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### **Deliverable 5.3**

Report on non-technological barriers within the project

> Work package: 5 Dissemination level: PU Lead partner: ICLEI Europe Author: Vasileios Latinos Due date: 2021/06/30 Submission date: 2021/07/02



Deliverable	Report on non-technological barriers		
Deliverable No.	5.3		
Work Package	5		
Dissemination Level	PU		
Author(s)	Vasileios Latinos (ICLEI Europe)		
Co-Author(s)			
Date	2021/02/02		
File Name	D5.3_Report on non-technological barriers_proGIreg_iclei.pdf		
Status	Submitted		
Revision			
Reviewed by (if applicable)	Bernd Pölling (SWUAS), Rolf Morgenstern (SWUAS), Barbara An- ton, Luca Arbau (ICLEI), Margot Olbertz (RWTH Aachen), Emilia Budeau (URBASOFIA), Codrut Papina (URBASOFIA)		
Information to be used for citations of this report	Report on non-technological barriers, Del. 5.3, proGlreg. Horizon 2020 Grant Agreement No 776528, European Commission, page number pp.		
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## **Partner organisations**

No.	Name	Short name	Country
1	South-Westphalia University of Applied Sciences	SWUAS	Germany
2	Local Governments for Sustainability	ICLEI	Germany
3	Environment Park	ENVIPARK	Italy

## **Abbreviations**

NBS:	nature-based solutions
proGlreg:	productive Green Infrastructure for post-industrial urban regeneration
EBRD:	European Bank for Reconstruction and Development
LL:	Living Lab
GI:	green infrastructure
FRC:	front-runner cities
FC:	follower cities



## **Executive Summary**

The report on non-technological barriers is part of WP 5 "Market readiness, barriers, and upscaling" of the EU HORIZON 2020 project proGIreg (productive Green Infrastructure for post-industrial urban regeneration). The interventions planned in the proGIreg front-runner cities (FRC) all embrace the concept of NBS, a fairly recent topic for some cities. Therefore, co-design and co-implementation processes for NBS encounter a variety of challenges, either in technical, financial or social terms.

One of the project's overarching objectives is to demonstrate how the lessons learnt from co-designing and implementing Nature-Based Solutions (NBS) can feed into selfsustained business models, which will be elaborated in WP 5.3. In order to achieve the objective of successfully transferring NBS into viable business models it is necessary to identify potential barriers and highlight bottlenecks and ways to overcome these as and when the various NBS models enter the market. Building on the NBS implementation processes in proGlreg's FRC in WP 3, and also the benefit assessment and monitoring during and after implementation in WP 4, WP 5 aims to and non-technological barriers identify technological that hinder broader implementation (Tasks 5.1 and 5.2) and, furthermore, to develop a catalogue of business models for NBS with regard to market readiness and upscaling (Task 5.3). In Task 5.1, proGlreg partners have developed a standardised questionnaire and conducted personal in-depth interviews with the project's cities and their local partners to identify the most important non-technological barriers to upscaling for each NBS implemented. The survey's standardised form enables a comparison between different NBS implementation processes in parallel to and following the implementation.

This report focuses on non-technological barriers encountered when planning, implementing and maintaining NBS. It was compiled through summarizing and analysing the interviews with both FRC and follower cities (FC) participating in the proGIreg project. It also suggests which factors the cities need to overcome in order to engage in a smooth and targeted NBS implementation and upscaling. Finally, it summarises some of the most important outcomes and lessons learnt that were expressed in the interviews and the ongoing work done in WP5 of the project.

- Key non-technological barriers identified through the review and analysis of all conducted interviews include:
- limited knowledge and/or awareness around NBS including both co-design and implementation processes;
- inadequate or ineffective governance structures for NBS;
- failure to understand and balance the multiple goals NBS can deliver;
- lack of awareness and limited citizen involvement such as a lack of open consultation processes;



- limited social inclusion and social acceptance by both citizens;
- lack of political support beyond traditional political cycles;
- lack of financial support and adequate funding streams for NBS;
- lack of communication between municipal departments; lack of holistic thinking and planning;
- lack of technical expertise and the general difficulties in upscaling NBS;
- conflicting regulations and interests related to land use and management

Uncertainties deriving from the COVID-19 pandemic crisis and ongoing/periodic lockdown situation in most of the proGIreg FRC and FC has presented an additional, extraordinary barrier that is however not generally applicable.

Besides detecting and analysing these barriers based on first-hand evidence collected through personal interviews with proGlreg partners, it is important to start collecting potential solutions for overcoming these barriers at different stages of NBS development.

## 1. Introduction

#### **1.1.** Introduction to the project

Productive Green Infrastructure for post-industrial urban regeneration (proGIreg) is developing and testing nature-based solutions (NBS) co-creatively with public authorities, civil society, researchers and businesses. Eight NBS, which will support the regeneration of urban areas affected by deindustrialisation, have been – or will be - developed, tested and implemented in a Living Lab approach in four FRC: Dortmund (Germany), Turin (Italy), Zagreb (Croatia) and Ningbo (China). These NBS will help create productive green infrastructures that not only help improve living conditions and reduce vulnerability to climate change, but also provide measurable economic benefits to citizens and entrepreneurs in post-industrial urban districts.

In the meantime, the FC of Cascais (Portugal), Cluj-Napoca (Romania), Piraeus (Greece) and Zenica (Bosnia and Herzegovina) closely follow progress in the Living Labs and engage in city-to-city exchanges and interact with local stakeholders to replicate those NBS that are most suitable in their own context.

Once the implementation process in FRC brings the first results, the FC will capitalize on them. In this way, the FC, after preparing the strategy for implementation in task 2.3, will represent the first "testers" of the NBS deployed by the FRC as well as of the solutions to overcome barriers as proposed in D5.5, Collective scheme/report of technical and administrative barriers.



The NBS to be tested in the FRC and replicated in the FC are:

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

#### 1.2. Non-technological barriers for NBS implementation and upscaling

Industrial decline, together with climate change and increasing urbanisation have resulted in several societal challenges for urban areas, making urban regeneration processes necessary for improving quality of life, protecting human health and enhancing resilience. NBS have gained an increasing importance in urban regeneration to address these challenges. However, the body of conceptual and practical knowledge regarding NBS remains fragmented when it comes to its broader significance for tackling societal challenges. This report is based on the assumption that a deeper analysis of the most important barriers to and enablers of NBS uptake can help close this gap [Ershad Sarabi et. al. 2019].

When conducting the interviews and writing this report, all cities involved in proGIreg were dealing with the impacts of the COVID-19 pandemic that also led to a general uncertainty regarding all kind of aspects of urban developmentThe cities fear that the pandemic will have long-term effects, even larger than the ones resulting from the 2009 financial crisis. However, the barriers identified in this report are differentiated between general non-technological barriers and the specific barriers caused by the current situation following the spread of the corona virus.



#### 1.3. Introduction to WP 5 and Tasks 5.1 and 5.2

WP5 builds on the NBS pilot implementation in WP3 and the benefit assessment and monitoring during and after the NBS pilot implementation in WP4. ProGIreg's overarching objective of demonstrating NBS integration into (partly) self-sustained business models requires a deeper analysis of the possible bottlenecks of implementation of NBS before they are getting ready for entering the market. This analysis of barriers - and also enablers - of NBS implementation was based on a standardized questionnaire that is part of proGIreg's WP 5 "Market readiness, barriers, and upscaling". While investigating barriers to implement NBS, WP 5 also aims to find solutions to overcome them, and to develop a catalogue of business models for NBS, that also takes the multiple benefits into account that they provide for social, ecological and economic regeneration.

The identification of barriers has been divided into an analysis of technological barriers (Task 5.1, led by ENVIPARK) and non-technological barriers (Task 5.2, led by ICLEI). The two lead partners have identified, analysed and rated the barriers by reviewing the outcomes of interviews with partners and stakeholders that were based on a standardized questionnaire. The questionnaire represents the first deliverable of WP 5 (D5.1, M23) and builds on desktop research and internal proGIreg progress, especially in WP 2. The desktop research took advantage of thematically similar projects and activities, e.g. Eklipse, URBAN GreenUP, CLEVER Cities, Connecting Nature, GrowGreen, and Naturvation. The data collected by the standardized questionnaire have been used to analyse technological and non-technological barriers (s. Figure 1).

