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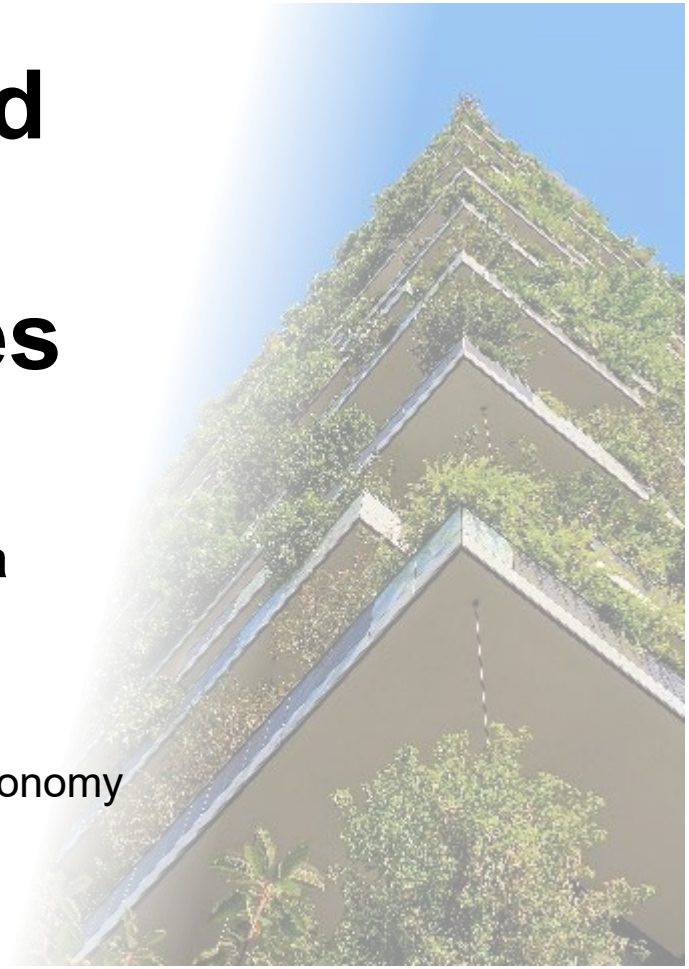
Potential of nature-based solutions for creating resourceful circular cities



Günter Langergraber and Natasa Atanasova

Wednesday, 6 May 2020

Session ERE1.4 - The Environment and Smart Circular Economy and Cities: A New Geo management Approach
EGU 2020, Vienna, Austria

What is a COST Action?

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- COST is the longest-running (since 1971) European framework supporting trans-national cooperation among researchers, engineers and scholars across Europe.
- COST fund pan-European, **bottom-up** networks across all science and technology fields.
- COST **does not fund research** itself.
- COST provides support for networking activities such as **meetings, workshops, conferences, training schools, short-term scientific missions** (STSMs) and dissemination activities.

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Duration

22 Oct 2018 – 21 Oct 2022

The main aim and objective

is to build an **interdisciplinary platform** for connecting city planners, architects, system designers, economists, engineers and researchers from social and natural sciences

- that **develop nature based solutions in the urban landscape** that
- facilitate **circular economies** based on the 3Rs (Reduce, Reuse and Recover) and
- allow cities to **cope with future challenges**.

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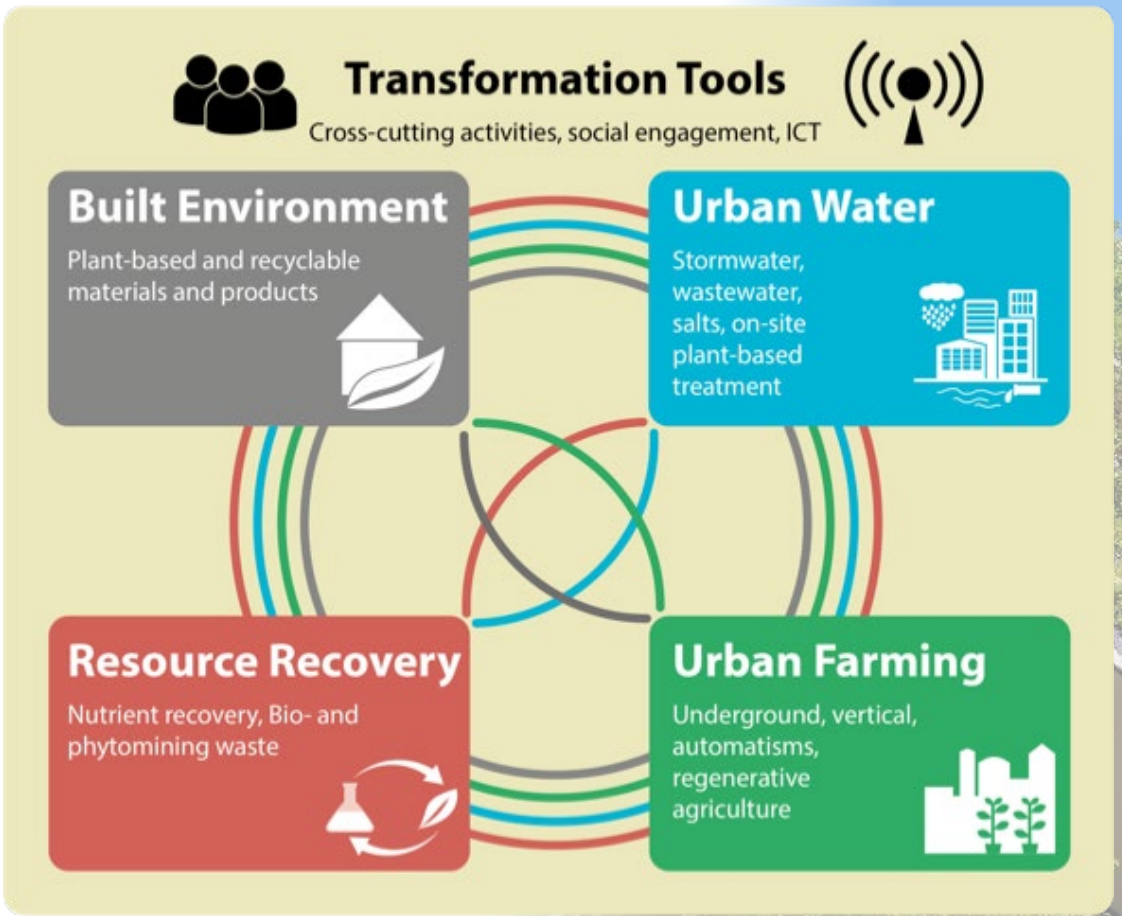
Working Groups

