DEVELOPMENT POLICY FOUNDATION

ERONGO SUSTAINABLE GOVERNANCE LAB:

Participatory urban governance for resilient, safe and inclusive multifunctional public spaces in Namibia

Co-funded by the European Union

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WALVIS BAY
YOUR OASIS OF OPPORTUNITIES

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Erongo Sustainable Governance LAB:

PARTICIPATORY URBAN GOVERNANCE FOR RESILIENT, SAFE AND INCLUSIVE MULTIFUNCTIONAL PUBLIC SPACES IN NAMIBIA

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INTRODUCTION

This manual was prepared as educational material for Namibian civil servants under the project Erongo Sustainable Governance Lab: Participatory urban governance for resilient, safe and inclusive multifunctional public spaces in Namibia, founded by the European Union. The project is implemented as a part of partnership between the municipality of Czerwonak in Poland and municipality of Walvis Bay in Namibia. LAs are democratically elected and wield power to design policies in municipal services, community engagement, initiatives and empowerment.

LAs in both countries, Poland and Namibia are autonomous bodies responsible for providing a wide range of economic and community development. LAs, inter alia, are responsible for local development, public space design waste, spatial planning, market management, environment and tourism.

The purpose of the manual aimed at closing the knowledge gaps and introducing the best EU experiences, in public consultations and green urban solutions. The manual includes detailed, step-by-step descriptions of the provision of exemplary municipal services and case studies for innovations implementation regarding smart public spaces, accessible designs, climate change adaptation solutions on increasing water resources, etc.

All prepared materials come with the purpose of ensuring the full comprehensiveness of the decision-making schemes and to provide the vision of possibilities to deal with issues related to the impacts of climate change on the environment and surrounding life.

With EU support in the EuropeAid grant program, Development Policy Foundation aims to adopt a capacity-building program to establish long-term peer-to-peer partnerships between LAs EU and Namibia cities through a capacity-building program to establish, promote sustainable urban management practices in line with the challenges of AGENDA 2030 & COVID-19 for urban development.

The green urban agenda on improving the resilience of Namibian towns will also be promoted through the project to raise climate awareness among communities and stakeholders.

The project strengthens urban governance in Walvis Bay and towns throughout the Erongo region, increases the inclusive development of society in Namibian towns, and engages disadvantaged groups to participate in conflicts. meaningful dialogue, making their needs real, contributing to improving the community space.

In addition, the project will improve the transparency and inclusiveness of decision-making in Walvis Bay, the quality of LA services further, and its operational efficiency throughout the Erongo Region of Central Namibia.

Development Policy Organization is the main provider of expert know-how, supporting project management and its implementation.

To ensure that information is better accessible to readers, the Manual was divided into four manual parts.

Manual 1 is to better explain the definitions of Universal Design, and the principles when establishing universal design. At the same time, it also links practical examples that have been successful in applying universal design to public spaces. The best applications section is also divided into two parts, the most practical examples of applying universal design in cities around Europe, noticeably are designs connected to marine landforms.

Manual 2 describes procurements in public and government level, tendering, transparency and especially schemes of decision-making processes in Europe which connected with the participations from many subjects, including the citizens. This part, in addition to the definitions, also incorporates practical examples to help readers better visualize the above procedures that have been successfully applied in Europe, examples also come with results, empowerment values after implementation.

Manual 3 is a section about typical lessons in the application of sustainable public green spaces to specifically deal with the heat and dryness caused by climate change in Europe. This section is clear about the green designs and ways that European cities have used to reduce climate change and better adapt to climate change to help make it green and sustainable. stable in public space.

Manual 4 especially highlights best case studies around the world about the application of smart and creative innovations in water retention from the atmosphere for the use in agriculture, domestic water, etc. to provide a new alternative water collection method to avoid over-exploitation, prolong and protect natural domestic water sources.

