combined sewer overflow. *Journal of Hydrology*, 560, pp. 150-159.

Masi F., Bresciani R., Rizzo A., Conte G. Constructed wetlands for combined sewer overflow treatment: Ecosystem services at Gorla Maggiore, Italy. *Ecological Engineering*. Volume 98, January 2017, Pages 427–438

Liquete, C., Udias, A., **Conte, G.**, Grizzetti, B. and **Masi, F.**, 2016. Integrated valuation of a nature-based solution for water pollution control. Highlighting hidden benefits. *Ecosystem Services*, 22, pp.392-401.

IRIDRA S.r.l. (www.iridra.com), *founded in 1998, is a private consulting engineering firm composed by an interdisciplinary group of professionals. All IRIDRA's partners have a multi-annual experience (about since 1992) in the sustainable water management, nature-based solutions, green-infrastructure, and ecosystem services. IRIDRA realises any activity connected with analysis, planning and design for sustainable management of water resources: design, feasibility study, construction site supervision, etc. Our group, composed by engineers, biologists, chemists, approach to nature-based solution design in a correct multidisciplinary based way. Particularly IRIDRA is specialised in the design of natural-based solutions for wastewater treatment, such as constructed wetlands, of which IRIDRA group designed and managed over 400 systems of natural waste water treatment in Italy and in several other countries in different geographical situations and in answer to different problems. To preserve its "leader" role, IRIDRA has takes part to research projects in international partnerships as a relevant part of its activities, with a continuous trend since 2000 to nowadays. IRIDRA was partner of OpenNESS project and is one of the founder of* ***Global Wetland Technology****, a consortium of 10 companies which have been operating for almost 20 years in the field of waste water treatment and water pollution control by Constructed Wetlands.*

OpenNEES project *(Operationalisation of Natural Capital and Ecosystem Services) aimed to translate the concepts of Natural Capital (NC) and Ecosystem Services (ES) into operational frameworks that provide tested, practical and tailored solutions for integrating ES into land, water and urban management and decision-making. It examined how the concepts link to, and support, wider EU economic, social and environmental policy initiatives and scrutinized the potential and limitations of the concepts of ES and NC. To this aim, OpenNESS involved 26 research institutes (22 from Europe and 4 extra-Europe) and 10 SMEs, gathering 27 case studies. OpenNESS was funded by the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 308428. OpenNESS started on December 2012 and ended on May 2017. IRIDRA was partner of the OpenNESS project.*

LIVA

The Concept of Livability in the Context of Development of Small Towns

Duration: 01/2019-12/2020

Programme: NAWA – the Polish National Agency for Academic Exchange and SRDA – Slovak Research and Development Agency

Website: https://nawa.gov.pl/en/, https://www.apvv.sk/

Abstract

The project refers to the creation of a city development model based on the improvement of the quality of life of residents and pro-ecological solutions. The project has a bilateral character and is implemented by the University of Warmia and Mazury in Olsztyn (Poland) and the Slovak Technical University in Bratislava (Slovakia). Among the Polish towns, as a case study, those belonging to the Cittaslow association were selected, while in Slovakia there are cities with a similar socio-spatial structure and scale. As part of the project, joint research activities are undertaken in the field of sustainable development and urban landscape planning, taking into account the urban environment as well as green infrastructure and public spaces, including the social aspect.

The concept of 'livability' in the project is based on three main pillars:

1) planning for a residents-friendly space
   - public spaces, including squares, streets, recreational and sports areas,
   - the green areas (parks, squares, green areas) and pro-health areas (promotion of green therapy, hortitherapy)
   - built-up space (objects with a cultural, educational, social and residential function)
   - transportation space (application of the rules of traffic calming),
2) social integration of various groups (older, young, disabled, excluded) through educational and cultural activities in urban public space and
3) environmental protection and pro-ecological solutions
   - protection of valuable natural areas,
   - protection of cultural landscapes in the context of greenery
   - introduction of pro-ecological solutions in space, architecture, transport.

The results of the research will be beneficial for individual institutions and entities that deal with the implementation of new solutions for small towns.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Agnieszka Jaszczak, UWM Olsztyn, Poland, Coordinator, agaj77@tlen.pl
- Katarina Kristianova, STU Bratislava, Slovakia, Coordinator, kristianova@fa.stuba.sk

The Concept of Livability in the Context of Development of Small Towns - LIVA

Programme: NAWA - the Polish National Agency for Academic Exchange and SRDA – the Slovak Research and Development Agency

Contact: Assoc. Prof. Agnieszka Jaszczak[1], Ing.arch. Katarina Kristianova, PhD[2],
[1] Department of Landscape Architecture, University of Warmia and Mazury in Olsztyn, Prawochenskiego St.177, 10-719 Olsztyn, e-mail: agnieszka.jaszczak@uwm.edu.pl
[2] Slovak University of Technology in Bratislava, Slovakia, Centre for Landscape Architecture, Institute of Urban Design and Urban Planning, Námestie Slobody 19, 812 45 Bratislava, kristianova@fa.stuba.sk

Abstract

The project refers to the creation of a city development model based on the improvement of the quality of life of residents and pro-ecological solutions. The project has a bilateral character and is implemented by the University of Warmia and Mazury in Olsztyn (Poland) and the Slovak Technical University in Bratislava (Slovakia). Among the Polish towns, as a case study, those belonging to the Cittaslow association were selected, while in Slovakia there are cities with a similar socio-spatial structure and scale. As part of the project, joint research activities are undertaken in the field of sustainable development and urban landscape planning, taking into account the urban environment as well as green infrastructure and public spaces, including social aspects.

Purpose and scope: Small towns play important functions in the structure of many regions in Slovakia and Poland. On the one hand, their potential is recognized (livability concept), on the other hand, it draws attention to a number of problems related to space planning. The term "livability" has become an important concept in the field of planning (eg. public spaces, green areas, transportation systems), as well as in the context of social policy (eg. quality of life, participation of residents in the life of the city). Therefore, the main goal of the project is to indicate the directions of improving the living conditions of the society in small towns in the selected regions of both countries. Detailed goals are:

1. Analysis of the impact of "livability" on the development of a small town,
2. Assessment of the city's potential (in terms of planning, landscape, architecture and social aspects),
3. Creation of guidelines for open friendly places for local communities with „eco” and „slow” trends.

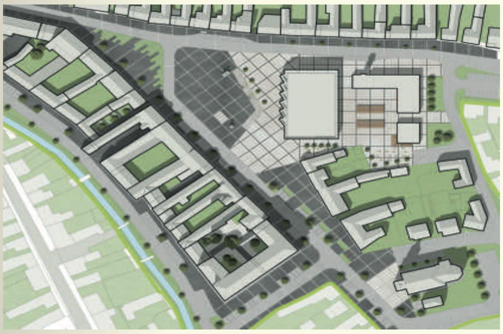


Fig. 1 Revitalization proposal for the square in a small pilgrimage town of Šaštín-Stráže, which was used only as a parking lot. The proposal has created a public-gathering place around the new shopping centre and tries to highlight the cultural potential of the space, by student Matej Šalát, supervisor Alžbeta Sopirová

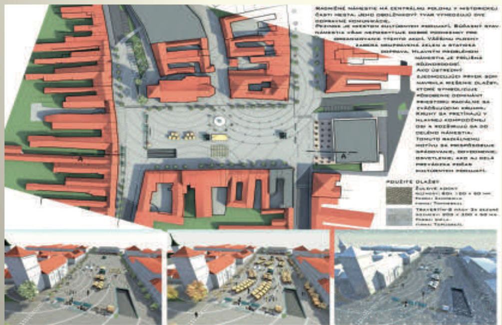
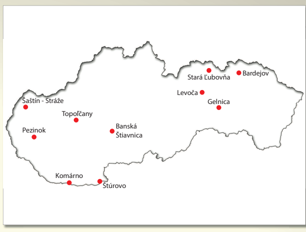


Fig. 2 The proposal for revitalization of the historical square in Pezinok, which underlines the genius loci of the territory through returning of the original paving and proposing solutions for the markets of the wine tradition of the Malokarpatský wine region, student Eva Kravcová, supervisor Peter Kardoš

Fig. 3 isualization of new public spaces proposed in the former hospital area, by students Romana Bonková and Dominika Bošáková, supervisor Katarina Kristianova

Case studies: selected small towns in Slovakia and towns from Cittaslow association in Warmia and Mazury region (Poland)
Field of research: public space with green areas
Topic: Livability



The concept of 'livability' in the project is based on three main pillars, including:

PLANNING FOR A RESIDENTS-FRIENDLY SPACE

- Public spaces, including squares, streets, recreational and sports areas,
- The green areas (parks, squares, green areas) of pro-health areas (promotion of green therapy, hortitherapy),
- Built-up space (objects with a cultural, educational, social and residential function),
- Transportation space (application of the rules of traffic calming).

SOCIAL INTEGRATION OF VARIOUS GROUPS (OLDER, YOUNG, DISABLED, EXCLUDED)

- Inclusion of all social groups in activities for the urban space by innovative pro-ecological projects
- The results of the research will benefit individual institutions and entities that deal with the implementation of new solutions for small towns

ENVIRONMENTAL PROTECTION AND PRO-ECOLOGICAL SOLUTIONS

- Protection of valuable natural areas
- Protection of cultural landscapes in the context of greenery
- Introduction of pro-ecological solutions in space, architecture, transport

In Poland, the research area will be cities associated in the Cittaslow network, while in Slovakia, cities of a similar nature, but not included in the association. The assumptions of the Cittaslow cities include a provision that concerns the conscious shaping of the towns' space based on heritage, with particular respect for the tradition of the place. On the other hand, it is also important to refer to contemporary trends and design trends and to induce "places" by residents. It has been hypothesized that these cities together with the surrounding rural areas may in the future be an alternative form for metropolitan structures, as well as a kind of pattern for others similar to them on a regional, national or international scale. A comparison of the examples from both countries can give answers to the following questions: does affiliation to the Cittaslow organization affect the attractiveness of small towns in Poland and is there a need and the conditions for including selected Slovakian cities in this international organization? The results of the research will benefit individual institutions and entities that deal with the implementation of new solutions for small towns.

The project uses the methods of research by design, alternative architectural, urban design and landscape design solutions for small cities are studied in design studios, as shown in Fig. 1-4.

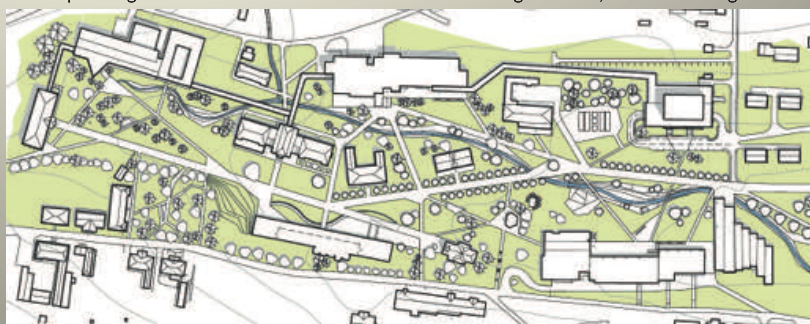


Fig. 4 Proposal for the central space of Bardejov spa area, with the recovery of the watercourse and implementation of nature-based solutions, by student Romana Hajduková, supervisor Katarina Kristianova

LEHS

Low-entropy human systems

Duration:

Programme:

Website: https://www.researchgate.net/project/Low-entropy-human-systems

Abstract

The overall goal of this research program is to provide urban and landscape planners with information and tools that will enable them to become better stewards of healthy, resilient, equitable and sustainable cities and landscapes. In our view, cities are part of Nature, modified ecosystems instead of mere human products. Solutions to real-world urban development problems take advantage from an understanding of cities as complex socio-ecological systems, which continuously evolve and continuously exchange matter and energy with the surroundings. Our research activity considers the Thermodynamics of open systems as the ground on which to build a new concept of city sustainability called Low-Entropy City. Indeed, the second law of Thermodynamics and the entropy principle provide a theoretical context which helps to clarify and unify a wide range of theories and studies, that go from ecology to social science and economy, connecting them to fundamental principles of Nature's evolution and functioning, and to define a long-term and solid sustainability of human-provoked land use changes and consequent biosphere alterations.

The objective of this contribution is to present a first application of the low-entropy city concept in the context of urban green infrastructure planning aimed at optimizing the storm water cycle and thus reducing its negative impacts on urban and extra-urban systems. Accordingly, some new indicators, derived from SWMM model application, are used to evaluate the entropy of a Bari urban district (South Italy) in terms of water quantity and quality parameters in a base scenario and a Nature-based scenario.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Raffaele Pelorosso, Dep. DAFNE, Tuscia University
- Federica Gobattoni, Dep. DAFNE, Tuscia University
- Antonio Leone, Dep. DAFNE, Tuscia University

Circular City
circular-city.eu

COST EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

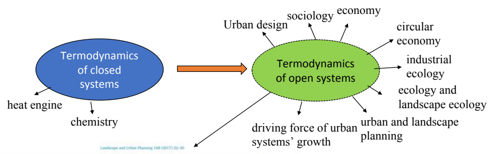
CA17133 Circular City
13-15 Feb 2019, Vienna, Austria

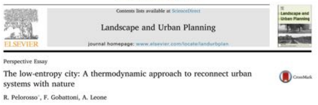
Raffaele Pelorosso, Federica Gobattoni, Antonio Leone
pelorosso@unitus.it, f.gobattoni@unitus.it, leone@unitus.it
UNIVERSITÀ DEGLI STUDI DELLA Tuscia

Project: Low-entropy human systems (LEHS)

INTRODUCTION

The overall goal of this research program is to provide urban and landscape planners with information and tools that will enable them to become better stewards of healthy, resilient, equitable and sustainable cities and landscapes. In our view, cities are part of Nature, modified ecosystems instead of mere human products. Solutions to real-world urban development problems take advantage from an understanding of cities as complex socio-ecological systems, which continuously evolve and continuously exchange matter and energy with the surroundings. Our research activity considers the Thermodynamics of open systems as the ground on which to build a new concept of city sustainability called Low-Entropy City. Indeed, the second law of Thermodynamics (SLT) and the entropy principle provide a theoretical context which helps to clarify and unify a wide range of theories and studies, that go from ecology to social science and economy, connecting them to fundamental principles of Nature's evolution and functioning, and to define a long-term and solid sustainability of human-provoked land use changes and consequent biosphere alterations..

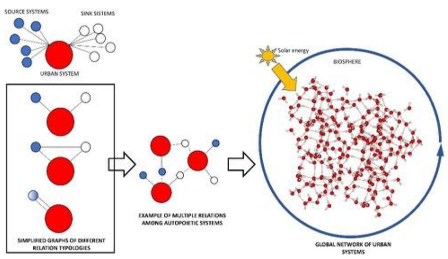



Landscape and Urban Planning
Perspective Essay
The low-entropy city: A thermodynamic approach to reconnect urban systems with nature
R. Pelorosso, F. Gobattoni, A. Leone

ENTROPY: A measure of the state of disorder of a system (Stremke & Koh, 2011). It is related to the dissipated energy (waste) during natural irreversible processes that trasform energy, move mass and drive the global biogeochemical cycles (Kleidon, 2009).

LOW-ENTROPY CITY DEFINITON

A responsive and conscious autopoietic human sociocultural niche which evolves and grows, enhancing its socio-ecological and structural complexity (reducing internal entropy) by adding and optimizing functional elements and synapses among them, while wastes (exported entropy to the biosphere) are minimized.



Low-entropy cities can be defined by a lower entropy release into the biosphere and strategies that mimic, as far as possible, Nature and the structure and functioning of ecosystems according to the Second Law of Thermodynamics (SLT) and the circular economy of Nature (Ho, 2013). In general, these objectives can be reached by the following actions:

the reduction of dissipative systems
the closure of cycles
the maximization of reciprocity, symbiosis, cooperative relationships
an increase in landscape diversity and complexity
the enhancement of energy and matter exchange

The low-entropy city approach can lead to a reduction in consumption, but more importantly, it aims to investigate what is consumed, how energy and matter are used and where waste might induce socially and environmentally negative consequences

THE OBJECTIVE OF THIS CONTRIBUTION is to present a first application of the low-entropy city concept in the context of urban green infrastructure planning aimed at optimizing the storm water cycle and thus reducing its negative impacts on urban and extra-urban systems. Accordingly, some new indicators, derived from SWMM model application, are used to evaluate the entropy of a Bari urban district (South Italy) in terms of water quantity and quality parameters in a base scenario and a Nature-based scenario

MAIN REFERENCES

Leone A., Gobattoni F., Pelorosso R. (2018). Pianificazione e incertezza. Una bussola e alcune mappe per navigare nel mondo liquido. FrancoAngeli.

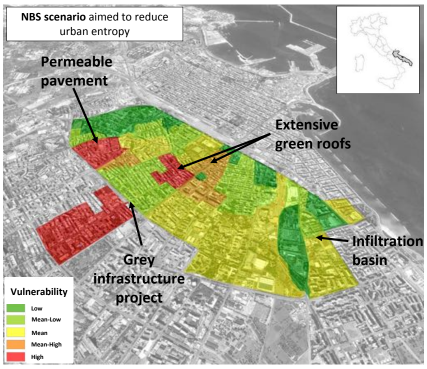
Pelorosso, R., Gobattoni, F., Leone, A. (2017). The low entropy city: a thermodynamic approach to reconnect urban systems with nature Landscape and Urban Planning, 168:22–30.

Pelorosso, R., Gobattoni, F., Ripa, M.N., Leone, A. (2018). Second law of thermodynamics and urban green infrastructure. A knowledge synthesis to address spatial planning strategies. Tema. Journal of Land Use, Mobility and Environment, Issue Volume 11(1), 27-50.

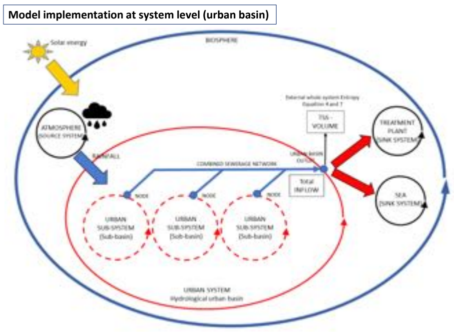
Pelorosso, R., Gobattoni, F., Leone, A. (2018). Reducing Urban Entropy Employing Nature-Based Solutions: The Case of Urban Storm Water Management. Springer

Pelorosso, R., Gobattoni, F., Leone, A. (2018). Increasing Hydrological Resilience Employing Nature-Based Solutions: A Modelling Approach to Support Spatial Planning. Springer

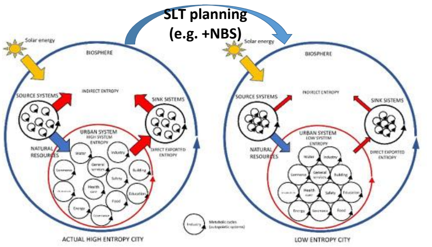
Low-entropy planning approach based on urban storm water modelling (SWMM)

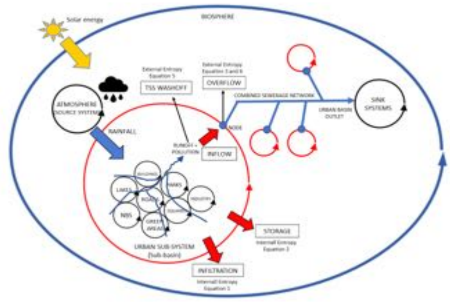


Model implementation at system level (urban basin)



Model implementation at sub-system level (urban sub-basin)





Entropy indicators at sub-system level

internal entropy

$$E^i_{infiltration\_j} = \frac{infiltration\ (mm)_j}{rainfall\ (mm)_j}$$

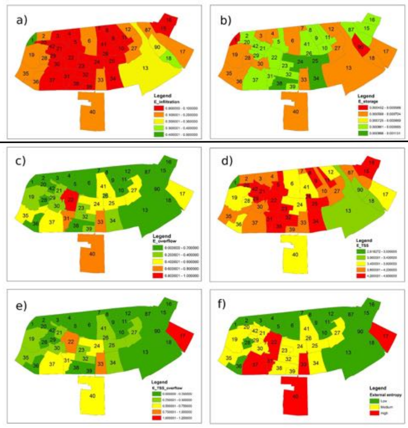
$$E^i_{storage\_j} = \frac{storage\ (mm)_j}{rainfall\ (mm)_j}$$

external entropy

$$E^e_{overflow\_j} = \frac{overflow\ (L)_j}{inflow\ (L)_j}$$

$$E^e_{TSS\_j} = \frac{TSS\ washoff\ (Kg)_j}{area\ (m^2)_j}$$

$$E^e_{TSS\_overflow\_j} = \frac{TSS\ overflow\ (Kg)_j}{TSS\ inflow (Kg)_j}$$



f) Composite indicator of external entropy at sub-basin scale is calculated as the sum of three standardized entropy indicators (c, e, d) obtained by dividing each one by the maximum value registered in the base scenario

EXTERNAL ENTROPY INDICATORS AT SUB-SYSTEM LEVEL
Base scenario and NBS scenario. Only sub-basins with significant variation of entropy are reported. $E_{infiltration}$ and $E_{storage}$ are expressed in absolute values.

Sub-basin	proposed intervention	$\Delta E_{infiltration}$	$\Delta E_{storage}$	$\Delta\% E_{overflow}$	$\Delta\% E_{TSS}$	$\Delta\% E_{TSS\ overflow}$
17	infiltration basin	0.05	0.18	-23.88	-50.94	-60.22
24	extensive green roof	0.20	0.07	-46.13	-21.73	-51.77
37	permeable pavement	0.56	0.00	-33.72	-59.07	-34.60
39		0.00	0.00	-100.00	0.00	0.00
40	grey infrastructure project	0.00	0.00	-18.25	0.00	-18.26
41		0.20	0.07	-12.83	-21.21	-12.68

EXTERNAL ENTROPY INDICATORS AT SYSTEM LEVEL
Base scenario and NBS scenario

$$E^e_{sewagedischarge\_s} = \frac{Total\ volume\ (L)_s}{rainfall\ (L)_s}$$

$$E^e_{TSS\_s} = \frac{TSS\ (Kg)_s}{area\ (m^2)_s}$$

Entropy indicator	Base Scenario	NBS Scenario	Δ%
$E_{sewagedischarge\_s}$ (eq. 4)	0.518	0.513	-0.965
E_{TSS_s} (eq.7)	2.328	2.283	-1.968

DISCUSSION AND CONCLUSIONS

- Proposed assessment methodology and entropy indicators can be used to evaluate different Nature-base solutions (NBS) and green scenarios and/or to guide the design process in building low-entropy cities.
- This work shows a quantitative modelling assessment approach could be successfully applied in urban planning practice while dealing with green infrastructure and grey infrastructure design.
- Further research is necessary both to define entropy more appropriately in ecological/environmental terms (e.g. impact on urban climate, biodiversity) and to investigate possible implications on social aspects.
- The integration of the SLT into the planning of NBSs will require a transdisciplinary approach with a proactive contribution from different research fields and experts.
- The choice and the spatial localization of NBSs should focus on the optimization of Urban Green Infrastructure (UGI) multifunctionality, considering SLT (i.e. available and recyclable water or intercepted waste), resilience (i.e. adaptive and recovery capacity) and a urban ecosystem services viewpoint (e.g. number and typology of beneficiaries). This work, using the scenario NBS coming from Pelorosso et al. (2018) can thus be considered as a first step towards the integration of the resilience and entropy concepts into a process of sustainable spatial planning of urban systems.
- We hope that the proposed low-entropy and nature-based view of urban systems will stimulate urban planners, civil engineers, architects and scientists, and inspire theoretical discussions as well as practical follow-ups that will contribute to realise even more low-entropy human systems.

METHANE YIELD DATABASE: ONLINE INFRASTRUCTURE AND BIORESOURCE FOR

METHANE YIELD DATA AND RELATED METADATA

University of Ljubljana
Faculty of Civil and Geodetic Engineering

Duration: 1.1.2017 - 31.12.2021

Programme: Water Science and Technology, and Geotechnical Engineering: Tools and Methods for Process Analyses and Simulations, and Development of Technologies. P2-0180 (B) - included in ARRS records

Website: https://methane.fe.uni-lj.si/

Abstract

The aim of this study is to upgrade developed and validated a community supported online infrastructure and bioresource for methane yield data and accompanying metadata collected from published literature. In total, 1164 entries described by 15,749 data points were assembled. Analysis of data collection showed little congruence in reporting of methodological approaches. The largest identifiable source of variation in reported methane yields was represented by authorship (i.e. substrate batches within particular substrate class) within which experimental scales (volumes (0.02–5 l), incubation temperature (34–40°C) and % VS of substrate played an important role ($p < 0.05$, $n_{permutations} = 999$) as well. The largest fraction of variability, however, remained unaccounted for and thus unexplained (>63%). This calls for reconsideration of accepted approaches to reporting data in currently published literature to increase capacity to service industrial decision making to a greater extent and to provide useful data for the support of urban farming.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Sabina Kolbl Repinc, University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia, sabina.kolbl-repinc@fgg.uni-lj.si

Other contact person(s):

- Blaž Stres, University of Ljubljana, Faculty of Civil and Geodetic Engineering, Slovenia, blaz.stres@fgg.uni-lj.si
- Boštjan Murovec, Faculty of Electrical Engineering, Tržaška 25, SI-1000 Ljubljana, Slovenia; bostjan.murovec@fe.uni-lj.si

METHANE YIELD DATABASE: ONLINE INFRASTRUCTURE AND BIORESOURCE FOR METHANE YIELD DATA AND RELATED METADATA

Boštjan MUROVEC[1], Sabina KOLBL REPINC[2], Blaž STRES[2*]

[1] *University of Ljubljana*, Faculty of Electrical Engineering, Tržaška 25, SI-1000 Ljubljana, Slovenia; bostjan.murovec@fe.uni-lj.si
[2] *University of Ljubljana, Faculty of Civil and Geodetic Engineering, Hajdrihova 28, 1000 Ljubljana, Slovenia; sabina.kolbl-repinc@fgg.uni-lj.si*
[2] *University of Ljubljana Faculty of Civil and Geodetic Engineering, Hajdrihova 28, 1000 Ljubljana, Slovenia; blaz.stres@fgg.uni-lj.si*

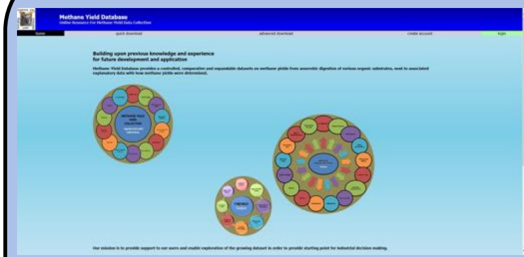
Abstract

The aim of this study is to upgrade developed and validated a community supported online infrastructure and bioresource for methane yield data and accompanying metadata collected from published literature. In total, 1164 entries described by 15,749 data points were assembled. Methane yield database is accessible online on the web site **http://methane.fe.uni-lj.si/**

1. Results and discussion

Classes of solid and liquid substrates

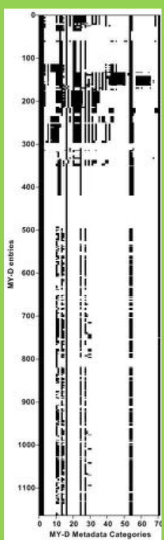
Characteristics of analytical approaches

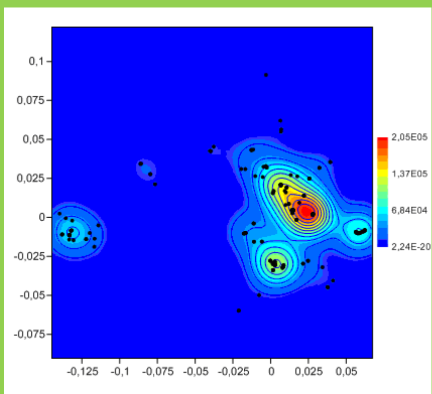


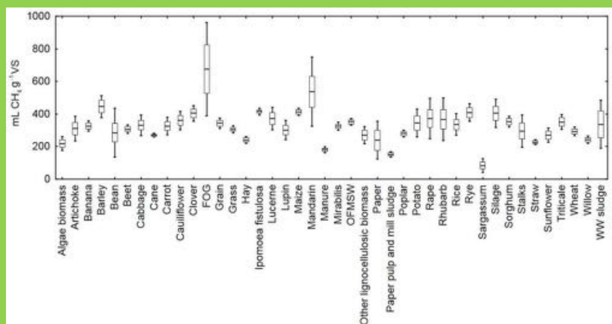
On-line methane yield database: http://methane.fe.uni-lj.si

Figure 1: A schematic view of data assembling, and collection of anayltical procedures to develope and build free on-line methane yiedl database.

Database of methane yields and metadata analysis







- hierarchically organized collection of methane yields and metadata,
- methane yields mapped to experimental conditions,
- end-user curated datasets for further data exploration,
- efficient data sharing and acceptance of user contributions

Figure 2: A schematic view of the assembled data in MY-D showing the extent of overlap in the reported metadata categories as observed from published literature (left). (middle) The Kernell density of data distribution presented in (left) shows the existence of six major classes of reporting strategies (contours with higher density of datapoints with similar reporting strategies).

2. Conclusions

Analysis of data collection showed litle congruence in reporting of methodological approaches. The largest identifiable source of variation in reported methane yields was represented by authorship (i.e. substrate batches within particular substrate class) within which experimental scales (volumes (0.02 l to 5 l), incubation temperature (34°C to 40°C) and %VS of substrate played an important role ($p<0.05$, $n_{permutations}=999$) as well. The largest fraction of variability, however, remained unaccounted for and thus unexplained (>63%). This calls for reconsideration of accepted approaches to reporting data in currently published literature to increase capacity to service industrial decision making to a greater extent and to provide useful data for the support of urban farming.

Reference: Murovec B, Kolbl S, Stres B. Methane Yield Database: online infrastructure and bioresource for methane yield data and related metadata. Bioresource Technology 2015. http://dx.doi.org/10.1016/j.biortech.2015.04.021.

MIUC
Multifuncational Datacenters for Attractive Cities

Duration: 11/2018-11/2022

Programme: Cloudberry, Swedish Energy Authority (Energimyndigheten)

Website: http://www.energimyndigheten.se/en/

Abstract

Thanks to its reliable grid system and clean and cheap energy supply, Data Centers (DC) are mushrooming in Nordic Countries. However, today's DCs are single function enterprises that are disconnected from the rest of the city and consume much energy. This puts DCs in competition with the local residents for energy resources. Also the emergence of the climate change discourse in society is pressing the DC industry to become more environmental friendly.

Our project situates DCs within the circular cities paradigm, addressing in particular the energy food nexus. Our aim is to re-think DCs as multifunctional urban devices able to close the energy cycle in place by recycling waste energy heat for food production. We imagine a locally run food production facility that sources its energy demands from local DCs and aims for quality, organic food that is consumed in local schools.

This vision poses several design and construction challenges, e.g.: size and location of DCs, building design optimization, and community participation. We aim to develop a "model dashboard" to optimize building design and downstream activities that address the energy-food nexus such as waste heat-to-food and renewable energy to support it.