- WG1: Built environment
- WG2: Sustainable urban water utilisation
- WG3: Resource recovery
- WG4: Urban Farming
- WG5: Transformation tools



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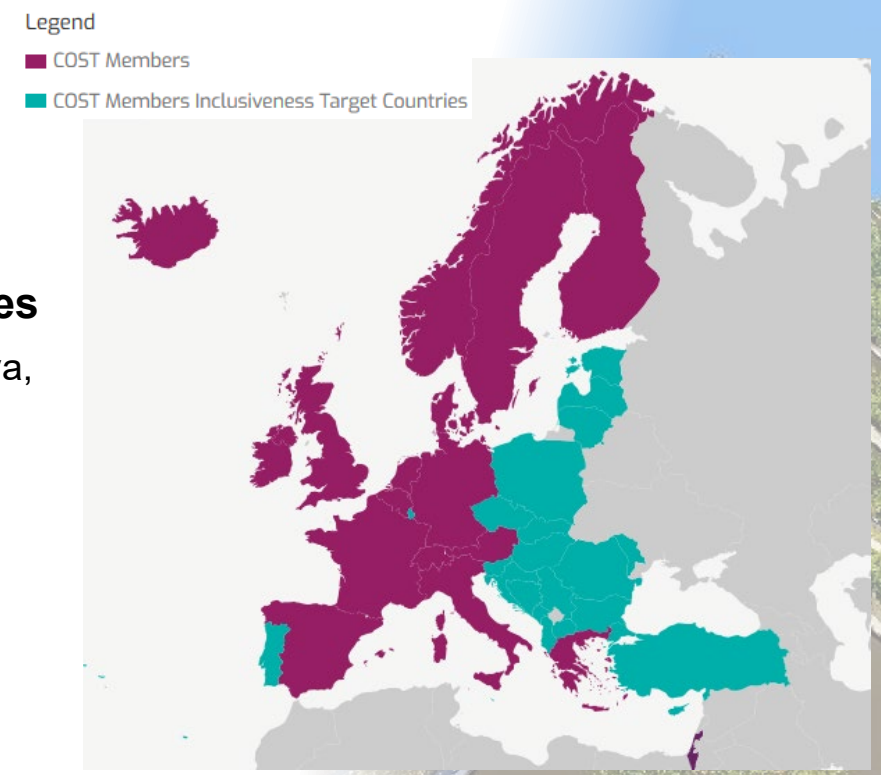
The network

All 39 COST countries participating!

- **EU 28**
- **EU Candidates and Potential Candidates**
  - Albania, Bosnia and Herzegovina, Moldova, Montenegro, North Macedonia, Serbia, Turkey
- **Other countries**
  - Iceland, Norway, Switzerland
- **COST Cooperating Member**
  - Israel