Following this report, Task 5.2 will also investigate barriers and solutions in the implementation and up-scaling of NBS in cities other than those involved in proGIreg. This activity will benefit from ICLEI's worldwide network of cities and result in D5.4, Report on non-technological barriers outside the project. The data collection of D5.4 will use an adapted version of the D5.1 standardized questionnaire, which will be designed for developing an online survey.





Figure 1. Sequence of WP5 deliverables on barriers and business models

#### 1.4. Context and methodology

WP5 distinguishes between technological and non-technological barriers for NBS implementation and upscaling. Both, technological and non-technological barriers are faced in the reports basing on skills and competences of the lead partners of these tasks and by analysing outcomes resulting from the answers provided by the stakeholders interviewed with the standardized questionnaire. The research on technological barriers, which are mainly technical and related to the NBS design and installation, has been conducted by EnviPark, while the research on non-technological ones was conducted by ICLEI Europe.

#### 1.4.1. What are non-technological barriers?

In order to identify non-technological barriers that hinder broader implementation whilst finding solutions to overcome them, the first round of interviews was carried out to answer the following key research question:



## Which barriers occur at different stages of NBS development and how can we overcome these in order to enable NBS upscaling?

For the purpose of this analysis, the WP5 team considered the classification of nontechnological barriers into three main categories, as these barriers are of political, legislative, financial and socio-cultural concerns and may jeopardize the implementation or hinder the upscaling of the proGIreg NBS. Below we try to set the limits around these three categories of barriers to NBS implementation and upscaling:

#### (1) Institutional (administrative, legislative, governance) barriers include:

Policies, guidelines, or procedures that are not favourable for implementation and upscaling; insufficient legislation and policies that would facilitate procedures, challenges linked to government assistance or political support, unfavourable planning schemes and more.

#### (2) Social and cultural barriers include:

Human or society induced challenges and constraints that are originating from social norms and/or cultural values; they may also refer to education, awareness, capacity building, stakeholder management and priorities, social inclusion and cohesion issues and more.

#### (3) Financial or market barriers include:

Constraints to entry in financial market, lack of funding, lack of mainstreaming processes for NBS that will bring the necessary funding, inadequate or ineffective financing schemes, unsustainable funding processes and more.

#### 1.4.2. Methodological elements

The following subchapters will explain these barriers for each NBS in more detail and will summarize outcomes of the interviews with both FRC and FC that implement these.

The interviews (spring/summer 2020) to detect barriers were carried out by ICLEI, SWUAS and EnviPark staff who engaged in conducting qualitative interviews using the standardized questionnaire developed as part of Task 5.1 as a starting point.

In the first round, interviews were carried out with three to five key persons per NBS development in each city where relevant experience with the respective NBS existed. As NBS implementation in FC has not yet taken place, the number of interviewees varied and included those partners and stakeholders that were identified as relevant



for specific NBS implementation and had experience from other relevant NBS activities outside proGlreg. The interviewees were selected with the support of key contact persons for each NBS in each city.

Data entry and collection took place in a team-internal Excel file for analysis and reporting of results. This Excel file will also be used for generating D5.5 (synthesis of barriers and solutions). The combination of these three deliverables will answer the before-mentioned research question on barriers.

#### 1.4.3. Data collection and GDPR

As a consequence of the COVID pandemic, all interviews were held online rather than in person. When conducting them, the interviewers used online platforms such as Zoom and GotoWebinar/GotoMeeting. It was not required to audio tape and transcribe all interviews; however, audio taping was recommended and used in most cases. After each interview, collected information was summarized from the interviewer's handwritten notes or by re-watching the recording – in the case of audio, the software Trint was used for collecting the main points of each interview.

All necessary and obligatory measures to ensure personal data protection and confidentiality were adopted according to GDPR and as described in proGIreg Deliverable 7.2. As the questionnaire includes personal and potentially sensitive data, these were handled with suitable care. The handwritten notes and/or recordings will remain with the individual interviewers only, while any shared Excel files or other documents, such as interview transcripts, were accessed and used by WP 5 task leaders ENVIPARK, ICLEI, and SWUAS.

Traceability to individual persons is not possible in this report, because all information is only presented on an aggregated level or, in case of personal quotes or statements, personal information will not be provided. Upon request of the interviewee, but latest after carrying out all planned activities on NBS barriers, their data will be deleted completely. This concerns all possible data: handwritten notes, recordings, and excel file entries.



## 2. Structure of the report

This report aims to detect and analyse non-technological barriers for the upscaling of NBS as they have emerged in both FRC and FC. The report includes sub-chapters compling the barriers for each NBS as recognised and highlighted by the interviewees from the FRC and FC. The following chapters also include lessons learned from previous experiences that were mentioned during the interviews.

The report is structured in two sections for each NBS: a general introduction on the various projects in the proGIreg cities that fall under the specific NBS and an analysis of the barriers identified through the interviews for each city and NBS.

The introduction and brief description of each NBS also includes the possible benefits of implementing it in the various proGlreg cities. The second section is then zooming in on the actual non-technological barriers experienced and highlights the differences between cities that have planned or implemented the NBS. The information is presented by city, and also by category of non-technological barrier, (see sub-chapter 1.4.1., i.e. Institutional (administrative, legislative, governance), social and cultural andfinancial and market barriers). In case a barrier applies to more than one city, it is shown under a 'cross-city' title, still following the above classification.

Following a review of all NBS, a subsequent section summarizes the most important barriers and provides initial suggestions on the cities' needs to implement and scale up NBS.



NBS	DO	TUR	ZA	CAS	CLUJ	PIR	ZEN	NING
NBS 1	х						х	
NBS 2		х						х
NBS 3	x	х	x	x	х			x
NBS 4	x	х	x					
NBS 5		х	x		х		х	
NBS 6	x	х	х	x	х	х	х	
NBS 7		х	x					х
NBS 8	х	х		x		х		

Table 1. NBS developments in proGlreg cities



# 3. NBS 1: Renaturing landfill sites for leisure use and energy production

#### 3.1. Introduction

Renaturing landfill sites is quite common in post-industrial areas as it can secure the continuity of use for a site and create an alternative future for it. Well-exposed elevations can be ideal for producing solar or wind energy, for transforming them into green or other public spaces for sports activities or leisure. Two cities are planning and implementing NBS 1: Renaturing landfill sites for leisure and energy production, namely FRC Dortmund and FC Zenica.

#### **FRC Dortmund**

Dortmund has partly redeveloped its large brownfield and landfill sites in the past. Former industrial sites are now transforming into industrial heritage sites, residential areas and green recreational areas. Dortmund benefits from its huge natural potential since it is fully surrounded by a green belt, the Emscher Park. Part of the Dortmund Living Lab is the Deusenberg landfill site which closed in 1992, and since then the area has gradually been re-cultivated – including photovoltaic energy production through installation of solar panels on the eastern, most accessible side of the landfill in 2017. Through proGlreg and funding received by the International Garden Exhibition, the city envisions the future of Deusenberg as an easily accessible community area with opportunities for activities such as mountain-biking, jogging and bird-watching.

#### FC Zenica

The City of Zenica has secured a budget to convert the currently dangerous and unsanitary landfill of industrial waste in the frame of the Sidje Landfill Rehabilitation Project. The landfill is to become a community open space that may attract both the younger and the older population of the city. The landfill is located on the eastern valley slope near Zenica, 1.5 km away from the River Bosna, which crosses the city, but just 150 m from the boundary-line canal that flows into the River Bosna. The area of landfill is around 30.000,00 m<sup>2</sup>. The Mošćanica Regional Landfill (the company that runs the landfill goes under the same name as well) that was founded by the City of Zenica, will take over the project implementation. The funds for this landfill remediation and redevelopment were obtained by a loan of the European Bank for Reconstruction and Development as well as financial contributions from the Bosnia and Herzegovina Environmental Fund and the Federal Ministry of Environment and Tourism.