Source:https://www.archdaily.com/961712/a-theme-park-inspired-urban-design-in-italy-and-a-floating-neighbourhood-in-iran-10-unbuilt-projects-submitted-to-archdaily?ad_medium=gallery

MANUAL 1:
BEST PRACTICES I
THE IMPLEMENTATION OF UNIVERSAL DESIGNS ON URBAN PUBLIC SPACES IN EUROPE

The demand for high quality in public spaces is increasing day by day. The universal design applications are being widely spread in public spaces in many cities to improve the quality of urban public spaces, making the city more accessible and equitable for all subjects. Following are detailed information regarding definitions and applied examples of universal design in the public spaces of cities in Poland, Europe, with the aim of helping the reader to broaden the perspectives on solutions and benefits of upgrading public spaces in the local area.

1. UNIVERSAL DESIGN: THE DEFINITION AND THE 7 PRINCIPLES OF UNIVERSAL DESIGN

1.1 THE UNIVERSAL DESIGN (UD)'S DEFINITION

The universal designs are modern designs which have a wide capacity in accessibility. They are known as Barrier-free designs, easy to adjust and they are working as a connect portal to link the users with the public spaces.

Ronald Mace, father of Universal Design, emphasized the idea of of making environmental design universal to make many lives simpler as it pays attention to the needs of users.

The standard of UD is that it focuses on accessibility, it doesn't specifically care about one subject1, instead the universal architecture gears towards high accessibility for all users, especially including elderly, people with disabilities, children, women, in some designs, well-covered for animals.

1.2 THE 7 PRINCIPLES OF UNIVERSAL DESIGN

The 7 principles of Universal Design were developed in 1997 ith the purpose to guide the design of environments, products and communications. The Principles may be applied to evaluate existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environments.

PRINCIPLES AS FOLLOWS;

PRINCIPLE 1: EQUITABLE USE
E.g : A park with different types of access, pathways for all, including people with disabilities

PRINCIPLE 2: FLEXIBILITY IN USE
E.g: A museum that allows visitors to choose either read or listen to the description of the content. The technology has been placed at seated eye levels, helpful for children shorter individuals and people in wheelchairs

PRINCIPLE 3: SIMPLE AND INTUITIVE USE
E.g: Ticket self-counters with a simple format, clear and simple buttons displaying multiple languages, suitable for a wide range of users.

PRINCIPLE 4: PERCEPTIBLE INFORMATION
E.g: Signage or public electronic advertising with integrated audio, captions, or mute signals

PRINCIPLE 5: TOLERANCE FOR ERROR
E.g: Visual or auditory cues that provide guidance when the user makes an inappropriate selection

PRINCIPLE 6: LOW PHYSICAL EFFORT
E.g: Doors that open automatically for people with a wide variety of physical characteristics

PRINCIPLE 7: SIZE AND SPACE FOR APPROACH AND USE2
E.g: The aisles are wide, open, and unobstructed, especially for people with disabilities and communication challenges.

2. THE BEST PRACTICES FOR APPLYING THE UNIVERSAL DESIGN FOR PUBLIC SPACES IN EUROPE

2.1 ACCESSIBLE HISTORICAL PLACES

Most of the Old Towns or the ancient ruins are often old and inaccessible designs. Moreover, these are places that are preserved by the historical nature of architecture and time, so it is not easy to change the architecture without destroying its historicity.

Warsaw (Poland)

Nowadays, historical sites are where a large number of tourists come and go, so creating a historical space that both preserves the historical essence and traces of time and combines with innovation that adapts to people's present needs is very challenging work. However, now the old town of Warsaw has ensured that history and accessibility can co-exist in harmony, and this is also one of the reasons that Warsaw has won the title Accessible City Award in 2020, which was organized by the European Commission together with the European Disability Forum.

Warsaw Royal Castle Square Source: A. Ring

An open square lined with flat brick and stone opens up a large public space that is not limited by architectural barriers for everyone to use, especially people with disabilities and people moving with strollers.