Methodologically, the tools and processes embedded in the MIUC platform will be developed in an urban living lab environment that involves companies, experts, and community stakeholders. In a four steps methodology (need-finding, create, prototype, and assess), we deploy design thinking tools to co-create together with stakeholders and users the future DC.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Agatino Rizzo, Lulea University of technology, project leader
- Marcus Sandberg, Lulea University of technology, principal investigator
- Cristina Ramos, Lulea University of technology, phd student
- Partners: ICE SICS North

Circular City
circular-city.eu

CA17133 Circular City
13-15 Feb 2019, Vienna, Austria

COST
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY
COST is supported by the Framework Programme Horizon 2020

- Implementing nature based solutions for creating a resourceful circular city -

"Multifunctional Datacenters for attractive cities"
-
MIUC Living Lab

Today's Data centers (DCs) are single function enterprises that are disconnected from the rest of the city and consume much energy. This puts DCs in competition with the local residents for energy resources. Also the emergence of the climate change discourse in society is pressing the DC industry to become more environmental friendly. Our project situates DCs within the circular cities paradigm, addressing in particular the energy food nexus. The aim is to re-think DCs as multifunctional urban devices able to close the energy cycle in place by recycling waste energy heat for food production. This vision poses several design and construction challenges, e.g.: size and location of DCs, building design optimization, and community participation. We aim to develop a "model dashboard" to optimize building design and downstream activities that address the energy-food nexus such as waste heat-to-food and renewable energy to support it. Methodologically, the tools and processes embedded in the MIUC platform will be developed in an urban living lab environment that involves companies, academia and community stakeholders. In a four steps methodology (explore, create, implement and evaluate), we deploy design thinking tools to co-create together with stakeholders and users of the future DCs.

Agatino Rizzo_agatino.rizzo@ltu.se
Marcus Sandberg_marcus.sandberg@ltu.se
Cristina Ramos Cáceres_cristina.ramos.caceres@ltu.se

CLOUDBERRY DATACENTERS
ICE RISE SICS NORTH
Swedish Energy Agency
LULEÅ TEKNISKA UNIVERSITET

Nature4Cities

Nature Based Solutions for re-naturing cities: knowledge diffusion and decision support platform through new collaborative models

Duration: 11/2016-11/2020

Programme: Grant agreement ID: 730468

- H2020-EU.3.5.4.2. - Support innovative policies and societal changes
- H2020-EU.3.5.2.3. - Provide knowledge and tools for effective decision making and public engagement
- H2020-EU.3.5.1.2. - Assess impacts, vulnerabilities and develop innovative cost-effective adaptation and risk prevention and management measures
- H2020-EU.3.5.1.3. - Support mitigation policies, including studies that focus on impact from other sectoral policies
- H2020-EU.3.5.2.2. - Developing integrated approaches to address water-related challenges and the transition to sustainable management and use of water resources and services

Website: https://www.nature4cities.eu

Abstract

Nature4Cities aims at raising awareness about Nature-Based Solutions (NBS) and foster new collaborative models for NBS uptake by developing a knowledge and decision support platform. This platform will provide tools for impact assessments, valorisation and follow-up of NBS projects.

For this platform, Nature4Cities develops a scientific and technical database and operational tools for the effectiveness of Nature Based Solutions applied in a framework which considers a holistic approach and, which integrates multiple stakeholders.

It intends to produce knowledge and to empower urban projects stakeholders (involved in urban planning/design/management intervention) to take decision. It addresses to scientists, urban decision makers, practitioners and citizens.

Nature4Cities project is based on:

- the building of a NBS knowledge base and associated, integrated analysis framework
- the development of a holistic assessment methodology exploring environmental, urban, socio-economic, governance, business and financing models aspects.
- the adaptation of existing technologies for citizen's participatory engagement, urban data acquisition and urban data management
- the co-development and assessment of actual NBS projects and strategies with Partner Cities

Nature4Cities research team is an interdisciplinary and international team (from 9 countries). The consortium partners take a pro-active part in the EU dynamics of R&D&I, at the crossing of urban green infrastructure planning and construction sector, environmental assessment, social sciences, innovation management and Information and Communication Technology supporting tools.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Stéphanie Decker, Nobatek/INEF4, France
- Benedetto Rugani & Javier Babi Almenar, LIST, Luxembourg
- Vera Enzi, Grün Statt Grau, Austria

NATURE 4 CITIES

A knowledge diffusion and decision platform for renaturing cities

New challenges for renaturing cities

Most Nature-Based Solutions (NBS) can't be thought just as replacements for conventional solutions, but require a new whole governance approach. Integrating NBS in urban planning requires both a change of mind in multiple stakeholders and new models of governance, business & funding as well as new integrated assessment capabilities.

Nature4Cities Answer

To support local authorities and urban planners in projects development and give them new tools to engage citizens in the process, Nature4Cities concept is based on:

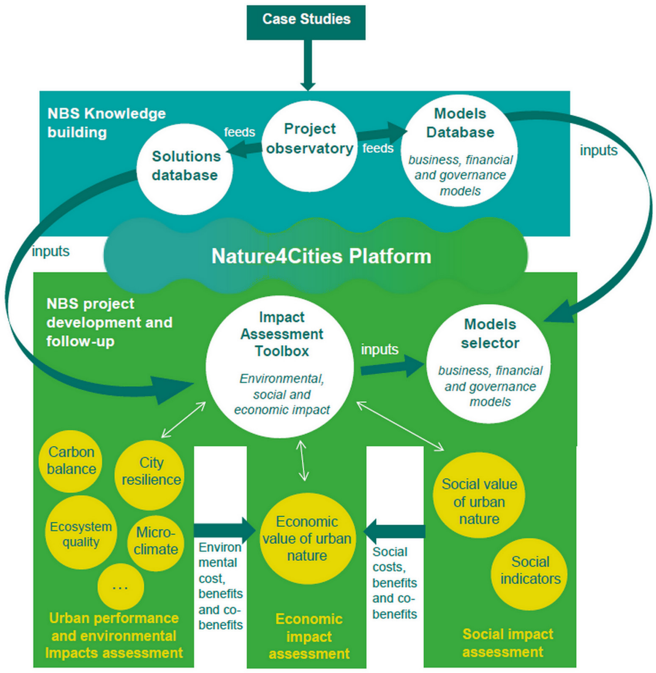
1/ the building of a NBS knowledge base and associated integrated analysis framework,

2/ the development of a holistic assessment methodology,

3/ the adaptation of existing technologies for urban data management and citizens' participatory engagement,

4/ the co-development and demonstration with partner cities.

By creating a reference framework on NBS, Nature4Cities will contribute to create a global market and new business opportunities within green economy.



Key moments

November 2016 — Official launch of the project with the Kick-off meeting

July 2018 — Web-based NBS project observatory online with pioneering projects

October 2019 — Prototype of N4C platform fully integrated and beginning of demonstration with partner cities on real case studies

October 2020 — Operational platform running

A 4-year project with

7.5 M€ budget
26 partners
9 countries
4 pilot cities

Adaptation of existing technologies for NBS Implementation

- > 3D city simulation platform
- > Urban metabolism platform
- > Drones and satellite imagery
- > Online citizen participation tools
- > tools for green areas assessment

Nature4Cities consortium

> 6 leading Research and Technology Organizations

NOBATEK/INEF4 (FR) – Coordinator
Cerema (FR), Tecnalia (ES), Eurecat (ES), Cartif (ES), Luxembourg Institute of Science & Technology (LU)

> 4 universities

University of Nantes (FR), Agrocampus Ouest (FR), University of Szeged (HU), Middle East Technical University (TR)

> 2 leading industrial organizations

Acciona Construction (ES), Acciona Ingenieria (ES), Rina Consulting (IT)

> 8 Small and Medium-sized Enterprises (SMEs)

Green4Cities (AT), Terranis (FR), Colouree (IT), Duneworks (NL), Argedor (TR), Ekodenge (TR), Innova Integra (UK), R2M Solution (IT), Grün statt Grau (AT)

> 2 clusters of stakeholders

Plante & Cité (FR), Hungarian Urban Knowledge Center (HU)

> 4 pilot cities

Alcala de Henares (ES), Città Metropolitana Di Milano (IT), Szeged (HU), Çankaya (TR)

Join the comunity!

www.nature4cities.eu

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 730468

NACHWUCHS - Sustainable Agri-Urban Growth

Design and Communication of sustainable Settlement Structures for growing Metropolitan Areas

Duration: 07/2018-06/2021

Programme: Stadt-Land-Plus BMBF

Website: n/a

Abstract

The metropolitan area of Cologne is expecting an increase in population. New living space is urgently needed and meanwhile farmers and the regional food production suffer from the endeavors for housing estates. Urban sprawl, a transformation of the regional landscape and the damage of fertile soil are consequences. Researchers, thirteen local municipalities and the local agriculture are working together to design an innovative “Garden City of the 21st century” having a prototypical character for other metropolitan areas.

The project associates various research interests such as the reduction of land consumption by future settlements, the preservation of open spaces, the spatial superposition of agriculture and local recreation and new possibilities of citizen participation in agrarian and urban land use (urban agriculture).

The research project aims to formulate a future scenario for the metropolitan area of Cologne and to find innovative solutions for its sustainable development. As a groundwork, a broad database will be collected and analyzed regarding a future scenario of “continuation“. The data base will be handed over to the participating municipalities to facilitate their regional network and planning in the future.

Furthermore, the research project is creating a living lab together with local communities, universities and regional cultivators. The guiding principle of the design process is a higher density of buildings and the development of hybrids that can mediate between agriculture and urban settlement.

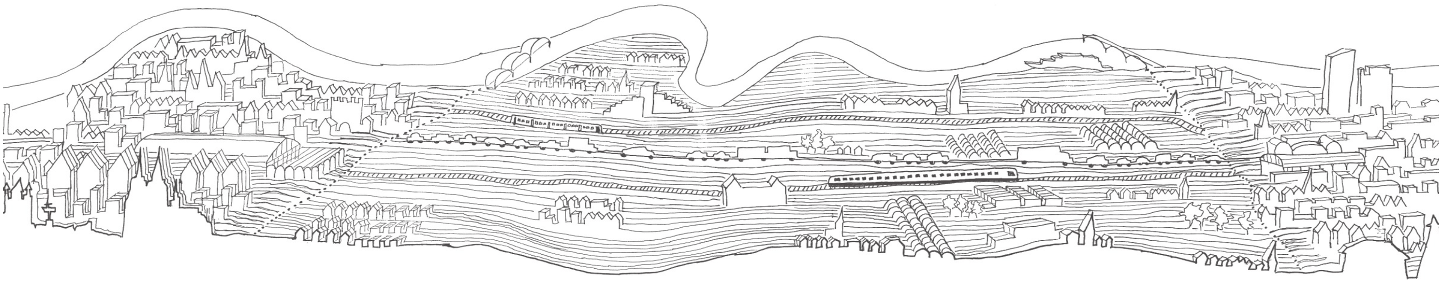
Workshops and Community Planning Activities build on one another and produce future-visions for the regional development. The design process is integrating student competitions and temporary interventions in cooperation with universities situated in the region. The results of these competitions can introduce precise settlement visions in selected focus areas (dense, rural, agrarian) and provide a basis for a constructive discussion between different stakeholders.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Nathalie Pszola, RWTH Aachen University, Germany

Sustainable Agri-Urban Growth

Design and Communication of sustainable Settlement Structures for growing Metropolitan Areas



Agroforestry Collective
(Nathalie Pszola)

„NACHWUCHS“ - “GROWTH“

The metropolitan area of Cologne is expecting an increase in population. New living space is urgently needed and meanwhile farmers and the regional food production suffer from the endeavors for housing estates. Urban sprawl, a transformation of the regional landscape and the damage of fertile soil are consequences. Researchers, thirteen local municipalities and the local agriculture are working together to design an innovative “Garden City of the 21st century” having a prototypical character for other metropolitan areas.
The project associates various research interests such as the reduction of land consumption by future settlements, the preservation of open spaces, the spatial superposition of agriculture and local recreation and new possibilities of citizen participation in agrarian and urban land use (urban agriculture).

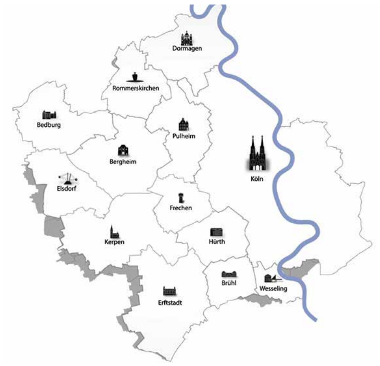


Fig. 1: NACHWUCHS living lab region with thirteen municipalities networking.
(Stadt Umland Netzwerk: https://www.stadt-umland-netzwerk.de/)

Design and Communication

The research project aims to formulate a future scenario for the metropolitan area of Cologne and to find innovative solutions for its sustainable development. As a groundwork, a broad database will be collected and analyzed regarding a future scenario of “continuation“. The data base will be handed over to the participating municipalities to facilitate their regional network and planning in the future. Furthermore, the research project is creating a living lab together with local communities, universities and regional cultivators. The guiding principle of the design process is a higher density of buildings and the development of hybrids that can mediate between agriculture and urban settlement.
Workshops and Community Planning Activities build on one another and produce future-visions for the regional development. The design process is integrating student competitions and temporary interventions in cooperation with universities situated in the region. The results of these competitions can introduce precise settlement visions in selected focus areas (dense, rural, agrarian) and provide a basis for a constructive discussion between different stakeholders.

Fig. 2 -7: Regional structures of settlements and agriculture.
(rhein-voreifel touristik e.V.; Bilderbuch Köln; ropa; google earth)

Landuse Comparison
(Nathalie Pszola)

Masterthesis “Subsistence“

The project “Subsistence“ proposes an "Agroforestry Collective“ as an alternative synergetic concept to the planned expansion of "Sechtem“, a small village between Cologne and Bonn. With a dense living structure and a superposition of programs, the area of 26 hectares accomodates almost the same number of inhabitants and still facilitates the production of local food. Hence, the new village area can live from agriculture as a self-sustaining collective and grow vegetables, fruits and grains combined with animal husbandry. By interweaving the subsistence of living and the subsistence of agriculture, the„"Agroforestry Collective“ is designing a sustainable and identity-forming vision for the future of suburban villages.

How much Space does a Person in Germany need for Subsistence?
(Atsuko Wakamiya; Image Nathalie Pszola)

Corresponding Author: Nathalie Pszola

Tel.: +49 (0)241 80 95032
E-Mail: pszola@la.rwth-aachen.de
Website: www.stadt-umland-netzwerk.de/tag/nachwuchs/

Institute of Landscape Architecture
RWTH AACHEN UNIVERSITY

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

NaturB

Nature-based solutions for increasing cities resilience and sustainability

C.C.M.E.S.I.

Duration: 2017-2019

Programme: PN-III-P4-IDPCE-2016 Exploratory Research Projects, Funding from the Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI – Romania)

Website: https://ccmesi.ro/?page_id=666

Abstract

The UN Global Report on Human Settlements has warned that future synergistic relations between urbanization and environmental changes will affect the stability of the human society. Urban ecologists need to develop integrative databases, principles, concepts and tools, required to create liveable cities. Nature-based Solutions (NbS) represent the cornerstone of new urban ecology approaches, which could help the urban areas to increase their resilience to new environmental challenges and improve their sustainability.

The assessment of NbS has become an important challenge for practitioners, due to the high complex relations between the components of the urban systems, the high vulnerability to climate change, and the consequences in the social-economical systems. The project aims to assess the integration, acceptance, and the efficiency of NbS in Romania's cities and to develop a conceptual model for enhancing cities resilience and sustainability, using and adapting some cutting-edge methods (i.e. Grounded Theory, Qualitative Comparative Analysis, scenarios planning).

The specific objectives of the project are: Identifying categories of NBS related to cities resilience and sustainability; Assessing the European, national and local policies directed toward NBS in cities; Evaluating the integration of NBS in different sectors of urban environments; Evaluating the acceptance of NBS in urban areas; Developing a conceptual model for enhancing cities resilience and sustainability on NBS.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Mihai-Răzvan NIȚĂ, University of Bucharest, Romania

NATURB - Nature-based solutions for increasing cities resilience and sustainability

Niță M.R., Iojă I.C., Popa A.M.
Center for Environmental Research and Impact Studies, University of Bucharest

The project aims to assess the integration, acceptance, and the efficiency of NbS in Romania's cities and to develop a conceptual model for enhancing cities resilience and sustainability, using and adapting (i.e. Grounded Theory, Qualitative Comparative Analysis, scenarios planning).

O1. Identifying categories of NBS related to cities resilience and sustainability

Figure 1: **Ten challenges to be solved by green solutions,** Source: Raymond et al., 2017 – adaptation to climate change, water management, coastal zone resilience, green space management, air quality, urban regeneration, public participation in planning and governance, equity and social cohesion, health and quality of life for the inhabitants and economic opportunities. .

Tabel 1: **Public policy domains in Romania,** Source: Romania Government, 2005 - Policies in Romania cover 19 potential areas of green solutions application. The information in the table was extracted from strategies and policies at national (84 policies), county and local level in Romania (82 plans), from 2002 to 2017. At European level, there have been identified 153 laws, strategies, reports and plans related to the promotion, implementation and management of green solutions in response to environmental challenges. The most relevant areas are: environmental protection (45), innovation (34), biodiversity (27), health (29) and the economy (18).

No.	Domain
1	Public environmental policies
2	Public policies on natural resources, agricultural production and processing
3	Public policies on transport and communications
4	Regional public policies
5	Public policies on tourism, sports and leisure activities
6	Industrial public policies
7	Public service policies
8	Public policies on civil society and democracy
9	Public business policies
10	Public policies on education and science
11	Public policies on budget and finance
12	Public health policies
13	Public policies on culture
14	Public policies on public administration
15	Social public policies on employment
16	Public policies on foreign affairs
17	Public policies on national defense
18	Public policies on justice
19	Public policies on internal affairs

O3. Evaluating the integration of NBS in different sectors of urban environments

Tabel 2: **The distribution of the measures in Environmental Action Plans on the overlap potential with the directions in NBS Eklipse report in Local Environmental Action Plans (LEAP) -** The most frequent Eklipse challenges to CEAP measures were represented by water management, planning and territorial governance, as well as the health and welfare of the population, and the least common ones related to coastal resilience (encountered only in CEAP Constanta), climate resilience or urban regeneration.

Climate Resilience	Water Management	Costal Resilience	Green Space Management	Air Quality
4,07	21,43	0,19	6,83	11,50
Urban regeneration	**P. Planning & Governance**	**Social Justice & Social Cohesion**	**Public Health and Well-being**	**Economic Opportunities & Green Jobs**
3,73	20,94	7,65	16,46	7,20

Figure 4: **Indoor house plants** - An analysis of 298 responses of the inhabitants living in Bucharest indicates a significant presence of plants in the analyzed dwellings. 29% of people questioned do not own plants in their homes. The number of plants varies greatly from 1 to 60-70 plants. These can be classified as plants with flowers, those with the highest proportion of 50%, 25% decorative plants and 3% aromatic, vegetable or fruit plants. The most commonly found species include *Ficus, Rosa, Japanese Hibiscus rosa-sinensis, Pelargonium, Cactaceae, Saintpaulia Cyclamen* or *Orchidaceae.*

Additional Reading:

Badiu D.L., Niță A., Ioja I.C., Niță M.R., (2018) Disentangling the connections: a network analysis of approaches on urban green infrastructures, Urban Forestry & Urban Greening (under review)

Vierikko K., Gonçalves P., Haase D., Elands B., Ioja I.C., Puttonen M., Pieniniemi M., Lindgren J., Grilo F., Santos-Reis M., Niemela J., Yli-Pelkonen V. (2018) Lived biocultural diversity in European parks – do public parks concurrently support interrelationships between people and nature? Urban Forestry & Urban Greening (under review)

Breuste J., Ioja I.C., Hossu C.A., Onose D.A., Vrinceanu A., Ponizy L., Mizgajski A., Zwierzchowska I., Kryger R. (2018) Urban nature: perceptions and use in suburban residential areas from Central European cities, Landscape and Urban Planning, (under review)

Badiu D.L., Onose D.A., Niță M.R., Lafortezza, R. (2018) From "red" to green? A look into the evolution of green spaces in a post-Socialist city, Landscape and Urban Planning, In Press, Corrected Proof

Zwierzchowska I., Hof A., Ioja I.C., Mueller C., Ponizy L., Breuste J., Mizgajski A. (2018) Multi-Scale Assessment of Cultural Ecosystem Services of Parks in Central European Cities, Urban Forestry & Urban Greening, 30, 84-97

Artmann M., Kohler M., Meinel G., Gan J., Ioja I.C. (2017), How smart growth and green infrastructure can mutually support each other — A conceptual framework for compact and green cities. Ecological Indicators, In Press, Corrected Proof

Artmann M., Chen X., Ioja I.C., Hof A., Onose D., Ponizy L., Lamovsek A.Z., Breuste J. (2017), The role of urban green spaces in care facilities for elderly people across European cities, Urban Forestry & Urban Greening, 27, 203-213

O2. Assessing the European, national and local policies directed toward NBS in cities

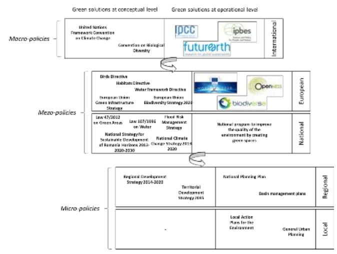


Figure 2: **Integration of green areas into policies, strategies and operational programs** – Green areas are the subject of policies across different scales and visions, from micro to macro scale, from local to international scale, and from conceptual to operational level

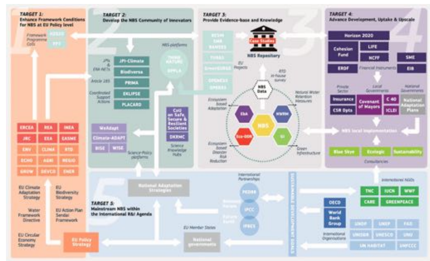


Figure 3: **The strategic model of the EU green strategy** Source: Faivre et al., 2017 - The EU strategy for greenfield research and innovation has five main targets, related to each other: (1) Enhance Framework Conditions for NBS at EU Policy level, (2) Develop the NBS Community of Innovators, (3) Provide Evidence-base and Knowledge, (4) Advence Development, Uptake and Upscale, (5) Mainstream NBS within the International R&I Agenda

O4. Evaluating the acceptance of NBS in urban areas

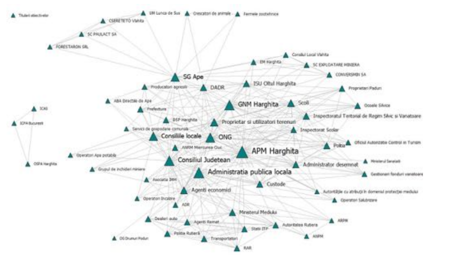


Figure 5: **Network analysis for actors involved in all activities in Local Environmental Action Plan** - The most common actors are represented by Local Public Administration, County Council, Local Councils, Environmental Guard, Environmental Protection Agencies, NGOs, Owners and Land Users, Economic Agents,

Tabel 3: **Proposed measures in greenfield endorsements / agreements** – In the analyzed environmental protection regulatory acts, there are no direct references to NBS. A number of measures have been identified that have the potential to integrate different categories of green solutions, mainly into domains such as: air quality, adaptation and control of climate change, water management, biodiversity, natural hazards, transport, agriculture and landscape.

No.	Domain	Measures
1.	Air quality	Green areas for protection in case traffic related air pollution
2.	Adaptation and control of climate change	Increasing energy efficiency in proposed activities (lighting, heating, etc.)
		Promoting alternative solutions for the production of thermal and electric energy through the use of renewable sources
3.	Water management	Rational use by saving water and reducing losses in transport systems, water distribution networks, technological processes and minimizing specific consumption
		Preventing stormwater pollution by proper manure management, ie collecting through gutters and discharging them into green spaces
4.	Biodiversity	Creating ecological corridors along access routes
5.	Natural hazards	Afforestation or reforestation actions of slopes
		Ecological restoration of rivers
		Afforestation actions on degraded and non-valuable agricultural land
6.	Transport	Simulating green transport by building bicycle tracks
7.	Agriculture	Application of organic and mineral fertilizers
8.	Landscape	Imposing landscape screening techniques (tree curtains) to help mask some low aesthetics areas

O5. Developing a conceptual model for enhancing cities resilience and sustainability on NBS

To be explaind in 2019

Acknowledgment

This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-III-P4-ID-PCE-2016-0635 - Nature-based solutions for increasing cities resilience and sustainability.

Contact:

Email: mihairazvan.nita@g.unibuc.ro
Website CCMESI: https://ccmesi.ro
Website NATURB: https://ccmesi.ro/?page_id=666

Nature as model for engineering - International Ecological Engineering Society (IEES)

Duration: 1993 – ongoing

Program --- not applicable ---

Website: https://www.iees.ch/

Abstract

Challenge: The next big challenge of humankind will be to develop a more sustainable society on Earth that respects the boundaries of the planet. Human society is now able to significantly modify all global processes. Engineers have been developing the approaches, tools and machines that brought us to this point. In IEES' view, the problem-solving approach of engineering is increasingly becoming an obstacle on the way towards a sustainable society.

Solution: IEES proposes to redefine Ecological Engineering as an **art of engineering** that uses **principles and insights from ecological science** as **paradigm for problem solving**. These principles and insights and a holistic way of system's thinking are combined with «classical» engineering practice, with the aim to achieve a benefit for both humans and nature.

Principles: IEES advocates the transformation of classical, sequential engineering thinking into a holistic way of design thinking. Based on the IEES definition, we propose seven guiding principles for this design process:

1. Avoidance (of consumption, of harmful substances…)
2. Ecological processes and organisms as tool or model for design
3. 100% renewable energy (during operation)
4. >99 % recyclability (during operation)
5. Low externalized environmental costs during the life cycle
6. Design aims for multifunctional
7. Enhancement of quality for humans and nature

Toolbox: Natural substances, organisms, ecological processes, natural or artificial ecosystems, system dynamics- and LCA-tools. IEES aims to inspire a set of new tools for analyzing system borders, circularity of circular systems or cross-linking and keystone elements.

Future: Following IEES' broad definition and its seven principles, ecological engineering is no longer limited to modifying or constructing ecosystems. Buildings, neighborhoods, cities or even road systems can be projects of ecological engineers. This approach can become a key practice for closing material circles in circular cities.

Learn more about Ecological Engineering and get involved in an exciting, rapidly evolving area of sustainable solutions! Join IEES today!

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Andreas Schönborn, Zurich University of Applied Science, Switzerland (co-president IEES)
- Ranka Junge, Zurich University of Applied Science, Switzerland
- Devi Bühler, Zurich University of Applied Science, Switzerland

NATURE AS MODEL FOR ENGINEERING

www.iees.ch

International Ecological Engineering Society

Zurich University of Applied Sciences
Life Sciences and Facility Management
Institute of Natural Resource Sciences

www.zhaw.ch/iunr

Contact:
Andreas Schoenborn[1], Ranka Junge[1] and Devi Buehler[1],

1: Zurich University of Applied Science, PO Box, CH-8820 Waedenswil, Contact: andreas.schoenborn@zhaw.ch

Challenge

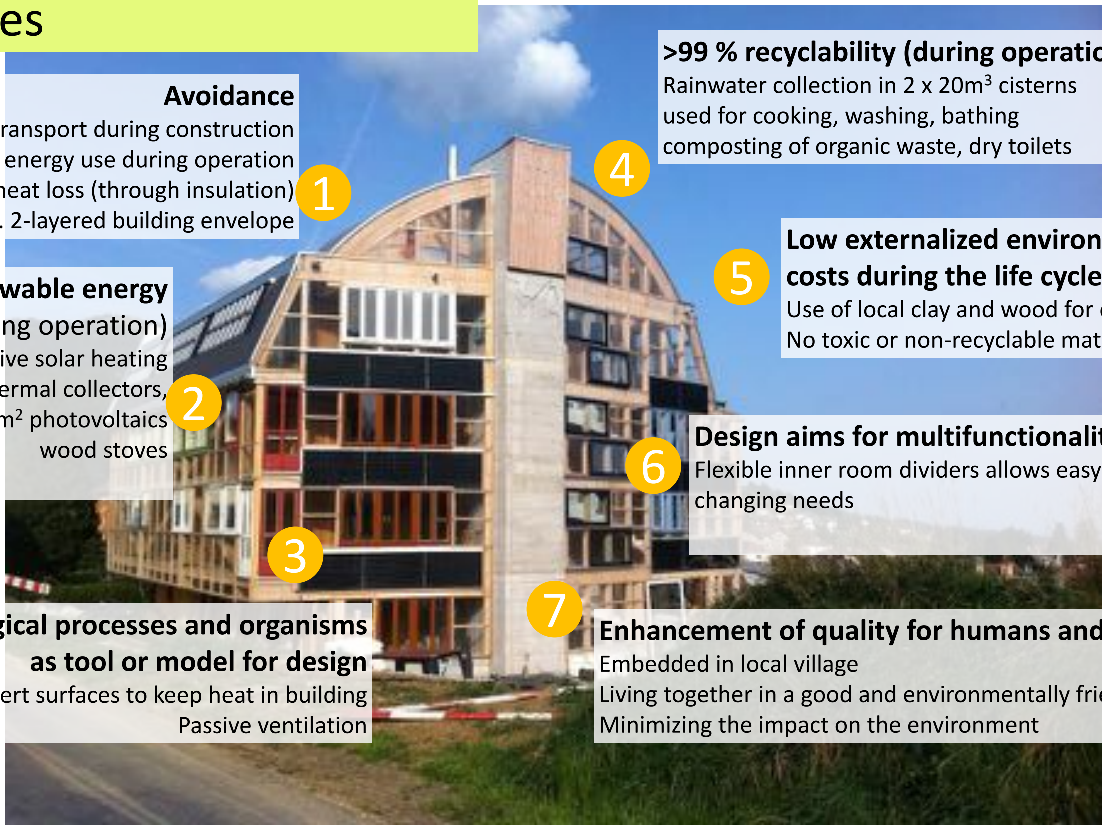
- The next big challenge of humankind will be to develop a more sustainable society on Earth that respects the boundaries of the planet
- Human society is now able to significantly modify all global processes
- Engineers have been developing the approaches, tools and machines that brought us to this point.
- The problem-solving approach of engineering is increasingly becoming an obstacle on the way towards a sustainable society

Ecological Engineering

Ecological Engineering is an **art of engineering** that uses **principles and insights from ecological science** as **paradigm for problem solving.**

A **holistic way of system's thinking** is **combined with «classical» engineering practice**, with the aim to achieve a **benefit for both humans and nature**.

Principles



1 Avoidance
… of transport during construction
… of external energy use during operation
… of heat loss (through insulation)
… 2-layered building envelope

2 100% renewable energy (during operation)
Passive solar heating
45 m² solar thermal collectors,
190 m² photovoltaics
wood stoves

3 Ecological processes and organisms as tool or model for design
Use of thermally inert surfaces to keep heat in building
Passive ventilation

4 >99 % recyclability (during operation)
Rainwater collection in 2 x 20m³ cisterns
used for cooking, washing, bathing
composting of organic waste, dry toilets

5 Low externalized environmental costs during the life cycle
Use of local clay and wood for construction
No toxic or non-recyclable materials used

6 Design aims for multifunctionality
Flexible inner room dividers allows easy adaptation to changing needs

7 Enhancement of quality for humans and nature
Embedded in local village
Living together in a good and environmentally friendly way
Minimizing the impact on the environment

Fig. 1: Appartment house "Domahabitare" (9 app.) in St. Croix, Switzerland, 1'100 m [1], [2]

Toolbox

- Organisms, biogeochemical and ecological processes, natural substances, natural or artificial ecosystems, system dynamics- and LCA-tools.
- A set of new tools for analyzing system borders, circularity of circular systems or cross-linking and keystone elements (yet to be developed)

Future

Following IEES' broad definition and its seven principles, ecological engineering is no longer limited to modifying or constructing ecosystems. Buildings, neighborhoods, cities or even road systems can be projects of ecological engineers. This approach can become a key practice for closing material circles in circular cities.