The City of Zenica envisions additional tree-planting actions, which will improve the area aesthetically, as well as help prevent potential landslides. In general, this future project aims at improving air quality, while, in parallel, preventing illegal and harmful waste disposal through effective monitoring.



Photo 2. Renatured landfill Deusenberg, Dortmund | © Stadt Dortmund, D. Knappe

#### 3.2. Non-technological barriers to NBS1

#### **FRC Dortmund**

#### Social and cultural barriers

In Dortmund, the most important non-technological barriers appear to be low social acceptance for the re-used sites and the importance of NBS for urban health, including the mental health of citizens. There are limited interests by the general public in NBS functions such as recreational activities, which may be implemented in Deusenberg. In addition, a couple of interviewees mentioned that local residents are afraid of rising housing prices and gentrification in the Huckarde district, but also in general in the



whole area around the Deusenberg. Most proGlreg partners including the City of Dortmund deem citizen involvement as very important for the success of the Deusenberg redevelopment process, therefore it was emphasized in the interviews that increased citizen engagement in the co-design and co-implementation process would lead to larger social acceptance and better connectivity of citizens with their enlarged neighbourhood.

#### FC Zenica

#### Financial and market barriers

The main barriers for Zenica are financial and market related. The city is not part of the European Union and does not have direct access to EU funding. Also in proGIreg, Zenica was only able to join as a 'learning city', but is not eligible for receiving funds for NBS implementation, too, The city therefore needs to search for own funds, private investors or seed funding from banks such as the European Bank for Reconstruction and Development (EBRD) to implement NBS or green infrastructure projects. On the positive side, the city has joined the EBRD Green Cities programme, developed a Green City Action Plan and will improve its air quality significantly through an investment led by the EBRD in a new local heat and power plant that will no longer rely on heavily polluting coal. In this case, the city has engaged in long-term planning, most likely beyond the current political term, unlike in the past when lack of funding and limited resources availability hampered planning.

#### FC Zenica

#### Institutional (administrative, legislative, governance) barriers

Due to extensive bureaucracy and the lack of past experiences on such projects, it proves quite difficult and complicated to secure permits and approvals with different levels of government and jurisdiction; this may lead to missing deadlines and delays in project and budget approvals. In addition, it is always hard to locate and secure financial resources - such as credits and donations - for the preparation of project documentation and for landfill redevelopment execution work. Not to forget here that these are quite costly projects – an estimation from the city of Zenica shows that the project would require in phase 1 (planning and implementation) about 1,500,000 EUR and in phase 2 (monitoring and maintenance) about 700,000 EUR.

#### Social and cultural barriers

Social acceptance and citizen engagement are important for the city of Zenica, but take a different perspective compared to Dortmund. It appears that citizens, other



stakeholders and even city councillors do not always comprehend the extent of NBS co-benefits for humans and their mental health as well as for better air quality and a cleaner environment. In addition, there are concerns regarding the costs for the implementation and the additional efforts needed for the maintenance of green spaces and the fear of vandalism.

Another important barrier for the city of Zenica is the lack of NBS technical knowledge, both at city and country level; another factor why the city is lagging behind with large-scale NBS promotion.

#### **Cross-city**

#### Institutional (administrative, legislative, governance) barriers

The interview results show that another important barrier is linked to the limited flexibility of the implemented solutions; this becomes an issue as EU-funded projects have a certain, well-defined timeline, while bureaucratic and other municipal processes tend to last long, especially when combined with mixed land ownership patterns and complicated regulatory measures for landfill redevelopment and waste management. Finally, it has often been hard for the proGIreg partners to reach a consensus in terms of practical steps and ways to move forward. There are difficulties to transform technical knowledge and tested practices into easy-to-upscale NBS at city level, as such processes have not been a relevant test-bed in the past.

## 4. NBS 2: New regenerated soil

#### 4.1. Introduction to NBS

After decades of neglect, the soil in post-industrial areas is often of poor quality, and is considered unfit for any use. In order to tackle this challenge, cities have tried to import fertile soil from other regions, something that is costly, both environmentally and economically. Carbon-neutral methods to restore soil fertility involve combining poor quality soil with compost from organic waste and biotic compounds. Two cities, namely the FRC Turin and Ningbo, are planning and implementing NBS 2: New regenerated soil thanks to biotic compounds for urban forestry and urban farming. All schools in Mirafiori Sud are involved in implementing and testing the innovative NBS planned within the proGlreg project. Ongoing work in Mirafiori Sud will enable local families and citizens to play an active role in developing their own neighbourhood.



#### **FRC Turin**

Turin's Living Lab is located at the banks of the river Sangone in the district of Mirafiori Sud. It is a former working class area with 40,000 inhabitants and a variety of social groups. The area has high potential for urban regeneration, with its active local associations, strong cultural heritage and abandoned industrial buildings available for new community ventures. Local authorities in Turin have identified the need for additional arable soil for new green spaces and have decided to use the Sangone Park for producing and testing regenerated soil. This soil is ideal for urban forestry and the aim is to make it available for use in public green spaces throughout the city.

#### **FRC Ningbo**

In addition to pioneer work done in the city of Turin, new regenerated soil will be implemented around the Moon Lake Park in the Chinese city of Ningbo, which kickstarted its co-design process through proGlreg in November 2020, following some COVID-19 related delays. In Ningbo, the implementation of NBS 2 has already started by introducing new regenerated soil in the rivers that lead to Moon Lake. This activity aims at tackling the existing water pollution, purifying harmful components in the silt at the bottom of the river, and relieve pollutant discharge to solve the problem of local polluted sediments. The Moon Lake Park is additionally suffering of reduced biodiversity as well as substandard water quality and eutrophication of the lake.

#### 4.2. Non-technological barriers to NBS2

#### **FRC Turin**

#### Social and cultural barriers

In Turin, significant work has already been done for implementing NBS 2. The most important non-technological barrier appears to be the lack of understanding of the multiple benefits that may arise from the introduction of regenerated soil for the use in public green spaces. This needs to be considered when new soil is meant to be used for the creation of green corridors, gardens, orchards and green roofs.

Institutional (administrative, legislative, governance) barriers



During the implementation phase, the bureaucracy around certain approval procedures can present a hurdle for testing and applying the new soil. Furthermore, potential trade-offs in relation to the other NBS implemented in the Turin Living Lab need to be taken into consideration and weighed up against each other. Work done under NBS 2 needs to consider multiple issues such as habitat preservation, pollinator biodiversity and environmental compensation measures and ensure that strategic and holistic thinking is winning over potentially arising conflicting interests of the stakeholder groups involved in decision-making; when it comes to planning schedules, prioritisation of implementation elements, procurement issues etc.

Other non-technological barriers mentioned include the lack of long-term planning in combination with changing priorities and topics that are given preference over the development of green infrastructure. There is lack of continuity in policies and decision-making processes when local governments are changing. This situation, in combination with budget constraints for introducing additional elements, in the short term, to existing measures with already approved budgets, leads to further constraints and de-lays in implementation.

#### **FRC Ningbo**

#### Institutional (administrative, governance) barriers

The Ningbo Living Lab is located in an area that is very close to a military base, some government buildings and a central railway station, which means that the whole area is under strict control and does not allow for much flexibility in planning and implementation. Relevant historical data and geographic data are difficult to obtain in general in Chinese cities, while any development that goes beyond schedule or framework is almost impossible to implement, as the Moon Lake Park is part of an important cultural heritage site.

#### Social and cultural barriers

In the city administration of Ningbo, lack of awareness is among the most frequently met barriers. Some municipal departments fail to understand and adopt technologies around soil regeneration. In addition, the influence of hydrological and meteorological conditions on construction positioning and depth control is very high. This means that the application of new soil depends on certain hydrological and meteorological conditions in a selected location, something that may lead to delays in implementation or a backlash in project and budget negotiations.