This design eliminates barriers and risks of collisions when moving caused by the old concave stone surface designs, helping users move with peace of mind, and be more comfortable in spending time in public spaces.

Warsaw Royal Castle Square is open and airy, without any architectural barriers, not affecting the surrounding historical images, but also increasing the convenience when accessing historical buildings.

Chester (England)

Due to the cobbled terrain, aging population, and long historical heritage, Chester added tactile paving, additional handrails and colors contrastingly to enhance the accessibility of this historic town. These features not only affect the historic architecture of the city but also make it easier to navigate, especially for those who are difficult with visibility, these changes have highlighted the city's commitment to equal access.

Colorful contrasting in Chester old barbican
Source: Accessible Europe: Cities pioneering transport for people with reduced mobility | Eltis

2.2 THE TACTILE PAVEMENTS

Compared to the normal pedestrian surface, Warsaw has been replaced with a brick containing a tactile pedestrian surface indicator which has a slightly rough part of the tile so that people with challenges in vision and hearing can be well alert when cross walking. This design also implements well with other subjects like children, they can also sense this warning before heading to the zebra crossing, to avoid the case of moving too fast without paying attention to the coming danger.

Not only do the tactile bricks warn people to cross the street, but also on most streets of Warsaw, the tactile bricks are also conceived as a guide wire in linking the pedestrian lanes to intersections, from small to large lanes, so that people with limited vision have guidance in a safer, separate path.

Tactile Pavement
Source: hhttps://discapacidadvisual.es/noticias/pavimento-podotactil-accesibilidad-en-la-via/999/

2.3 CURB CUT

This is a typical example of a simple feature that greatly increases the usability without considerably increasing its cost.

This accessible curb cut design was created to support the mobility of pedestrians, specially assist those who move with wheelchairs, baby strollers, others strollers or even individuals traveling by e-scooters, bicycles, can also apply this feature, reducing the difficulty in moving and increase the safety when exposed to the point of contact between 2 lanes.

2.4 OTHER ELEGANT SMALL-SCALE DESIGNS IN THE POLAND URBAN PUBLIC SPACES

2.4.1 PARKOWER

The image of cycling has exponentially increased in Poland and whole Europe, thus, to support this ecological transport, in 2018, the engineering team of Studio zKompott (Warsaw) created a two-in-one utility, by taking advantage of the pillars on the Warsaw sidewalk, and drilling an additional central hole in the pillars to use as a bicycle rack. This is an interesting and cost-effective design without taking up too much space in urban areas.

Example of bicycle parking
Source:https://www.aucklanddesignmanual.co.nz/sites-and-buildings/mixed-use/guidance/accommodatingcars/bicycleparking

2.5 ACCESSIBLE OUTDOOR FITNESS PARK

Through the Participatory Budgeting consulting tools, many accessible outdoor gyms and children playgrounds have been established in Poland. The outdoor fitness provides the integration between new and old residents of the neighborhood and helps people to stay fit. Thus, this is considered one of the designs that bring good health benefits and has flexibility.

This design integrates the application with tools for different types of exercise with different audiences from young to old, to meet the aspirations of members of a basic family. Exercise equipment is selected with a minimalist design, compact, safe and easy to use for everyone. The gym is located in a place surrounded by trees, shade, airy space, easy to access, making the atmosphere of practice become more comfortable, making exercise more favorable.

2.6 A ROOM FOR THE SUMMER (POKÓJ NA LATO BY H2 ARCHITEKCI)

Pokój na Lato (A Room for the Summer) is a summer pavilion created by H2 Architekci. The architecture of this space, in addition to the light wooden furniture, also combines green lawns and gardens. This architecture opens up a green space that is not only accessible and safe but also has the function of contributing to protecting the ecosystem. The green grass will act as a natural cooler, water moves through the plants and evaporates from the small holes in the leaves, cooling the surrounding air. This also contributes to the release of heat to the atmosphere as more soil is present, the better heat is released from the soil compared to asphalt or concrete pavements. Therefore, it helps increase the ability to withstand the impacts of climate change. This green public space design helps to connect people and animals with more public spaces.