References

[1] https://prixlignum.ch/de/21/project/projects-up-1477-2/0/domahabitare.html (31.1.19)
[2] http://domahabitare.ch/ (31.1.19)

NBS in smart city planning
For healthy and liveable cities

Duration: Poster presented at NBS2017 Tallinn conference in Estonia Nature-Based Solutions Tallinn, 24-26 October 2017

Programme: H2020 SCC-02-2017

Website: Nature-based Solution Conference ,Tallinn ,24-26 October2017 pag 101

Abstract

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 iNBS a global investing market, using a trans-disciplinary, stakeholder-oriented co-creation approach, we intend to re-think traditional urban greening and will combine innovations and fundamental research from urban planning and design, eco-hydrology, mechanical engineering, water engineering and economy to enable decision-making using a nexus approach considering both co-benefits and trade-offs of nature-based solutions for the cities of the future.

Contact person:

- Mari Carmen Garcia Mateo, MCGM R&I Architecture, Murcia , Spain

NBS2017 NATURE-BASED SOLUTIONS From innovation to common use
EU2017.EE
Mari Carmen Garcia Mateo
MCGM- R&I Architecture
Sustainability Strategist Advisor,H2020
Senior Architect, Urban Planner.

Poster presentation at:
COST Action CA17133
Workshop Vienna,
Implementing nature based solutions for creating a resourceful circular city

SP +34 635351423
maricarmengarcia.archt@gmail.com

NBS IN SMART CITY PLANNING FOR HEALTHY AND LIVEABLE CITIES

AIM

HELP SOLVE SOCIETAL CHALLENGES IN THE CITY
Converting challenge into Opportunities

APPROACH

INNOVATING WITH NATURE

help build resilience, sustainable and adapt to climate change

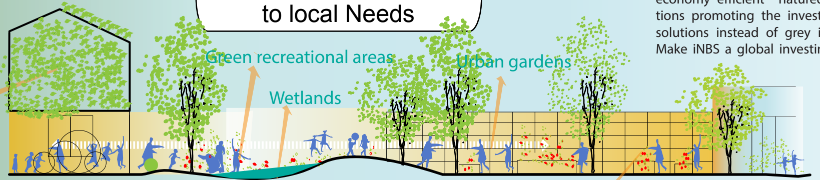
NBS
Nature-Based Solutions
urban gardens, community gardens, green recreational areas, wetlands, green walls and roofs...

Systemic approach: Social, Environmental, Sustainability, Economic

Through locally adapted NBS Solutions to local Needs

nature

Neighbourhood



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 iNBS a global investing market, as role model in Europe and Worldwide.

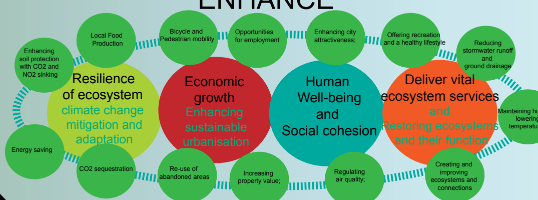
Cities by using nature-based solutions such as creating urban gardens, community gardens, green recreational areas to play sports or do activities, and other actions ,are linked to improving quality of life for its citizens.Through innovative Nature Based-Solution applies in Cities, they will enhance 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.

IMPACT

Social Environmental Economic — BENEFITS

ENHANCE



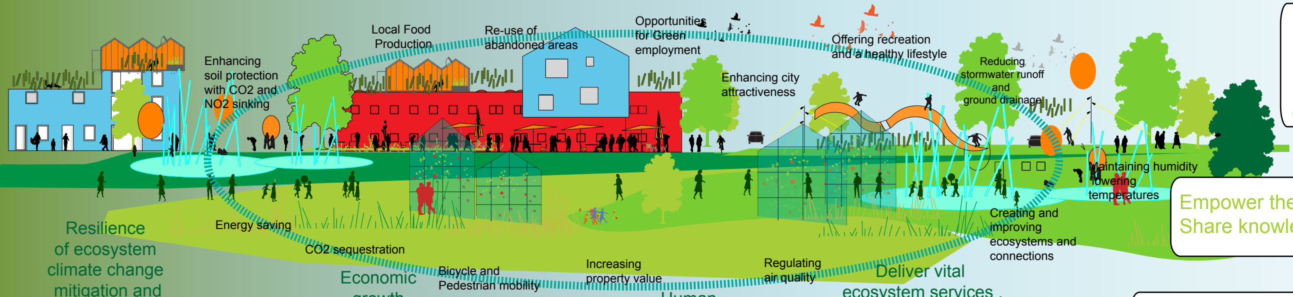
OUTCOMES

- Culturally diverse
- Enhance well-being
- Green regenerated district
- Physical and mental health
- Social cohesion
- Create jobs-Economic growth
- Green growth
- Enhance social interaction
- Healthier cities and citizens
- Implementing 'SDG11' 'SDG13'

Sustainable solutions to optimize quality of life

Empower the green growth community
Share knowledge and expertise

Making Ecosystem and Nature an integral part of sustainable urban development



Resilience of ecosystem climate change mitigation and adaptation
Economic growth
Enhancing sustainable urbanisation
Human well-being , citizens health
Deliver vital ecosystem services . Restoring ecosystems and their function

METHODOLOGY

SUCCESSFUL RESEARCH & INNOVATION PROJECT RENATURING CITIES

HOW TO ACHIEVE?
Create a **framework** "Living Citie Lab" with experts, multi-stake-holders, collaboration with citizens, communities, industry, investors, institutions, governments to co-design, co-create, co-develop, co-implement, co-promote, and test in front-runners city consortium (Finland-Espoo, South Africa- Johannesburg, Spain-Murcia) innovative actions, a **pilot project** for urban regeneration through NBSs. to solve Societal Challenge and be engaged as a "coaching-cities" in further networking and knowledge sharing to maximise the benefits of the project for a broader community beyond the limit of the project_(monitoring scheme).

Scope : Murcia Scenario deprived districts that are part of the old city and neglected or abandoned areas (across the Segura river). Via urban farming and diverse nature-based solution action .We would test to what extent, nature-based solutions can enhance human health, well-being and social cohesion.

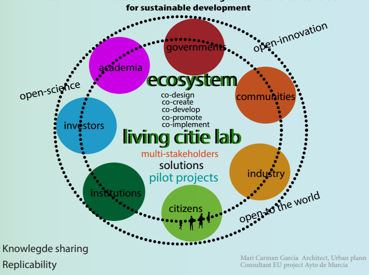
_"The role of social innovation, and hence the participation of social sciences and humanities disciplines such as law, economics, political science, architecture or design studies, is particularly important to properly address these complex challenges." _text from the call H2020.

CITY LIVING LAB ECOSYSTEM

Social Dimension of Sustainable Urbanization

Nature Based Solution STRATEGY

Create a framework to Solve Societal Challenge with nature-based solution for sustainable development



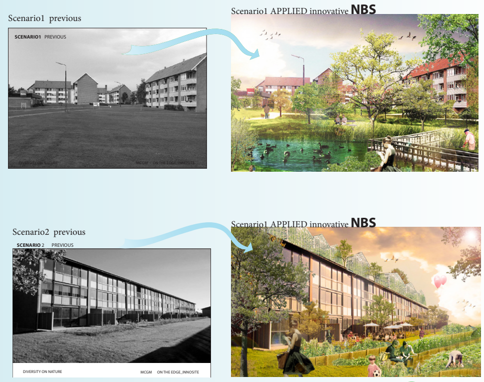
Knowledge sharing
Replicability

RESULT/CASE STUDY

Diversity on Nature

"Transforming Vision."
Enhancing sustainable urban development.
Promotes interaction between Nature and people, creating a network for sharing communities opening them to an inspiring social sustainable world.

The project is focusing on developing the public housing in Denmark for the 21st Century, enhancing sustainable urbanization through Nature-based solution, improving the resilience of ecosystem services, help stimulate economic growth as well as improving the environment making cities more attractive and enhancing human well-being and social cohesion between communities.



netWORKS 4

Contributions of urban supply systems to climate justice

Duration: 10/2016–09/2019

Programme: German Federal Ministry of Education and Research (BMBF), funding measure „Transformation of urban spaces", research priority "Social-ecological research"

Website: https://networks-group.de/de

Abstract

How water infrastructures are designed plays a central role in the transformation of urban spaces. The goal of netWORKS 4 is to initiate dialogue processes about the sustainable design of urban infrastructures in order to foster synergies. Synergies between different infrastructures can save resources and act to mitigate the effects of climate change, e.g. heavy precipitation or heat waves. The project is also addressing the issue of whether this can help improve "climate justice" for the citizens.

Grey (water supply and sewage disposal), green (parks and green spaces) and blue (streams and water bodies) infrastructures are being studied. The research work on the connection of these infrastructures with a view to more climate justice will initially focus on the two German cities of Norderstedt and Berlin. The specific research topics and questions will be developed and verified in and with them.

ISOE is contributing to a catalogue on the elements of sewage- and precipitation management which can be used at the identified linkage points of grey, green and blue infrastructure. This includes e.g. the greening of buildings, seepage or the use of service water. The catalogue will offer an overview of the elements' relevant characteristics as well as their social and ecological effects.

A second focus of the research work will be the examination and integration of private and semi-public spaces. The aim is to develop ideas for how these spaces can be integrated into a holistic plan and how to enlist the support of private stakeholders, e.g. homeowners or housing companies.

The goal is ultimately to optimize transformation management in planning processes and improve cooperation between the stakeholders involved in the process. This final conceptual work will also contribute to social-ecological theory formation.

Project partners: ISOE – Institute for Social-Ecological Research, German Institute for Urban Studies gGmbH, Berlin Centre of Competence for Water (KWB), Berliner Wasserbetriebe

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Martin Zimmermann, ISOE – Institute for Social-Ecological Research, Germany
- Martina Winker, ISOE – Institute for Social-Ecological Research, Germany, Coordinator

netWORKS 4 – Resilient networks: Contributions of urban supply systems to climate justice

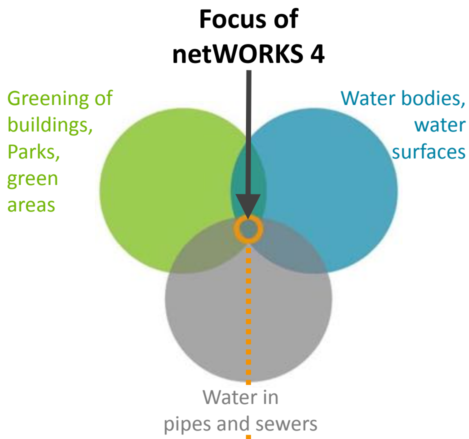
Approach

Water infrastructures play a central role in the design of sustainable and climate-friendly cities. They must be robust and adaptable to the consequences of climate change, such as heavy precipitation or heat waves. At the same time, they must take into account the careful use of resources. To this end, it makes sense to link grey, blue and green infrastructures.

This linkage of different water-related infrastructures requires a dialogue between urban and infrastructure development in which strategies and measures are jointly sought. To this end, the project investigates approaches to integrated planning and coupling of grey, green and blue infrastructures.

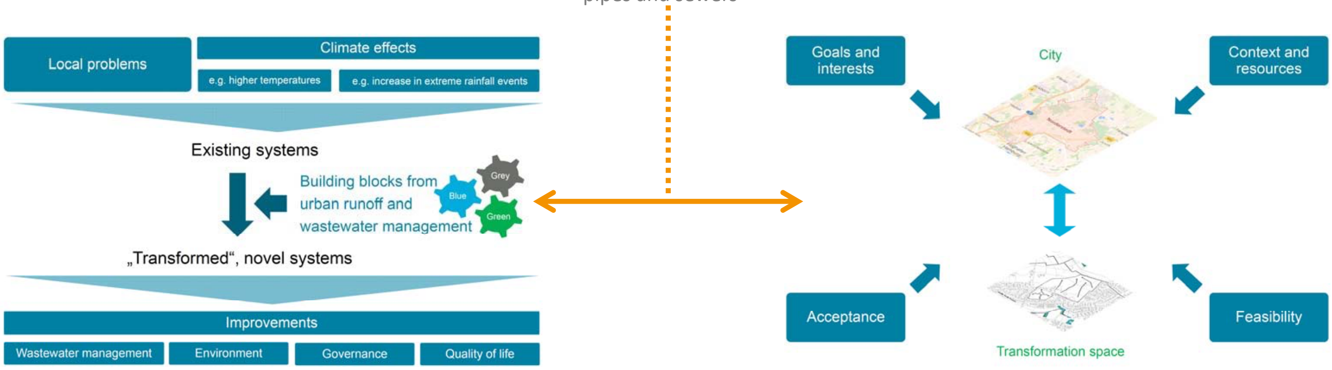
… contentwise/conceptually

- Co-transformation of grey, blue and green infrastructure
- Use of the ecosystem services approach to describe building blocks and impacts
- Development of the concept of climate justice
- Possibilities and limits of a quantification of resilience
- Modelling of the impact of stakeholder interests and urban framework conditions on effectiveness



… urban dialogue

- Focus on subspace level and on the urban area as a whole in Norderstedt and Berlin
- Bridging between different (technical) plans, urban spaces and sectors
- Consideration and inclusion of private and semi-public areas
- Analysis/evaluation of phases, dynamics, actors and contents of planning processes



Project goals

… for science

- Identification of meaningful forms and types of coupling of grey, green and blue infrastructure to achieve climate resilience and climate justice as political goals, taking into account the urban framework conditions
- Transformation potential of the grey (water) infrastructure through coupling with green and blue infrastructure
- Identify appropriate governance structures for the effective interconnection of infrastructures

… for practicioners

- Identification of possible contributions of water infrastructures to the achievement of targets in urban planning
- Identification of integrating elements and contributions of water infrastructures
- Agreement on guidelines for future infrastructure development and the integration of urban planning and infrastructure planning
- Establishment, expansion and consolidation of governance structures in the practice partner municipalities

Project partners

Institut für sozial-ökologische Forschung | difu Deutsches Institut für Urbanistik | KOMPETENZZENTRUM WasserBerlin | Berliner Wasserbetriebe | be Berlin Senatsverwaltung für Stadtentwicklung und Wohnen | be Berlin Senatsverwaltung für Umwelt, Verkehr und Klimaschutz | STADT NORDERSTEDT Der Oberbürgermeister | RAMBØLL | STUDIODREISEITL

Contact

ISOE – Institut für sozial-ökologische Forschung | Hamburger Allee 45 | 60486 Frankfurt am Main
Dr. Martina Winker | Tel.: +49 69-707 6919 53 | winker@isoe.de

Deutsches Institut für Urbanistik gGmbH (Difu) | Zimmerstraße 13-15 | 10969 Berlin
Jan Hendrik Trapp | Tel.:+49 30 39001 210 | trapp@difu.de

www.networks-group.de

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung
FONA Nachhaltiges Wassermanagement BMBF

NWRM

Natural Water Retention Measures

Duration: 09/2013-08/2015 (14 months + 10 months extension)

Programme: DG ENV (European Commission)

Website: http://nwrm.eu/

Abstract

NWRM are multifunctional measures to protect and manage water resources using natural means.

NWRM project was implemented from Sept 2013 up to Nov. 2014 on request of EC DG ENV to develop a structured knowledge base on NWRM and to contribute to the development of an active European "community of NWRM practitioners". The study was implemented by a consortium of 10 partners under the coordination of OIEau (International Office for Water). Project results were the basis for the preparation of the "EU policy document on Natural Water Retention Measures" (WFD Common Implementation Strategy Working Group on Programme of Measures, 2014). NWRM are part of Green Infrastructure for water. The web platform is still maintained by under a contract with DG ENV and additional case studies are added.

The main outcomes are a reference web platform that provide access to a structured catalogue of NWRM, a set of 120 case studies illustrating the implementation of NWRM in a wide set of context, 11 synthesis documents allowing to go deeper in the understanding of the key specificities of NWRM implementation, a NWRM practical guide, a serious game to make the NWRM community and the key actors better understand constraints and opportunities of implementing NWRM, but also communication material with a leaflet translated in 22 languages and a MS-Power-point presentation that can be customised.

NWRM is a toolbox to support planners for river basin management, urban planning, agricultural landscape management, and flood management. It allows to assess how NWRM are contributing to multiple policy objectives (WFD, Flood Directive, Habitat and Bird Directives, Biodiversity Strategy), and as well as added value compared to grey/standard measures.

The catalogue of measures is structured around 4 application sectors: agriculture (13), forest (14), hydro-morphology (14) and urban (12) with cross-benefits analysis on bio-physical impact, Ecosystem services and EU policy.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Eric MINO, SEMIDE – e.mino@semide.org

Introduction

Natural Water Retention Measures (NWRM) are multi-functional measures that aim to protect water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes.

Project results (2013-2015)

- Comprehensive European collaborative knowledge web base on NWRM across four sectors.
- European NWRM community of practice to support implementation of NWRM to support WFD; Floods, Habitat & Bird Directives; Biodiversity strategy; climate change adaptation and sustainable urban plans.

Agriculture

Forest

Urban

Hydro Morphology

Why use NWRM?

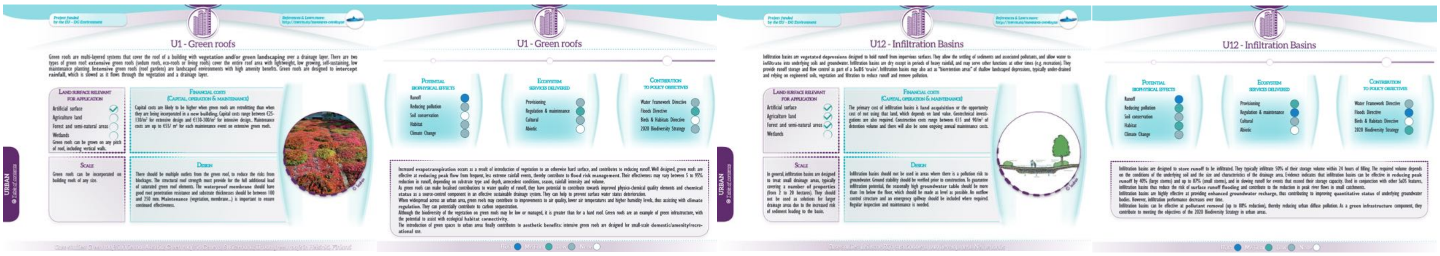
- Give more space to nature
- Deliver multiple benefits
- Achieve multiple policy goals
- Cost-effective solutions
- Multiple financing options

How to implement NWRM

- Identify: objectives, pressures and challenges
- Pre-screen NWRM: relevance to context and expected benefits
- Assess: impacts, effectiveness and compare measures
- Feasibility: technical, financial, governance
- Resources : monitor, interact, adjust and communicate

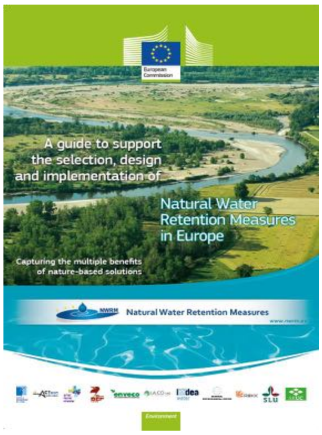
Ensuring effectiveness

- Ensure knowledge is multidimensional
- Make functioning and scale explicit
- Mobilise stakeholders
- Find the right incentives
- Widen scope of monitoring and evaluation



'Visit' NWRM in practice

- NWRM have been applied across Europe by water managers, conservation organisations, farmers, urban planners and many others
- Read our in depth and light case studies



To read more visit the website www.nwrm.eu

Partners

Office International de l'Eau · ACTeon · REKK · Regional Environmental Center · I.A.CO Ltd · enveco · amec · imdea water · SLU · SRUC · BEF Latvia

This document is provided in the framework of "ENV.D.1/SER/2013/0010 "Pilot Project - Atmospheric Precipitation - Protection and efficient use of Fresh Water: Integration of Natural Water Retention Measures in River Basin Management" (09/2013-10/2014) with the support of the European Commission. However, it only reflects the views of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Ouagadougou Parc
Alternative rainwater management within a new urban development: The Ouagadougou Parc in Grenoble

Duration: 2006-2008

Website: http://graie.org/graie/BaseDonneesTA/11_38_Grenoble_Parc_Ouagadougou.pdf

Abstract

The Ouagadougou Park is innovative in that it combines many stormwater management solutions: collection in open channels, treatment of road runoff by vertical flow reed bed filters, irrigation, storage in a wetland, landscaping and "fun"/educational showcasing. Illustrating the value of integrating rainwater management at the earliest phase of urban planning, the project won the Novatech trophy at the 2013 Novatech international conference on integrated and sustainable stormwater management, in the category, "Strategies and solutions for sustainable water management in the city".

In addition to its technical innovations, the Ouagadougou Park is exemplary in that it featured consultation and involvement of residents prior to the project and throughout the design phase. The many exchanges with the residents fostered appropriation and ownership of the site.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

Dirk Esser, SINBIO

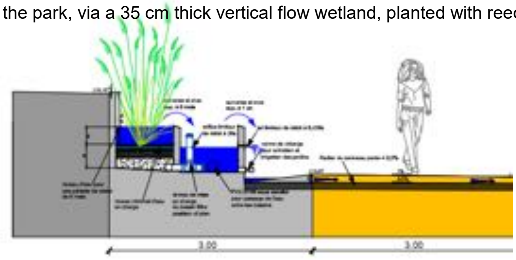
Alternative rainwater management within a new urban development: the Ouagadougou Parc in Grenoble

Aim of the project : To combine alternative, innovative rainwater management techniques to reduce Ouagadougou's Park dependency on drinking water, to limit the volume of rainwater discharged into the combined sewer system, to enhance urban landscape and to create biodiversity in urban areas.

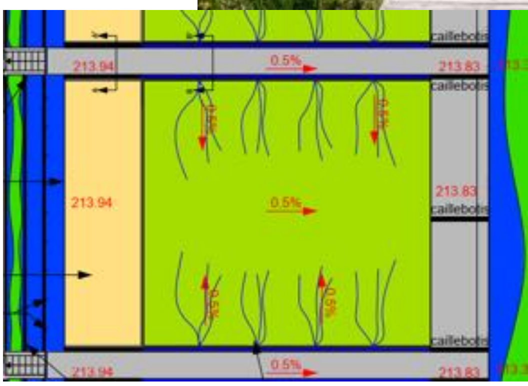
Location and implementation: :
The Ouagadougou Park, in south-eastern Grenoble, is located at the junction between the Teisseire and Jouhaux neighbourhoods. Initiated in 2006, the park was created to open up these two public housing neighbourhoods by creating a common public space. The city had two major aims for the park: to involve the residents of both neighbourhoods in designing the park, and to implement innovative, alternative rainwater management. Prior to the project, at the very earliest stage, important consultative meetings were held to fully involve the residents of both neighbourhoods and to integrate their project needs. Hence, the building plans were submitted to residents, and as a result of their input some changes were made. This iterative process, combining public meetings and participatory workshops, continued throughout the park's design phase. Rainwater management extended beyond the perimeter of the park, at the scale of the "Zone d'Aménagement Concerté Teisseire-Jeux-olympiques", under construction at the time.

Technical description :

The innovative, alternative management system includes:
• Collection of rainwater via drainage channels installed along the roads leading to the park ;
• Treatment of the road runoff in a rear channel, along the western edge of the park, via a 35 cm thick vertical flow wetland, planted with reeds ;



• The treated outflow of the rear channel and further runoff from roofs and pedestrian walkways run into a front channel, which provides storage and feeds the parks irrigation network
•Water is fed into a gulley running alongside of the structure, through a line of outlet jets in the wall structure, creating an additional water feature ;
• From there the water flows via small channels alongside the walkways to irigate four theme based gardens:
• In winter and in case of heavy rainfall, the surplus water flows into a wetland at the opposite side of the park, which provides storage volume before throttled discharge into the combined sewer network, and enhances biodiversity.



Contact person at the COST Action CA17133 Workshop Vienna :
Dirk ESSER, SINBIO

What are the local benefits?

> Improved water management: many direct benefits

Innovative rainwater management in the Ouagadougou Park saves drinking water, as watering of gardens mainly uses rainwater. In addition, it regulates urban rainwater runoff, limiting volumes used by the intercommunal combined sewer system upstream and the risk of overburdening the network. The presence and circulation of water within the park also reinforces its purpose of providing a cool greenspace during hot weather.

> Highlighting the water cycle

Featured via the different humid areas (irrigation channels, humid zone and water games), the water itinerary structures the park. Showcasing of the water allows visitors to understand the water route, which functions differently depending on the season and the weather. In addition to its ecological function, rainwater management is both fun and educational.

> Promoting biodiversity

For the management of planted areas in the park, the Green Areas department of the city decided to limit its intervention in planted areas, leaving species to colonize areas depending on their potential. In 2012, four years after launching of the park, the range of plants growing in the humid zone has largely diversified. In addition, in summer, in the canal, there are many aquatic insects, notonectides, dragonfly larvae and odonates, as well as frogs.

> Key success factors

• Cooperation at an early stage with building promoters to enable connection of new buildings to the rainwater collection system.
• Consultation with residents and widespread communication fostering appropriation of sites.
• Inter-departmental cooperation for park upkeep and collection networks.

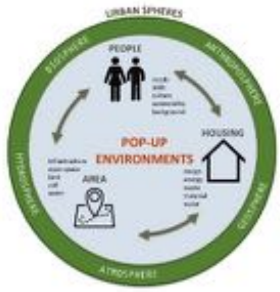
> How is this action exemplary?

The combination of different rainwater management systems
The Ouagadougou Park is innovative in that it combines many rainwater management solutions: collection, treatment by planted filtration, irrigation, catchment in a humid zone, and "fun"/educational showcasing. Illustrating the value of integrating rainwater management at the earliest planning phase, the project won an award in 2013 at the Novatech trophies in the category, "Strategies and solutions for sustainable water management in the city".

A project co-built with residents
In addition to its technical innovations, the Ouagadougou Park is exemplary in that it featured consultation and involvement of residents prior to the project and throughout the design phase. The many exchanges with local residents fostered appropriation and ownership of the site.

Pop-up environments

Urban pop-up housing environments and their potential as local innovation systems



Duration: 04/2018-03/2021

Programme: WWTF (Environmental Systems Research 2017)

Website: http://popupenvironments.boku.ac.at/

Abstract

The building sector is responsible for energy consumption and release of emissions all over the world. Thus, addressing the challenges of climate change are highly relevant in densely populated urban areas. Growing cities, such as Vienna, are experiencing an increasing demand for temporary housing facilities. The reasons for requiring affordable temporary accommodation are manifold and span from the planned (educational training) to the unforeseen (natural disasters, migration). Sustainability considerations are, however, not yet commonplace in temporary housing. To address the increasing demand for temporary 'pop-up' housing purposefully, it is important to find affordable and flexible, but sustainable and reusable temporary housing concepts that are easy to construct, rapid to implement and take into account social and societal aspects. Temporary forms of housing are an excellent way to explore the future of housing and can serve as experimental spaces for urban innovation towards sustainability.

However, comprehensive modelling approaches including resource- and reuse-related, technical and social dimensions have not yet been established. The WWTF-funded research project *"Urban pop-up environments and their potential as local innovation systems"* aims to address these gaps in knowledge with the following objectives:

- Systematic investigation and evaluation of existing temporary housing concepts.
- Conceptualizing and exploring pop-up housing concepts as local innovation systems.
- Development of holistic, innovative and sustainable models for pop-up living systems in urban environments for case study o Vienna.
- Portrayal of integrated, sustainable urban pop-up concepts based on environmental, technical and social evaluation of temporary housing models and scenarios.

The project's objectives can only be addressed in an inter- and transdisciplinary research environment, in which a systemic approach is applied to investigate and evaluate existing temporary housing concepts and to develop interdisciplinary models for sustainable urban pop-up housing environments. Urban and landscape planning, architecture and building systems technologies are interlinked to resource related disciplines such as energy optimisation, green technologies, sustainable waste and resource management, water supply and wastewater treatment as well as social and political sciences.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Julia Zeilinger, BOKU University (Institute of Waste Management)
- Gloria Rose, Austrian Academy of Sciences (Institute of Technology Assessment)
- Gustav Puhr, BOKU University (Institute of Spatial Planning, Environmental Planning and Land Rearrangement)
- Gaetano Bertino, alchemia-nova (Institute for innovative phytochemistry & closed loop processes)

Urban pop-up housing environments and their potential as local innovation systems

University of Natural Resources and Life Sciences, Vienna – Department of Water, Atmosphere and Environment

Relevance and Introduction

Climate change and resource depletion are major challenges of today's world. The building sector is associated with substantial energy and resource consumption and release of emissions. The importance of the role of cities on the way to sustainability is recognised in SDG11. Therefore, further emphasis on sustainability performance of the building sector is indicated.

Growing cities, such as Vienna, are experiencing an increasing demand for temporary housing facilities, due to planned (e.g. educational training) or unforeseen reasons (e.g. natural disasters, migration). Temporary forms of housing are an excellent way to explore the future of housing and can serve as experimental spaces for urban innovation towards sustainability.

This WWTF funded project aims to address temporary 'pop-up' housing by developing ideas for affordable, flexible, sustainable and reusable concepts that are easy to construct, rapid to implement and take into account social and societal aspects. So far, comprehensive modelling approaches including resource- and reuse-related, technical and social dimensions have not yet been established.

Project Objectives

- Systematic investigation and evaluation of existing temporary housing concepts.
- Conceptualizing and exploring pop-up housing environments as local innovation systems.
- Development of holistic, innovative and sustainable models for pop-up living systems in urban environments (for case study of Vienna).
- Portrayal of integrated urban pop-up concepts based on environmental, technical and social evaluation of temporary housing models and scenarios.

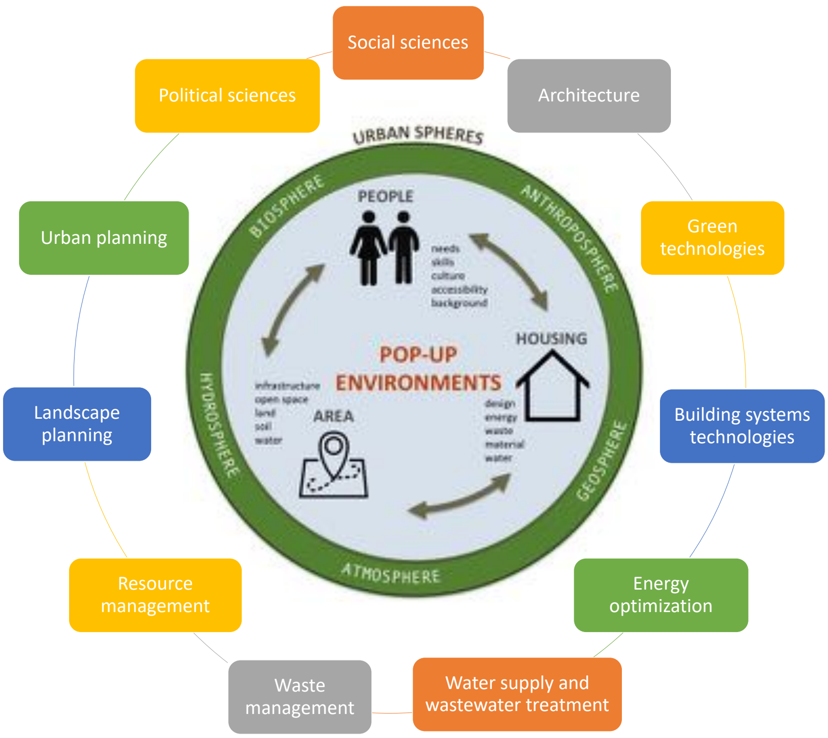
Interdisciplinary Research Environment

Interdisciplinary model development

In this inter- and transdisciplinary research environment the scope, system boundaries and input data for temporary housing model development are established, taking into account *PEOPLE, HOUSING* and *AREA* – three integral elements of urban pop-up housing environments, which are interlinked and have specific impacts on urban systems.