+ MC Observers from

  - Armenia, Colombia, Georgia, Taiwan, Russia, Tunisia



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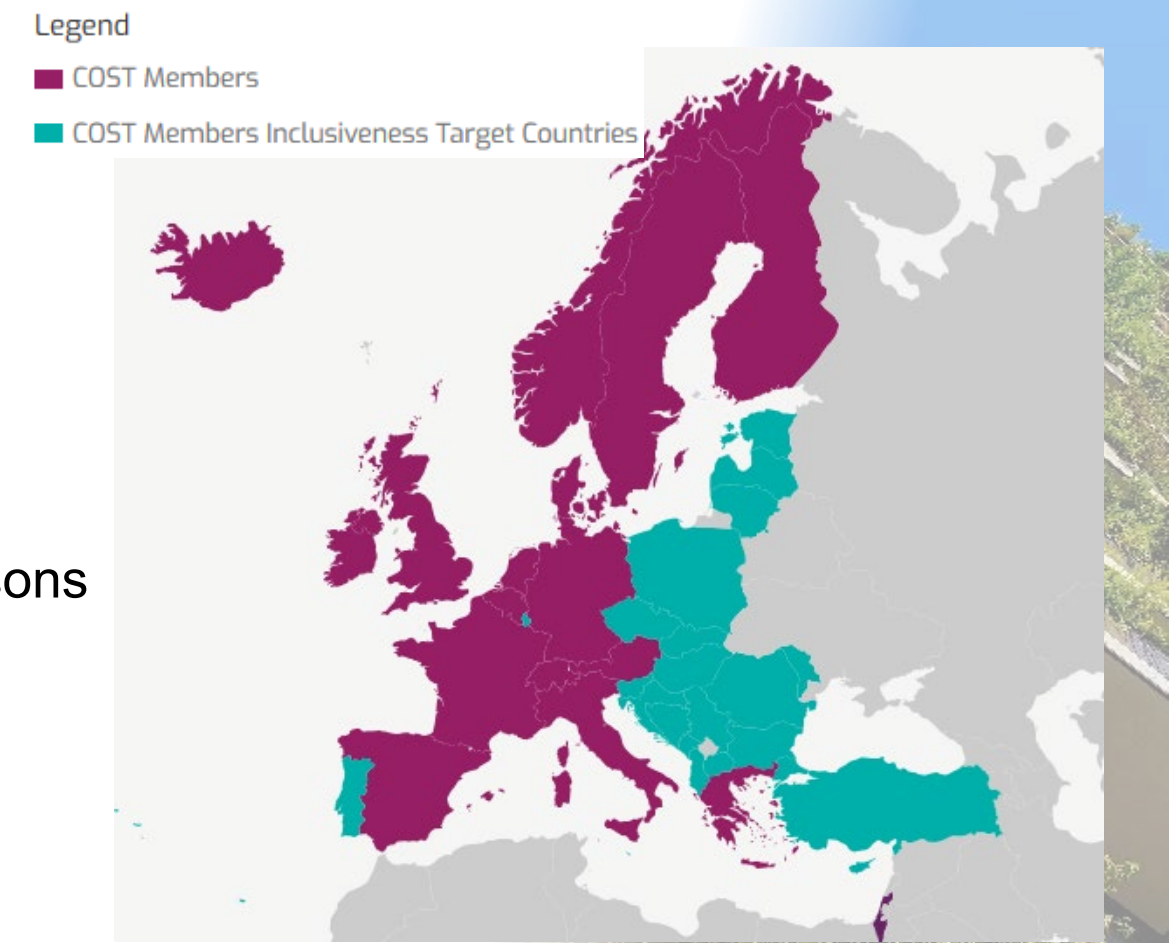
The network

39 COST Members
→ 78 MC Members
+ 95 MC Substitutes

+ 6 MC Observers
+ ca. 275 interested persons

➔ **> 450 persons**



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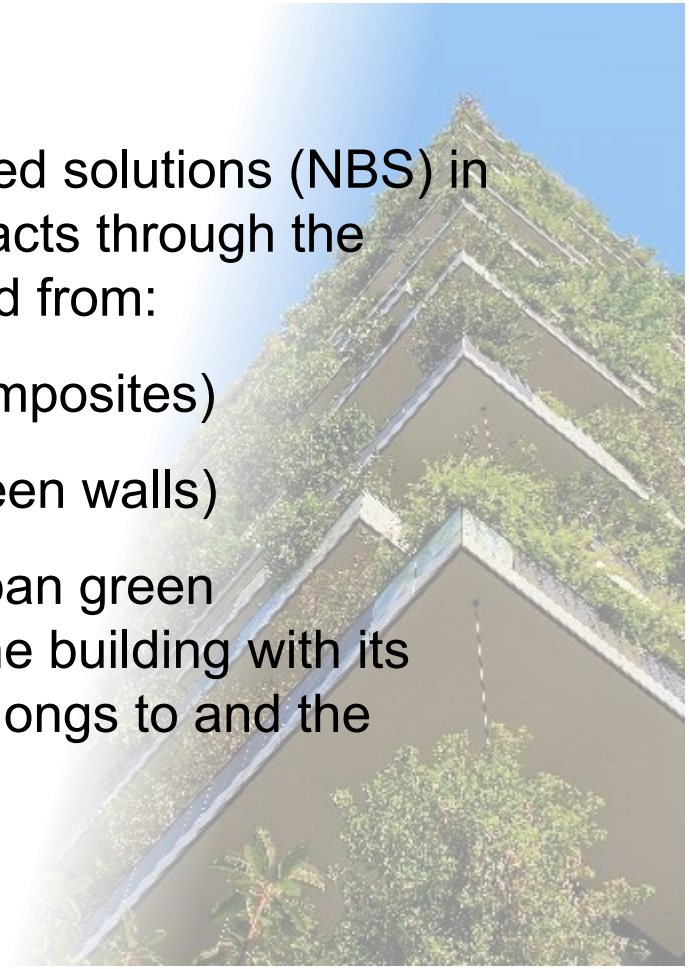
WG1 Built environment