Outdoor gym for disabled people on the Tatar Lagoon in Rawa Mazowiecka
Source:https://erawa.pl/silownia-dla-niepelnosprawnych-oficjalnie-otwarta-urzadzenia-stanely-nad-rawskim-zalewem-w-ramach-budzetu-obywatelskiego/

2.7 ACCESSIBLE RIVER EMBANKMENT PUBLIC SPACES

2.7.1 VISTULA (POLAND) BOULEVARDS

The space of Vistula Boulevards is designed with no barriers, flat paved roads and limited ridges so that in addition to pedestrians, cyclists and people with disabilities can move comfortably in wheelchairs without problems. The design of this space helps to increase the accessibility of public spaces, towards a friendly space for all. Moreover, the space of Vistula Boulevards also reduces the limitation of views of the riverside scenery, which can be observed by anyone sitting on the terrace. In addition, this modern terrace is combined with public furniture such as domes and public seats to provide a fully functional public space in many situations.

Importantly, most of the Boulevard is exposed to regular flooding, occurring every few years. This fact was a vital influence on the design; from the 'flowing layout' of elements following the course of the river's current, to a set of unique solutions for safeguarding the pavilions from flooding, to the selection of non-corrosive materials as well as the linear layout of tree planting, designed to allow water to flow freely. It was also necessary to consider the existing heritage structures, in particular the pre-war Starzyński Embankment. Moreover, one of the goals of the design team was to make the street furniture unique to this place.

Vistula Boulevards. Source: warsaw tour

Public benches across Vistula Embankment. Source: landezine

The entire furniture was designed specifically to be used here. This includes the lamps with sails, the mentioned fish sculptures and wooden elements for children, sitting areas styled to look like post-glacial rocks seemingly unearthed by the river's current. Such design solutions are to build an even greater sense of place for this public space.

2.7.2 HAMBURG (GERMANY) BOULEVARDS3

Hamburg's Niederhofen Flood Fence by Zaha Hadid Architects, was designed to redevelop Hamburg's Niederhafen flood barrier reconnecting the river promenade with the urban fabric surrounding the city, acting as it serves as a popular riverside walkway and creates links with neighboring areas.

It is located in a prominent location incorporating the city's famous riverside promenade. It is a major attraction for tourists and one of Hamburg's most important public spaces since it was designed to sit atop a flood barrier. The promenade also offers undisturbed views of the Elbe and the port.

The fence has a linear structure 8.60m above sea level in the eastern part and 8.90m above sea level in its western part to protect the city from storm surge due to dark winter storms. and extremely high tides.

Wide staircases resembling small amphitheaters are carved in flood barriers at the points where streets from neighboring neighborhoods meet the structure; giving passers-by at street views by stroll along the promenade atop the barrier, as well as views of the masts and superstructures of ships on the Elbe.

These stairs are oriented towards their intersecting city streets: Stubbenhuk, Neustädter Neuer Weg, Rambachstraße, Reimarusstraße and Ditmar-Koel-Straße. A new pedestrian crossing connects each street with a river promenade.