#### Financial and market barriers



In many cases, difficulties arise since early investment in sludge treatment projects is relatively large. In particular, the amount of investment in a sewage treatment project with a daily treatment capacity of 20,000 tons/day is about 40 million yuan, and the investment in unit treatment capacity is about 20 million yuan, with relatively high capital barriers.

# 5. NBS 3: Community-based urban farming and gardening on post-industrial sites

#### 5.1. Introduction

Post-industrial areas often lack green spaces for public use. Turning unused urban land into productive community gardens can have a positive impact on locals, contributing to improved mental and physical health through exposure to nature and healthy sources of food and a community feeling. Community-based urban farming and gardening are very popular among proGIreg cities, as many cities have chosen this NBS either at proposal stage or later in the proGIreg process. Six cities are planning and implementing NBS 3 and these are the FRC Dortmund, Turin, Ningbo and Zagreb and the FC Cascais and Cluj-Napoca.

#### **FRC Dortmund**

In Dortmund, a 10,000m<sup>2</sup> food forest - a self-sustaining woodland ecosystem designed for food production - will be created together with local residents next to the Huckarde district. Additionally, a permaculture orchard with fruits, nuts and berries will enhance soil fertility. Located next to the open vegetation on the slopes of the former landfill site of Deusenberg (NBS 1), the orchard will increase the availability of pollinator flora, thus creating a connection to NBS 8 (pollinator biodiversity).

#### **FRC Turin**

In Turin, abandoned parts of the Sangone Park will be redesigned and used for community urban gardens. The aim is to improve the safety of the area and encourage community activities and productivity. In the Piemonte Park, 2.5 hectares of land will be used for social farming activities including teaching, training and for job placements.



Furthermore, a pollinator garden with an apiary for honey production will be developed on a former industrial site, linking NBS 3 with NBS 8. Turin is, in any case, aiming high with NBS3, with the objective to consolidate the social enterprise model and progressively add new services such as an educational farm and a kiosk, and offering educational and training sessions and other social agriculture activities to the citizens and visitors of the gardens in the Living Lab.

#### FRC Zagreb

The Sesvete 'City Garden' will initially have around 100 units (and can be extended to new areas at a later stage). The garden will enable locals to grow traditional vegetables, herbs and flowers. This is one of 12 'City Gardens' created in Zagreb since 2013. A nursery at the park entrance will serve as an educational centre for local schools. Food production will be organic and the water pumps will be run on solar power. In addition to this garden, the Zagreb City Council and the local NGO in Sesvete, called ZIPS developed a plan for a garden equipped for people with psychological and physical disabilities. Therapeutic gardens are specially designed gardens with the aim of strengthening the motor, sensory, cognitive and social potentials of their users. Gardens have been constructed for human health and wellbeing all around the world for hundreds of years, but this type of specifically designed garden would be the first one for the Croatian capital.

#### **FC Cascais**

The city of Cascais has a long tradition in driving urban agriculture and the social economy. Bulding on existing activities they plan to create urban gardens for local organic food production which will not only made available for own-consumption, but also be sold under the local brand 'Products of Cascais' land'

#### FC Cluj-Napoca

Following the success of similar urban gardening projects in other parts of the city, Cluj-Napoca will regenerate the post-industrial land (and its soil) in the areas flanking central rail tracks. The aim is to create new jobs and opportunities for marginalized groups.

#### **FRC Ningbo**

Finally, the proGlreg Living Lab in Moon Lake Park in Ningbo China will implement urban gardens co-designed with local stakeholders.





Photo 2: Orti Generali - Source: City of Turin

#### 5.2. Non-technological barriers to NBS3

#### **FRC Dortmund**

#### Institutional (administrative and governance) barriers

For the city of Dortmund, one important issue, after securing a site and before transforming it into a garden or food forest is to ensure that all other uses of land are respected, e.g. those by nearby businesses including shops as well as institutions such as schools, retirement homes, and hospitals, etc. but also to respect and deal with private interests of individual citizens.

#### **FRC Turin**

#### Institutional (administrative and governance) barriers

The Mirafiori Sud residents in Turin have various reasons to support and become active in the proGIreg Living Lab: A good deal of them have been trying for many years to access and manage a city-run garden plot, while they also appreciate the offer of services, the cheaper rates for renting the plots and the community-focused vision of



the project. On the other hand, there are no established procedures yet on how the citizens could approach the municipality of Turin with suggestions that involve social and technological innovation. Municipal processes are also lengthy, bureaucratic and time-consuming.

#### Social and cultural barriers

Turin has also flagged vandalism as an important barrier; this would be relevant for NBS3 and NBS5 or NBS6 as well.

#### FRC Zagreb

#### Institutional (administrative and governance) barriers

For the city of Zagreb, one of the most important non-technological barriers are the ongoing conflicts between municipal departments or between the city council and external stakeholders who have different interests. In most past cases, the city administration tended to favour grey solutions - for example concrete squares instead of green spaces, having the wrong perception that grey solutions are less constly.

#### Social and cultural barriers

Vandalism is flagged as an important barrier. Parts of the "City Gardens" in Zagreb were damaged, resulting in increasing costs for repair and maintenance. In contrast, it seems that interviewees appear confident that vandalism may not be an issue in Sesvete as the district is characterised by increased social cohesion, including a variety of efforts for a social economy and numerous solidarity actions.

#### **FC Cascais**

#### Financial and market barriers

In Cascais, one important barrier is the lack of financing for compost and other materials and equipment necessary for the gardens, as the city council cannot always provide to the gardeners free of charge. Work done in Cascais' urban gardens is also dependant on volunteers who may not be available throughout the year. In some cases, the urban gardeners face difficulties to transform knowledge and ongoing practices into easy-to-transfer, hands-on knowledge to other, newer farmers as well.

#### FC Cluj-Napoca

Institutional (administrative, legislative, governance) barriers



For the city of Cluj-Napoca, one of the most important barriers for the implementation of social projects, such as urban gardens and similar community structures, is the lack of holistic thinking and planning in terms of bigger issues such as climate change. There is also lack of continuity, but also limited information sharing and transparency. For Cluj-Napoca, it is important to increase flexibility when implementing urban agriculture projects, as the urban gardeners (citizens who will rent a plot) may be asked to work with limited budgets in the case of arising financial constraints – therefore, would need to implement the same activities with less resources, meaning that basically whoever is in charge of the gardens should not necessarily rely on money from the city administration.

#### **FRC Ningbo**

#### Social and cultural barriers

For the city of Ningbo, one of the most important non-technological barriers that are expected is the increased number of tourists in the Moon Lake Park, which would lead to damages in the orchards, but also the lack of cultural acceptance around gardens that are co-owned by state and citizens.

#### **Cross-city**

#### Institutional (administrative, legislative, governance) barriers

For both Zagreb and Cluj-Napoca, political will is rather important to push agendas around green infrastructure and urban agriculture. Political will, however, needs to go hand-in-hand with environmental education for both city officials and the general public. In general, there is a lack of knowledge and little interest in environmental matters among city officials, advisors and stakeholders, especially when it comes to current policy processes and changes in the framework conditions on European, regional and local sustainability. Interviewees from Zagreb and Cluj-Napoca expressed that there is little awareness and knowledge around environmental/sustainability matters among politicians and in the administration, therefore also hardly any well-designed activities exist. And there is also little interest and will to change this - and this is also true for other relevant stakeholders.

In both Turin and Zagreb, there has been a shift in strategic municipal planning in the last years, which emphasises the importance of green spaces, health and well-being, and social inclusion equality. The cities have started talking about their overall environmental footprint and about keeping a balance between the built environment and green and open spaces to create more liveable spaces.



Finally, a very important barrier that has come up in many interviews from the cities of Cascais and Cluj-Napoca is that city departments have worked for many years in silos, and in the end, all information acquired by a department stays within it. Especially in the case of NBS 3 many municipal departments would need to cooperate, e.g. the urban planning department, green spaces department, social policy department and many more.