Waste- and resource-related aspects of model development will address environmental impacts and performance of temporary housing. **LCA (Life Cycle Assessment)** is considered a suitable methodology for this environmental evaluation and will focus on:

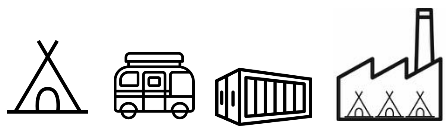
- Design, construction, adaption, operation phase of temporary housing
- Impacts and potentials of reusing or recycling of temporary housing or its end-of-life phase
- Comparison of different temporary housing types and interim use of existing (non-residential) buildings for temporary living
- Identification of sources of most significant environmental impacts
- Evaluation of alternative design strategies for eco-friendly and sustainable temporary housing



Outlook

As basis for modelling of sustainable urban pop-up housing environments, the following ongoing tasks are carried out:

- Collection of temporary housing concepts (both real-world examples and prototypes)
- Development of a typology of temporary housing concepts
- Identification of adequate area types and vacancies for temporary housing in Vienna
- Mapping of niche experiments (in Vienna) with focus on sustainable innovation
- Stakeholder interaction (workshop)



(adapted after designs by Freepik, Smashicon, Pause08, Lyolya, monkik from Flatication)

http://www.wau.boku.ac.at/abf.html, http://popupenvironments.boku.ac.at/

Contact

Julia Zeilinger, MSc BSc

julia.zeilinger@boku.ac.at
+43-1-47654-81322

Institute of Waste Management

Department of Water, Atmosphere and Environment
University of Natural Resources and Life Sciences, Vienna

Muthgasse 107
A – 1190 Vienna
+43-1-47654-81300

Projekt partners

ÖAW ITA INSTITUTE OF TECHNOLOGY ASSESSMENT
alchemia nova institute for innovative phytochemistry & closed loop processes
BOKU IRUB IVET SIG ILAP

This project is funded by Vienna Science and Technology Fund W|W|T|F

Produktive Stadt

Produktive Stadt: Gestaltung und Planung des öffentlichen Grüns [Productive City: Design and planning of public green spaces]

Duration: 12/2018 – 09/2019 (phase 1**)**

Programme: --- funded by the Senate of Berlin ---

Website: not yet, its design is one of the aims of the project

Abstract

Context:

In 2015, Berlin‘s Senate has agreed on the principals of an indicatory „sustainability profile“. One of three profile aspects to concentrate on in the future is „the productive city“ to a large part centred around the city‘s open spaces, metabolic processes and nature-based solutions. The project presented here is creating the profile‘s first component, an online platform on and for the city‘s more than 100 community gardens with the aim of alignment with future urban planning strategies and policies.

Objectives:

This phase of the project has the following aims:
(1) contextualise Berlin's community gardening movement nationally and internationally; (2) conceptualise Berlin's community gardening within the city's recent "productive city" strategy; (3) work with and develop, in a participatory process, Berlin‘s community gardeners‘ network; (4) design and make live an online platform to register and exchange information and services around community gardening in Berlin.

Process:

This multi-stakeholder project has been initiated by the local (and regional) council of Berlin. Its roots lay in a negotiation process between community gardeners and the Senate which started many years ago. It is of great importance to co-create this project or at least achieve a participatory approach. For this reason, the project will be advanced via a series of stakeholder workshops coordinated by the Working group "City&Food" and strongly build on the already existing local knowledge and community gardeners' needs.

Outcomes:

None yet**.**

Contact person(s) at the COST Action CA17133 Workshop Vienna:

Katrin Bohn, University of Brighton, UK

DIE PRODUKTIVE STADT [The Productive City]

Die Produktive Stadt: Gestaltung und Planung des öffentlichen Grüns [The Productive City: Design and planning of public green spaces]

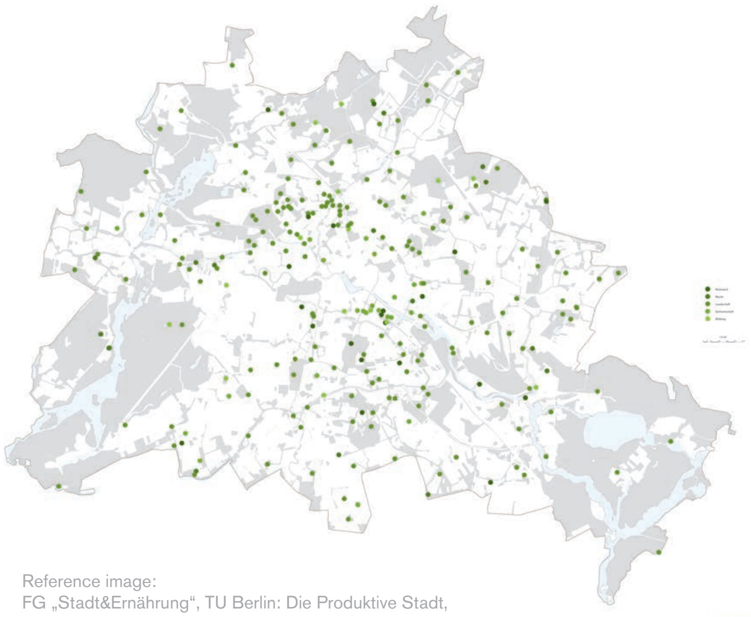
Land Berlin Senatsverwaltung für Umwelt, Verkehr und Klimaschutz
[Land Berlin Senate Department for the environment, transport and climate protection]

Context:
In 2015, Berlin's Senate has agreed on the principals of an indicatory „sustainability profile". One of three profile aspects to concentrate on in the future is „the productive city" to a large part centred around the city's open spaces, metabolic processes and nature-based solutions. The project presented here is creating the profile's first component, an online platform on and for the city's more than 100 community gardens with the aim of alignment with future urban planning strategies and policies.

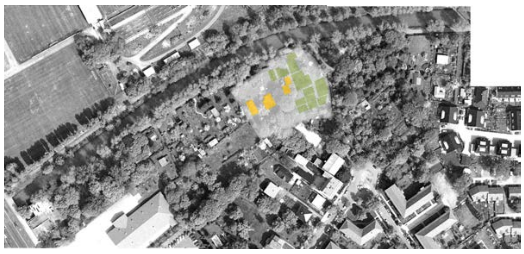
Objectives:
This phase of the project has the following aims:
(1) contextualise Berlin's community gardening movement nationally and internationally; (2) conceptualise Berlin's community gardening within the city's recent "productive city" strategy; (3) work with and develop, in a participatory process, Berlin's community gardeners' network; (4) design and make live an online platform to register and exchange information and services around community gardening in Berlin.

Process:
This multi-stakeholder project has been initiated by the local (and regional) council of Berlin. Its roots lay in a negotiation process between community gardeners and the Senate which started many years ago. It is of great importance to co-create this project or at least achieve a participatory approach. For this reason, the project will be advanced via a series of stakeholder workshops coordinated by the Working group "City&Food" and strongly build on the already existing local knowledge and community gardeners' needs.

Outcomes:
None yet.



Reference image:
FG „Stadt&Ernährung", TU Berlin: Die Produktive Stadt, International urban design and architecture exhibition at the Architekturmuseum of the Technical University Berlin, 2011



Reference images:
FG „Stadt&Ernährung", TU Berlin: Die Produktive Stadt, International urban design and architecture exhibition at the Architekturmuseum of the Technical University Berlin, 2011

Scale (e.g. supply chain level, stage, process, unit)	Timeframe	Assessment methodologies used (e.g. LCA, LCC, CBA etc.)	Key performance indicators considered					Identified barriers and drivers (type)	ICT solutions and tools	Citizens satisfaction & Engagement methodology
			Inventory based	Economic/Cost	Environmental	Social	Policy			
Geographical; City-wide; Space use focus; Production focus; Berlin	Current phase 1: Dec 2018 – Sep 2019	Only needed for the classification of local community gardening activities	X		x	X	x	t.b.a.	Council-owned web design program; Open source database; Online „market place" function	Participapatory process; Citizen-science approach to data collection; Integration and accurate crediting of citizens' previous achievements

prepared for:

prepared by:

Productive Neighborhoods

Local and Participative Reuse of Building and Production Waste demonstrated in a Productive Community Center

Duration: 05/2019-05/2021

Programme: BBSR / BMBF

Website: n/a

Abstract

Productive Neighborhoods aims to reuse local building materials from the neighborhood by encouraging a large participation process of the local citizens. One key aspect for the implementation is the 'Map of Neighborly Building Materials' which was created to locate all available building materials within a 2,2km radius. As for now, it gives us information about the existing potential for local reuse of building and production waste. We suggest for further research, that a process is developed which helps inhabitants and local businesses to exchange and reuse their waste via an online platform.

The Productive Community Center will function as a prototype to demonstrate the wide range of possibilities for reused building materials. Firstly, brick rubble (from former brick buildings located next to the site) can be used as concrete aggregate for those prefabricated elements which shape the supporting structure of the building. Secondly, the current waste wood surplus in combination with the communal recycling center being located on the other side of the street offers a great opportunity to collect wood (and windows, doors and plants) and use it e.g. for non-load bearing walls, possibly also designing them during a collective building workshop. Lastly, two greenhouses from soon-to-be closed nurseries can be dismantled and rebuilt at the site.

During the design and construction phase the interaction of the community plays a huge part of the concept. Through building workshops and seminars, the reuse of building and production waste will be integrated in the neighborhood. After being constructed the Productive Community Center still offers various opportunities for interaction and cooperation. Within the center a community space with an open kitchen was created, which on the one hand offers local citizens to bond with other people from the neighborhood. In the west the workshop for the reuse of building materials is located. Building materials can be donated, edited and you can ask for necessary expertise. On the upper floor the seminar room offers possibilities for the interchange of knowledge, e.g. seminars about aquaponics, permaculture and recycling possibilities.

The R&D concept was developed in the Master thesis „Productive Community Center". Currently the concept was submitted to different research funding schemes, evaluation for funding is ongoing.

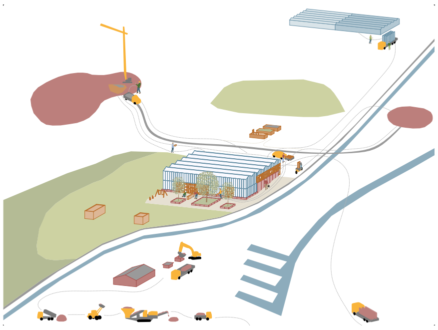
Contact person(s) at the COST Action CA17133 Workshop Vienna:

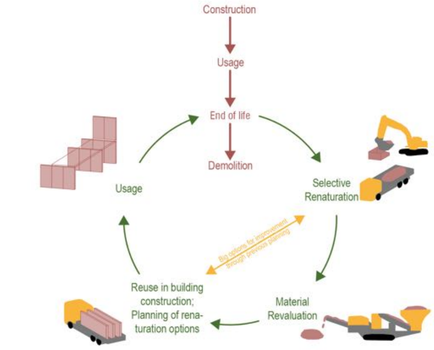
- Luisa Ropelato, RWTH Aachen University, Germany
- Axel Timpe, RWTH Aachen University, Germany

Productive Neighborhoods

Local and Participative Reuse of Building and Production Waste demonstrated in a Productive Community Center

The R&D concept was developed in the Master thesis „Productive Community Center“. Currently the concept was submitted to different research funding schemes, evaluation for funding is ongoing.

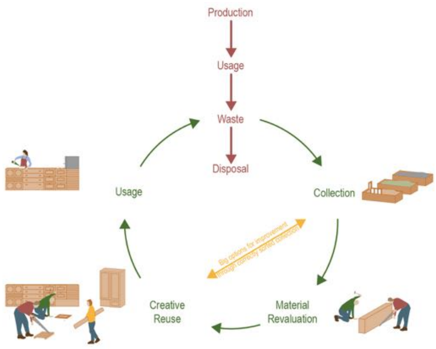




Reintegration of demolition material into the cycle
(Luisa Ropelato)

Neighbourly Building Materials

The Productive Community Center aims to reuse local building materials from the Huckarde neighbourhood by encouraging a large participation process of the local citizens. One key aspect for the implementation is the ‘Map of Neighbourly Building Materials’ which was created to locate all available building materials within a 2,2km radius. As for now, it gives us information about the existing potential for local reuse of building and production waste. We suggest for further research, that a process is developed which helps inhabitants and local businesses to exchange and reuse their waste via an online plattform.
The Productive Community Center will function as a prototype to demonstrate the wide range of possibilities for reused building materials. Firstly, brick rubble (from former brick buildings located next to the site) can be used as concrete aggregate for prefabricated elements which shape the supporting structure of the building. Secondly, the current waste wood surplus in combination with the communal recycling centre being located on the other side of the street offers a great opportunity to collect wood (and windows, doors and plants) and use it e.g. for non-load bearing walls, possibly also designing them during a collective building workshop. Lastly, two greenhouses from soon-to-be closed nurseries can be dismantled and rebuilt at the site.



Reintegration of waste material into the cycle
(Luisa Ropelato)

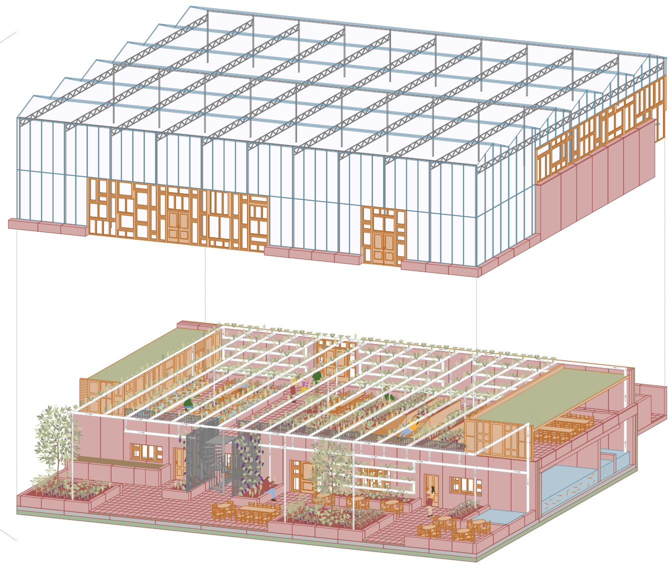
Alternative Growing Methods

The Productive Community Center is designed as a landscape of plants, shrubs and trees growing on the floor, walls and ceiling and finally extending into the exterior space. The upper floor is connected with the ground floor through a two-storied space in the south, which works as a climatic buffer zone. The two floors are not only spatially interwoven but also thematically by hydroponics. In the centre options for interaction are arranged. The produced food is sold next to entrance. The building links up with the south by several landscape phases: a lively forecourt, followed by a community garden and finally a surrounding permaculture garden.

Strengthening the Community

The Productive Community Center offers various opportunities for interaction and cooperation. Within the centre a community space with an open kitchen was created, which on the one hand offers local citizens to bond with other people from the neighbourhood. In the west the workshop for the reuse of building materials is located. Building materials can be donated, edited and you can ask for necessary expertise. On the upper floor the seminar room offers possibilities for the interchange of knowledge, e.g. seminars about aquaponics, permaculture and recycling possibilities.

Map of Neighbourly Building Materials
(Luisa Ropelato; geodata: Land NRW (2017))



Productive Community Center
(Luisa Ropelato)

Corresponding Author: Luisa Ropelato
Co-authors: Axel Timpe, Linda Hildebrand

Tel.: +49 (0)241 80 95058
E-Mail: luisa.ropelato@rwth-aachen.de

Juniorprofessur Rezykliergerechtes Bauen
RWTH AACHEN UNIVERSITY
Institute of Landscape Architecture
RWTH AACHEN UNIVERSITY

proGIreg

productive Green Infrastructure for post-industrial urban regeneration

Duration: 06/2018-05/2023

Programme: HORIZON 2020 (H2020-SCC-2016-2017, GA no. 776528)

Website: http://www.progireg.eu/

Abstract

For proGIreg four front-runner cities (Dortmund (DE); Turin (IT); Zagreb (HR); Ningbo (CN)) will create Living Labs in urban areas which face the challenge of post-industrial regeneration. These areas suffer from social and economic disadvantages, inequality and related crime and security problems. They lack quality greenspaces, have a negative impact on human health and wellbeing and are more vulnerable to the effects of climate change.

Going beyond the current state-of-the-art with Green Infrastructure as a one-off state intervention, the proGIreg Living Labs will develop NBS which are citizen owned and co-developed by state, market and civil society stakeholders. Innovation will take place on the technical level through the NBS deployments, on the social level through co-designing, co-creating and co-implementing NBS with local communities and on the economic level through combining NBS with market-ready business models. Four follower cities in Eastern and Southern Europe (Cascais PT, Cluj-Napoca RO, Piraeus GR, Zenica BA) will be co-steering the research process to assure replicability and adaptability to their local context resulting in urban plans for NBS deployment. The NBS to be tested i.a. include: regenerating industrial soils with biotic compounds, creating community-based urban agriculture and aquaponics and making renatured river corridors accessible for local residents.

Scientific assessment and monitoring results from the Living Labs will be made available on the EU NBS platforms OPPLA and THINKNATURE and will contribute to the European reference framework for NBS. Global impact will be achieved by a training programme for cooperative planning, implementation and management of NBS. It will be provided by partners from the cities, SMEs and universities involved. Training events will be organised in cooperation with the partner ICLEI. Massive Open Online Courses (MOOCs) will be distributed via EdX, the most renowned MOOCs platform worldwide.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Axel Timpe, RWTH Aachen University, Germany, Coordinator
- Luisa Ropelato, RWTH Aachen University, Germany, Assistant

Horizon 2020 Innovation Action proGIreg

Productive Green Infrastructure for post-industrial urban regeneration

proGIreg Project:

For proGIreg three front-runner cities (Dortmund DE; Turin IT; Zagreb HR) will create Living Labs (LLs) in urban areas which face the challenge of post-industrial regeneration. These areas suffer from social and economic disadvantages, inequality and related crime and security problems. They lack quality greenspaces, have a negative impact on human health and wellbeing and are more vulnerable to the effects of climate change. Going beyond the current state-of-the-art with Green Infrastructure as a one-off state intervention, the proGIreg Living Labs will develop nature-based solutions (NBS) which are citizen owned and co-developed by state, market and civil society stakeholders. Innovation will take place on the technical level through the NBS deployments, on the social level through co-designing, co-creating and co-implementing NBS with local communities and on the economic level through combining NBS with market-ready business models. Four follower cities in Eastern and Southern Europe (Cascais PT, Cluj-Napoca RO, Piraeus GR, Zenica BA) will be co-steering the research process to assure replicability and adaptability to their local context resulting in urban plans for NBS deployment. The NBS to be tested i.a. include: regenerating industrial soils with biotic compounds, creating community-based urban agriculture and aquaponics and making renatured river corridors accessible for local residents.
Scientific assessment and monitoring results from the Living Labs will be made available on the EU NBS platforms OPPLA and THINKNATURE and will contribute to the European reference framework for NBS. Global impact will be achieved by a training program for cooperative planning, implementation and management of NBS. It will be provided by partners from the cities, SMEs and universities involved. Training events will be organized in cooperation with the partner ICLEI. Massive Open Online Courses (MOOCs) will be distributed via EdX, the most renowned MOOCs platform worldwide.

Living Labs:

The most significant role will be taken by the four municipalities who will create Living Labs (LLs) for NBS implementation in cooperation with the private sector and local communities. The role of the cities will not be limited to implementing concepts from research, they will also actively perform research tasks.
A LL is a citizen/user –centred open-innovation format, operating in a territorial context (e.g. district or quarter areas) integrating concurrently research and innovation processes within a public-private-partnership. These are integrated through the co-creation, exploration, experimentation and evaluation of innovative concepts and technologies in real life. LLs intend to foster societal, environmental and technological innovation in a well-known real-life context to transfer the acquired knowledge for application in other locations (Schneidewind 2014). They rely on the idea of designed experiments for the study of urban ecosystems (Felson and Pickett 2005, Felson et al. 2013) but take an important step beyond these experiments: The proGIreg LLs involve user communities, not only as observed subjects but as a source of creation. This approach is aimed at enhancing stakeholder and citizen ownership of NBS through the systematic involvement of citizens in participatory, trans-disciplinary and multi-stakeholder consultation processes for co-design and co-development, co-implementation and market readiness assessment and evaluation of the solutions.
The FRC engaged in proGIreg share the common goal of post-industrial urban regeneration. They have existing GI master plans and proposed regeneration targets based upon NBS which will be implemented within the first half of the project lifetime and which will establish the database for the evaluation being undertaken within the proGIreg research. The H2020 support for these projects will boost the quality of the existing planning processes by allowing transnational and transdisciplinary exchange and through bringing additional innovation to the projects.

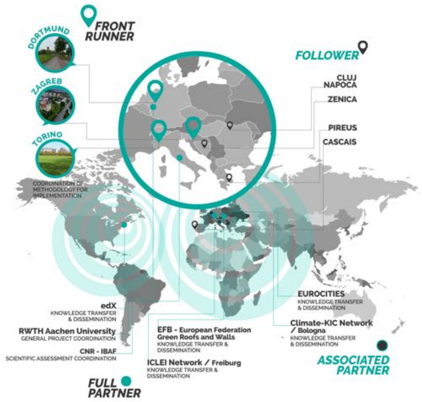


Fig. 1: proGIreg network for NBS design, implementation, research and training

Literature:

Felson, Alexander J.; Pickett, Steward T. A. (2005): Designed experiments: new approaches to studying urban ecosystems. In: Frontiers in ecology and the environment 3 (10), S. 549–556. DOI: 10.1890/1540-9295(2005)003[0549:DENATS]2.0.CO;2.

Felson, Alexander J.; Bradford, Mark A.; Terway, Timothy M. (2013): Promoting Earth Stewardship through urban design experiments. In: Frontiers in ecology and the environment 11 (7), S. 362–367. DOI: 10.1890/130061.

Schneidewind, Uwe (2014): Urbane Reallabore – ein Blick in die aktuelle Forschungswerkstatt. In: pnd | online 9 (III). Available online: http://www.planung-neu-denken.de/images/stories/pnd/dokumente/3_2014/schneidewind.pdf.

NBS 1: Renaturing landfill sites for leisure use and energy production	**NBS 5:** Capillary GI on walls and roofs
NBS 2: New regenerated soil thanks to biotic compounds for urban forestry and urban farming	**NBS 6:** Making post-industrial sites and renatured river corridors accessible for local residents
NBS 3: Community-based urban farming and gardening on post-industrial sites	**NBS 7:** Establishing protocols and procedures for environmental compensation at local level
NBS 4: Aquaponics as soil-less agriculture for polluted sites	**NBS 8:** Pollinator biodiversity improvement activities and citizen science project

Table 1: Nature based solutions to be implemented in the three Living Labs in Dortmund, Turin and Zagreb

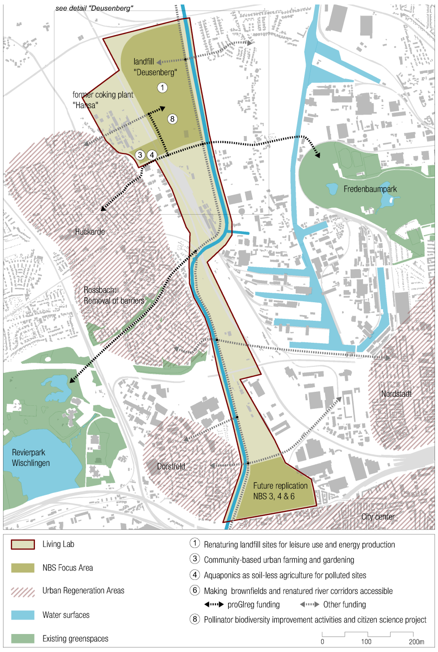


Fig. 2: Living Lab Dortmund - NBS will improve the future „Emscher nordwärts" green corridor. (map: Axel Timpe, Luisa Ropelato; geodata: Land NRW (2017))

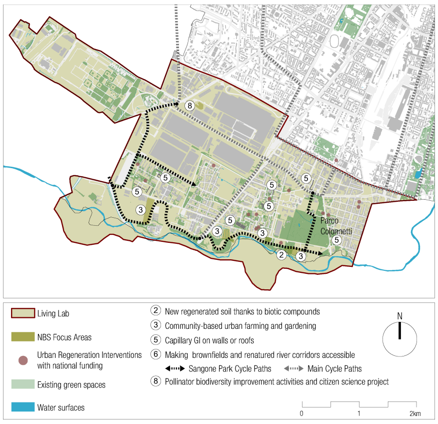


Fig. 3: Living Lab Turin - The Mirafiori district will see numerous NBS implementations. (map: Axel Timpe, Luisa Ropelato; geodata: Comune di Torino 2017)

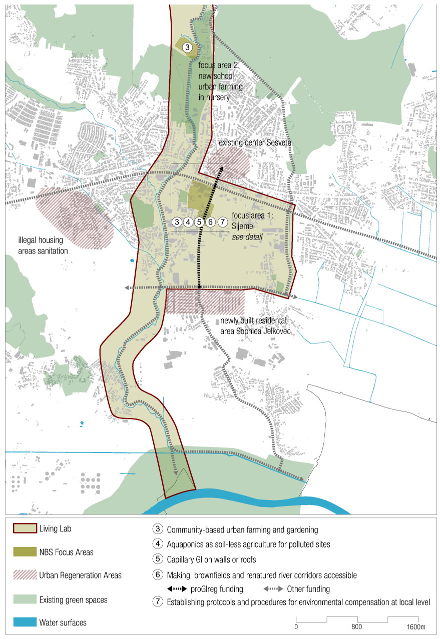


Fig. 4: Living Lab Zagreb - Sesvete district with a new social center and better connection to the Sava river (map: Axel Timpe, Luisa Ropelato; geodata: City of Zagreb 2017)

Corresponding Author: Axel Timpe
Co-authors: Rieke Hansen, Luisa Ropelato

Tel.: +49 (0)241 80 95061
E-Mail: timpe@la.rwth-aachen.de
Website: www.progireg.eu

Institute of Landscape Architecture

RWTH AACHEN UNIVERSITY

proGIreg

This project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement no. 776528.

PVadapt

Prefabrication, Recyclability and Modularity for cost reductions in Smart BIPV systems

Duration: 10/2018-03/2022

Programme: HORIZON2020 LC-SC3-RES-6-2018 (IA)

Website: http://www.pvadapt.com/

Abstract

The **overall goal** of the project is the delivery of a **prefabricated**, **modular** and **multifunctional turn-key BIPV system**. This construction method will reduce the complexity and costs of the BIPV systems, maximizing their accessibility. Achieving a substantial reduction of the BIPV costs would trigger the penetration of BIPV in the building sector, contributing therefore to the creation of new opportunities and the diversification of the European PV manufacturing industry. The project will further contribute to the implementation of policies towards Zero-Energy Buildings.

A **two-component integrated BIPV system** is produced separately and an assembly/joining method is developed for on-site integration. The first component, the structural & thermal one, features a construction grade steel frame and a thermal module based on three main material formulations. The second component consists of a Heat Mat bonded to PV modules. The combination of the two will produce "building blocks" of sufficient customization to allow components suitable for roof and façade installations, as well as new construction.

In order to enable architects to create aesthetically pleasing installations, the PVadapt project will also produce various **secondary building blocks** to complement the BIPV system. These are panels that provide passive functions to the building envelop as well as aesthetics. They include of a green wall panel, or the combination of a green wall panel with a semi-transparent PV unit.

Throughout the whole project, principles of **circular design** are applied to all levels of product development, including production processes, installation, maintenance, dismantling and reuse/recycling of the components. The design process is based on circularity criteria for employment of non-toxic materials, optimized environmental performance and circular utilization of materials.

alchemia-nova's office building in the 14th district of Vienna is one of the demonstration sites. The building functions as a showcase model for buildings in Austria built at the turn of the century. The goals are to transform this house into an energy efficient building, to set up a demonstration building for circular economy and innovative building materials and to present innovative solutions in the building sector to national and international stakeholders. alchemia-nova is also be responsible for the circularity design specifications, production of Oriented Strand Boards (OSB) from agricultural waste, the adaptability of Nature Based Solutions (NBS) secondary building blocks, the Environmental Technology Verification, value chains and sustainability branding.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Johannes Kisser, alchemia-nova research & innovation gemeinnützige GmbH, Austria
- Helene Pattermann, alchemia-nova GmbH, Austria

PVadapt

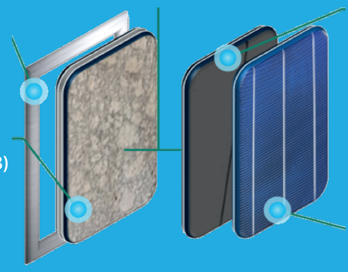
Prefabrication, Recyclability and Modularity for cost reductions in Smart BIPV systems

Duration: 10/2018-03/2022
Programme: HORIZON2020 LC-SC3-RES-6-2018 (IA)

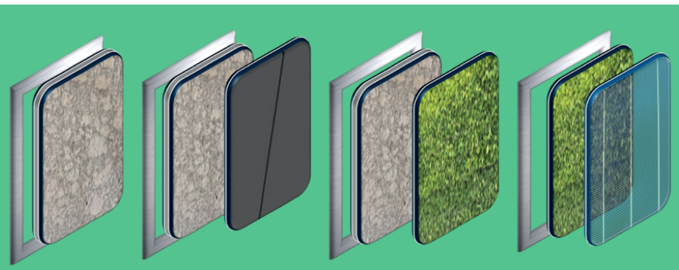
www.pvadapt.com

The **overall goal** of the project is the delivery of a prefabricated, modular and multifunctional turn-key BIPV system. This construction method will reduce the complexity and costs of the BIPV systems, maximizing in this way their accessibility. Achieving a substantial reduction of the BIPV costs would trigger the penetration of BIPV in the building sector, contributing therefore to the creation of new opportunities and the diversification of the European PV manufacturing industry. The project is further expected to contribute to the implementation of policies towards Zero-Energy Buildings.

A **two-component integrated BIPV system** is produced separately and an assembly/joining method is developed for on-site integration. The first component, the structural & thermal one, features a construction grade steel frame and a thermal module based on three main material formulations. The second component consists of a Heat Mat bonded to PV modules. The combination of the two will produce "building blocks" of sufficient customization to allow components suitable for roof and façade installations, as well as new construction.

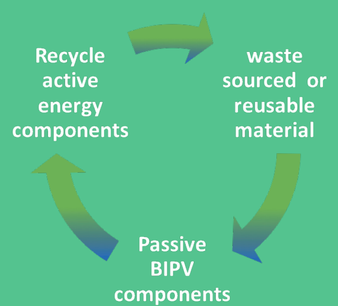


In order to enable architects to create aesthetically pleasing installations, the PVadapt project will produce also various **secondary building blocks** to complement the BIPV system. These are panels that provide passive functions to the building envelop as well as aesthetics. They include of a green wall panel or the combination of a green wall panel with a semi-transparent PV unit.