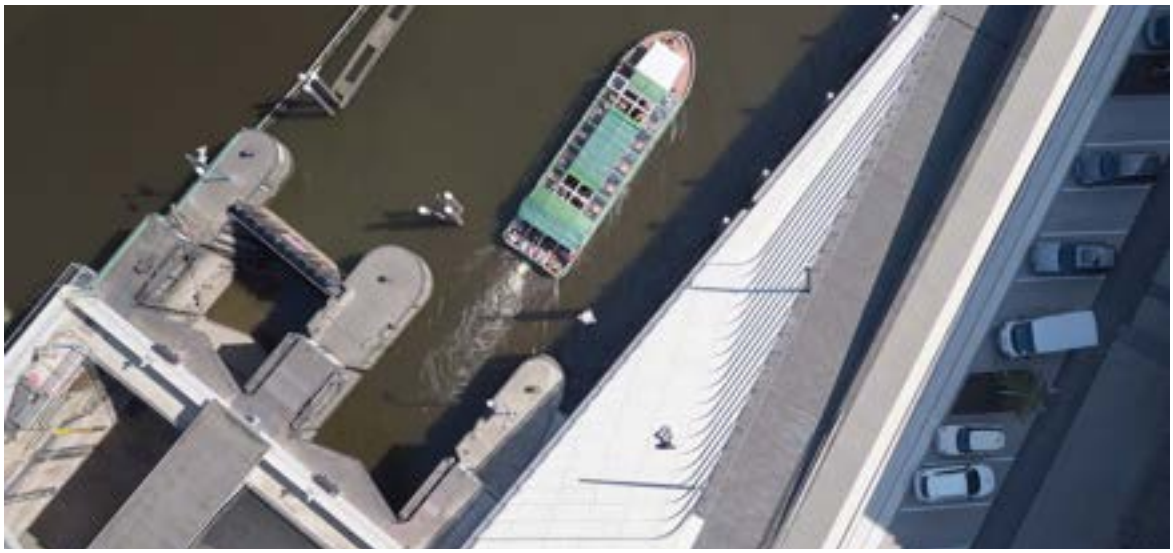
A minimum width of 10 meters ensures this popular riverside promenade offers ample public space for pedestrians, joggers, street performers, food stalls and cafes. Shops and public facilities are also provided in the structure at street level facing the city.

The pedestrian areas of the promenade are clad in dark anthracite granite that contrasts with the light gray granite of the stairs.
The river promenade is divided into two parts with different spatial qualities.

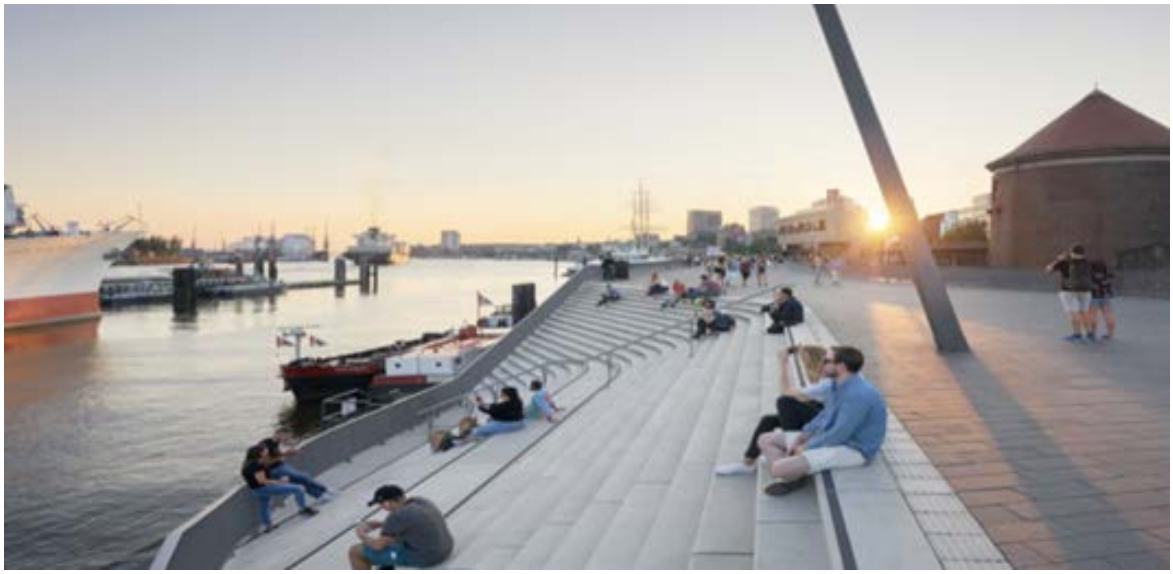
The western area is larger in size, providing a wide view downstream of all river transport. To the east, the harbor's marina creates a more intimate atmosphere with a long ramp along the amphitheater leading visitors down to the water's edge.