The scope of WG1 is to investigate nature-based solutions (NBS) in the built environment, countering negative impacts through the provision of ecosystem services (ESS) obtained from:

- green building materials (plant-based biocomposites)
- green building systems (green roofs and green walls)
- green building sites (gardens, parks and urban green infrastructure – focusing on the relation of the building with its direct surroundings, the urban plot that it belongs to and the interface with the public realm)



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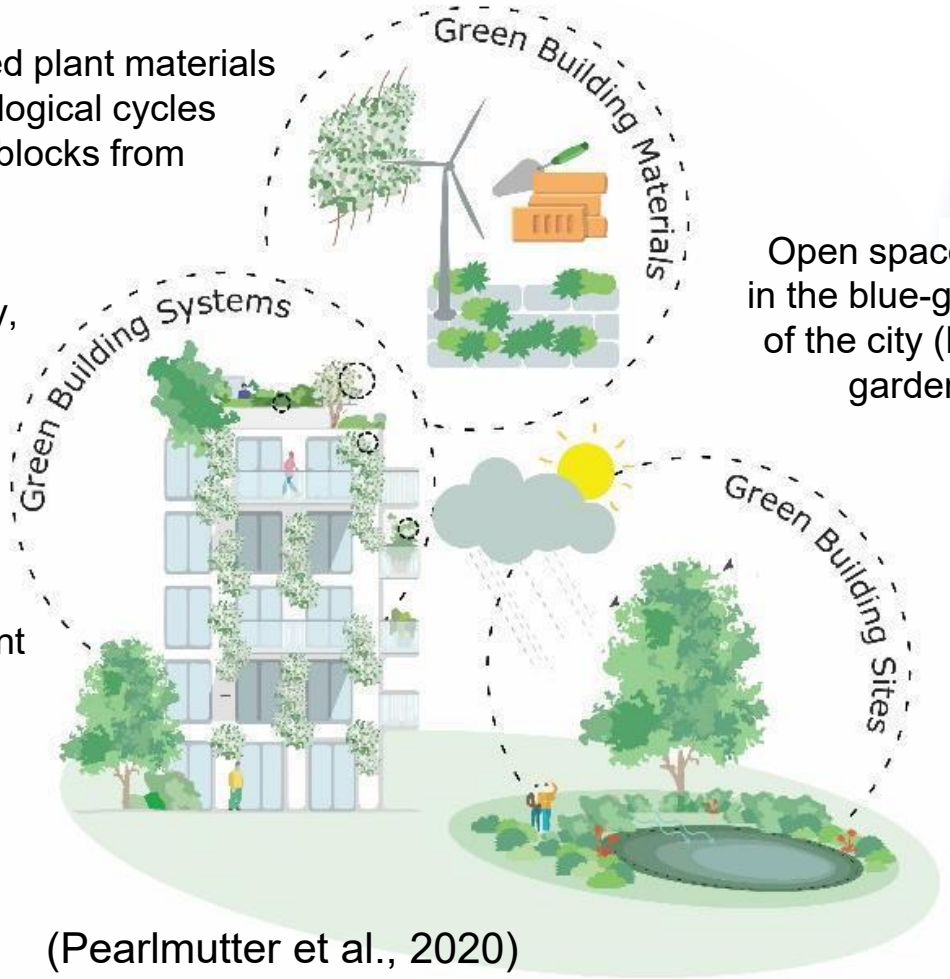
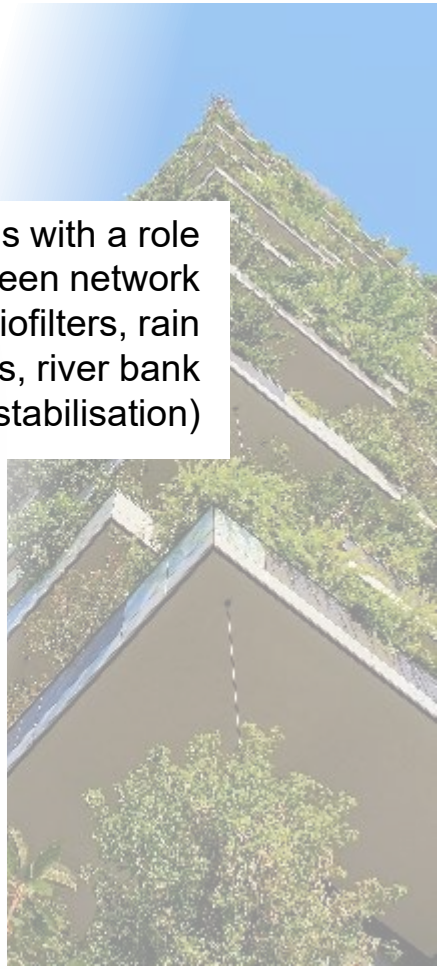
Living and harvested plant materials compatible with biological cycles (e.g. biocomposite blocks from agricultural waste)