## 6. NBS 4: Aquaponics

#### 6.1. Introduction

Aquaponics is the combination of raising fish (aquaculture) in tanks together with the soilless cultivation of plants (hydroponics) in a symbiotic environment, whereby the fish waste provides the nutrients needed to feed the plants. Aquaponics is ideal for promoting local food production in areas with contaminated or poor-quality soil. Local food production based on aquaponics systems can lead to healthier diets. Additionally, the aquaponics systems may create new green job opportunities, where they do not exist yet, such as in the cities of Zagreb and Zenica. The aquaponics promoted by the pro-Glreg project are low-cost, but stable systems, which are easy to operate. Three cities, Dortmund (Germany), Turin (Italy) and Zagreb (Croatia) are planning and implementing for NBS 4: Aquaponics.

#### **FRC Dortmund**

Considered the focal activity of proGlreg in Dortmund, a community-managed aquaponics system on 200m<sup>2</sup> will be located next to the food forests and the orchard (NBS 3) in the Living Lab area. Supported also by the City of Dortmund, the aquaponics system is expected to provide new green job opportunities.

#### **FRC Turin**

In addition, and supported by the Dortmund Living Lab, Turin will test its first ever aquaponics system with the potential for further replication, if successful. The small-scale community-designed system will be set up on an abandoned public site.

#### **FRC Zagreb**



Assisted by technology from Dortmund and expertise from the University of Zagreb's Faculty of Agriculture, Zagreb will also test the potential of an aquaponics system on a 100m<sup>2</sup> former industrial site, however, the location and business model needs to be confirmed before starting with a planning process.



Photo 3: The Dortmund Living Lab - Source: ©proGlreg

#### 6.2. Non-technological barriers to NBS4

#### **FRC Dortmund**

#### Institutional (administrative and legislative) barriers

The main challenge around the Dortmund community-managed aquaponics systems has been to clarify all details around the construction permit, which ended up to be a very lengthy and complicated process. All these issues were overcome with the support of project partners with experience on aquaponics systems, but, in general, relevant information was difficult to understand and digest.



The most important issue with aquaponics in Dortmund has to do with existing building permits and the connected business model. The structural design of the foil greenhouse is only certified for agricultural production, therefore, no usage or visit by foreigners is allowed, since snowfall and wind load can make the structure collapse. For the building permit, the general public has to be excluded from freely entering the greenhouses and thus from the business model. The implementing partners, in order to tackle this issue, adapted the "rent-a-raft" idea, which means that the "Urbanisten", still can give visitors guided tours of the system, while visits during extreme weather conditions will be excluded. In addition, other interested persons can become a member of the "Urbanisten", to participate in food production, and take part in workshops outside the greenhouse and in the venues of the industrial heritage buildings close-by.

Finally, an experimental aquaponics system, using fish (vertebrates) is considered as animal experiment although no experiments on the fish themselves would be carried out. Employing an animal welfare officer is not feasible for the implementing partners. Therefore, a system with a multitrophic feeding stage with python plankton and zooplankton (invertebrates) will be implemented in a first stage. This will allow for testing a more sustainable system which produces fish fodder on the first trophic stages which otherwise would be imported. Also, as energy optimization requires sensors on the system, it will be possible to record data on good living conditions for fish and the next trophic stage including fish can be added later.

#### **FRC Turin**

#### Institutional (administrative and legislative) and financial barriers

In the city of Turin (also mentioned in the Zagreb interviews), there is definite interest in the potential profitability and long-term implementation of aquaponics systems, while the existing knowledge of proGIreg partners on hydroponics and community agriculture can be beneficial. However, there are concerns that after spending the initial proGIreg financing and staff time it would be difficult to scale up the systems into permanent or longer-term solutions and to move from a pilot project stage to an ongoing NBS for the city of Turin,.

#### **FRC Zagreb**

#### Institutional (administrative and legislative) barriers

In the city of Zagreb, coordination with the company that was initially authorised to plant and implement the aquaponics system has turned out difficult and eventually also led to replacing the company with another partner. Following internal discussions, the



city and the proGlreg partners decided to integrate NBS 4 and NBS 5 in a stand-alone system with two equal units (ship containers) measuring 25-50m2, with an example of green walls and roofs as well as solar panels, i.e. a complete and integrated solution. The aquaponics system is planned to be located in one of the two containers and the plant growth system in the other, incl. a microclimate automation and control system and irrigation system. The implemented mini urban farm will be a green technology center in the Sljeme factory area, with both commercial and educational functions. Following delays, the mini farm solution was deemed as the most appropriate for the Sesvete Living Lab, while the partners managed to overcome barriers that can be summarized under failing coordination between partners and failure to address synergies and conflicts between economic, environmental, and societal interests.

#### **Cross-city**

Institutional (administrative and legislative) barriers

• Even if funding is secured, the implementation of aquaponics has to follow rather complicated regulations. In Germany, for example, using fish (vertebrates) in the acquaponics makes the testing of the system an animal experiment - although no experiments on the fish themselves would be carried out. The fish had therefore to be replaced by shrimps.

In Zagreb and Turin, the specific legislation on aquaponics has been quite slow to develop, while the implementation and operation of aquaponics is generally scattered and involves very small units. Therefore, a combination of lacking permission legislation and the relatively low number of applications makes aquaponics difficult to upscale, even if they are in line with the most important principles of the circular economy.

#### Social and cultural barriers

Finally, for all three cities, one of the most important non-technological barriers when it comes to NBS 4 would be the lack of capacity (in the sense of awareness, knowledge amd skills) to educate farmers and consumers with the goal to create, even a small, market for locally produced food through aquaponics systems.



## 7. NBS 5: Capillary GI on walls and roofs

#### 7.1. Introduction

Green roofs and vertical gardens improve a building's insulation, reduce storm water run-off, capture CO2, filter pollutants, and increase biodiversity. This all leads to reduced energy consumption and increased urban resilience. Available technology is advanced but the challenge is to increase uptake by integrating it into local urban policies. Four cities are planning and implementing NBS 5: Capillary GI on walls and roofs and these are the FRC Turin and Zagreb and the FC Cluj-Napoca and Zenica.

#### **FRC Turin**

In Turin, the proGIreg team have decided to install vertical gardens on in-door and outdoor walls. Therefore, green roofs and walls will be fitted to public buildings, including the Casa nel Parco community centre, some social housing units, public schools and other buildings – which are all chosen with the help of local citizens.

#### **FRC Zagreb**

In Zagreb, green roofs and walls will be created on public buildings, making them more pleasant and energy efficient. The former Sljeme meat-processing factory will be fully revamped into a business innovation centre with a 700m<sup>2</sup> green roof (150m<sup>2</sup> of solar panels) and 300m<sup>2</sup> of green walls in the future ((after the end of the proGlreg project). There is also potential to replicate this on other factory buildings on the same site. For now, and for proGlreg purposes, the city will implement the mini farm that was described in the previous chapter (NBS4) and which will include both an aquaponics system and green roofs and walls.

#### FC Zenica

The city of Zenica has plans to implement green walls and roofs aiming to provide shelter, insulation and help with air quality issues.

#### FC Cluj-Napoca

Finally, in Cluj-Napoca, the intention is to install green roofs and walls on public buildings in the city, making them more pleasant and energy efficient.





Photo 4: Sljeme Main Building - Source: City of Zagreb

#### 7.2. Non-technological barriers to NBS5

In general, the implementation of this NBS does not face very important non-technological barriers, at least at the stage of implementation when the interviews took place. Despite this, a variety of non-technological barriers have arisen due to the recent COVID-19 pandemic crisis in all proGIreg cities, from lacking authorisation mechanisms to access buildings and roofs where capillary GI would be implemented in Turin and Cluj-Napoca to a general prioritization of COVID-19 contingency measures over any other municipal activity in Zagreb, Turin and Zenica.

#### **FRC Zagreb**

Institutional (administrative, legislative and governance) and financial and market barriers

Heavy bureaucracy is the most important barrier for the implementation of capillary GI in roofs and walls in the Croatian capital. In addition, many public institutions and private companies had to limit their operations in order to comply with COVID-19 prevention measures.