A dedicated bicycle lane at street level runs the length of the flood barrier. The wide ramps at Baumwell and Landungsbrücken

The comprehensive view of Hamburg embankment from above
Source: https://urbannext.net/niederhafen-promenade/



The comprehensive view of Hamburg embankment from above
Source: https://urbannext.net/niederhafen-promenade/



The public east wing of the Niederhafen Promenade
Source: https://urbannext.net/niederhafen-promenade/

The western area at the Niederhafen Promenade
Source: https://urbannext.net/niederhafen-promenade/

2.8 ACCESSIBLE PLAYGROUND

2.8.1 PLAYGROUND FOR CHILDREN WITH DISABILITIES, AUTISM IN FRANCE

Children with disabilities often have to watch people play instead of participating in outdoor playground activities, but in France, this situation has been changed by creating an accessible playground for children in wheelchairs, including children with autism. The playground is designed with a smooth, accessible floor for moving with wheelchairs.

The games in the yard are incorporated with wheelchair-accessible walkways to allow children with wheelchairs to still participate in the games. Play equipment meets the needs of children with all types of disabilities including motor, hearing, visual, cognitive, and intellectual.

Products include: wheelchair-adapted swings, multi-activity structures with ramps, wide platforms and ground-playing boards, acoustic and tactile play items, braille signage and sign language, wraparound spring-loaded play items, and trampoline. All products are installed on a highly themed surface with contrasting colors and prominent areas.

A sensory trail weaves through play spaces that feature different surface materials (artificial grass, cobblestones, balanced logs, brushed concrete, paving stones, etc.) leads children to new tactile experiences and creates more stimulation for children with visual impairments.

In addition, the playground was equipped with music, and braille boards for the autism has its own space, self-access and experience the games. This playground is not only for one but for every child, this is an inclusive playground.

2.8.2 THE SPATIAL ORIENTATION PARK IN CZERWONAK (POLAND)

The perception of the world around us in terms of universal design, i.e. a world without barriers, available to every user, has recently gained more and more importance and is spreading in public space. Such understanding of the surrounding world plays an increasingly important role in shaping the concept of functionality and accessibility of the built environment for all users and brings tangible benefits to all members of society. It contributes to the promotion of equal, and thus equitable for all, access to goods and services, while taking into account the needs of those users whose functioning may be limited in some aspects.

This concept was reflected in the provisions of generally applicable law through the adoption of the Act of 19 July 2019 on ensuring accessibility to people with special needs (i.e. Journal of Laws of 2020, item 1062, as amended) to ensure accessibility to people with special needs and the obligations of public entities in this regard. The very concept of Universal Design was based on the principle of equality to a much greater extent than the concept of general accessibility for people with disabilities.

Spatial solutions in accordance with the principle of universal design provide that the basic activities will in principle meet the needs of all users of a given area and will not require the use of specialized solutions. Universal design should therefore be understood as a common term for all activities related to shaping the environment. These include community planning, land use, as well as architecture, construction and manufacturing.

Thus, universal design contributes to promoting equal access for all to generally understood goods and services, taking into account the needs of those users whose functioning is in some aspect limited. The use of good universal design practices allows to create common principles. It is an attempt to reject the previously used model of the average person, according to which standards or design guidelines have been developed.

The model was not developed for such social groups as people with disabilities, children or the elderly. A great number of buildings was built at a time when people with disabilities needs were hardly taken into account. These buildings are actively being used by this group of people.

Therefore, not only will be an important task to design new generally available objects or spaces, but also to modernize those already existing. When analyzing the concept of universal design, one cannot ignore the difficulties concerning, for example, contradictory or rather different needs of particular groups of users of such space.