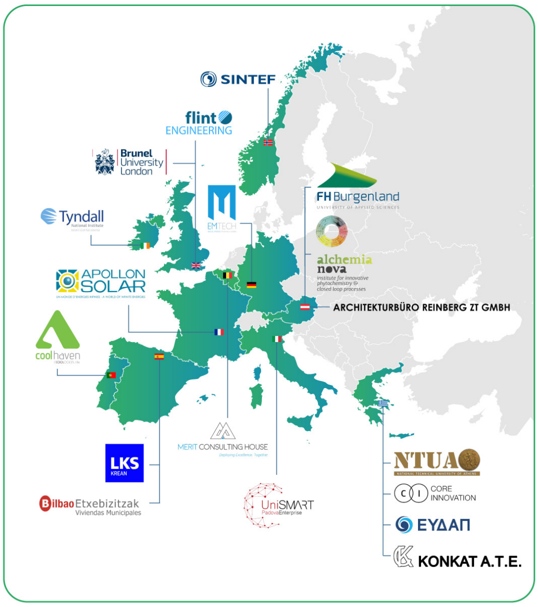


Structural/ Insulating | + Solar thermal | + green wall | + green wall + semi-transparent PV

Throughout the whole project, principles of **circular design** are applied to all levels of product development, including production processes, installation, maintenance, dismantling and reuse/recycling of the components. The design process is based on circularity criteria for employment of non-toxic materials, optimized environmental performance and circular utilization of materials.

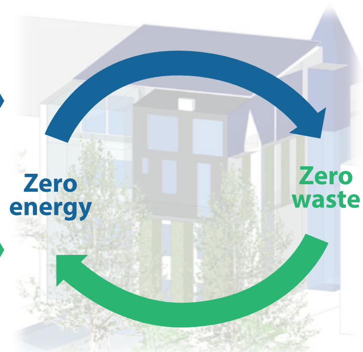


alchemia-nova's office building in the 14th district of Vienna is one of the demonstration sites. The building functions as a showcase model for a number of buildings in Austria that are built at the turn of the century. The goals are to transform this house into an energy efficient building, to set up a demonstration building for circular economy and innovative building materials and to present innovative solutions in the building sector to relevant national and international stakeholders. alchemia-nova is also be responsible for the circularity design specifications, production of Oriented Strand Boards (OSB) from agricultural waste, the adaptability of Nature Based Solutions (NBS) secondary building blocks, the Environmental Technology Verification, value chains and sustainability branding.



PVadapt — **modular panels** — photovoltaic and solar thermal installations will produce enough energy for heating/electricity demand

HOUSEFUL — **water and nutrient flows** — green walls at the facade of the building will treat the waste water stream



CONTACT
Johannes Kisser
Nektaria Efthymiou-Charalampopoulou
office@alchemia-nova.net
www.alchemia-nova.net

alchemia nova
institute for innovative phytochemistry & closed loop processes

Funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement Number: 818342

PV-Roofgarden

Innovative concepts for energy producing green roofs

Duration: 01.04.2013-30.09.2015

Programme: COIN Cooperation & Innovation - Programmlinie Kooperation & Netzwerke

Website:

Abstract

Due to climate change, the urban heat island effect becomes more and more a problem in our cities. One way to improove the microclimate in urban areas is to cool the air with help of plants transpiring. Green roofs for example can offer a moderate recreation space and cool the building below (Österreichischer Verband für Bauwerksbegrünung, 2014, p.14). Although there is the need to produce clean energy by photovoltaic systems (EC, 2012). Usually those photovoltaic-modules get installed on flat roofs. So a competitive situation in between using the space of a flat roof for recreation, or as a place for plants or for green energy production occurs.

The research project "PV-Rooftop Gardens - Innovative Systems for the Future" focuses on the combination of all named usages: new synergies between roof greening, energy production by photovoltaic and usability for the recreation and retention of stormwater shall be found, by combining green roof technology and translucent photovoltaic panels held by a pergola-construction. This synergy allows plants to grow under the photovoltaic, to produce clean energy and to give shadow to users of the roof at the same time.

Within the project comprehensive analyses regarding users' needs were done, and investigations to legally bases were done. Out of this, user scenarios were defined and examples for roof landscapes were shown generically.

Also a basis prototype-system was developed, and the statics calculated (system lasts with the weight of green roof- substrate on roof - no roof penetration needed).

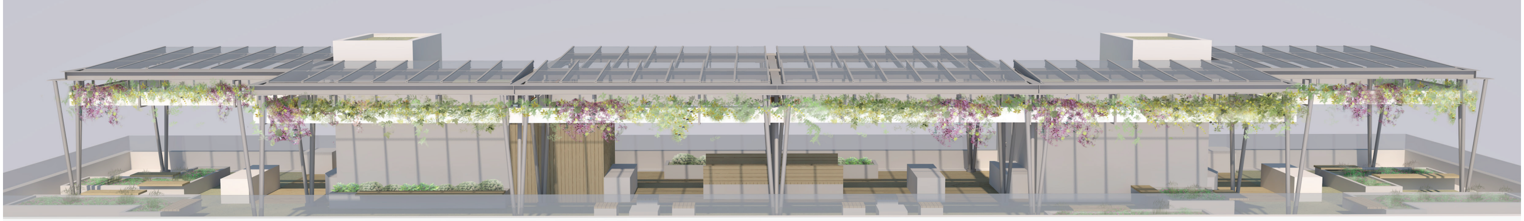
Different translucence of photovoltaic modules and the plant growth in their shadow were tested also in small scale, and in real situation on a roof at Boku. Of the collected information light zones were identified and planting concepts created.

Additionally, air-temperature, humidity, radiation and wind was measured to find out the user comfort (UTCI) under the Photovoltaics.

Further a cost calculation was done and an information package for architects was written.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Irene Zluwa, Ulrika Pitha, Bernard Scharf, BOKU University (Soil Bioengineering), Austria



source: IKI, AG Ress.Bauen, BOKU Wien.

Rooftop Gardens of the Future

- multifunctional concepts to produce biomass under photovoltaic panels

The project was fund by Austrian Research Agency

Irene ZLUWA - IBLB Boku , AG Vegetationstechnik
Ulrike PITHA, Bernhard SCHARF, Vera ENZI

Partner: University of life Science Vienna, Tatwort, ATB -Becker, Fricke,Ertex Solar, Raintime, Treberspurg und Partner,IC-Ces

Introduction:

Due to climate change, the urban heat island effect becomes more and more a problem in our cities. One way to improve the microclimate in urban areas is to cool the air with help of plants transpiring. Green roofs for example can offer a moderate recreation space and cool the building below (Österreichischer Verband für Bauwerksbegrünung, 2014, p.14). Although there is the need to produce clean energy by photovoltaic systems (EC, 2012). Usually those photovoltaic-modules get installed on flat roofs. So a competitive situation in between using the space of a flat roof for recreation, or as a place for plants or for green energy production occurs.

Problem solving aproach:

The research project "PV-Rooftop Gardens - Innovative Systems for the Future" focuses on the combination of all named usages: new synergies between roof greening, energy production by photovoltaic and usability for the recreation and retention of stormwater shall be found, by combining green roof technology and translucent photovoltaic panels held by a pergola-construction. This synergy allows plants to grow under the photovoltaic, to produce clean energy and to give shadow to users of the roof at she same time.

Methods/ Tasks:

Within the project comprehensive analyses regarding users needs were done, and investigations to legally bases were done. Out of this, user scenarios were defined and examples for roof landscapes were shown generically.

Also a basis prototype-system was developed, and the statics calculated (system lasts with the weight of green roof- substrate on roof - no roof penetration needed).

Different translucence of photovoltaic modules and the plant growth in their shadow were tested also in small scale, and in real situation on a roof at Boku. Of the collected information light zones were identified and planting concepts created.

Additionally air-temperature, humidity, radiation and wind was measured to find out the user comfort (UTCI) under the Photovoltaics.

Furthera cost calculation was done and an information package for architects was written.

RENDERING _source: IKI, AG Ress.Bauen, BOKU Wien.

Methods/Test Site Boku:

After testing different modules from 10 to 40 % transluscence with 6 indicator plants monitored for two years, it was recommendet to have about 30 % transluscence of the photovoltaics to provide enough light for a planting layer below.

Then a big scale testing setup was constructed on a terrasse of a Boku-building.

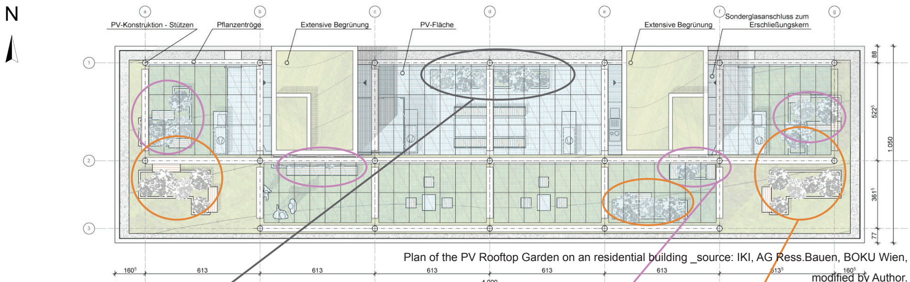
21 species of perannials and grasses, 4 climbers und several annuals were tested as indicator plants for 3 vegetation periods.

With this monitored indicator plants in combination to literature research planting concepts for the different light zones and user-requirements in a photovoltaic rooftop garden could be suggested.

Test site at BOKU Wien (Pics Irene Zluwa).

Results:

the results are shown on the example of an residential building:



Plan of the PV Rooftop Garden on an residential building _source: IKI, AG Ress.Bauen, BOKU Wien, modified by Author.

areas with a lot of influence of PV

--> Species that grow in the shadow an can deal with heat cold and wind.
Mostly non flowering aspects, but ornamental leaf perannials, fern and also moss.

Example of species:
Ajuga reptans
Alchemilla mollis
Aquilegia vulgaris
Asplenium trichomanes
Bergenia cordifolia
Carex ornithopoda
Carex sylvatica
Geranium spec.
Lamium galeobdolon
Mahonia aquifolium
Saxifraga cotyledon
Saxifraga umbrosa
Phyllitis scolopendrium
Primula veris
Waldsteinia ternata

Bergenia sp.

Geranium sp.

Phyllitis scolop.

Waldsteinia sp.

Asplenium trichomanes

border areas with influence of PV

--> Species that grow in half to light shadow an can deal with heat cold and wind.
Northern areas get less light then western or eastern borders.

Example of species:
Arthemisia absinthium
Allium schoenophrasum
Anthirrhinum majus
Calamagrostis x Acutiflora
Campanula portenschlagiana
Coreopsis lanceolata 'Sternthaler' Deschampsia cespitosa 'Goldschleier'
Festuca gautieri
Fragaria vesca
Foeniculum vulgare 'Atropurpureum'
Hemerocallis spec.
Iris foetidissima
Jasminum nudiflorum
Origanum vulgare
Primula denticulata
Sedum album
Sedum floriferum

Allium schoenoph.

Campanula port.

Foeniculum vulg.

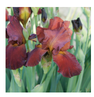
Iris foetidissima

areas in the sun and areas with minimal influence of PV

--> Species that deal with strong heat and radiation, lot of flowering aspects, herbs and vegetables possible.

Example of species:
Alyssum montanum 'Berggold'
Aster linosyris
Calendula officinalis
Briza media
Bouteloua gracilis
Dianthus carthusianorum
Dianthus deltoides
Festuca ovina
Festuca valeisiaca
Hiracium pilosella
Iris barbata
Lavandula angustifolia
Petrorhagia saxifraga Potentilla neumanniana
Satureja spec.

Sedum telephium



Iris sp.

RECO2ST

REsidential retrofit assessment platform and demonstrations for near zero energy and **CO_2** emissions with optimum co**ST,** health, comfort and environmental quality.

Duration: 01/2018-06/2021

Programme: HORIZON2020 EEB-05-2017

Website: https://reco2st.eu/

Abstract

RECO2ST addresses the challenges of attaining zero and near-zero energy buildings. The project proposes for the refurbishment of existing building via a systemic 3-step approach: First, the project Refurbishment Assessment Tool (RAT) identifies possible refurbishment scenarios. Secondly, the refurbishment actions are mapped out (regarding order and costs) using an Integrated Project Delivery (IPD) vehicle; and finally, the deployment and installation of the Retrofit-Kit (refurbishment package) comprising of a comprehensive index of the latest innovative technologies available.

The Retrofit-Kit features a host of cost-efficient, customizable and modular technologies such as vacuum insulation panels; photovoltaics, smart windows, wireless sensor networks, intelligent energy management systems and nature-based technologies (NBT).

As specialists in the nature-based solutions, alchemia-nova advances its development of two bio-technical air-treatment systems for inclusion in the Retrofit-Kit. These systems exploit the cleansing, cooling and humidification properties of strategically placed plant-matter. The first comprises of a decentralized pot-plant-based system easily installed into buildings as part of a retrofit-kit, or as stand-alone solutions. In the second system, ambient-air is treated by directing ventilation through a 'winter-garden' plant chamber.

The systems are automatable and designed to obtain better and healthier air-quality and a stable indoor temperature, heightening comfort and significantly enhancing the aesthetics of the indoor environment.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Johannes Kisser, alchemia-nova research & innovation gemeinnützige GmbH, Austria
- Helene Pattermann, alchemia-nova GmbH, Austria

ReCO2ST

REsidential Retrofit assessment platform and demonstrations
for near zero energy and **CO2** emissions with optimum co**ST**,
health, comfort and environmental quality

Taking up the challenges of the near-zero energy building, ReCO2ST proposes the refurbishment of existing building in 3-steps:

Step 1: Refurbishment Assessment Tool (RAT)
- identifies possible refurbishment scenarios

Step 2: Integrated Project Delivery (IPD)
- maps out refurbishment implementation

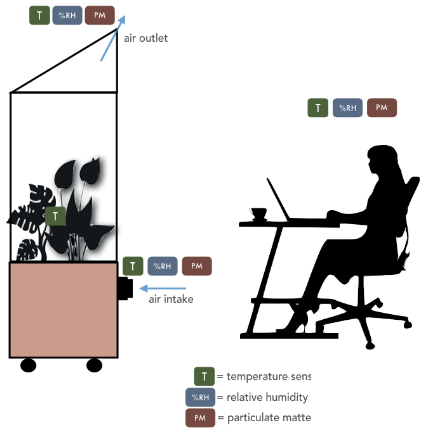
Step 3: Retrofit-Kit
- deployment & installation of the innovative technologies

THE RETROFIT-KIT

A comprehensive index of latest available building refurbishment technologies, including innovative project technologies such as:

- o vacuum insulation panels
- o high intensity photovoltaics
- o smart windows
- o wireless sensor networks
- o integrated intelligent energy management systems
- o nature-based technologies (NBT)

As specialists in nature-based solutions, alchemia-nova advances its development of two bio-technical air-treatment systems that exploit the cleansing, cooling and humidification properties plant-matter.

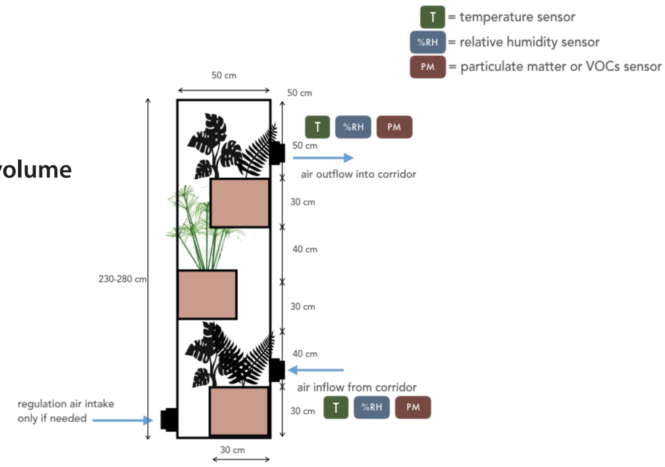


AeroPlant™

- o **Increase in %RH by 10 pts/75m3 volume**
- o **Reduction in temp by 2°C**
- o **Reduction in PM ≈18 %**
- o **Reduction in VOCs ≈ 40 %**
- o **Footprint ≈ 54 cm x 54 cm**
- o **Fans powered by photovoltaic cell**
- o **Approx. weight 100 kg**

Wintergarden Casetta™

- o **Increase in %RH by 10 pts/250m3 volume**
- o **Reduction/Increase in temp by 2°C**
- o **Reduction in PM ≈15 %**
- o **Reduction in VOCs ≈ 15 %**
- o **Footprint ≈ 0,5 m x 1 m x 2,8 m**
- o **Approx. weight 600 kg**
- o **80kg x 3 – container**



The systems are automatable and designed to obtain better and healthier air-quality and a stable indoor temperature, heightening comfort and significantly enhancing the aesthetics of the indoor environment.

This project has received funding from the European Union's Horizon 2020 Research and Innovation program under Grant Agreement No 768576

CONTACT
Johannes Kisser
Nektaria Efthymiou-Charalampopoulou
office@alchemia-nova.net
www.alchemia-nova.net

alchemia nova
institute for innovative phytochemistry & closed loop processes

ReNature

Promoting research excellence in nature-based solutions for innovation, sustainable economic growth and human well-being in Malta

Duration: 09/2018-08/2021

Programme: H2020-EU.4.b. - Twinning of research institutions

Website: http://renature-project.eu

Abstract

The challenge of putting together socio-economic demands and environmental challenges is particularly felt in Malta, the smallest member state of the European Union (EU). Malta has limited natural resources, but also the highest population density in the EU, a strong and demanding tourism sector, and rapid urbanisation and economy growth. The region is also characterised by an increased risk to human life driven by a strong rise in the frequency and intensity of heatwaves towards the south of Europe, and an upsurge in drought conditions, with previous studies indicating higher rates of weather fatalities in Southern European countries as a consequence of climate change. A central idea in the use of nature-based solutions is that of addressing societal challenges of innovation, job creation and community development but at the same time creating net positive effects on the environment by making a sustainable use of biodiversity and natural resources, in order to improve human well-being.

The ReNature project aims to establish and implement a nature-based solutions research strategy for Malta with a vision to promote research and innovation and develop solutions in a pursuit of economic growth, whilst at the same time improving human well-being and tackling environmental challenges. The strategy will be complemented by a newly-developed research cluster to act on it, with a vision to stimulate both scientific excellence and innovation capacity towards achieving the goals of sustainable development. More specifically, the ReNature project will:

1. strengthen collaborations across the science-policy interface and stimulate common research projects and information flow among the different players;
2. provide opportunities for capacity-building to enable Maltese entities to collaborate and link up with third parties for the development of excellent scientific research in the nature-based solutions sector;
3. develop the evidence-base to inform practitioners and policy-makers on landscape and urban planning as key components of green infrastructure;
4. extend the collaborations with European practitioners by implementing knowledge synthesis approaches, promoting knowledge exchange and openly sharing resources and data in an online compendium;
5. extend the partnership by clustering with ongoing and future projects on nature-based solutions at European scale;
6. provide solutions and alternatives to national authorities, policy-makers and businesses on the implementation of nature-based solutions.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Mario Balzan, Institute of Applied Sciences, MCAST, Paola, Malta. Coordinator.

ReNature

renature-project.eu @ReNature_H2020 @ReNatureH2020

PROMOTING RESEARCH EXCELLENCE IN NATURE-BASED SOLUTIONS FOR INNOVATION, SUSTAINABLE ECONOMIC GROWTH AND HUMAN WELL-BEING IN MALTA

Nature-based solutions are living solutions, inspired by nature, which address societal challenges whilst providing economic, social and environmental benefits. They also help build resilience and bring biodiversity to cities and landscapes through adapted interventions. Example include urban green spaces, green roofs and walls, sustainable urban drainage systems, hedgerows, and natural water retention systems.

The challenge of putting together socio-economic demands and environmental challenges is particularly felt in Malta, the smallest member state of the European Union. ReNature will build the evidence-base through improved capacity, networking and knowledge synthesis, adopt business and policy approaches, and develop a strategic research strategy to foster nature-based solutions research in Malta and the Mediterranean region.

OBJECTIVE: Strengthen collaboration between MCAST, Maltese national authorities and ReNature partners

ACTION: Promote dialogue and knowledge co-creation among scientists and practitioners

OUTCOME: Create a National Research and Innovation Cluster to contribute to nature-based innovation in Malta and Europe.

OBJECTIVE: Inform practitioners and policy-makers on landscape and urban planning

ACTION: Promote open-source innovation by creating a compendium and sharing information with interested users

OUTCOME: Develop a Nature-Based Solutions Impacts Toolbox for practitioners

OBJECTIVE: Promote collaboration for the development of excellent scientific research

ACTION: Offer training for capacity building within MCAST and for stakeholders, young researchers, academics and practitioners

OUTCOME: Learning modules for Masters programmes in environmental science

OBJECTIVE: Extend the partnership by collaborating with European practitioners

ACTION: Implement mentoring visits from researchers in research intensive institutions

OUTCOME: Implement knowledge and technical practices within project results, toolbox and complementary training courses

OBJECTIVE: Develop guidelines for national authorities, policy-makers and businesses on nature-based solutions implementation

ACTION: Organise meetings and disseminate outcomes for an amplified effect on environmental management, landscape planning and businesses.

OUTCOME: Embed project results in a larger community through promotional materials, website, social network profiles, and an online open-source compendium.

This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 809988.

RUN4LIFe

Recovery and utilisation of nutrients for low impact fertiliser

Duration: June 2017 – May 2021

Programme: EU Horizon 2020; G.A. No 730285

Website: www.run4life-project.eu

Abstract

Paradigm shift

The world food supply is entirely dependent on the use of fertilisers. However, current fertiliser production practices are not sustainable. Domestic wastewater is an important nutrient carrier that is currently not exploited. Run4Life demonstrates an alternative strategy for improving nutrient recovery, based on a decentralised treatment of segregated domestic wastewater streams and organic kitchen waste. This radical change opens a new paradigm in society.

Objectives

- Improve innovative nutrient recovery technologies;
- Demonstrate large scale nutrient recycling from domestic wastewater;
- Evaluate impacts on environment, society and economy; Promote full product
- Acceptance and review legal framework
- Implement a value chain for the products, including new business models

Large scale demonstration

At 4 full-scale sites in Europe different innovative technologies are combined (see diagram below). The resulting fertiliser products will be characterised and the possibilities for their agricultural application will be determined.

A joint force of 15 well-matched partners

The Run4Life consortium represents the entire value chain. The combination of partners increases the market success of the proposed solutions and enhances social acceptance.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

Grietje.Zeeman@wur.nl (LeAF bv)

Miriam.vanEekert@wur.nl (WUR)

Recovery and utilisation of nutrients for low impact fertiliser

Grietje.Zeeman@wur.nl (LeAF bv) / Miriam.vanEekert@wur.nl (WUR)
www.run4life-project.eu

Paradigm shift

The world food supply is entirely dependent on the use of fertilisers. However, current fertiliser production practices are not sustainable. Domestic wastewater is an important nutrient carrier that is currently not exploited. Run4Life demonstrates an alternative strategy for improving nutrient recovery, based on a decentralised treatment of segregated domestic wastewater streams and organic kitchen waste. This radical change opens a new paradigm in society.

Large scale demonstration

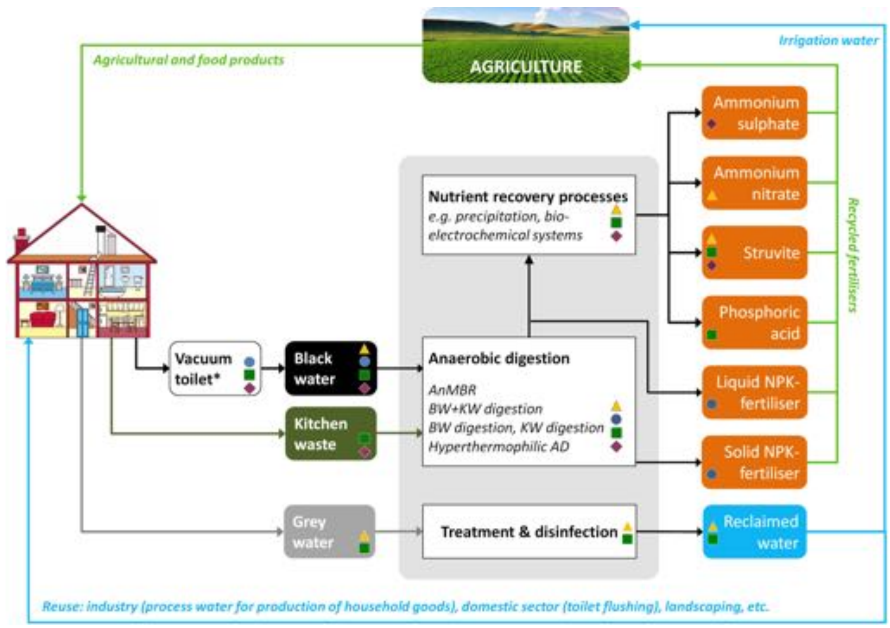
At 4 full-scale sites in Europe different innovative technologies are combined (see diagram below). The resulting fertiliser products will be characterised and the possibilities for their agricultural application will be determined.

A joint force of 15 well-matched partners

The Run4Life consortium represents the entire value chain. The combination of partners increases the market success of the proposed solutions and enhances social acceptance.

Run4Life aims to:

- Improve innovative nutrient recovery technologies
- Demonstrate large scale nutrient recycling from domestic wastewater
- Evaluate impacts on environment, society and economy
- Promote full product acceptance and review legal framework
- Implement a value chain for the products, including new business models



* In Sneek newly developed ultra-low flush vacuum toilets will be used

Vigo (ES): Porto do Molle business centre, 200 people

Sneek (NL): neighbourhood, 75-100 people

Nieuwe Dokken, Ghent (BE): new district 1200 people

H+, Helsingborg (SE): new district 1800 people

European Sustainable Phosphorus Platform
ict4water.eu
aqualia, desah, SLU Swedish University of Agricultural Sciences, LeAF, LEITAT managing technologies, NSVA, USC Universidade de Santiago de Compostela, WE&B, Wageningen University & Research, ZFV Consorcio Zona Franca de Vigo, ecomotive, isle, CEIP Clean Energy Innovative Projects, farmers, Greenworld

EU Horizon 2020
G.A. No 730285

SAVE

Innovative approaches for sustainable storm water management in urban areas

Duration: 05/2016 - 04/2020

Programme: Municipality of Vienna; Green infrastructure

Website:

Abstract

Increase of extreme events, flooding and shortage of water in a long-term perspective - those headings are used in our everyday life connected to climate change in urban areas. Therefore, innovative storm water management using green infrastructure in combination with filtration systems could be an effective strategy to increase water availability for plants and remove contaminants from roadway runoff.

The goal of the SAVE project (**Straßen-Abwasserlösungen für Vegetation & Entwässerungssysteme**) is to evaluate the effectiveness of developed vegetated filtration systems for storm water management regarding to water quantity and quality. Three pilot plants with different scopes of application are used to evaluate the designed systems through monitoring their performance in the field. This study is focused on the following objectives:

a) Ground water protection
b) Hydraulic stability of the systems over the time
c) Behavior of different vegetation clusters under climate stress
d) Influence of road runoffs on vegetation
e) Influence of deicing agents regarding to a) and d).

The monitoring program of the three pilot plants is focused on:

a. Investigation of hydraulic behavior (inflow & drainage)
b. Water quality regarding to relevant pollutants (pH, EC, heavy metals, deicing agents, polycyclic aromatic hydrocarbons, mineral oil hydrocarbons and nutrients)
c. Substrate filter materials, regarding to their potential for water and contaminant retention
d. Vegetation (trees, grass and weeds)
e. Weather conditions (T, precipitations)

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Alexander Pressl, Roza Allabashi, Thomas Ertl; BOKU University (Sanitary Engineering), Austria
- Ulrika Pitha, Bernard Scharf, Oliver Weiss; BOKU University (Soil Bioengineering), Austria

Application of innovative monitoring strategies for urban stormwater management

Alexander Pressl*, Oliver Weiss, Bernhard Scharf**, Roza Allabashi*, Ulrike Pitha**, Thomas Ertl***

University of Natural Resources and Life Sciences, Vienna

* Institute of Sanitary Engineering and Water Pollution Control

** Institute of Soil Bioengineering and Landscape Construction

1. Introduction

Increase of extreme events, flooding, shortage of water in a long term perspective – those headings are used in our every day life connected to climate change in urban areas. Therefore, innovative storm water management using green infrastructure in combination with filtation systems could be an effective strategy to increase water availability for plants and remove contaminants from roadway runoff.

The goal of the **SAVE** project (**Straßen-Abwasserlösungen für Vegetation & Entwässerungssysteme**) is to evaluate the effectiveness of developed vegetated filtration systems for stormwater management regarding to water quantity and quality. Three pilot plants with different scopes of application are used to evaluate the designed systems through monitoring their performance in the field. They are located in different parts of Vienna.

This study is focused on following objectives:

a) Ground water protection
b) Hydraulic stability of the systems over the time
c) Behavior of different vegetation clusters under climate stress
d) Influence of road runoffs on vegetation
e) Influence of deicing agents regarding to a) and d)

Figure 1: Filter strip (vegetated swale) – Edith Piaf Strasse, 22nd District.

Figure 2: Stormwater Planter (planted with trees) – Attemsgasse, 22nd District.

Figure 3: Rain garden – Kuchelauer Hafenstrasse, 19th District.

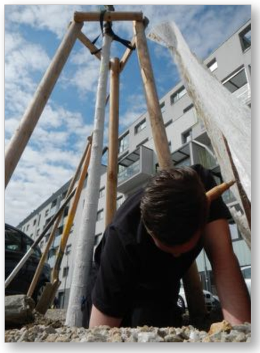


Figure 4: Great commitment of the people involved.

2. Material and methods

The monitoring program of the three pilot plants (see Figure 1 to 4) is focused on:

a) Investigation of the hydraulic behavior (inflow & drainage) → Figure 5, 6 and 10.
b) Water quality regarding to relevant pollutants (pH, EC, heavy metals, deicing agents, polycyclic aromatic hydrocarbons, mineral oil hydrocarbons and nutrients) → Figure 7 and 9.
c) Substrate filter materials, regarding to their potential for water and contaminant retention → Figure 9.
d) Vegetation (trees, grass and weeds) → Figure 8.
e) Weather conditions (air temperature, precipitation) → Figure 11.

Figure 5: Trench – pilot plant inflow monitoring.

Figure 6: Collectorpanel (CP) – drainage collection.

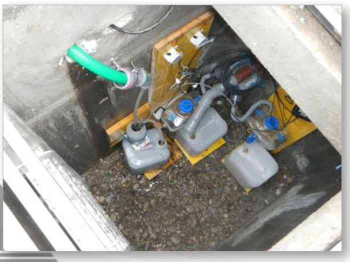


Figure 7: Drainage and trench monitoring – online probes, tipping counter and water sampling.

Figure 8: Vegetation monitoring.

Figure 9: Online-monitoring probes: left – TEROS 12® (METER), right – TetraCon® 925 IDS (WTW / Xylem)

Figure 10: Infiltration monitoring

Figure 11: Precipitation - rain gauge

3. Preliminary monitoring insights

The first conclusions from monitoring program:

a) The online monitoring in water and substrate (EC, volumetric water content- VWC) delivers useful information about the distribution of water and specific contaminants within the system. → Figure 12 and 13.
b) The information gained from the preliminary performed lab tests on substrate and water is very important for the plausibility of the field monitoring.
c) Quantity & quality estimation of diffuse runoffs, needed to address the monitoring objectives, is a big monitoring challenge.
d) The representative sampling and definition of monitoring points is crucial for the final system estimation.

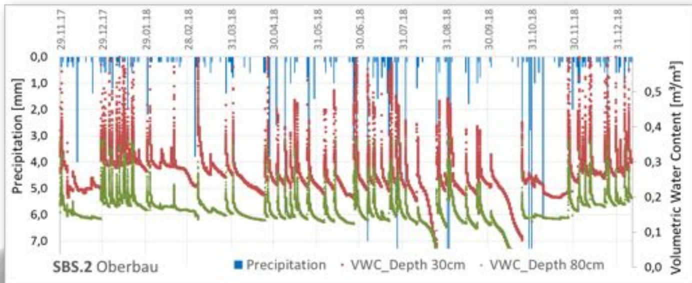


Figure 12: Volumetric water content of one used substrate in different depths (30cm and 80cm) in correlation to the precipitation over one year monitoring.