#### **FRC Turin**

## Institutional (administrative, legislative and governance) and financial and market barriers

In Turin, there have been many efforts to combine NBS5 with NBS8 and enhance the biodiversity of green walls and roofs with new species that would attract pollinators. This effort has been challenging because of the continuous lockdown in Turin, as beekeepers also had to adapt their work and schedules to comply with COVID-19 restrictions. This combination of NBS has been the reason for another delay in implementation in a very extraordinary situation (pandemic), but also represents a general barrier for all NBS, not only for green roofs and walls.

#### FC Zenica

Institutional (administrative, legislative and governance) and financial and market barriers

In the city of Zenica, while capillary GI would aesthetically improve public space and rigid building forms, the materials required for their installation cannot be easily found on the market. In addition, it was apparent in the interviews that the city has a significant lack of market experience related to this NBS, including techniques for installation, but also irrigation, maintenance and monitoring of green roofs and walls.

In addition, in Zenica is limited public awareness regarding the benefits of green roofs and walls, while the high installation and maintenance costs make this a costly solution, which would require additional, external funding. Furthermore, the existing legislation is quite complicated when it comes to private ownership, which means that the city could potentially implement capillary GI only on public buildings or social housing.

#### FC Cluj-Napoca

#### Social and cultural barriers

For the city of Cluj-Napoca, the main barrier that came up in the interviews was linked to citizen engagement and awareness. There is a general underestimation of the environmental benefits of capillary GI in roofs and walls by the general public, while citizens are also not effectively included in local decision making. There are open consultation processes that are not well attended, while GI is not high in the agenda of these consultations.

#### Financial and market barriers



The biggest barrier, in any case and for all cities, appear to be the high costs of installation and maintenance, since they are also beyond the control of the owner in some cases.

## 8. NBS 6: Making post-industrial sites and renatured river corridors accessible for local residents

#### 8.1. Introduction to NBS6

Needed for transporting goods, rivers were a common feature of early industrialization. Nowadays, in post-industrial cities, they are often left derelict and inaccessible for locals. While other existing projects are involved in renaturing the rivers and green corridors of the Living Labs, the focus of proGIreg is to improve the accessibility to these green corridors so that the cities become more liveable and locals can connect more to nature. Seven cities are planning and implementing for NBS 6: Making post-industrial sites and renatured river corridors accessible for local residents and these are the FRC Dortmund, Turin and Zagreb and the FC Cascais, Zenica, Piraeus and Cluj-Napoca.

#### FRC Dortmund

Dortmund will connect the district Huckarde with the renatured Emscher River, which flows through the Living Lab area.

#### **FRC Zagreb**

In Zagreb, green corridors will connect the Living Lab to the Sava River and the forest ecosystem in the North of Sesvete with the river that lies in the Southern part of the district. A cycling path by the Vuger Stream will also connect the urban gardens to the neighbourhood of Novi Jelkovec (approx. 11,000 inhabitants). This cycling path has also been deemed as very important, during the COVID-19 pandemic, as there is no path now to connect the two neighborhoods.

#### **FRC Turin**



A new green cycling path along the river Sangone will connect to the Turin metropolitan cycling network. Access to the 'Sangone beach' and improved vegetation and pollinator biodiversity is also planned.

#### FC Zenica

Zenica intends to improve the quality of life for locals by creating new cycle and walking paths along rivers, previously used and degraded by industry.

#### **FC Cascais**

Cascais plans to improve the accessibility to green river corridors and create recreational areas for local citizens to enjoy.

#### **FC Piraeus**

The city of Piraeus intends to bring more nature to its densely populated streets by introducing a network of green corridors. Additionally, there are plans in place to introduce more green elements to the waterfront of the port of Pireaus.

#### FC Cluj-Napoca

Finally, Cluj-Napoca, through an open design competition, will improve accessibility to the Someş River and green inter-connections between neighbourhoods, which also serve as cycle paths. These paths will provide health alternatives in the city's urban mobility system that has been quite dominated by the use of private car.





Photo 5: View from Pireaus City Hall - Source: Vasileios Latinos

#### 8.2. Non-technological barriers to NBS6

#### FRC Zagreb

Institutional (administrative, legislative and governance) barriers

The city of Zagreb faces land ownership issues. For a green corridor, for example, it is always necessary to check land uses and consider private and commercial conflicts.

#### **FC Piraeus**

Institutional (administrative, legislative and governance) barriers



In Piraeus, knowledge and information on the implications of integrating NBS into traditional planning processes, such as the redevelopment and regeneration of streets and their transformation into green corridors, is scattered and hard to access – there is a general lack of concrete data for GI, while it is difficult to understand and digest evidence.

The city of Piraeus is one of the most populous and dense cities in Greece, while, in many cases, fights with its conservative history and lack of awareness among both citizens and municipal staff on the potential business opportunities offered by NBS.

This is combined with a lack of technical expertise among municipal departments. This was the reason why the city aims at planning and implementing NBS6 and NBS8, which are considered easier to implement in the Greek context. In order to install more complicated NBS, such as aquaponics, the city would need to sub-contract this process to an external, private company.

#### **FC Cascais**

Institutional (administrative, legislative and governance) barriers

In Cascais, missing frameworks are a very important barrier. There are no established ways on how to approach topics such as biodiversity enhancement and green quays and corridors.

#### **FC Piraeus**

#### Social and cultural barriers

The lack of social acceptance about the necessity of NBS is a key barrier for the city of Piraeus. Both citizens and city councillors do not understand the NBS co-benefits, while there are limited interests in NBS functions such as recreation and 'fun' activities. In one of the interviews, it was stated that if a particular NBS would bring some revenue to the city, it would be much more accepted by the local government and the relevant stakeholders.

#### FC Zenica

#### Institutional (administrative, legislative and governance) barriers

In the city of Zenica, construction works that are going on along existing or new green corridors often lead to removing trees to avoid redirection of routes; the city aims at



protecting these tree lines, but also soil quality, through specific agreements with the contractors in the future.

#### Social and cultural barriers

The citizens of Zenica show very little awareness of the importance of greenery until now, while the main issue for biodiverse green corridors is that the market of certain species is quite limited.

#### **Cross-city**

#### Institutional (administrative, legislative and governance) barriers

Most of the times there are issues like failure to address synergies and conflicts between various economic, environmental, and societal interests – this is the case in both Piraeus and Cluj-Napoca. In both cities, there is also a general distrust in publicly announced costs and benefits.

In both Piraeus and Cascais the governance and management of green spaces is often the competence of different departments, i.e. a specific department may deal with maintenance and another one with the r planning processes.

#### Financial and market barriers

In Piraeus, Cascais and Cluj-Napoca there are concerns regarding the costs for the maintenance of green corridors, while in Dortmund and Turin, the interviewees mentioned that the public is afraid of potential rises in housing prices and of gentrification.

Concerns were raised in general with regard to ongoing budget constraints or budget cuts due to the COVID-19 pandemic situation as significant amounts have been redirected towards recovery and preparedness measures.

#### Social and cultural barriers

Vandalism was mentioned among the most important non-technological barriers in many cities, i.e. in Dortmund, Turin, Piraeus and Cluj-Napoca.



## 9. NBS 7: Establishing protocols and procedures for environmental compensation at local level

#### 9.1. Introduction

For all NBS implemented within the proGlreg project, measures to compensate the environment are available. However, embedding them into mainstream policies and urban planning procedures requires more effort, namely an evidence-base for NBS and t financing, for example via climate change adaptation funds, taxes or public-private partnerships. Three FRC, namely Turin, Zagreb and Ningbo are implementing NBS 7: Establishing protocols and procedures for environmental compensation at local level.

#### **FRC Turin**

The city of Turin will create a financial instrument to support the scaling-up of NBS; this instrument will include a catalogue of environmental actions that companies can implement as part of their corporate social responsibility.

#### **FRC Zagreb**

The city of Zagreb will monitor and evaluate the environmental and social benefits of the proGIreg NBS implemented and, if successful, integrate NBS into planning procedures and policy development at local level.



#### **FRC Ningbo**

Finally, the city of Ningbo is collecting meteorological, hydrological, chemical and ecological data to develop quantitative protocols and procedures for environmental compensation.