Such, the simplest example, may be curbs on the streets, which, on the one hand, make it much more difficult to move for people in wheelchairs, parents with prams, people with shopping carts or cyclists, and, on the other hand, they make it easier for the blind and visually impaired to distinguish the road from the pavement, which significantly improves the safety of this group of public space users.

SPATIAL ORIENTATION PARK

Analyzing in detail the needs of blind and partially sighted people, based on the example of the Czerwonak Commune, it can be indicated that the needs of this group have been present in the consciousness for many years. In the commune, the State Educational Institution for Blind Children was operating in the area of the post-Cistercian complex in Owińska since 1946, later transformed into a Special School and Education Center for Blind Children.

Special School and Educational Center for Blind Children in Owińska
Source: https://www.pion.pl/aktualnosci/park-orientacji-przestrzennej-w-owinskach-juz-otwarty/

In recent years, the first Spatial Orientation Park in Poland and Europe was opened at the Special Educational and Educational Center for Blind Children in Owińska. Its main purpose is enabling learning to move independently in an urban agglomeration, as well as simply having fun in a beautiful environment.

The Spatial Orientation Park is a unique model of space for the rehabilitation and revalidation of visually impaired people on a European scale. The complex consists of a park with an area of almost 3 hectares with a recreation area, which is a combination of a landscape park and a reconstructed baroque garden with a historic hornbeam alley. The architectural solutions, development of space and the devices installed in the Park help the blind and visually impaired in learning spatial orientation. Despite its basic educational function, the Park itself is available to all interested persons.

In the process of teaching and rehabilitation of the blind children, orientation and movement play a vital role. One of the most severe effect of blindness is a lack of independence in space orientation, i.e. the so-called lack of mobility. In case of young children, classes conducted in the Spatial Orientation park include, among others, sensory awareness, i.e. gaining knowledge about the world thanks to information provided by other senses, orientation in the body schema, i.e. awareness of individual parts of the body and the way they move, spatial concepts, i.e. awareness that objects exist even when they are not heard or cannot be felt and awareness of the position of objects in relation to each other, searching skills, safe, independent movement, the use of a seeing guide, protective techniques.

Owińska Spatial Orientation Park, examples of solutions for various surfaces, wooden surfaces of various shapes

Source: K.Gała 30/09/2022

Owińska Spatial Orientation Park, examples of solutions for various surfaces, wooden surfaces of various shapes

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Owińska Spatial Orientation Park, examples of solutions for various surfaces, wooden surfaces of various shapes

Source:https://www.researchgate.net/figure/Owinska-Spatial-Orientation-Park-2014-M-Trojanowska_fig8_270901806

Owińska Spatial Orientation Park, examples of solutions for various surfaces, wooden surfaces of various shapes

Source:https://www.researchgate.net/figure/Owinska-Spatial-Orientation-Park-2014-M-Trojanowska_fig8_270901806

Owińska Spatial Orientation Park, examples of solutions for various surfaces, wooden surfaces of various shapes

Source:https://www.researchgate.net/figure/Owinska-Spatial-Orientation-Park-2014-M-Trojanowska_fig8_270901806

Classes in the Spatial Orientation Park prepare people for the greatest possible independence and safe movement in known and unknown surroundings. For this purpose typhlographic boards, tactile boards and models showing the surroundings have been prepared. Both mock-ups and information boards facilitate the exploration of the environment. The information is displayed to the standard description and presented in Braille. Braille language allows the visually impaired to write and read texts. All the solutions used make learning much easier.eing guide, protective techniques.