Green roofs, facade greenery, (edible) living walls, building-integrated constructed wetlands



(Pearlmutter et al., 2020)

Open spaces with a role in the blue-green network of the city (biofilters, rain gardens, river bank stabilisation)



Multifunctional:

- Drainage & water treatment
- Reduce GHG emissions, operational energy use, „urban heat island effect“
- Enhance air quality
- Regenerative effect

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WG2 Urban water

The scope of WG2 is to investigate the sustainable urban water utilization and management. The themes of the WG include the following topics as follow:

- Urban water use and control
- Urban water disaster management (flood protection)
- Urban water pollution control
- Urban water and climate city adaptation (storm water, microclimate,…)
- Urban water and nexus in the field of food, water and energy ecosystem
- Urban water governance including rules, regulations and legislation
- Urban water economics and financial management of urban water

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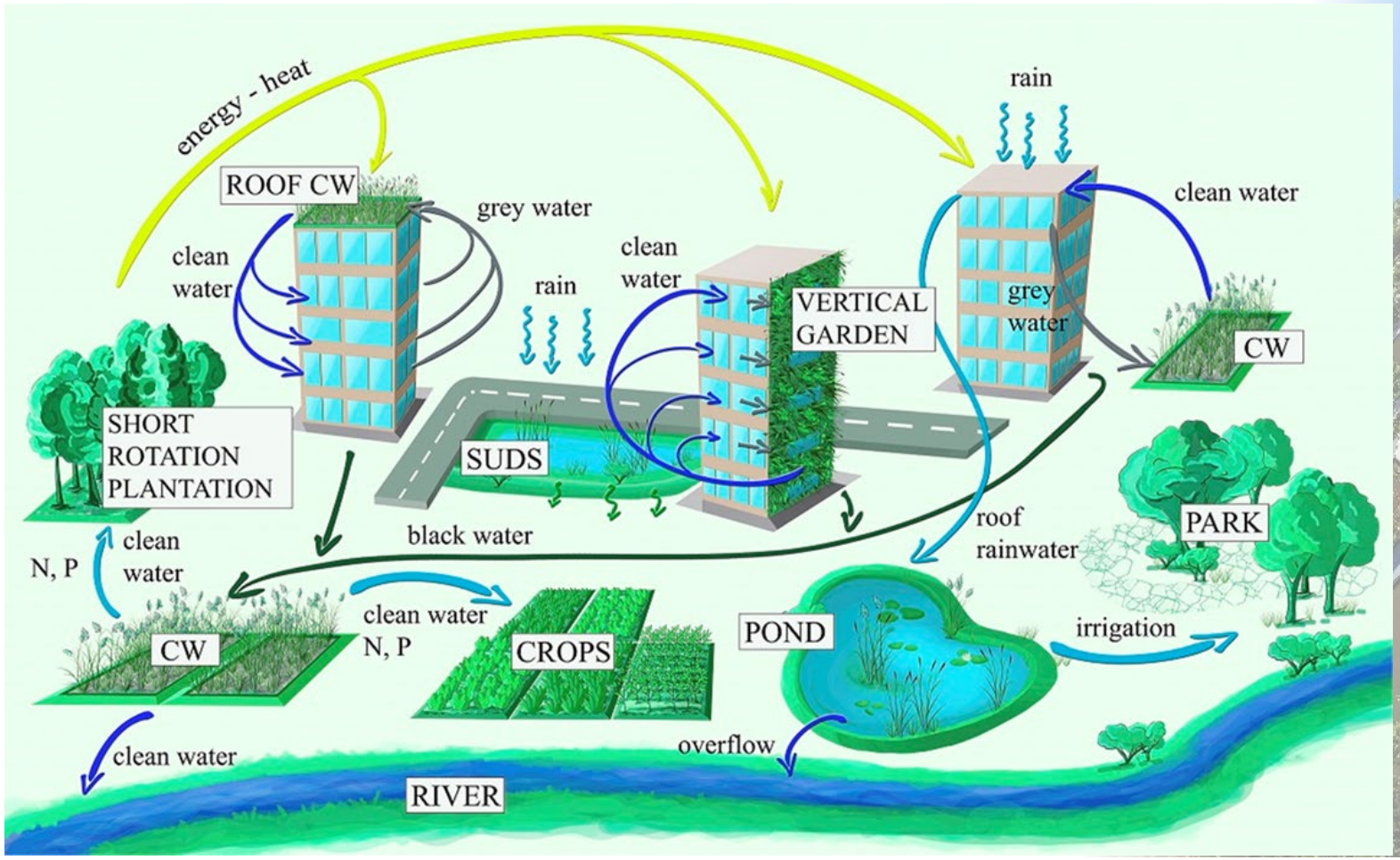

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WG3 Resource recovery

- 4 principal resource streams in cities + additional category:
  1. Urban wastewater
  2. Industrial waste and wastewater
  3. Municipal solid waste
  4. Gaseous effluents

  + Source-separated waste
- Description
  - Technologies
  - Products
  - Barriers