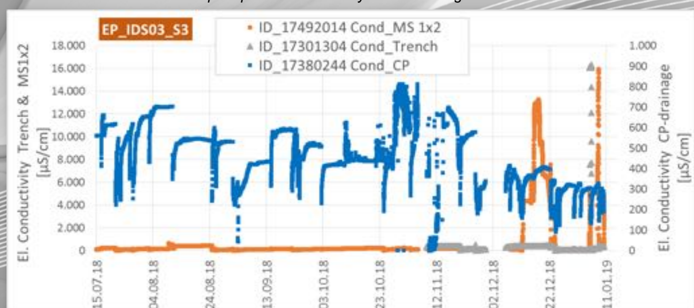


Figure 13: Electric conductivity monitoring of inflow (Trench and MS1x2) and drainage (CP). The high inflow conductivity is due to strong application of deicing salt (NaCl) during snowfall events.

This work is part of the project Urban runoffs for vegetation and drainage (SAVE), Collaboration of Institute of Sanitary Engineering and Water Pollution Control & Institute of Soil Bioengineering and Landscape Construction, BOKU with the City of Vienna; Duration of the project: May 2016 - April 2020, Project funded by Wien Kanal - BA 9

SELENEX

Recovering valuable resources from industrial effluents

Duration: 06/2018-06/2021

Programme: National Science Center (NCN), Poland

Website: http://ddg.biol.uw.edu.pl/projects/staicu-sonata

Abstract

Selenium (Se) and bacteria are intimately linked in a complex interplay. Selenium serves both essential and energy generation functions for bacterial metabolism, in addition to behaving as a powerful toxicant under certain conditions. Conversely, bacteria are involved in all valence state transformations of Se, thus acting as a tremendous vehicle for the cycling of this element in nature. With the advent of the Industrial Revolution, the natural cycles of numerous chemical elements, including Se, have been altered. Nowadays, an important share of global energy is generated by coal combustion. During coal combustion in power plants, Se enters the wet Flue Gas Desulfurization (FGD) scrubber, where an important share is concentrated in the FGD wastewater. FGD effluents can be treated by bioremediation, using bacterial metabolism to convert soluble and toxic forms of Se into solid, elemental Se, Se^0. These redox transformations can be harnessed to clean-up industrial pollution, and additionally coupled with the recovery of selenium as biogenic Se^0 nanoparticles and biogas. Various bioreactors have been tested for FGD treatment and some are commercially available. Here we explore the coupling of the FGD treatment and resource recovery using an integrated system, in the framework of circular economy. This approach not only reduces the burden of Se pollution on aquatic ecosystems, but also provides a way to recover valuable resources, thus generating profit and offsetting the treatment costs.

This project is developed in cooperation with major coal-fired power plants in Poland and attempts to link wastewater biotreatment with resource recovery in an integrated, circular economy, platform using a trans-disciplinary (Microbiology, Biotechnology, Analytical Chemistry), stakeholder-oriented, approach. We intend to reconsider waste materials as secondary resources, thus generating valuable materials from problematic wastes for a sustainable development and a smart city objective.

Contact person at the COST Action CA17133 Workshop Vienna:

- Dr. Lucian Staicu, University of Warsaw, Poland, Coordinator

Harvesting resources from industríal effluents

Lucian C. Staicu*, Lukasz Dziewit, Lukasz Drewniak

Faculty of Biology, University of Warsaw, ul. Miecznikowa 1, 02-096 Warsaw, Poland (*staicu@biol.uw.edu.pl)

1. Introduction

Selenium (Se) respiration by bacteria was identified for the first time at the end of 1980s as a novel type of anaerobic respiration (Macy et al., 1989). Selenium oxyanions, **SeO_4^{2-} and SeO_3^{2-}**, are converted to **elemental Se, Se^0**, by means of bacterial respiration (*Eqs. 1 and 2*; *Fig. 1*). These metabolic conversions lead to the intracellular production of biogenic Se^0, which is solid, of submicron size and amorphous. Various industrial effluents contain high levels of Se that could be recovered using anaerobic respiration. One such effluent is Flue Gas Desulfurization (FGD), a waste stream generated by coal combustion on a large scale worldwide (*Fig. 2; Table 1*).

The aim of this paper is to identify and discuss the recovery of resources from FGD streams using a biotech approach.

$2SeO_4^{2-} + C_3H_6O_3^- \rightarrow 2SeO_3^{2-} + C_2H_3O_2^- + HCO_3^- + H^+$ Eq. 1
ΔG_f° = -343.1 kJ mol^{-1} lactate ($C_3H_6O_3^-$)

$SeO_3^{2-} + C_3H_6O_3^- + H^+ \rightarrow Se^0 + C_2H_3O_2^- + HCO_3^- + H_2O$ Eq. 2
ΔG_f° = -241.6 kJ mol^{-1} lactate ($C_3H_6O_3^-$)

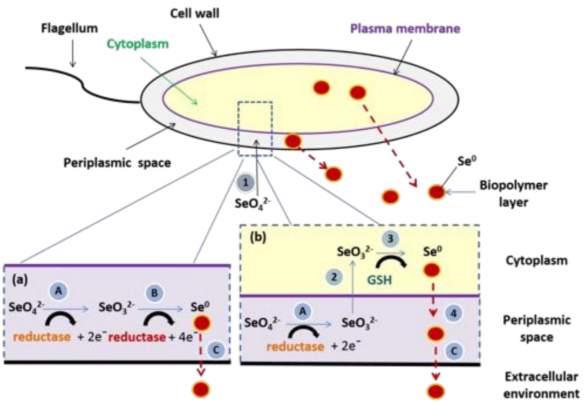


Figure 1. Selenium respiration in *Thauera selenatis* coupled with the production of biogenic Se^0 (Staicu and Barton, 2017).

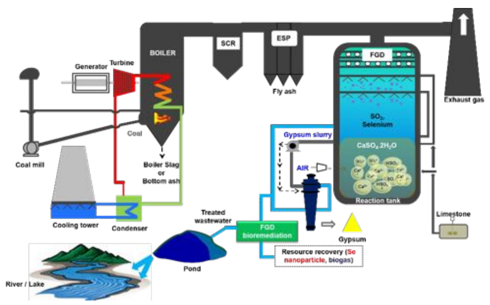


Figure 2. Coal-fired power plant equipped with FGD unit (Cordoba and Staicu, 2018).

Table 1. FGD effluent
➢ Se: 200 - 3,000 µg L^{-1}
➢ SO_4^{2-}: 1-20 g L^{-1}
➢ NO_3^- <250 mg L^{-1}; Cl^- <10 g L^{-1}
➢ Toxic metals: Cd, Hg, V, Zn etc.

Table 2. Se ultilization
▪ **Photovoltaic cells**
▪ **Glass industry**
▪ **Alloys**
▪ **Antidandruff shmapoo**
▪ **Dietary supplements**

2. Resource recovey

FGD effluents should not be considered a waste material, but rather as a secondary resource. These effluents are loaded with selenium, sulfate and have the potential to produce resources using various bioreactor systems (*Fig. 3*).

3. Circular economy

Bacterial respiration can be harnessed to clean up industrial effluents rich in selenium such as FGD, in parallel with applying a resource recovery strategy (*Figs. 3 and 4*). This approach serves a double purpose since it links treatment and valuable material recovery (Se^0 and biogas) in an integrated platform. It is noteworthy to mention the high value of Se for industry and domestic applications (*Table 2*). We calculate that 5 m^3 of FGD (with an average of 1 mg L^{-1} of Se) are necessary to produce 5 g of Se^0, worth ~88 € (Sigma Aldrich), assuming stoichiometric conversions.

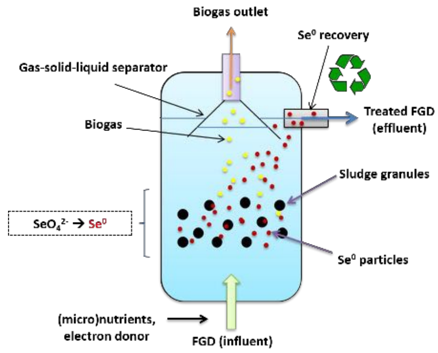


Figure 3. Upflow anaerobic sludge blanket bioreactor (UASB) treating Se-laden wastewater using mixed microbial communities (granular sludge) (Cordoba and Staicu, 2018).

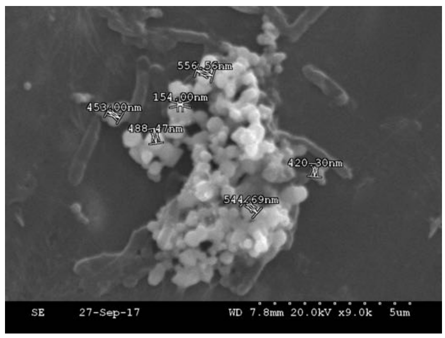


Figure 4. Biogenic Se^0 (nano)particles produced by *Sulfospirillum* sp. (personal archive).

4. Conclusions

- **Anaerobic respiration of Se provides cellular energy for specialized bacteria;**
- **This bacterial inocula can be used in biotech applications to clean up difficult-to-treat industrial effluents and recover valuable resources;**
- **Such resources include Se^0, biogas and biomass;**
- **Se^0 has a high market potential and finds use in numerous industrial and domestic applications.**

5. Bibliography

▪ Cordoba P, Staicu LC (2018) Flue Gas Desulfurization effluents: an unexploited selenium resource. *Fuel* 223:268-276.
▪ Macy JM, Michel TA, Kirsch DG (1989) Selenate reduction by Pseudomonas species: a new mode of anaerobic respiration. *FEMS Microbiol Lett* 61:195-198.
▪ Staicu LC, Barton LL (2017) Microbial metabolism of selenium – for survival or profit. Springer, pp. 1-31.

SOIL-RECIPE

Characteristics and performance of technical soil-like substrates manufactured entirely from [de]construction materials and green compost.

Duration: 04/2016-03/2021

Programme: Scottish Government's Rural and Environmental Sciences and Analytical Services (RESAS) funded project

Website:

https://www.hutton.ac.uk/staff/luke-beesley

https://www.hutton.ac.uk/staff/malcolm-coull

Abstract

Increasing efforts have been made to create functional soil-like substrates from waste materials, prompted by the need to replace degraded or sealed soils in urban environments, and to re-utilise value-laden materials otherwise disposed of.

The central aim of this project is to;

- produce a range of soil-like substrates entirely from locally sourced mineral and organic materials,
- test the created substrates in the field and laboratory for their ability to perform a range of soil functions (plant growth, carbon storage, habitat for soil biota, moisture retention, pollutant filtration etc),
- compose a 'recipe' book to aid the creation of viable soil-like substrates from currently value-less materials.

Experiments performed in the first two years of this project indicate that substrates made from various ratios of [de]construction materials and green compost provide a suitable medium for the growth of perennial ryegrass *(Lolium perenne)* and reed canary grass *(Phalaris arundinacea),* equal or superior to a control 'real' soil. Substrate made of equal volumes of the two base materials proved to be the best of those tested with regards to dry biomass production in the field. CO2 emissions from all tested substrates/soil were significantly greater at 15°C compared to 5°C. Substrate 50:50 (mineral:organic) emitted the lowest CO2 of those tested and compared to the control soil, in controlled laboratory tests.
The presence of *Eisenia fetida* sp worms significantly increased the NO3 concentrations in the pore water for the substrates but had no influence on this parameter in the control soil. Worm survival was not significantly different between substrates and control soil ($P<0.05$). In all cases, with or without earthworms, SO4 concentrations were much higher in the substrates (~500mg l^{-1}) than the control soil (<50 mg l^{-1}), alluding to possible high gypsum contents of the mineral material, due to its origin as mixed [de]construction material. The same effect has been recorded in controlled column leaching tests (data not shown) and will be closely monitored throughout the project.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Luke Beesley (James Hutton Institute, UK)

Characteristics and performance of technical soil-like substrates manufactured entirely from [de]construction materials and green compost.

Malcolm Coull[1], Caroline Stevenson [2], Mireia Uranga Ruiz de Eguino[3], John ferguson[4], Gareth Norton[2], Luke Beesley[1*]

[1]The James Hutton Institute, Craigiebuckler, Aberdeen, UK

[2]University of Aberdeen, St Machar Drive, Aberdeen, UK

[3]CSIC, Valencia, Spain

[4]BINN group Ltd, Binn farm, Perth, UK

*Email: luke.beesley@hutton.ac.uk

Introduction & Aims

Increasing efforts are being made to create functional soil-like substrates from waste materials, prompted by the need to replace degraded or sealed soils in urban environments, and to re-utilise value-laden materials which may otherwise disposed of to landfill.

The central aims of this project were to;

- ***produce a range of soil-like substrates entirely from locally sourced mineral and organic materials,***
- ***test the created substrates in the field and laboratory for their ability to perform a range of soil functions (plant growth, carbon storage/emission, habitat for soil biota, moisture retention, pollutant filtration etc),***
- ***compose a 'recipe' book to aid the creation of viable soil-like substrates from currently low/value-less materials.***

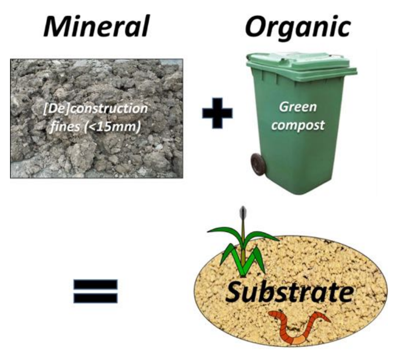


Figure 1. Diagrammatic representation of the composition of created soil-like substrates.

Materials & Methods

Substrate creation; construction and demolition materials (BW) at a particle size of < 15 mm was mixed with green waste compost (BW) using a cement mixer, on a volumetric basis (BW:GWC); 100:0, 90:10, 75:25, 50:50. The two materials, supplied by BINN group Ltd (Perth, UK) represent mineral and organic components (as shown in figure 1). A local topsoil was sourced in bulk providing a 'control' soil.

Field experimental set-up (> 1 year); six large pots (80L) were filled with each substrate, or control soil, to allow triplicated treatments of two grass types (perennial ryegrass *Lolium perenne* and reed canary grass *Phalaris arundinacea*), in an outdoor compound at the James Hutton Institute (Aberdeen, UK). Grasses were grown from seed sown in May 2018. One macro-rhizon sampler (VanWalt LTD, Netherlands) was inserted into each pot at a depth of 15cm into the substrate, for the purpose of collecting soil pore water periodically. Pots were left unattended for grasses to germinated and grow for a period of 6-7 months, before being harvested, dried and their mass determined in November 2018 (see figure 2).

Laboratory tests (< 1 month); sub-samples of control soil, and substrates 50:50 and 100:0 were placed into six 2L meso-cosms, allowing for 1) triplicates for CO_2 sampling 2) triplicates for earthworm testing. Open bottomed jars were placed on top of the soil/substrates in all mesocosms, with the edges 2cm below the surface to create a seal. The mesocosms were left at 5˚C for one week, then saturated with tap water and allowed to drain to field capacity. Gas samples were taken 48h after wetting using a syringe and injected into 5ml vacuum vials, before analysis by GC-MS. The temperature was then raised to 15˚C, and the gas sampling repeated, to account for temperature effects. The other triplicate set of mesocosms were prepared in the same way as above but had 8 juvenile earthworms *Eisenia fetida* sp. added. These were incubated for one week as above at 15ºC only, then gas samples were taken. Pore water was sampled in all mesocosms using the method described previously, one-week after earthworms were added, from rhizon samplers. These were analysed for TOC, NO_3, PO_4 and SO_4 using an Agilent 7700 ICP-MS. After an additional 2 weeks incubation, to allow worms to reach maturity, mesocosms were destructively sampled and worm survival recorded.

Figure 2, Vigorous ryegrass and reed canary grass growth in the field trial, as shown before harvest in Nov 2018.

Results & Discussion

Grass yield; in the field experiment substrate 50:50 yielded the greatest mass of ryegrass and reed canary grass (mean = 41g and 31g per pot respectively), being significantly greater than the next highest yielding substrate, and superior to the 100:0 substrate and the control soil ($P < 0.05$).

Influence of earthworms; the presence of worms significantly increased the NO_3 concentrations in the pore water for the 50:50 substrate 100:0 substrates, but concentrations of NO_3 were greatest from the control soil, where worms had no significant influence of concentrations of any measured elements in pore water (figure 4). In all cases, with or without earthworms, SO_4 concentrations were much higher in the substrates (~500mg l^{-1}) than the control soil (<50 mg l^{-1}), alluding to high gypsum contents of the BW material. Worm survival was not significantly different between substrates and control soil ($P<0.05$).

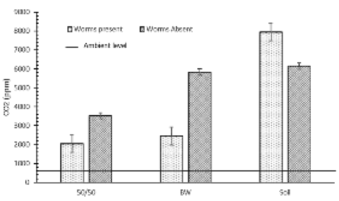


Figure 3.Mean CO2 emissions from tested substrate and control soil in the presence/absence of worms (bottom), compared to ambient. n = 3.

Emission of CO_2; concentrations of CO_2 from all tested substrates were significantly greater at 15°C compared to 5°C ($P < 0.05$). Substrate 50:50 emitted the lowest CO_2 of those tested, and when compared to the control soil, in the presence and absence of worms (figure 3).

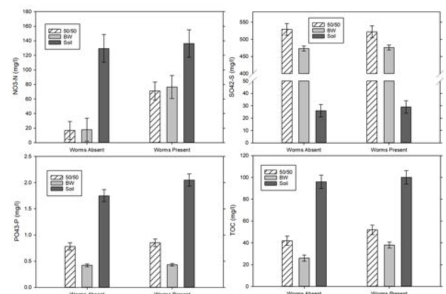


Figure 4. Concentrations of selected chemical parameters measured in pore water collected from the mesocosms containing tested substrates and control soil, in the presence/absence of worms. n = 3.

Conclusions & Further advancements

Substrate made of equal volumes of [de]construction material and green compost proved to be the best of those tested with regards to dry biomass production in the field, and not deleterious to earthworm survival or producing excess leachable NO_3, measured in laboratory mesocosm tests. Excessive leachable SO_4 concentrations associated with [de]construction materials will be investigated to inform whether alternative compositions of base materials should be sought. Preliminary work on additional experiments to determine plant root architecture indicates favourable root densities of substrates compared to control soils (see figure 5), which could provide vital stability to aggregates in these young soils, as well as increased nutrient uptake.

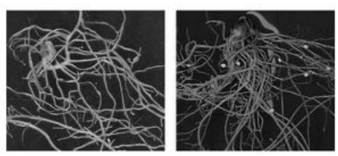


Figure 5. Preliminary root imaging and root surface area determination, showing increased pea (Pisum sativum L. cv. Corus) root densities in 50:50 substrate (right) compared to control soil (left); ~100 cm² and ~40 cm² respectively.

SOLAR CITY LULEA

PV Districts: a bottom-up approach to steer the energy transition

Duration: 11/2018-12/2020

Programme: Swedish energy Authority (Energimyndigheten)

Website: http://www.energimyndigheten.se/en/

Abstract

The Paris agreement calls for transformative steps to lower greenhouse gas emissions and deliver climate-resilient development. The implementation of climate and sustainability policies (see Agenda2030), alongside the transformation of the European energy system towards a more decentralized system, will push energy production, such as photovoltaic (PV), closer to the final users, of which the majority live in urbanized areas.

This transformation poses several challenges to medium and small size cities (65% of the population in Sweden) that are not prepared to steer such a process. Also, literature point to the importance of community "ownership" of energy facilities that are considered to intrude their spaces. We define ownership in a larger sense than usual: it implies not only the possession of the rights to exploit it but also to contribute to its design, which ultimately implies the way PV technologies are integrated in our lifestyles.

Based on our previous research, we claim that a solar district approach is the most useful to develop, test, and evaluate a design-driven, democratic method to transform cities into energy-integrated environments. The ability to close the energy cycle in place, as close to its users as it is possible, situates our project within the circular city paradigm.

Our project aims to develop theories and tools to deliver solar districts. To do so we engage with the concept of "prosumer". To mobilise the prosumer concept to deliver solar districts we deploy design thinking. Design thinking will enable us to co-create with the policy makers, residents, and energy companies a testbed in Luleå for the future solar distrcits.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Agatino Rizzo, Lulea University of technology, project leader
- Kristina Ek, Lulea University of technology, principal investigator
- Suzanna Törnroth, Lulea University of technology, phd student
- Björn Ekelund, Lulea University of technology, investigator
- Partners: Lulea municipality (Frida Wikstöm), Lulea Energy (Sofia Antonsen), ENEA (Alessandra Scognamiglio)

SOLAR CITY LULEÅ

PV Districts: a bottom-up approach to steer the energy transition

LULEÅ KOMMUN

ABOUT THE PROJECT

Duration: 11/2018-12/2020

Programme: Swedish energy Authority (Energimyndigheten)

Website:

THE PROJECT

- The Paris agreement, as well as the implementation of climate and sustainability policies (see Agenda 2030), brings forth a transformation of the European energy system towards a more decentralized system. This will push energy production, such as photovoltaic (PV), closer to the final users, of which the majority live in urbanized areas.

- Based on our previous research, we claim that a solar district approach is the most useful to develop, test, and evaluate a design-driven, democratic method to transform cities into energy-integrated environments. The ability to close the energy cycle in place, as close to its users as it is possible, situates our project within the circular city paradigm.

- Our project aims engage with the concept of the "prosumer" in the context of energy. To mobilise the "prosumer" concept to deliver solar districts we deploy design thinking. Design thinking will enable us to co-create with the policy makers, residents, and energy companies a testbed in Luleå for the future solar districts.

Fig. 1. The Vision: Solarschiff (Solar ship) in the residential area Solarsiedlung in Freiburg im Breisgau in Germany. Taken from Wikimedia Commons.

THE FUTURE CITY OF "PROSUMERS"

In light of this current energy transition, it is apt to reimagine the community's role within the energy transition. In the context of small-scale solar energy production, research has indicated a need for more bottom-up approaches that engage the public in the local neighbourhood energy transition [1], which in turn, could motivate a personal choice for them to produce, in line with consume, energy themselves. In doing so, they become "prosumers" that could potentially be optimally positioned for society's transition to solar energy by facilitating change in the consumption and production behaviour patterns of the public, as well as fulfill a future electricity need in a decentralised energy system [2]. The term "prosumer", popularised by Alvin Toffler in 1980 [3], could therefore be translated into the current energy discourse to mobilise society towards a distributed energy system.

FROM ENERGY MONOPOLY TO ENERGY DEMOCRACY

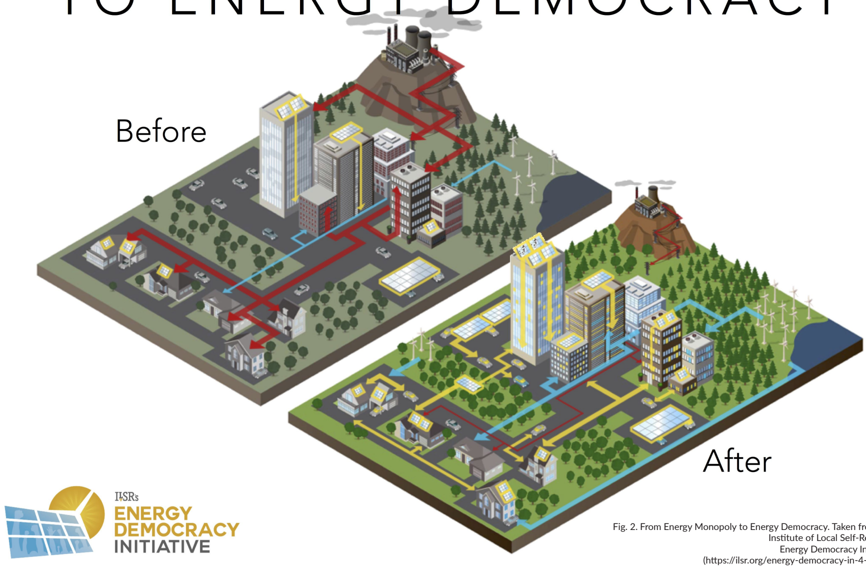


Fig. 2. From Energy Monopoly to Energy Democracy. Taken from The Institute of Local Self-Reliance: Energy Democracy Initiative (https://ilsr.org/energy-democracy-in-4-steps/)

Fig. 4. The location of Luleå in relation to Northern Europe. Image sourced and edited from Goway.com.au.

THE CONTEXT

Luleå is Sweden's largest northern city with a population of approximately 76,000 [7]. The city is located approximately 100 km from the Arctic Circle, and the city's main energy distributor is Luleå Energy. Recent research has shown PV technology to work more efficiently in lower temperatures [8], and annual solar irradiance in Luleå being higher than more southern cities, such as Gothenburg [9], opening up possibilities for solar power generation.

To Contact Us at the COST Action CA17133 Workshop Vienna:

- ***Agatino Rizzo, Lulea University of Technology, project leader***
- ***Kristina Ek, Lulea University of Technology, principal investigator***
- ***Suzanna Törnroth, Lulea University of Technology, phd student***
- ***Björn Ekelund, Lulea University of Technology, investigator***
- ***Partners: Lulea Municipality (Frida Wikstöm), Lulea Energy (Sofia Antonsen), ENEA (Alessandra Scognamiglio)***

DESIGN THINKING METHODOLOGY

Fig. 3. Series of Design Thinking workshops conducted at Luleå University of Technology Campus in Luleå and Piteå [4].

INSPIRATION IDEATION PROTOTYPING

Design thinking is a way of need-finding and developing new solutions using the tools and the mindsets of design practitioners [5]. In using design thinking for a practical workshop session, one would go through several stages of intense, hands-on work and prototyping. These stages, are categorised by Kelley into four phases: inspiration, synthesis, ideation and experimentation, and finally, implementation. Design thinking supposedly creates a natural flow from research to rollout, and immersion in the user experience produces insights that help teams agree on what is critical to the success of solutions. The ideas are tested with rough prototypes that help teams further develop innovations and prepare them for real-world experiments [6].

References

[1] Van der Schoor, T. & Scholtens, B. (2015). Power to the people: Local community initiatives and the transition to sustainable energy. Renewable and Sustainable Energy Reviews 43, p. 666–675.
[2] Koirala, B. P., Koliou, E., Friege, J., Hakvoort, R. A., Herder, P. M. (2016). Energetic communities for community energy: A review of key issues and trends shaping integrated community energy systems. Renewable and Sustainable Energy Reviews 56, p. 722–744.
[3] Toffler, A. (1980). The third wave. New York, NY: William Morrow.
[4] Rizzo, A., Ekelund, B. & Bergström, J. (2015). Participatory Design as a Tool to Create an Energy Smart Campus in Sweden. Proceedings of the conference "Energy Landscapes: Perception, Planning, Participation and Power". Dresden: Leibniz Institute of Ecological Urban and Regional Development, September.
[5] Kelley, T., & Kelley, D. (2013). Creative Confidence : Unleashing the Creative Potential Within Us All. New York: Currency
[6] Liedtka, J. (2018). Why Design Thinking Works. Harvard Business Review, September - October.
[7] Luleå Municipality. (2018). Retrieved from: https://www.lulea.se/language/english/facts.html
[8] Nordic Energy Research. (2011, October 18). Solar Power at the Arctic Circle. Retrieved from: http://www.nordicenergy.org/article/solar-power-at-the-arctic-circle/
[9] Palm, A. (2018). Solceller för mindre aktörer i Sverige – regler, ekonomi, teknik. Retrieved from: http://hallbarutvecklingvast.se/system/files/pm_solel_maj_2018.pdf

Sponge City Austria

Sponge City Austria – Working Group

Duration: 07/2018 - open end

Programme: -

Website: -

Abstract

Nature based solutions have been identified as a key strategy to multifunctional land use. Most `water sensitive´ urban design strategies aim to retrofit centralized infrastructure as temporary relief to flooding incidents rather than as holistic measures.

The principal approach of the Sponge City System ("Schwammstadtsystem") is working with rainwater rather than only defending against it. The novel transdisciplinary ideas lie in providing comprehensive benefits to the urban environment in view of climate change by combining responses to urban flooding with water retention and evapotranspiration via trees for urban cooling.

The urban Sponge City System is often referred to as the "Stockholm system" following the publication of a handbook on the system for the city of Stockholm by Embrén, Alvem, Stal and Woodward. There the system was promoted as a response to urban flash floods and a measure to avoid costly extensions in sewer systems. The system is always a sustainable strategy for climate change adaptation. It combines the three different approaches of

- improvement of local heat islands (UHI) by adiabatic cooling by evapotranspiration via urban trees
- site improvement for street trees by structural soils providing water and air in the root zone
- rainwater (stormwater) retention directly on site in the streets.

The system is a design strategy towards a coherent and integrated approach for climate change resilient cities that can be implemented step by step.

The aim is of the working group is to introduce and develop the Sponge City System as Green Infrastructure (GI) in urban road construction in Austria as an alternative to conventional drainage. The intrinsic nature of landscape architecture and urban design on the one side and engineering approaches on the other side often hinder a move towards holistic solutions.

The working group acts as an Austrian network and fosters exchanges in the sense of "intervision": The members in a transdisciplinary group inform and coach each other. The group coordinates projects and project ideas that correspond to the principles of the sponge city system under different framework conditions as field trials in Austria. Obstacles are identified and possible answers are discussed. Obstacles are for instance

- the different goals and design cultures in the disciplines involved
- legal requirements and standards for the disciplines involved
- practice on the construction site in civil engineering

The working group seeks contacts and information on an European level for finding and exchanging practical solutions.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Karl Grimm, Karl Grimm Landscape Architects, ÖGLA, Austria
- Daniel Zimmermann, 3:0 Landschaftsarchitektur, ÖGLA, Austria
- Stefan Schmidt, HBLFA Vienna - College for Horticulture and Landscape Design, Austria

SPONGE CITY AUSTRIA ARBEITSKREIS SCHWAMMSTADT

ÖGLA Österreichische Gesellschaft für Landschaftsarchitektur

CIRCULAR CITY POSTERWALK - COST ACTION CA17133 WORKSHOP VIENNA - BOKU, VIENNA

KARL GRIMM, ERWIN MURER, STEFAN SCHMIDT, DANIEL ZIMMERMANN

Sponge City System Principle / Schwammstadtprinzip

Section

Sponge City Effect

Nature based solution
Nature based solutions have been identified as a key strategy to multifunctional land use. Most 'water sensitive' urban design strategies aim to retrofit centralized infrastructure as temporary relief to flooding incidents rather than as holistic measures.

Transdisciplinary approach
The principal approach of the Sponge City System ("Schwammstadtsystem") is working with rainwater rather than only defending against it. The novel transdisciplinary ideas lie in providing comprehensive benefits to the urban environment in view of climate change by combining responses to urban flooding with water retention and evapotranspiration via trees for urban cooling.

Combining approaches
The urban Sponge City System is often referred to as the "Stockholm system" following the publication of a handbook on the system for the city of Stockholm by Embrén, Alvem, Stal and Woodward. There the system was promoted as a response to urban flash floods and a measure to avoid costly extensions in sewer systems. The system is always a sustainable strategy for climate change adaptation. It combines the three different approaches of

- improvement of local heat islands (UHI) by adiabatic cooling by evapotranspiration via urban trees
- site improvement for street trees by structural soils providing water and air in the root zone
- rainwater (stormwater) retention directly on site in the streets.

The system is a design strategy towards a coherent and integrated approach for climate change resilient cities that can be implemented step by step.