Photo 6: Planning boxes - Source: Pixabay

#### 9.2. Non-technological barriers to NBS7

Nature-based solutions have proven to be effective to reduce pollution levels. Gathering data on a local level allows to assess and adapt solutions and develop suggestions for replication on other sites. Local environmental compensation also allows for quick action, and the quantified results can help guide implementation and policy making on a wider scale. While this NBS has been deemed as very important by the proGlreg cities, it has been quite hard to implement and get effective outcomes and results. **FRC Turin** 

#### Institutional (administrative and governance) barriers

In Turin, there are always conflicts between municipal departments; the same goes for municipal staff or stakeholders that would favour towards grey solutions as they can be less costly and would not consider environmental compensation as important. Most of the times, however, new processes or innovative solutions interfere with previously



developed ways of planning and acting; there is sometimes hesitance towards innovation at city level. Moreover, sustainability processes tend to become more and more complicated for cities like Turin with proven practices on sustainability and biodiversity enhancement, as they have to meet with environmental, ethical, ecological standards, to combine solutions for built infrastructure with nature etc.

#### **FRC Zagreb**

#### Institutional (legislative and governance) barriers

The main challenge of the city of Zagreb is that new concepts such as GI and NBS are continuously viewed from the perspective of existing practices, norms and standards, which are created to support local policies that are already in place. To move forward, these norms should be compared to current best practices, but the city has nither the necessary human resources nor the adequate funding to perform such a matchmaking exercise in the long-term. Therefore, existing, key policy instruments cumulatively act as barriers to adopting local environmental compensation practices. In addition, the current administration in Zagreb has promoted and supported a top-down approach and not so transparent system of information sharing; there are significant efforts to change this and promote transparency and openess in all processes and actions.

#### **FRC Ningbo**

#### Institutional (administrative, legislative governance) barriers

Heavy bureaucracy is the most important barrier for Ningbo, and makes it difficult for a department to systematically analyse a specific project step-by-step, from the initial idea, to planning, procurement, implementation, maintenance and monitoring. Other departments and entities would need to interfere, including legal departments and regulatory structures. In addition, environmental compensation patterns are set at state or national level; therefore, there is limited flexibility at local level.

#### **Cross-city**

#### Institutional (administrative, legislative governance) barriers

In Turin and Zagreb, the complicated regulatory measures and bureaucratic policy delay or put a stop to similar efforts at local level.

#### Financial and market barriers

One of the most important barriers in Zagreb and Turin is the lack of financial incentives and the lack of access to relevant EU funding that would support such processes. In most of the cases, the municipalities does not have the necessary human resources that would understand the financial and European landscape and would know how to



combine different solutions and different funding schemes that would enable local environmental compensation processes.

# 10. NBS 8: Pollinator biodiversity improvement activities and citizen science project

#### **10.1. Introduction**

Pollinator biodiversity complements and links all other greening actions of pro-Glreg since pollinators are essential to a healthy and functioning ecosystem. To make urban areas more pollinator-friendly, cities can reduce pesticide usage and increase the size of green spaces and plant species diversity. In addition, green networks and corridors help prevent in breeding of isolated populations, which can lead to species extinction. Monitoring the variety and amounts of bees and butterflies is a good way of assessing the pollinator-friendliness of a city. ProGlreg's citizen science approach involves joining with local citizens to create, monitor and promote awareness of the pollinator-friendly spaces. Four cities are implementing NBS 8: Pollinator biodiversity improvement activities and citizen science project and these are the FRC Turin , and Dortmund and the FC Cascais and Piraeus .

#### **FRC Turin**

The city of Turin takes a socially inclusive and bottom-up approach by working with doctors and patients of mental health centres to promote pollinator-friendly spaces across the Living Lab. The Farfalle in Tour project, a collaboration between the city, the university and the Mental Health Centre creates networks of pollinator-friendly plants and works with mental health patients who help monitor the increase in butter-flies and bees in the area. Using a so-called 'citizen science' model of increasing bio-diversity through the help of marginalised groups, pollinator-friendly biodiversity is being replicated throughout Mirafiori Sud. By creating pollinator-friendly gardens next to shelters, health facilities, refugee centres and community spaces, the network of green spots throughout the Living Lab is expanding, and being closely monitored by Turin's dedicated citizen scientists.

#### **FRC Dortmund**



Pollinator-friendly plants will be introduced to the open slopes of the former-landfill site Deusenberg in the city of Dortmund, but also in the neighbouring permaculture orchard (NBS 3). Local citizens in Dortmund will help monitoring numbers and species variety.

#### **FC Cascais**

By running workshops for schools and the local community, the city of Cascais is also planning to increase awareness of the importance of pollinators in the local ecosystem, encourage beekeeping and the reduction of pesticide-use.

#### **FC Piraeus**

During the process and inspired by the actions for NBS 8 implemented by FRC Turin, FC Piraeus proposed to modify their current plan and shift planning and implementation of NBS 3: Community based Urban farms and gardens to NBS 8: Pollinator Biodiversity. Therefore, following consultation with proGlreg partners, Piraeus will involve the local community in pollinator monitoring, protection and fostering throughout its green corridors.



Photo 7: Pollinator biodiversity - Source: Sabina Leopa

#### 10.2. Non-technological barriers to NBS8

#### **FRC Dortmund**



#### Institutional (administrative and governance) barriers

The city of Dortmund appears very open to moving ahead with the implementation of NBS8, as beekeeping and butterfly breeding requires minimal investment, can produce diverse products and are not in conflict with land ownership rights. There is also flexibility in implementation throughout the Dortmund Living Lab sites. The only (and still minor) barrier would be to coordinate with local citizens/producers in the permaculture orchard of the Deusenberg to provide the necessary data and monitor numbers and varieties.

#### FC Pireaus

#### Institutional (administrative and governance) barriers

In Piraeus, one of the most important barriers is the lack of communication among departments that are used to work in silos. In addition, the current administration is somewhat influenced by staff to include green infrastructure and urban greening strategies into their overall agenda, but this does not mean that future governance structures will take on these specific agenda items.

#### Financial and market barriers

For Piraeus, and most Greek cities the most important barrier remains the lack of financial incentives and the inability to make use of own municipal funds for breakthrough projects and activities. There is budget available through loans and grants, but this is linked to specific topics, sectors and following a specific application process. Following the financial crisis, the city has limited national and own funding; constraining their liberty and flexibility to implement new projects easily. They need to combine sources of funding, potentially start with a pilot project or application and after significant effort to collect funding to move towards a more permanent solution. This process is lengthy and most of the times goes beyond a regular term of an administration.

#### Social and cultural barriers

Low awareness among citizens and municipal staff. Without increased awareness, increased communication and integrated

#### **FRC Turin**

#### Social and cultural barriers

Pollinator biodiversity is becoming very popular due to a local cooperative taking over and scaling-up relevant activities. The social cooperative 'II Margine' trains people with mental disabilities to become experts in breeding caterpillars and in identifying the



most suitable plants for attracting butterflies; they are also engaged in training other vulnerable groups, in particular single mothers who have been evicted from their homes. If there is no external organisation or cooperative to cooperate with the city and take ownership of the process, these projects tend to stay at pilot stage.

#### FC Cascais

#### Social and cultural barriers

The city of Cascais considers as most important barrier the lack of communication between stakeholders and the lack of a targeted campaign that will emphasize the importance supporting pollinators and the multiple co-benefits that can be brought to the city. A campaign would increase awareness between the citizens, would inherently empower them to conserve nature or enhance biodiversity in the urban farms and gardens, and would emphasize on the aims of NBS development.

#### **Cross-city**

#### Institutional (administrative and governance) barriers

A key barrier is governance: Introducing pollinator biodiversity activities through citizen science projects is lacking holistic thinking and planning. Another challenge is the lack of clear objectives and an overall vision on biodiversity and pollinators in most cities, which would be needed in order to create a targetd plan for associated actions. Pollinator biodiversity is therefore not streamlined or included in planning policies and frameworks, while updates to relevant strategies and plans tend to take long.