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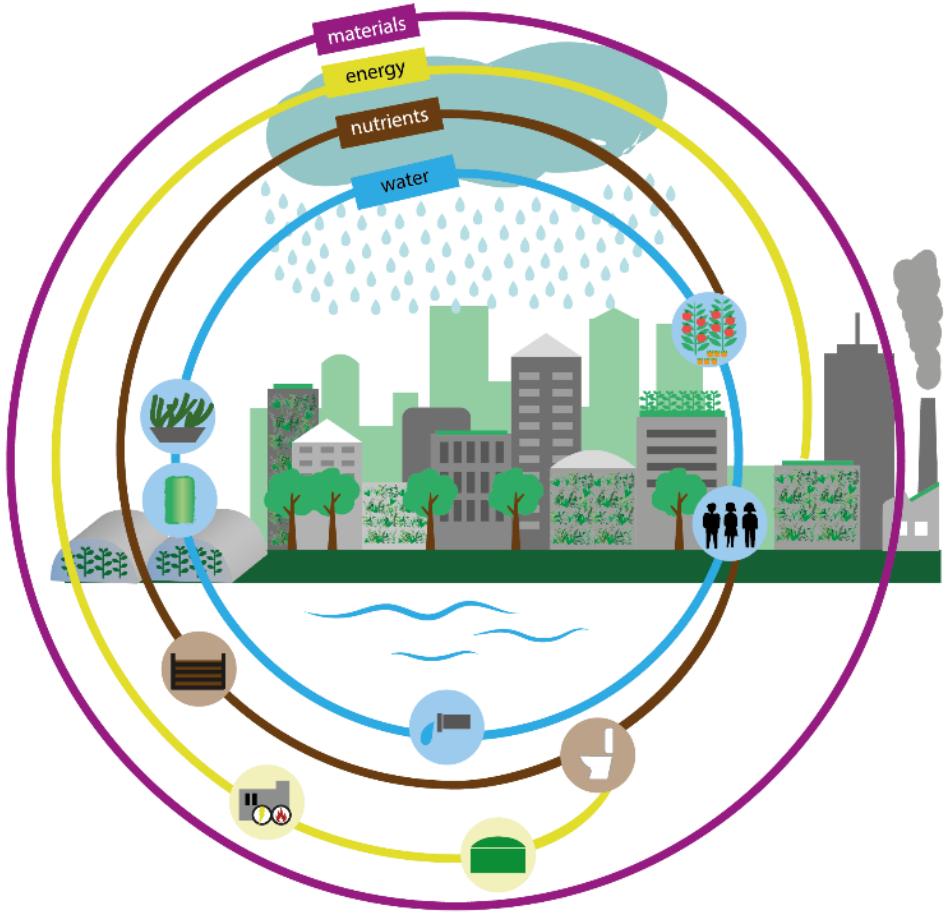

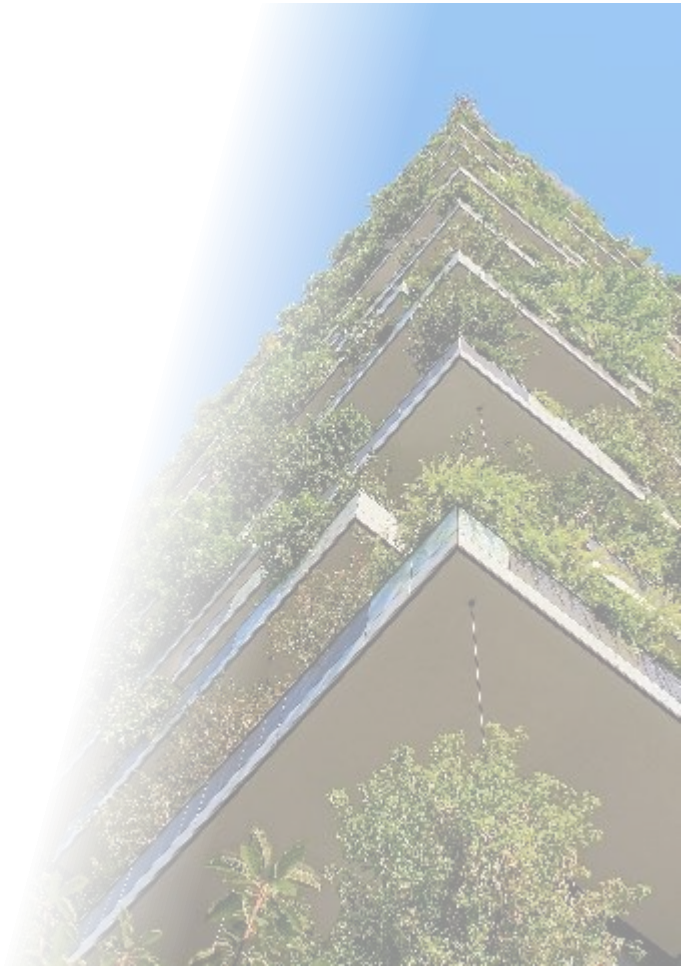

Overview of urban water, nutrient, material and energy loops enabled using NBS within cities (Kisser et al., 2020)

Urban Farming

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WG4 Urban Farming

- Circular cities are born:

  "*Urban farming is a key component of circular cities in the scope of sustainable urbanization*."