Working group ("Arbeitskreis Schwammstadt")
The aim is of the working group is to introduce and develop the Sponge City System as Green Infrastructure (GI) in urban road construction in Austria as an alternative to conventional drainage. The intrinsic nature of landscape architecture and urban design on the one side and engineering approaches on the other side often hinder a move towards holistic solutions.
The working group acts as an Austrian network and fosters exchanges in the sense of "intervision": The members in a transdisciplinary group inform and coach each other. The group coordinates projects and project ideas that correspond to the principles of the sponge city system under different framework conditions as field trials in Austria. Obstacles are identified and possible answers are discussed. Obstacles are for instance

- the different goals and design cultures in the disciplines involved
- legal requirements and standards for the disciplines involved
- practice on the construction site in civil engineering

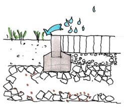
The working group seeks contacts and information on an European level for finding and exchanging practical solutions.

Research & Development

All sketches © Stefan Schmidt

Path of the water

rainfall runs through a soil filter into the structural substrate



drainage into retention substrate or root substratum

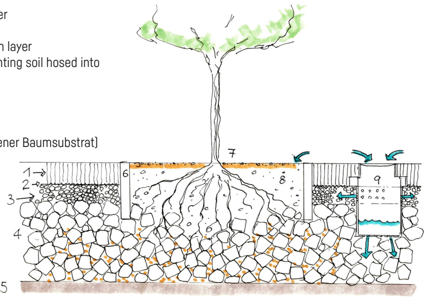
stormwater via gully or a technical filter into structural soil

drainage through a distribution layer into a retention substrate or root substrate

Root and retention volume underneath the circulation area

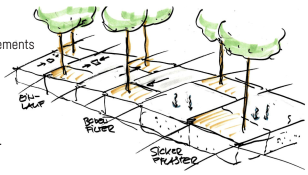
1. surface and bearing layer
2. filter fleece
3. aeration and distribution layer
4. structural soil (with planting soil hosed into the structural volume
5. planum
6. tree slice boundary
7. tree slice surface
8. planting substrate (Wiener Baumsubstrat)
9. drain sump

rooting area



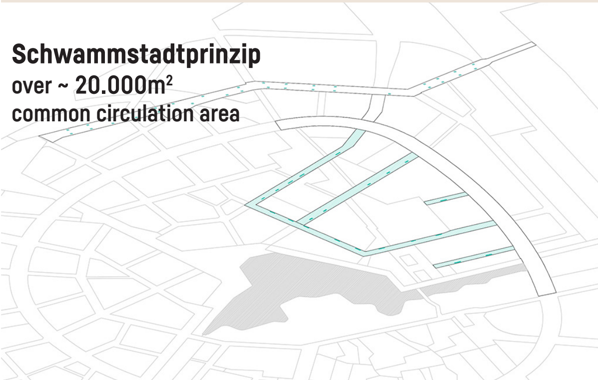
Need of research
structural soil & root substrate

optimizations and requirements
- rooting
- water holding capacity
- retention capacity
- water permeability
- availability of nutrients
- pollutant dynamics, ect.



With Lysimeters in Open Space Locations

Seestadt Aspern



Area view

Seestadt Aspern vision © 3:0

Examples: Graz

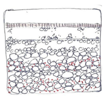
Under construction. Flushing the soil into the structure

Final result

Stormwater via drain sump

in general
surface
bearing layer
distribution layer 36/63

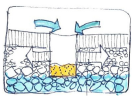
structural soil
rooting substrate
flushed in two steps



shaft and mud sump

drain pipe
spreading layer

retention substrate
structural soil 63/150



Eggenberger Allee © Stadt Graz, Büro Freiland, Stefan Schmidt

Forecourt Hotel Lend in Graz © Tomas Stoisser

Vienna

Stockholm system in test © Stefan Schmidt

ÖGLA Österreichische Gesellschaft für Landschaftsarchitektur
www.oegla.at
sekretariat@oegla.at

HBLFA Schönbrunn Gartenbau
www.gartenbau.at
stefan.schmidt@gartenbau.at

Bundesamt für Wasserwirtschaft
www.baw.at
erwin.murer@baw.at

Landschafft Wasser
www.landschafftwasser.at
office@landschafftwasser.at

3:0 LANDSCHAFTS ARCHITEKTUR
www.3zu0.com
dz@3zu0.com

DIPL.-ING. KARL GRIMM INGENIEURKONSULENT FÜR LANDSCHAFTS-PLANUNG UND LANDSCHAFTSPFLEGE
www.grimm.co.at
k.grimm@grimm.co.at

STADT GRAZ GRÜNRAUM & GEWÄSSER
www.graz.at
tomas.stoisser@stadt.graz.at

LANDSCHAFTS ARCHITEKTUR STEFAN SCHMIDT
www.landschaftsarchitekt.at
office@landschaftsarchitekt.at

freiland UMWELTCONSULTING ZT GMBH
www.freiland.at
stadler@freiland.at

Sustainable architecture and usage of traditional materials

Duration: 2009-2011, 2015-2017

Programmes: EU IPA 2007 Support to Civil Society in Montenegro, The Headley Trust Foundation

Website: http://www.expeditio.org/

Abstract:
Under this topic we present a series of projects seen as a continuous initiative, realized in order to encourage sustainable development through activity in the fields of sustainable architecture, green architecture and energy efficiency. Activities were implemented in cooperation with numerous partners and stakeholders at local, regional and international levels, and funded under different grant schemes.

The aim of the project **Benefit Living: a new layer of creative building and planning in Montenegro** (2009-2011) was to create a conceptual model "BeneFIT House" – for modern, energy-efficient and low-cost houses in Montenegro; to influence the designing of new spaces that will unite the characteristics of Montenegrin environment and the advances in modern architecture, new technologies and knowledge existing in the EU and neighbouring countries. The project was realized by EXPEDITIO, Montenegro; CORNUCOPIA Institute for Space and Culture, Slovenia and Academica, Serbia, and funded by the EU, IPA 2007 Support to Civil Society in Montenegro.

Main outcomes of the project:
- Exchange of experiences and knowledge about the achievements of the EU in contemporary architecture and planning, with an emphasis on sustainable architecture, the culture of living and creative cities
- Promotion of new models of houses, of a modern approach to designing the space and the principles of creative cities planning.
- Brochure and poster "Build a modern, energy-efficient and cost-effective home in Montenegro"

The project **Traditional materials and building techniques in Boka Kotorska** (2014-2016) was realized with the aim of increasing the knowledge and awareness of the use of traditional materials and building techniques in restoration of buildings, in accordance with contemporary challenges (energy efficiency, modern standards and requirements). The project was implemented by EXPEDITIO and funded by *The Headley Trust Foundation*

Main outcomes of the project:
- Raising awareness of the value and importance of traditional materials and building techniques in the restoration of buildings through publications and TV programs on restoration of traditional wooden windows and lime mortar
- Education and networking of the key stakeholders (craftsman, architects, conservators, young professionals) and demonstration of an adequate approach through conducting Restoration Work Camps on restoration of wooden windows and the usage of lime mortar

All the activities were implemented on the territory of the *Natural and Culturo-Historical Region of Kotor,* in Boka Kotorska Bay, which has been on the UNESCO World Heritage List since 1979 because of its Outstanding Universal Value embodied in the quality of the architecture and their harmonious integration to the landscape.

Contact person at the COST Action CA17133 Workshop Vienna:

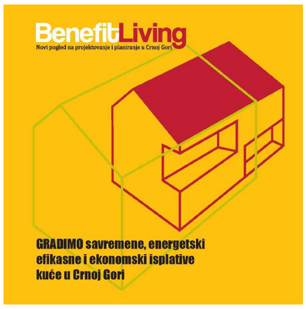
- Aleksandra Kapetanović, NGO EXPEDITIO, Kotor Montenegro
- Dr Jelena Lazarević, University of Montenegro, Biotechnical Faculty

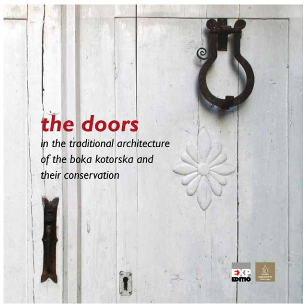
BENEFIT LIVING, TRADITIONAL MATERIALS AND BUILDING TECHNIQUES IN BOKA KOTORSKA

Sustainable architecture and usage of traditional materials

DURATION: 2009-2011, 2015-2017
PROGRAMMES: EU IPA 2007 Support to Civil Society in Montenegro, The Headley Trust Foundation
WEB: http://www.expeditio.org/

Under the topic **Sustainable architecture and usage of traditional materials** we present a series of projects seen as a continuous initiative, realized in order to encourage sustainable development through activity in the fields of sustainable architecture, green architecture and energy efficiency. Activities were implemented in cooperation with numerous partners and stakeholders at local, regional and international levels, and funded under different grant schemes.





Benefit Living

The aim of the project Benefit Living: a new layer of creative building and planning in Montenegro (2009-2011) was to create a conceptual model "BeneFIT House" – for modern, energy-efficient and low-cost houses in Montenegro; to influence the designing of new spaces that will unite the characteristics of Montenegrin environment and the advances in modern architecture, new technologies and knowledge existing in the EU and neighbouring countries.

The project was realized by EXPEDITIO, Montenegro; CORNUCOPIA Institute for Space and Culture, Slovenia and Academica, Serbia, and funded by the EU, IPA 2007 Support to Civil Society in Montenegro.

Main outcomes of the project:

• Exchange of experiences and knowledge about the achievements of the EU in contemporary architecture and planning, with an emphasis on sustainable architecture, the culture of living and creative cities.

• Promotion of new models of houses, of a modern approach to designing the space and the principles of creative cities planning.

• Brochure and poster "Build a modern, energy-efficient and cost-effective home in Montenegro"

Traditional materials and building techniques in Boka Kotorska

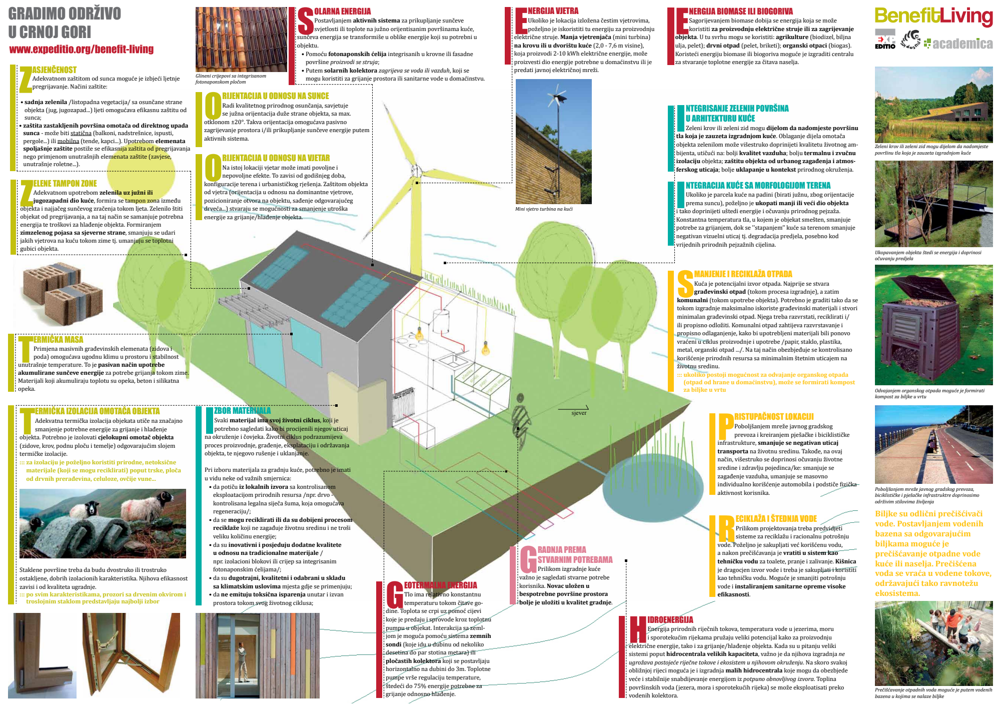
The project **Traditional materials and building techniques in Boka Kotorska (2014-2016)** was realized with the aim of increasing the knowledge and awareness of the use of traditional materials and building techniques in restoration of buildings, in accordance with contemporary challenges (energy efficiency, modern standards and requirements). The project was implemented by EXPEDITIO and funded by The Headley Trust Foundation

Main outcomes of the project:

• Raising awareness of the value and importance of traditional materials and building techniques in the restoration of buildings through publications and TV programs on restoration of traditional wooden windows and lime mortar

• Education and networking of the key stakeholders (craftsman, architects, conservators, young professionals) and demonstration of an adequate approach through conducting Restoration Work Camps on restoration of wooden windows and the usage of lime mortar

All the activities were implemented on the territory of the Natural and Culturo-Historical Region of Kotor, in Boka Kotorska Bay, which has been on the UNESCO World Heritage List since 1979 because of its Outstanding Universal Value embodied in the quality of the architecture and their harmonious integration to the landscape.

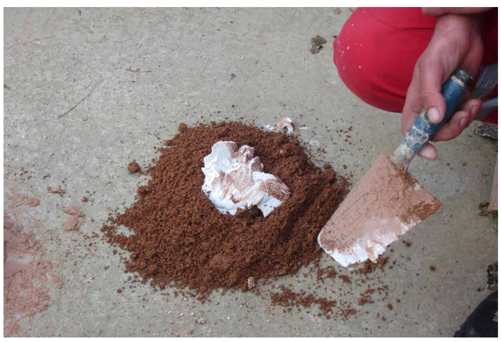


BENEFIT LIVING

TRADITIONAL MATERIALS AND BUILDING TECHNIQUES IN BOKA KOTORSKA

TRADITIONAL MATERIALS AND BUILDING TECHNIQUES IN BOKA KOTORSKA

TRADITIONAL MATERIALS AND BUILDING TECHNIQUES IN BOKA KOTORSKA



TRADITIONAL MATERIALS AND BUILDING TECHNIQUES IN BOKA KOTORSKA

Contact persons at the COST Action CA17133 Workshop Vienna:
• Aleksandra Kapetanović, NGO EXPEDITIO, Kotor Montenegro
• Dr Jelena Lazarević, University of Montenegro, Biotechnical Faculty

SUWAM-Solutions for Urban WAter Management

Vegetated systems as urban solutions for water management

Duration: 01/2018-12/2020

Programme: Strategic Funding UID/Multi/04423/2013

Website: https://www2.ciimar.up.pt/team.php?id=239

Abstract

Sustainable urban water management urges for the use and treatment of water in an efficient and circular way. The use of nature based solutions with the later purpose fosters the understanding of the structures and processes of ecosystems and societies. It is thus important to conceive solutions that deliver a fully integrated approach concerning their planning, design, and operation for cities.

Green roofs and floating wetlands, are two solutions that in an urban context play important roles concerning the ecosystem services that provide and functions that they play. Especially in coastal areas where information is scarce in order to support good practices towards application of these systems.

For the development and implementation of this project alliances with local stake-holders it were established in order to:

-Develop solutions at roof top building (green roofs-GR) assessing the establishment of autochthonous drought-tolerant plants in the coast line.

- Develop solutions for port marina (Floating wetland islands-FWI) in order to promote ecosystem rehabilitation and water quality improvement.

-Involve local communities and to promote inclusive participatory practices in order to acknowledge the interventions with the FWIs and GR.

-Empower the local system through education (local stakeholders, policy makers and communities), capacitation and inclusive participatory practices.

-Bridging the gap from innovative water solutions to market replication.

The presented innovative approach sets environment and sustainability challenges, contributing for an integrated use of aquatic resources and mitigation of human activities impact on ecosystems, with potential economic valorization at a national and international level.

Contact person at the COST Action CA17133 Workshop Vienna:

- Cristina Calheiros, CIIMAR-Interdisciplinary Centre of Marine and Environmental Research of the University of Porto, Portugal (ccalheiros@ciimar.up.pt)

Vegetated systems as urban solutions for water management – coastal line

Core team: Calheiros, C.S.C.*, Almeida, M., Arenas, F., Mucha, A. P.,
CIIMAR-Interdisciplinary Centre of Marine and Environmental Research of the University of Porto, Portugal
*ccalheiros@ciimar.up.pt

Sustainable urban water management urges for the use and treatment of water in an efficient and circular way. The use of nature based solutions with the later purpose fosters the understanding of the structures and processes of ecosystems and societies. It is thus important to conceive solutions that deliver a fully integrated approach concerning their planning, design, and operation for cities.

Green roofs (GR) and floating wetlands islands (FWI), are two solutions that in an urban context play important roles concerning the ecosystem services that provide and functions that they play. Especially in coastal areas where information is scarce in order to support good practices towards application of these systems.

For the development and implementation of this project alliances were established with local stake-holders in order to:

-Develop solutions at roof top building (GR) assessing the establishment of autochthonous drought-tolerant plants in the coast line;

-Develop solutions for port marina (FWI) in order to promote ecosystem rehabilitation and water quality improvement;

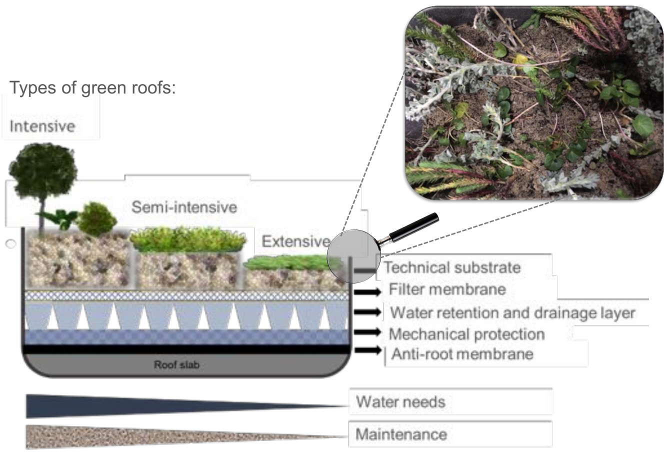
-Involve local communities and to promote inclusive participatory practices in order to acknowledge the interventions with the FWIs and GR;

-Empower the local system through education (local stakeholders, policy makers and communities), capacitation and inclusive participatory practices.

The presented approach sets environment and sustainability challenges, contributing for an integrated use of aquatic resources and mitigation of human activities impact on ecosystems, with potential economic valorization at a national and international level.

. Green roofs

Implementation of green infrastructures, using green roofs, is gaining interest worldwide, not following just a trend but foreseeing the several ecosystem services provided and the strong positive impact on the environmental and socio-economic dynamics. They are highly dependent on plant establishment, which in turn, are directly interconnected with the substrate and associated biota. Although there is already research supporting this technology the knowledge is still scarce, when considering its application to coastal areas, where harsh climate conditions may arise.



Pilot green roofs, with drought-tolerant plants, set in the first coast line

. Floating Wetland Islands

A Floating Wetland Island is a technology based in phytoremediation processes, that intents to enhance water quality, promote biodiversity and ecosystem rehabilitation, mimicking natural processes. It has been tested in multiple contexts worldwide such for remediation of eutrophic lakes and stormwater, showing good results regarding reduction of nutrients levels and other types of pollutants. However, knowledge associated to the biocenosis of the platform and their ability for contaminant removal is still scarce and more research is needed to support this low cost and eco-friendly biotechnology, specially in port marina environments.

Floating Wetland Island, cork based, with halophytes, at APDL port marina

Acknowledgements
This research was partially supported by the Strategic Funding UID/Multi/04423/2013 through national funds provided by FCT – Foundation for Science and Technology and European Regional Development Fund (ERDF), in the framework of the programme PT2020

Collaboration

SWAMP

Responsible water management in built-up areas in relation to the surrounding landscape

Czech University of Life Sciences Prague
Faculty of Environmental Sciences

Duration: 2018-2022

Programme: MŠMT, OP VVV - Call No. 02_16_026

Website: https://www.fzp.czu.cz/en/r-9411-projects-and-partnerships/r-9880-projects/r-13952-swamp-responsible-water-management-in-built-up-areas-in-relation-to-the-surrounding-landscape

Abstract

The project will expand and deepen the cooperation between the Faculty of Environmental Sciences (FES) at the Czech University of Life Sciences (CULS) and the project partner, DEKONTA, a.s., and will build upon prior cooperation involving research for development and education projects. Both subjects have agreed to significantly deepen their cooperation primarily at the level of basic and industrial research in a thematic area that is presently the subject of intense discussion, namely the rational use of water in urban environments in relation to the surrounding landscape, where the main goal of the project is to design and test new approaches and measures to increase the efficiency of landscapes in resisting extreme climate phenomena and protecting residential areas. The principles of this „smart“ landscape will be based on increasing water retention and accumulation, but also on creating sophisticated irrigation and drainage systems that in dry periods will be able to effectively manage water with minimal energy demands. At the same time, the system will be supplemented with additional functions to purify runoff water by employing natural and constructed wetlands with retention, accumulation or irrigation functions. As a result, water in the landscape will be used efficiently for nearby residential communities. Another focus will be water management and optimizing indoor environments within large residential areas. The aim of the submitted project is comprehensive and also considers the suitability of all proposed measures for organisms that are integral components of the entire system which must be protected given the increasing impacts of climate change. Negative impacts on the environment will be minimized and ecological and biological functions will be supported by significantly promoting biodiversity.

Close cooperation between the Czech University of Life Sciences in Prague and the DEKONTA Company will be crucial for implementing the research plan. This cooperation will enable verification and validation of new approaches to handling water in urban environments and managing adjacent land (especially agricultural land) on a society-wide scale. The academic partner will then convey these innovations to both the professional public (designers, architects, researchers, water and building authority employees, etc.) and to those using the land (water managers, farmers, landowners, etc.).

Practical feedback from the experts and practices of DEKONTA, a.s., will also enable better selection of new research topics and determine the direction of research for issues currently being addressed by the research teams of the CULS Faculty of Environmental Science in Prague. This will result in long-term, effective cooperation on pressing issues of global environmental impact and will quickly and effectively transform science and research into practical applications.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Adam Sochacki, CULS Prague, Czech Republic, team member
- Zhongbing Chen, CULS Prague, Czech Republic, team member

SWAMP - Responsible water management in built-up areas in relation to the surrounding landscape

Czech University of Life Sciences Prague
Faculty of Environmental Sciences

dekonta

CZECH REPUBLIC

CONTACT PERSON AT THE COST ACTION CA17133 WORKSHOP VIENNA

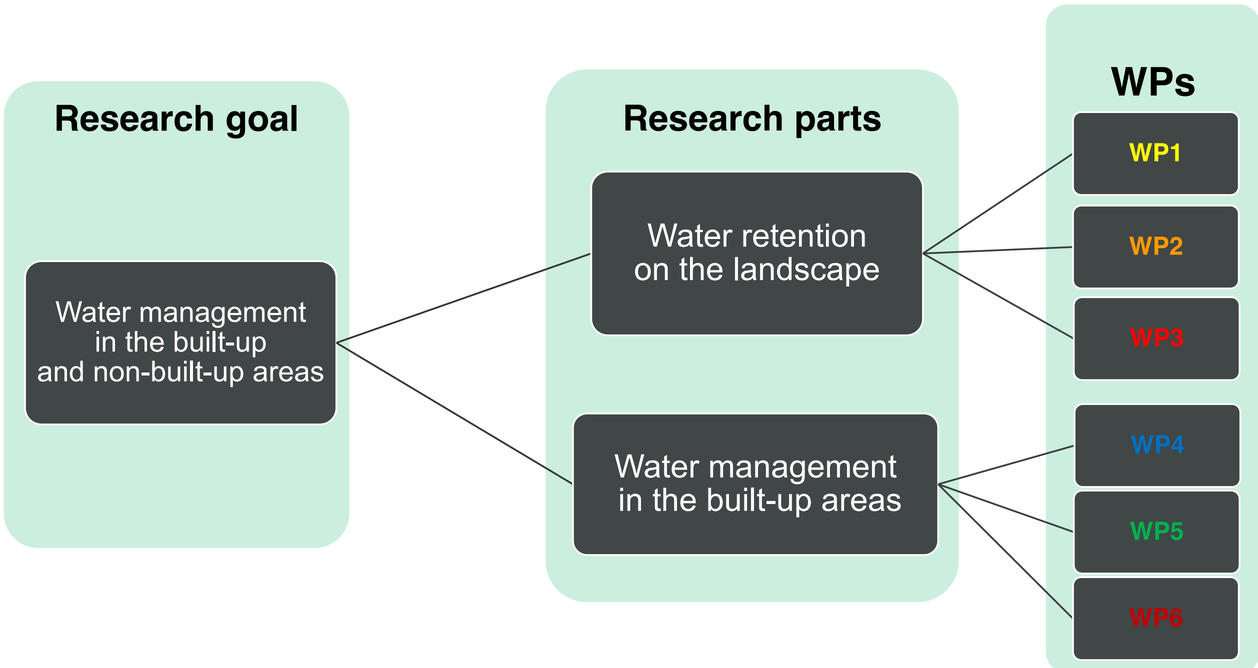
Adam Sochacki, CULS Prague, Czech Republic, team member, sochacki@fzp.czu.cz
Zhongbing Chen, CULS Prague, Czech Republic, team member, chenz@fzp.czu.cz

DESCRIPTION

The project will expand and deepen the cooperation between the Faculty of Environmental Sciences (FES) at the Czech University of Life Sciences (CULS) and the project partner, DEKONTA, a.s., and will build upon prior cooperation involving research for development and education projects. Both subjects have agreed to significantly deepen their cooperation primarily at the level of basic and industrial research in a thematic area that is presently the subject of intense discussion, namely the rational use of water in urban environments in relation to the surrounding landscape, where the main goal of the project is to design and test new approaches and measures to increase the efficiency of landscapes in resisting extreme climate phenomena and protecting residential areas. The principles of this „smart" landscape will be based on increasing water retention and accumulation, but also on creating sophisticated irrigation and drainage systems that in dry periods will be able to effectively manage water with minimal energy demands. At the same time, the system will be supplemented with additional functions to purify runoff water by employing natural and constructed wetlands with retention, accumulation or irrigation functions. As a result, water in the landscape will be used efficiently for nearby residential communities. Another focus will be water management and optimizing indoor environments within large residential areas. The aim of the submitted project is comprehensive and also considers the suitability of all proposed measures for organisms that are integral components of the entire system which must be protected given the increasing impacts of climate change. Negative impacts on the environment will be minimized and ecological and biological functions will be supported by significantly promoting biodiversity.

Close cooperation between the Czech University of Life Sciences in Prague and the DEKONTA Company will be crucial for implementing the research plan. This cooperation will enable verification and validation of new approaches to handling water in urban environments and managing adjacent land (especially agricultural land) on a society-wide scale. The academic partner will then convey these innovations to both the professional public (designers, architects, researchers, water and building authority employees, etc.) and to those using the land (water managers, farmers, landowners, etc.).

Practical feedback from the experts and practices of DEKONTA, a.s., will also enable better selection of new research topics and determine the direction of research for issues currently being addressed by the research teams of the CULS Faculty of Environmental Science in Prague. This will result in long-term, effective cooperation on pressing issues of global environmental impact and will quickly and effectively transform science and research into practical applications.



WPs in more detail

WP1 - Description of selected types of aquatic ecosystems depending on their management in relation to microclimate, water quality, ecological and hydrological functions
WP2 - Creation of simulation management models ecosystems outside of the built-up area
WP3 - Preparation of supporting materials for application, preparation of methodologies, their verification and optimization
WP4 - Prediction of the quantity and quality of rain and grey waters suitable for reuse in the built-up area
WP5 - Simulation models for rainwater and grey water management in the built-up area
WP6 - Preparation of supporting materials for application, preparation of methodologies, their verification and optimization

FUNDING ACKNOWLEDGEMENT

Project Responsible water management in built-up areas in relation to the surrounding landscape (acronym SWAMP) is carried out by the Czech University of Life Sciences, Faculty of Environmental Sciences in collaboration with the company Dekonta a.s. The project is funded from the ESF through the Operational Program Research, Development and Education and from the state budget of the Czech Republic. The project registration number is CZ.02.1.01/0.0/0.0/16_026/0008403.

TR36034

Research and Systematization of Housing Development in Serbia in the Context of Globalization and European Integrations for the Purpose of Improving Housing Quality and Standards / Subtopic: Design and Development of Housing in Harmony with Nature and Sustainable Development in High-Density Urban Areas

Duration: 2011-2020

Programme: Scientific-research projects funded by Ministry of Education, Science and Technological Development RS

Website: -

Abstract

This project is based on the analysis of the housing planning and design at several spatial levels and subtopics from the angle of related scientific discourses: architectural, urban, technological and historical ones. Considering the growing awareness of climate changes issues, as well as health and environmental problems in contemporary cities and urban areas, this research starts from the premise that it is very apparent and essential to bring nature into our living spaces. It deals with different design strategies, principles, models, concepts, patterns and housing design scales in high-density urban areas, with the aim of improving the relation of architecture and nature in line with a resilient, healthy and sustainable urban environment. Research emphasizes approaches to housing design based on biophilic design, green design, sustainable design, biomimicry, etc. The goal is to achieve as greater applicability and efficiency through applying new green technologies and materials, recycling, and NBS for housing design and planning in high-density urban areas.

Results of research and assessment of the current situation in Serbia are new guidelines, design solutions based on nature, comparisons and recommendations with relevant European experiences and case studies, as well as promotion and education of citizenship on the importance of the application of NBS, environmental values and the need for responsible behavior in relation to the environment. For the purpose of directly applying the research results in planning and design practice, the focus is placed on exploring the possibilities for operationalization through a set of applicable standards and parameters which are relevant for strategic planning and design of residential buildings and settlements. Considering that the housing problem is a complex phenomenon which is always affected by many various disciplines, the research implies comprehensive consideration of the subject, with a goal to investigate the exiting housing solutions as well as to define new contemporary improved models and principles. At the methodological level, the focus is placed on re-examination of the results of so far actions and on introduction of new contemporary technical and technological solutions, both at the local and at the global level. At the level of the model, the emphasis is placed on the mapping of current problems and possibilities, linking the system with the singular parts, upgrading the standards in the field of sustainability and energy efficiency. Results and recommendations would be an important source of information both for students and for professionals in this field.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Jelena Ristic Trajkovic, University of Belgrade – Faculty of Architecture, Serbia

Dr Jelena Ristić Trajković
University of Belgrade - Faculty of Architecture

Dr Verica Krstić
University of Belgrade - Faculty of Architecture

Aleksandra Milovanović
University of Belgrade - Faculty of Architecture

Project Title: Research and Systematization of Housing Development in Serbia in the Context of Globalization and European Integrations for the Purpose of Improving Housing Quality and Standards

Subtopic: **Design and Development of Housing in Harmony with Nature and Sustainable Development in High-Density Urban Areas**

Belgrade morphogensis: Development of urbanistic thoughts and actions since 1921 / green infrastructure within the urban landscape

1921/22.

plan: *Cometition entry project - Urbs magna*
authors: *J.M.Auburtin, A.H.Parenty, J.E.Naville, A.H.Chauquet*
basic method: *Infrastructure network studies*
concept: *Regional networking of Belgrade; Garden City*

1927.

plan: *Sketch of the metropolis for the future Belgrade*
author: *Jan Dubovi*
basic method: *Demographic-economic studies*
concept: *Garden city*

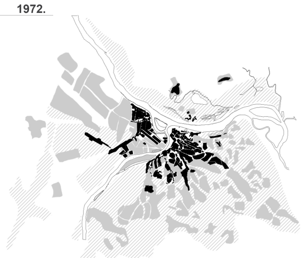
1950.

plan: *General urban plan of Belgrade*
project coordinator: *Miloš Somborski*
basic method: *Program-functional zoning*
concept: *New City*

1968.

plan: *General urban plan for the left bank of the Danube*
plan coordinator: *Bratislav Stojanović*
basic method: *Environmental and climatic studies*
concept: *Lamelar City*

1972.



plan: *General urban plan of Belgrade*
plan coordinators: *Aleksandrar Đorđević, Milutin Glavički*
basic method: *Morphological studies*
concept: *Arhipelag settlement in the sea of greenery*

2016.

plan: *General Urban Plan 2021.*
plan coordinators: *Vladimir Macura, Miodrag Braca Ferenčak*
basic method: *Study of thematic areas*
concept: *European metropolis; Danube City Orientation*

This project is based on the analysis of the housing planning and design at several spatial levels and subtopics from the angle of related scientific discourses: architectural, urban, technological and historical ones. Considering the growing awareness of climate changes issues, as well as health and environmental problems in contemporary cities and urban areas, this research starts from the premise that is very apparent and essential to

bring nature into our living spaces.