### **11. Conclusions and recommendations**

The most important barriers identified through the review and analysis of all conducted interviews fall within the previously identified groups. The following table summarizes key barriers for each NBS, while presenting a ranking of their importance for NBS implementation and upscaling.

NBS 1	Description of barrier	Ranking
Institutional (administrative	Extensive bureacracy in most municipal pro- cesses	Major
and governance) barriers	Mixed land ownership patterns	Medium



Social and cultural barriers	Lack of social acceptance and citizen en- gagement in NBS	Major
	Limited interest for NBS among general pub- lic	Medium
	Lack of technical expertise for NBS	Medium
	Lack of access to appropriate funding	Major
Financial and market barriers	Limited resources vs. long-term planning	Major

 Table 2. Most important non-technological barriers for NBS1

NBS 2	Description of barrier	Ranking
Institutional (administrative	Lack of previous experience with aquaponics systems	Medium
and governance) barriers	Delays in coordinating with technical partners	Minor
Social and cultural barriers	Lack of social acceptance and citizen en- gagement in NBS	Major
	Lack of understanding of multiple NBS co- benefits	Minor
Financial and market barriers	Increased costs of large-scale NBS projects	Medium

 Table 3. Most important non-technological barriers for NBS2

NBS 3	Description of barrier	Ranking
	Lengthy and time-consuming bureaucratic processes	Major



Institutional (administrative and governance) barriers	Lack of established procedures for social and technological innovation	Medium
Social and cultural barriers	Vandalism incidents	Major
	Lack of appropriate funding for NBS	Major
Financial and market barriers	Dependance of project implementation to vol- unteering action	Minor

NBS 4	Description of barrier	Ranking
Institutional (administrative	Lack of previous experience with aquaponics systems	Medium
and governance) barriers	Delays in coordinating with technical partners	Minor
Social and cultural barriers	Lack of social acceptance and citizen en- gagement in NBS	Major
	Lack of expertise and education on aquapon- ics	Medium
	Limited resources vs. long-term planning	Medium
Financial and market barriers	Lack of funding to scale up a project beyond pilot phase	Medium

Table 5.	Most im	portant r	non-techno	ological	barriers	for N	<b>IBS4</b>
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NBS 5	Description of barrier	Ranking
	Lengthy bureaucratic processes	Major
	Complicated existing legislation	Medium



Institutional (administrative and governance) barriers	Lack of existing collaboration agreements with technical partners	Minor
Social and cultural barriers	Ineffective inclusion of citizens to local deci- sion-making processes	Major
	Lack of social acceptance and citizen en- gagement in NBS	Major
	Increased costs for installation and mainte- nance	Major
Financial and market barriers	Difficulties to create a market for NBS5	Minor

Table 6.	Most im	portant non	-technologica	l barriers f	or NBS5
	most m	portant non	teennoiegieu		

NBS 6	Description of barrier	Ranking
	Mixed land ownership patterns	Major
Institutional (administrative and governance) barriers	Limited integration of NBS into traditional planning processes	Major
	Missing frameworks and lacking relevant leg- islation	Medium
Social and cultural barriers	Lack of social acceptance and citizen en- gagement in NBS	Major
	Lack of understanding of multiple NBS co- benefits	Medium
	Increased costs for installation and mainte- nance	Major
Financial and market barriers	Ongoing budget constraints and budget cuts linked to covid-19 pandemic	Medium

Table 7.	Most important	non-technological	barriers for NBS6
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NBS 7	Description of barrier	Ranking



Institutional (administrative	Lack of communication between municipal departments	Major
and governance) barriers	Difficulties to coordinate with local producers and citizens	Medium
Social and cultural barriers	Lack of social acceptance and citizen en- gagement in NBS	Major
	Lack of NBS mainstreaming into traditional plans and practices	Major
	Lack of communication between municipal departments	Major
Financial and market barriers	Difficulties to coordinate with local producers and citizens	Medium

 Table 8. Most important non-technological barriers for NBS7

NBS 8	Description of barrier	Ranking
Institutional (administrative	Lack of communication between municipal departments	Major
and governance) barriers	Difficulties to coordinate with local producers and citizens	Medium
Social and cultural barriers	Lack of social acceptance and citizen en- gagement in NBS	Major
	Lack of NBS mainstreaming into traditional plans and practices	Major
	Lack of financial incentives for NBS 8	Major
Financial and market barriers	Increased costs for installation and mainte- nance	Major
	Limited national and municipal funding to in- vest in own pilot projects	Medium

Table 9.	Most in	mportant	non-techno	ological	barriers	for NBS8
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#### Need for NBS mainstreaming into traditional planning practices

The interviews with FRC and FC show that there is a critical need to increase the priority of environmental issues in city agendas and actions plans. In addition, cities need guidance for the inclusion of NBS within spatial and environmental planning, in sustainability or strategic action plans. There is a real need to clarify the purpose of NBSs, but also communicating the main co-benefits for other processes. Cities are asked to invest in new concepts for NBS, therefore a clear concept and guidance is needed.

#### Overcoming social and cultural barriers through co-creating NBS

Participation is crucial for NBS implementation; the most successful processes are encountered in cities with increased citizen participation and bottom-up established action, such as in Cascais, Turin, but also in the Sesvete district in Zagreb, where the local partner and NGO ZIPS has previous experience in such practices. Through participation, the citizens create a feeling of co-ownership and engage further in implementation, maintenance and monitoring activities; for this reason, regular meetings with local partners and stakeholders are needed early in the process, combined with openness to change as a result of obstacles and difficulties encountered. In addition, flexibility is needed to recognize and adapt to changing circumstances and improve performance when intermediate solutions are found.

The potential positive interactions of environmental, economic and social systems lie at the heart of NBS and have to be kept in mind at all stages of co-creation, implementation, evaluation and upscaling of the interventions. ProGIreg can draw on the experiences of past and ongoing projects in the field of NBS and green regeneration of cities in general. In co-designing, implementing and evaluating ProGIreg FRC and FC will add to the knowledge base on NBS that is created in Europe at the moment. This will further help to mainstream the concept of NBS within city governments which is essential to transform NBS beyond single interventions into citywide planning processes.

There is a general uncertainty related to the COVID-19 pandemic situation in most cities, especially in Dortmund, Piraeus and Turin. The cities fear that the current crisis will have long-term effects, even larger than the ones resulting from the 2009 financial crisis.

Sometimes a crisis helps start thinking about ways and means to plan, prepare and organise the city. For example, five years ago, no one was talking about flooding events in FC Piraeus. During the last years, however, the city has experienced severe flash flooding events and is now working on flood preventing mechanisms. The same could be the case for introducing and mainstreaming NBS into strategic and operational planning processes.



#### Increasing funding for uptake of NBS

Financial barriers may be overcome by opening extensive funding programmes at European, national and local level, meaning that the cities should also mobilise local resources. Most cities lack financial incentives, additional to EU funding, which usually runs for three to five years. Municipalities need to develop the necessary know-how on NBS, but also need to learn to combine different solutions and funding schemes to scale up green infrastructure projects in the future and move away from short-lived pilot projects. The proGIreg cities also need to potentially handle mixed financial interests from those that would invest in such projects, after the EU funding runs out. Until now, there is only limited interest from private investors for NBS.

What is needed in order to mainstream NBS implementation and funding specifically is:

- A better understanding of the multiple benefits of NBS including their economic value; a specific NBS can serve several policy objectives simultaneously which makes them often economically rather attractive.
- More/better cost-benefits analyses, also in comparison to grey solutions, to support better decision-making;
- A higher prioritisation of NBS when it comes to the allocation of existing budgets;
- Increased stakeholder engagement also with the aim of sharing the costs of investment and maintenance.

Finally, difficulties are encountered when it comes to transforming knowledge, practices and technologies into easy to replicate solutions.

## 12. References

Ershad Sarabi, S.; Han, Q.; L. Romme, A.G.; de Vries, B.; Wendling, L. Key Enablers of and Barriers to the Uptake and Implementation of Nature-Based Solutions in Urban Settings: A Review. *Resources* 2019, *8*, 121. https://doi.org/10.3390/resources8030121