- People who live in cities need sustinable and fresh food.
- A city is now a place for growing food again, and the scope of urban agriculture is to establish production sites by building integrated agriculture including concepts:
  - aquaponics, indoor agriculture, vertical farming, rooftop production, edible walls; urban farm, edible landscape, school garden, community garden.
- The volume of municipal waste streams in general, push forward the development of material and resource cycling in cities.

Urban Farming

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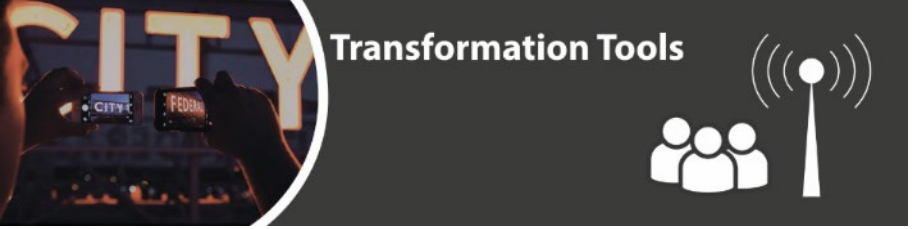
Involvement of urban population											Involvement of professionals
Urban gardening					Urban and peri-urban farming						Conventional farming
Private Garden	Allotment Garden	Commu-nity Garden	School Garden	Rooftop Vertical gardening/ farming (BIA)	Urban farms	Community-supported agriculture (CSA)	Educational or leisure farms	Social farms	Local food farms				NO adaptation to the urban environment
									CSA	Direct selling	City or farmers market	Boxes	
Mainly in building zone and affected by planning					Hybrid		Mainly in agricultural zone and affected by agricultural policy						

Typologies and social aspects of urban agriculture initiatives (Skar et al., 2020)

WG5 Transformation tools

The scope of WG5 is to identify and evaluate the Transformation Tools of NBS in built environment, urban water, resource recovery and urban farming. This will be conducted through:

- Analysis and recommendation of methods, frameworks, tools, and the indicators for circularity performance assessment (e.g. MFA, LCA, Urban metabolism etc.)
- Evaluation of the technological, social, market, environmental, policy, legislative, regulatory drivers and constraints for NBS implementation within WG 1-4
- Evaluation of the implementation of transformation tools developed in real and operational environment
- Investigation of the cost, capabilities and the effectiveness of ICT solutions for monitoring, control and dissemination of information to end users.



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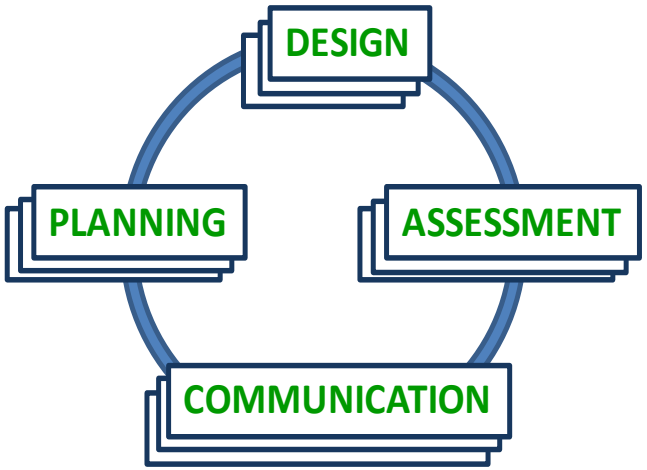
Response to the complexity of systemic implementation of NBS to transform the cities of today into circular cities



4 main interrelated steps for successful implementation of NBS for CC

- Goals
  - to identify and group specific tools and methods for assessing NBS for CC
  - to identify means of society and stakeholders' engagement and awareness, and
  - to identify barriers and facilitators within current policies and regulations in order to promote and enable the implementation of NBS for improving future city transitions.
- Methodology
  - Literature review
  - Project survey approach

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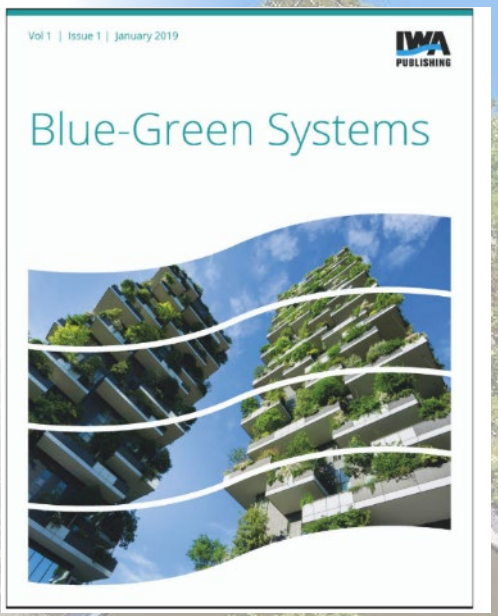
Main deliverables