It deals with different design strategies, principles, models, concepts, patterns and housing design scales in high-density urban areas, with the aim of

improving the relation of architecture and nature in line with a resilient, healthy and sustainable urban environment.

Research emphasizes approaches to housing design based on biophilic design, green design, sustainable design, biomimicry, etc.

The goal is to achieve as greater applicability and efficiency through applying new green technologies and materials, recycling, and NBS for housing design and planning in high-density urban areas.

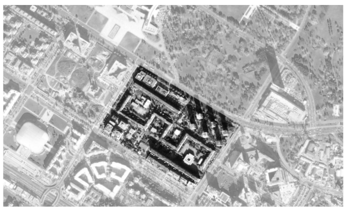
Results of research and assessment of the current situation in Serbia are new guidelines, design solutions based on nature, comparisons and recommendations with relevant European experiences and case studies, as well as promotion and education of citizenship on the importance of the application of NBS, environmental values and the need for responsible behavior in relation to the environment. For the purpose of directly applying the research results in planning and design practice, the focus is placed on exploring the possibilities for operationalization through a set of applicable standards and parameters which are relevant for strategic planning and design of residential buildings and settlements. Considering that the housing problem is a complex phenomenon which is always affected by many various disciplines, the research implies comprehensive consideration of the subject, with a goal to investigate the exiting housing solutions as well as to define new contemporary improved models and principles.

At the methodological level, the focus is placed on re-examination of the results of so far actions and on introduction of new contemporary technical and technological solutions, both at the local and at the global level. At the level of the model, the emphasis is placed on the mapping of current problems and possibilities, linking the system with the singular parts, upgrading the standards in the field of sustainability and energy efficiency. Results and recommendations would be an important source of information both for students and for professionals in this field.

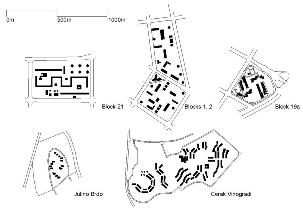
Urban garden as lived space: Informal gardening practices and dwelling culture in socialist and post-socialist Belgrade

Although **the application of nature-based solutions** (NBS) is not sufficiently represented and researched in scientific papers dealing with this topic in Serbia, **the improvement of urban biosphere and the impact of the built environment on the nature, as well as on general sustainability and resilience of cities,** is a significant aspect of research in the domain of architecture and urbanism since the mid-eighties.

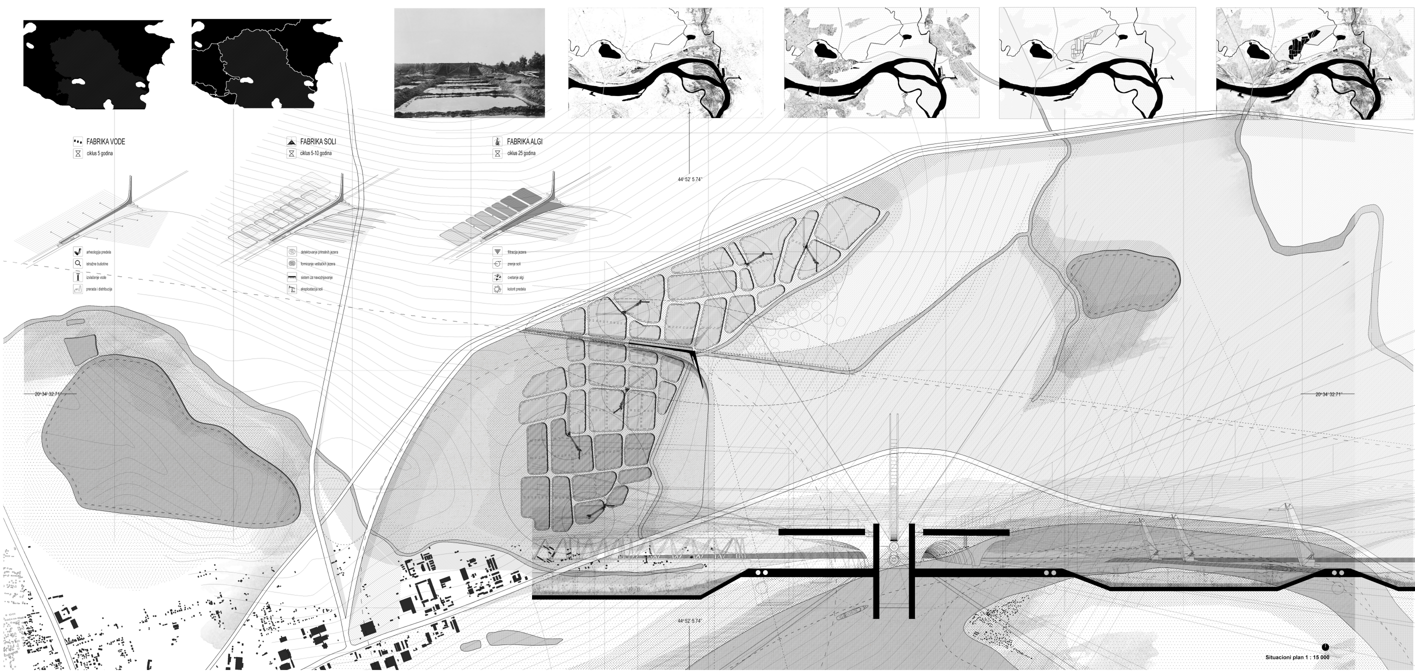
An Environmental Critique: Impact of Socialist Ideology on the Ecological and Cultural Sensitivity of Belgrade's Large-Scale Residential Settlements



Architecture and Nature: The Application of Environment-Behavior Theories in Architectural Design



Experiment and Research of Third Belgrade Ultrastructure: Programming Circular City



UPCE

Urban Platform for Circular Economy

Duration: 2018-2023

Programme: Academy of Finland, Competitive Funding to Strengthen University Research Profiles (PROFI4 call, 2017)

Website: http://www.internationaldoctorate.unicas.it/abwet/

Abstract

Since a growing fraction of human life, consumption, and industrial activity takes place in urban centers, the functions and manner of living in the cities have to become sustainable. The profiling area responds to this challenge by combining diverse expertise from the areas of technology (particularly biotechnological and thermo-chemical processes, aerosol measurements processes and atmospheric and air quality impacts), policy and governance (administrative and political studies), business and innovation management (particularly innovation and business ecosystems, business models, concepts and social institutions).

To find solutions, which are easier to adopt and could better fulfill the critical needs of the society, our project Urban Platform for Circular Economy (UPCE) applies new co-creative approaches, such as living lab, that enable matching technological and societal development and implementation. Due to the systemic nature of circular economy, advancing towards it requires contributions from complex networks of actors. Living labs as open innovation platforms lower the barriers for these actors to pilot technologies in a real world setting, accelerating the transformation. Living labs allow the platform to apply open innovation platforms in developing circular economy in urban environments in a multidisciplinary way.

The research platform is already involved in two living labs, Hiedanranta and ECO3 area. Hiedanranta is an old industrial site next to Lake Näsijärvi in Tampere that will be a new neighborhood built for 15,000-25,000 new residents. It is planned to be a future city district with smart city technologies, including sustainable energy production, resource-efficient and near carbon-neutral solutions. Circular economy belongs to the main development visions for Hiedanranta. Experimental demonstrations (both technological and social) in the area have already been started together with the city, e.g. participation of planning different sanitation options and alternatives for local nutrient recycling.

Via the above-mentioned approaches, we aim to

1) accelerate multidisciplinary broad-spectrum research in this field at national and global level and thus also accelerate transformation to circular economy, and

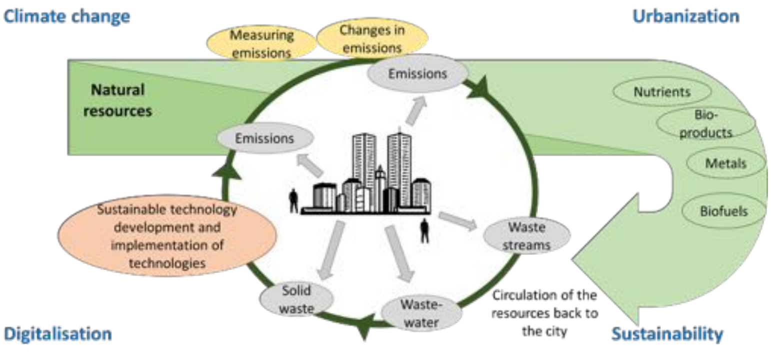
2) scale up circular economy research in international collaborations, identify what are the preconditions of optimal solutions spreading globally and thus, also scale up the transformation at the global level.

Contact person at the COST Action CA17133 Workshop Vienna:

- Marika Kokko, Tampere University, Finland

Tampere University

Urban Platform for Circular Economy (UPCE)



Grand challenge and focus of the project

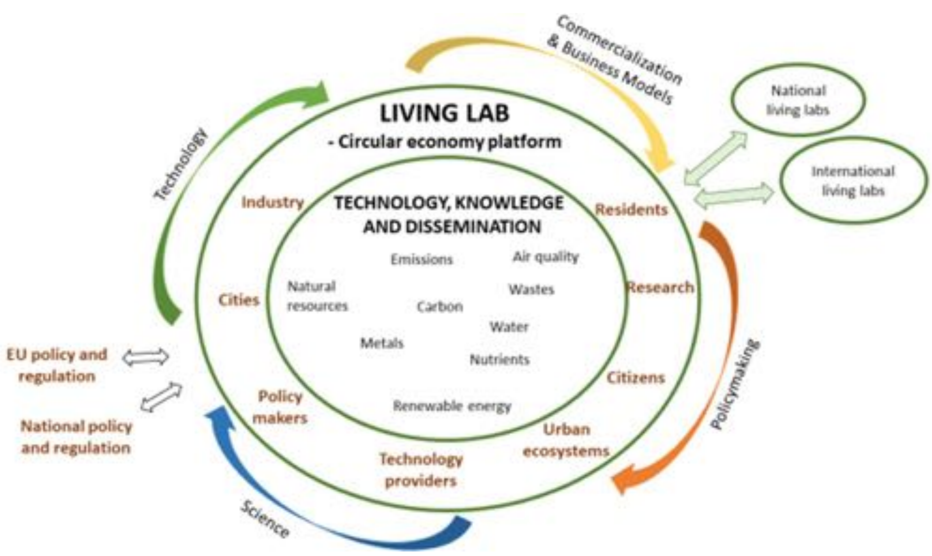
Since a growing fraction of human life, consumption, and industrial activity takes place in urban centers, the functions and manner of living in the cities have to become sustainable. The project responds to this challenge by combining diverse expertise from the areas of technology, policy and governance and business and innovation management and by applying living lab platform approach to develop circular economy solutions that respond to global challenges.

Research topics involved in the platform

- ***From waste to nutrients, chemicals and fuels***. The aim of the Bio and Circular Economy research group is to develop processes to improve energy and eco-efficiency, to conserve the limited resources of raw materials and to reduce environmental emissions. Our goal is the production and recovery of bioenergy, biochemicals, metals and nutrients from different industrial and urban feedstocks.
- ***Effects of trends in urban development on urban atmosphere***. The Instrumentation, Emissions, and Atmospheric Aerosols research group has pioneered studies in urban sources of nanoparticles and nanocluster aerosol. Another focus is on the research on secondary aerosols.
- ***New business models and value networks***. Capturing business opportunities in the circular economy is the expertise of the research groups Center for Innovation and Technology Research and Business Networks and Ecosystems. The groups' expertise supports the transition as its pioneering research has developed new understanding on business models, value networks and ecosystems, and technology commercialization in systemic circular economy.
- ***Decision-making, stakeholder involvement and societal participation***. The groups within Regional and Environmental Studies develop new approaches on cities, regions and the environment. The studies clarify the essence of urban sustainable development and produce also practicable solutions to problems of urban governance.

Urban living labs for circular economy

- Urban living labs are used to promote the development, testing and implementation of circular economy approaches to tackle global megatrends.
- Multidisciplinary approach and participation of different stakeholders accelerate the implementation of knowledge and technologies through simultaneous consideration of societal dynamics and development of new business models.
- Networking of urban living labs in European and global level is needed to scale up the impact of the developed technological processes and governance innovations.



COST Action TU1201

Urban Allotment Gardens in European Cities - Future, Challenges and Lessons Learned

Duration: 18/10/2012-17/10/2016

Programme: COST (European Cooperation in Science and Technology)

Website: http://www.urbanallotments.eu/

Abstract

Aim of the action was to fully comprehend and conclude the relevance of urban allotment gardens in political, social, ecological and urban design aspects in the context of European cities.

Among the main collaboration objectives were:

- Study of relationships between different social, cultural and ethnic groups and their gardening practices in allotment and community gardens;
- Study of ecological function of allotment gardens; deeper research on habitat connection, provision of ecosystem services, general role of allotment gardens in the green infrastructure, biodiversity, water cycle, micro-climate regulation, etc.;
- Study about integration of allotment gardens in relation to urban morphology, spatial distribution;
- Support integrated approaches in urban development by the identification of municipal/national development and planning policies; study restrictions concerning use of allotment gardens, design, maintenance, land use zoning etc.

The output of this scientific collaboration includes book “Urban Allotment Gardens in Europe” (ed. S.Bell, R. Fox-Kämper, N.Keshavarz, et al.), research articles and proceedings, funded projects, academic thesis, seminars/workshops, factsheets available in 12 languages, etc. More detailed description is available on project web site.

In this action individual research by the contact person (A.Korolova) was held in terms of Short Term Scientific Mission in Malmo (2015). The main aim of that scientific mission was to get an insight on the role of community gardens in revitalization of residential areas, impact of gardening on social sustainability and quality of life of residents. Summary of the data collected during STSM is available on: http://www.urbanallotments.eu/fileadmin/uag/media/STSM/STSM_short_report_A.Korolova_revised.pdf

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Alisa Korolova, Riga Technical University, Faculty of Architecture (was COST TU1201 WG4 Member), Latvia

COST EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

COST (European Cooperation in Science and Technology) is a pan-European intergovernmental framework. Its mission is to enable break-through scientific and technological developments leading to new concepts and products and thereby contribute to strengthening Europe's research and innovation capacities.

www.cost.eu

URBAN ALLOTMENT GARDENS

COST is supported by the EU Framework Programme Horizon 2020

COST Action TU1201

Urban Allotment Gardens in European Cities - Future, Challenges and Lessons Learned

MC Chair: Ms Runrid Fox-Kämper, ILS Research Institute for Regional and Urban Development, Germany

MC Vice Chair: Mr Simon Bell, Institute of Agricultural and Environmental Sciences, Estonia

Aim of the action was to fully comprehend and conclude the relevance of urban allotment gardens in political, social, ecological and urban design aspects in the context of European cities.

Among the main collaboration **objectives** were:

- Study of relationships between different social, cultural and ethnic groups and their gardening practices in allotment and community gardens;
- Study of ecological function of allotment gardens; deeper research on habitat connection, provision of ecosystem services, general role of allotment gardens in the green infrastructure, biodiversity, water cycle, micro-climate regulation, etc.;
- Study about integration of allotment gardens in relation to urban morphology, spatial distribution;
- Support integrated approaches in urban development by the identification of municipal/national development and planning policies; study restrictions concerning use of allotment gardens, design, maintenance, land use zoning etc.

The **output** of this scientific collaboration includes book "Urban Allotment Gardens in Europe" (ed. S.Bell, R. Fox-Kämper, N.Keshavarz, et al.), research articles and proceedings, funded projects, academic thesis, seminars/workshops, factsheets available in 12 languages, etc.

All Factsheets are available on the official web page of COST Action TU1201: http://www.urbanallotments.eu/

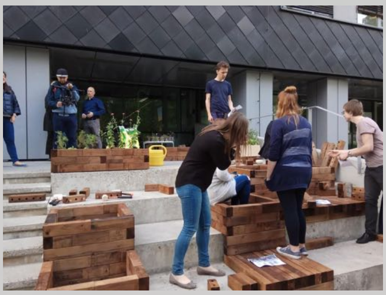
Every factsheet is available in English, German, Dutch, Japaneese, Latvian, Italian, Portugeese, Greek and almost each was translated into Polish, Turkish, Slovak, Finnish, Macedonian.

These factsheets include practical, easy to read information on how to deal with various challenges when creating and managing allotment or community gardens: http://www.urbanallotments.eu/fact-sheets.html

For authorship related to Factsheets please visit the digital version: http://www.urbanallotments.eu/fact-sheets.html

Contacts created during the COST Action TU1201 supported collaboration after the project (RTU organised in cooperation with University of Latvia) :

- Lectures and workshops for municipality representatives from different towns in Latvia
- Mobile (community) garden event
- Creation of community garden next to the faculty of Architecture, RTU
- Active participation in public discussions during development of new Riga territory plan until 2030
- Etc.



Author of pictures: A.Korolova

VEAS EDSS

Long-term planning for a potential stepwise switch towards decentralized cyclic management of urban waterborne resources

Duration: 2015-2016

Programme: Regional Research Funds the Capital (Norwegian)

Website: -

Abstract

VEAS (Vestfjorden avløpsselskap) is the largest wastewater treatment plant (WWTP) in Norway (ca. 750 000 PE). The population projections within the treatment district of VEAS indicate that the wastewater treatment capacity need be increased by around 50% until 2050. This capacity increase can be done in full (step by step) at VEAS, or measures such as the implementation of nature-based solutions (NBS) or resource recovery, can be taken out in the treatment district to reduce the volume-related load and/or material load on VEAS.

The environmental decision support system VEAS EDSS is intended to support VEAS and its municipal owners (Oslo, Bærum and Asker) to make well-informed decisions related to this type of strategic, long-term investment in water infrastructure within the VEAS treatment district and at the WWTP itself. In the project the framework for this EDSS was concretized. Three phases have been defined on the way to a new VEAS with increased capacity; Phase 1, which deals with the overall strategic management of wastewater in the area, Phase 2, which deals with the conceptual design of the treatment plant, and Phase 3, which deals with the design and optimization of unit processes. The VEAS EDSS is intended to provide support for decisions up to and including Phase 2.

The VEAS EDSS will contribute to providing a comprehensive picture of the overall environmental impact - in a local and global perspective - of current investments and measures within the treatment district and at VEAS; local water environment, consumption of non-renewable resources, recovery and local and regional reuse of resources, consumption of non-renewable energy sources and greenhouse gas emissions. Simple economic analyzes will also be included.

VEAS EDSS is intended to be used directly by two user groups; personnel at VEAS with responsibility for the strategic investment and development at VEAS, as well as personnel in various agencies in the municipalities of Oslo, Bærum and Asker with responsibility for long-term planning of water infrastructure (including blue-green) and who need to interact and coordinate their plans. Although VEAS EDSS should initially be used by these user groups, it will be important that expert opinions are included in the final decisions.

The VEAS EDSS is intended to be composed of three main modules:

- The "treatment district module" looks at the management of consumer water, wastewater and stormwater in VEAS' catchment area.
- The "VEAS module" looks at the treatment of wastewater and sludge on VEAS.
- The "Inner Oslofjord module" looks at the effects of emissions directly from the treatment district and from VEAS to the Inner Oslofjord.

Contact persons at the COST Action CA17133 Workshop Vienna:

- Christian Vogelsang, Norwegian Institute for Water Research, Coordinator
- Pawel Krzeminski, Norwegian Institute for Water Research, NOVEDAR assessment

Christian Vogelsang[1], Erik Svanes[2], Andreas Brekke[2], Pawel Krzeminski[1], André Staalstrøm[1], Hege Gundersen[1], Elisabeth Alve[3] , Trine Bekkby[1], Silvia Hess[3] and Rune Holmstad[4]
1 Norwegian Institute for Water Research; 2 Østfoldforskning; 3 Department of Geosciences, University of Oslo; 4 Vestfjorden Avløpsselskap

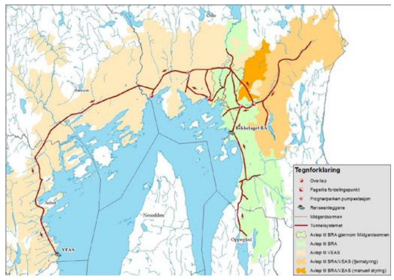
Long-term planning for a potential stepwise switch towards decentralized cyclic management of urban waterborne resources

Background

VEAS (Vestfjorden avløpsselskap) is the largest wastewater treatment plant (WWTP) in Norway (ca. 750 000 PE). The population projections within the treatment district of VEAS indicate that the wastewater treatment capacity need be increased by around 50% until 2050. This capacity increase can be done in full (step by step) at VEAS, or measures such as the implementation of nature-based solutions (NBS) or resource recovery, can be taken out in the treatment district to reduce the volume-related load and/or material load on VEAS.

The environmental decision support system (VEAS EDSS) is intended to support VEAS and its municipal owners (Oslo, Bærum and Asker) to make well-informed decisions related to this type of strategic, long-term investment in water infrastructure within the urban areas of the VEAS treatment district and at the WWTP itself. In this project the framework for this EDSS have been concretized. Three phases have been defined on the way to a new VEAS with increased capacity; Phase 1, which deals with the overall strategic management of wastewater in the area, Phase 2, which deals with the conceptual design of the treatment plant, and Phase 3, which deals with the design and optimization of unit processes. The VEAS EDSS is intended to provide support for decisions up to and including Phase 2.

VEAS' targets for 2030:
- ✓ Be able to handle 50 % increase in load
- ✓ Be CO_2 neutral or better
- ✓ Have a 230 GWh/y energy production
- ✓ All nutrients are recycled

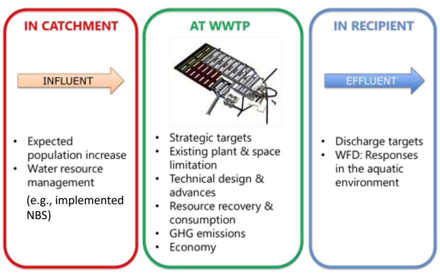


Water framework directive require good ecological status in rivers and fjord

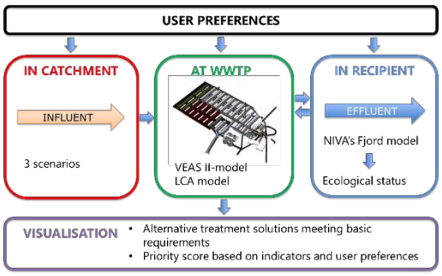
Thresholds cause poor circulation in deep waters = low oxygen levels.

Approach

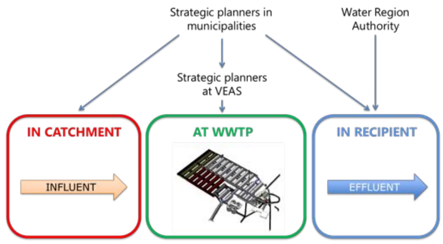
Factors influencing the choice of technical solutions



Environmental decision support system (EDSS)



Who will find the VEAS EDSS useful?



Based on user-specified preferences in regard to measures undertaken in the catchment and specific targets to be met at the WWTP and in the recipient, the EDSS should be able to generate a number of alternative technical treatment solutions that meet these targets. Each alternative may be given a priority score based on a set of control indicators and user preferences.

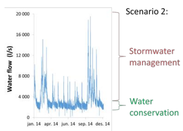
Results

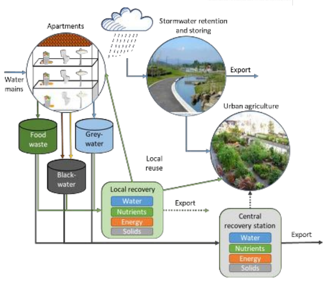
Treatment district scenarios

Scenario 1: Status quo

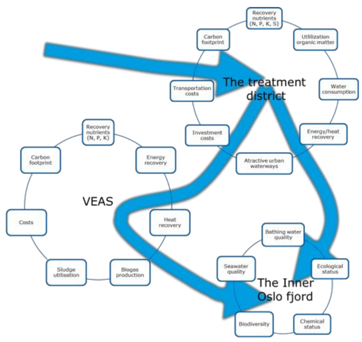
Scenario 2: Stormwater management & water conservation (including NBS)

Scenario 3: Separation and local management of urine, faeces and food waste

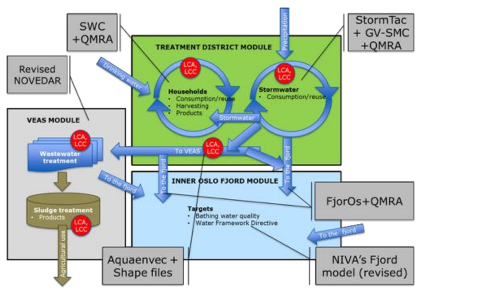




The targets



The EDSS model units



SWC: The SmartWater Communities™ Calculator - https://smartwatercluster.no/smart-water-kalkulator/?lang=en
QMRA: Quantitative Microbial Risk Assessment
NOVEDAR: www.novedar.com
Aquaenvec: The Aquaenvec tool - http://www.life-aquaenvec.eu/the-aquaenvec-tool/
Shape files: from MIKE URBAN - https://www.mikepoweredbydhi.com/products/mike-urban
StormTac: http://www.stormtac.com/
GV-SMC: Green Values® National Stormwater Management Calculator - https://greenvalues.cnt.org/national/calculator.php
FjordOs: www.fjordos.no
NIVA's Fjord model: Eutrophic model designed for the Inner Oslo fjord - Bjerkeng (1994) - https://brage.bibsys.no/xmlui/handle/11250/207884 .

Future perspectives

In order for the VEAS EDSS to be a functional tool, the different models must work together as one. Necessary information needed elsewhere in the system must be passed on in the correct format and with the correct time resolution. It is also important that the level of uncertainty in the stated results is at the right level; not unnecessarily detailed and thus cumbersome, but not too approximate so that it cannot be trusted with the values presented. This will be an important concurrent task for the further development of the VEAS EDSS as a tool.

Contact info:
Norwegian Institute for Water Research (NIVA), Gaustadalléen 21, N-0349 OSLO, Norway
Email: Christian.vogelsang@niva.no

The authors would like to acknowledge Vestfjorden Avløpsselskap for good collaboration and funding and the Regional Research Funds the Capital (RFF Hovedstaden) for funding. Special thanks go to Joaqim Comas at ICRA and Jose Porro at LEQUIA/Cobalt Water Global for exiting testing and valuable discussions regarding the NOVEDAR model.

Vertical Green 2.0

Vertical greening for livable cities - co-create innovation for the breakthrough of an old concept

Duration: 08/2018-07/2021

Programme: SUGI-FWE Nexus (JPI Urban Europe)

Website: https://jpi-urbaneurope.eu/project/vertical-green-2-0/

Abstract

UVG 2.0 fosters transformations of cities to sustainable, resilient spaces by re-thinking, re-designing and re-managing vertical greening as progressive food-water-energy nexuses. Vertical greening is interpreted and designed as a biological-technical system in an architectural-technical context with a substantial capacity to implement multiple ecosystem services like passive cooling, flood alleviation, bioenergy and possibly food production, biodiversity, noise reduction and it could be consistently installed as a part of the built environment especially in dense city districts.

In order to unfold the full potential of VG, three focal governance and management aspects will be approached for the mid-latitude partner cities (Berlin, Vienna and Ljubljana) in alliance with stakeholders:

4) integration of vertical green at building and district scales with habitat, water, heat and energy management,
5) technological innovation for maintenance and automated harvesting machinery and
6) adaptation of design strategies and governance for a secure, city-integrated cultivation and operation.

Using a trans-disciplinary, stakeholder-oriented co-creation approach, we intend to re-think traditional urban greening and will combine innovations and fundamental research from urban planning and design, eco-hydrology, mechanical engineering, water engineering and economy to enable decision-making using a nexus approach considering both co-benefits and trade-offs of nature-based solutions for the cities of the future.

Contact person(s) at the COST Action CA17133 Workshop Vienna:

- Thomas Nehls, TU Berlin, Germany, Coordinator
- Irene Zluwa, Ulrika Pitha, Bernard Scharf, BOKU University (Soil Bioengineering), Austria
- Bernhard Pucher, Guenter Langergraber, BOKU University (Sanitary Engineering) , Austria
- Tomaž Šuklje, University of Ljubljana, Slovenia

For questions and contact to all project partners please mail to: thomas.nehls@tu-berlin.de

VERTICAL GREEN 2.0

Our project will re-invent and re-introduce vertical green systems (VG) as nature-based solutions which have the capacity to close cycles of energy, nutrients and water. VG re-introduces biological primary production to unproductive land while 2.0 points directly to the participation of all relevant stakeholders when it is about designs, maintenance plans and business models, no matter if profit or non-profit oriented.

VG is understood as a bio-technical solution for the single building, the street and the neighbourhood as well as for the whole city and it is tested for Ljubljana, Vienna and Berlin.

Aim/objective

- What are the needs, preferences and prejudices towards vertical green? What are the unsolved problems?
- How can we design sustainable vertical green? (Water & nutrients, acceptance & participation, profitability)
- What is the city-wide impact of vertical green under realistic distribution scenarios? How much vertical green do we want?

Approaches/methods

- Stakeholder workshops on future scenarios and preferable futures, co-creating VG 2.0 with stakeholders
- Focus on existing building stocks, retrofitting of quarters
- Modelling ecosystem services of VG 2.0 such as water uptake, biomass production and cooling potential on the building and quarter scale

Expected results and impacts

- Set of designs fitting to the city structures of Ljubljana, Vienna, Berlin and Taipei
- Set of strategies to integrate VG 2.0 into the urban cycles of energy, nutrients, and water including sustainable harvest and maintenance technology
- Set of business and participation models, planning strategies (planning 3D in 2D)

Vertical Green 2.0 – Vertical greening for liveable cities – co-create innovation for the breakthrough of an old concept
Duration: 2018–2021
Internet: jpi-urbaneurope.eu/project/vertical-green-2-0/
Contact: Dr. Thomas Nehls, Technische Universität Berlin
E-mail: thomas.nehls@tu-berlin.de
Budget: 1.351.601 €
Partners: Technische Universität Berlin, University of Natural Resources and Life Sciences Vienna, Green4Cities Vienna, Urban planning institute of the Republic of Slovenia, National Taiwan University

Involved cities

- Berlin (Germany)
- Ljubljana (Slovenia)
- Taipei (Chinese Taipei)
- Vienna (Austria)

Sustainable Urbanisation Global Initiative (SUGI)/Food-Water-Energy Nexus

The Sustainable Urbanisation Global Initiative (SUGI)/Food-Water-Energy Nexus is a call jointly established by the Belmont Forum and the Joint Programming Initiative Urban Europe. The cooperation was established in order to bring together research and expertise across the globe to find innovative new solutions to the Food-Water-Energy Nexus challenge.

jpi-urbaneurope.eu **www.belmontforum.org**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730254.