- Report on the state of the art and existing case studies → **review papers on the state-of-the-art** → Special issue in the IWAP OA online **Blue-Green Systems** journal
- Catalogue of technologies for providing/recovering resources with NBS within each WG.
- Description of possible resource input provided from NBS systems
- **Guideline on combined NBS and CE possibilities within the urban environment**



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Special issue "Towards Circular Cities"

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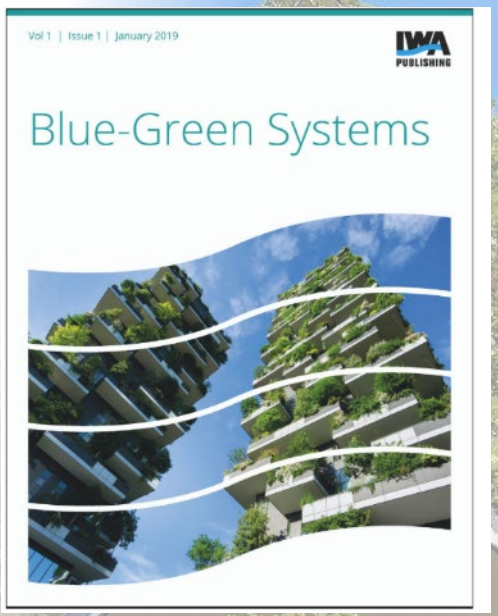
- ✓ Oral et al., BSG 2(1), 112-136: WG2
- ✓ Kisser et al., BSG 2(1), 138-172: WG3
- ✓ Skar et al., BSG 2(1), 1-45: WG4
- ✓ Katsou et al. BSG 2(1), 186-211: WG5

In total > 100 authors from 35 countries



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Activities 1/3

- ✓ **22 October 2018**, 1st MC meeting, official start of COST Action (ca. 75 persons)

Grand Period 1: 1 Nov 2018 – 30 Apr 2019

- ✓ 1st Circular City Workshop + MC Meeting, 13-15 February 2019, **Vienna** (ca. 150 persons)
- ✓ 2nd Circular City workshop, 28+29 March 2019, **Ljubljana** (ca. 60 persons)
- ✓ 3 Short-Term Scientific Missions granted
- ✓ 2 ITC Conference Grants
- ✓ Preparation of review papers for a Special Issue in the **Blue-Green Systems** journal

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Activities 2/3

Grand Period 2: 1 May 2019 – 30 Apr 2020

- ✓ review papers submitted
- ✓ 1st training school "Sustainable tourist resorts", 18-28 Jun 2019, Piran, Slovenia (with GWP)
- ✓ 2nd training school, 30 Sep – 4 Oct 2019, Malta (with H2020 ReNature project)
- ✓ 3rd Circular City workshop, 16-18 Sep 2019, **Finland** (ca. 60 persons)
- ✓ 4th Circular City workshop + MC Meeting, 4-6 Mar 2020, **Istanbul** (ca. 90 persons)

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Activities 3/3

Grand Period 2: 1 May 2019 – 30 Apr 2020 (cont'd)

Conferences and workshops:

- ✓ Presentation of the Action at the session "NBS in Circular Economy" @ WETPOL 2019 conference, 17-21 June 2019, Århus, Denmark
- ✓ Workshop “Towards Circular Cities” @ IWA Resource Recovery Conference, 8 Sep 2019, Venice, Italy
- ✓ Presentation of the Action @ the stand-up innovation #3: Circular Cities, 28 Oct 2019, Vienna, Austria
- ✓ Presentation of the Action @ Stakeholder event "Circular Cities", 28 Jan 2020, Impact Hub Zurich, Switzerland

Workshop “Towards Circular Cities”

8 Sep 2019, Venice, Italy

- 15 participants (besides Action members)
- Introduction of the COST Action
- Discussion on **beneficial and hindering factors** for implementation of NBS and CE in cities:
  1. General
  2. Planning
  3. Implementation
  4. Standards

Results from “Towards Circular Cities”, 8 Sep 2019, Venice, Italy

Beneficial and hindering factors for implementation of NBS and CE in cities:

1. General barriers
    - Planning People habits
    - Lack of knowledge/understanding & lack of communication
2. During planning
    - Short term political thinking vs. long-term planning
    - Only economic criteria are considered
3. During implementation
    - Need of skilled personnel and thus training required
4. Do we need standards?
    - Technology-neutral standards, unified within the EU
    - "Accepted practice" for validation of research results and choices for technologies

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Upcoming Activities

Grand Period 3: 1 May 2020 – 30 Apr 2021

- Sessions/workshops planned at
  - Symposium on Circular Economy and Sustainability, 1-3 Jul 2020, Alexandroupolis, Greece **(web-based)**
  - Closed Cycles symposium, 2-5 Sep 2020, Wädenswil, Switzerland **(web-based)**
  - Soilless Culture and Hydroponics, 1-4 Nov 2020, Lemesos, Cyprus

- 5 Training schools planned (starting in fall 2020)
  - For updates see Action website

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