Owińska Spatial Orientation Park, examples of signage solutions, a model of the park, description in Braille

Source:https://www.researchgate.net/figure/Owinska-Spatial-Orientation-Park-2014-M-Trojanowska_fig8_270901806

Owińska Spatial Orientation Park, examples of signage solutions, a model of the park, description in Braille

Source: K.Gała 30/09/2022

Owińska Spatial Orientation Park, examples of signage solutions, information boards, description in Polish and Braille

Source: K.Gała 30/09/2022

Owińska Spatial Orientation Park, examples of signage solutions, staircases / handrails, description in Polish and Braille

Source: K.Gała 30/09/2022

Other example of the wide application of the principles of universal design is the modernization of educational units in the Czerwonak Commune. In 2017 the Municipal Kindergarten No. "Krasnala Hałabały" in Koziegłowy was designed and equipped with the equipment adjusted to the needs of the disabled children. Besides, there are 20 playgrounds existing in the Czerwonak Commune. These playgrounds are located in 10 different places, and during each modernization, they are successively equipped with the appropriate devices.

Examples used in the Municipal Kindergarten No. "Krasnala Hałabały" in Koziegłowy - toys enabling the integration of children with limited mobility

Source: https://www.ekozieglowy.pl/rozbudowano-plac-zabaw-przedszkola-nr-2/

Examples used in the Municipal Kindergarten No. "Krasnala Hałabały" in Koziegłowy - toys enabling the integration of children with limited mobility

Source: K.Gała 30/09/2022

TROPICANA BATHING BEACH

The Akwen Tropikana Bathing Beach is another example of caring for the general availability of recreational areas. The swimming pool was established in 2009 in Owińska. On a sandy beach with an area of over 1500 m2, artificial palm trees with coconuts, reed canopies, flamingos and umbrellas have been set up. The bathing area is guarded by lifeguards and the bathing area itself is approx. 1000 m2. Its basin has been divided into 3 parts adjusted to the needs of users. The swimming pool is a paddling pool for the youngest, up to 0,4 m deep and approx. 50 m2, some for non-swimmers, up to 1,2 m deep and approx. 300 m2, and some for those who can swim up to 3 m deep and approx. 650 m2. It is an ideal holiday destination for the whole family during the holiday season.

OrtoPhotoMap Akwen Tropikana

Source GoogleEarthPro as of May 2017.
https://www.google.com/maps/@52.51408,16.99286,673m/data=!3m1!1e3

The swimming pool has a 14-meter pier, water equipment rental, beach volleyball court, food court and the sanitary facilities also adapted for the disabled. Just 50 meters from the beach, there is a convenient car park, which allows you to reach the area of the Bath almost directly. In addition, you can use the wi-fi internet here. To make the stay more attractive for the youngest, the playground has been installed, equipped with an arcade set, swings and sandboxes with a roof protecting against the sun.

For active enthusiasts, beach soccer fields and a water equipment rental facility are available. There is a water ski and wakeboard lift nearby. The very arrangement and execution of most of the facilities/attractions enables the use by diverse groups of users.

View of the development of the available space

Source: https://akwenczerwonak.pl/vt/tropicana.html

2.9 ACCESSIBLE PATHWAYS

The traditional-style stone roads make it difficult and annoying to people with disabilities, thus, nowadays many tourist cities of Greece have also applied a fairly level pedestrian path that is mostly cobblestone, with some sections of flat marble, in order to facilitate movement for people with disabilities or people with walking difficulties.

The beautiful caldera town of Oia is easily visited with a wheelchair, as it has a wide, flat, marble path that runs along the caldera. These roads are also designed close to the cliff edge so that they can easily enjoy the scenery

Accessible Pathways in Oia

Source: https://santorinidave.com/santorini-accessible-hotels

2.10 ACCESSIBLE BEACHES

The Blue Flag is certified by the Foundation for Environmental Education (FEE). Beaches, marinas, boating tourism operators with this certification are recognized as sustainable beaches, meeting the needs of the organization's standards related to Pure Water, Clean Coasts, Safety and Access for all. Therefore, any beach marked with a blue flag will be identified as an accessible beach.

Here are famous examples with the name as Accessible Wheelchair Beaches or "Blue-flag" beaches due to its equipment fit with every user.

The black-sand Perissa Beach in Greece

Source: https://santorinidave.com/santorini-accessible-hotels

2.10.1 WALKWAYS OF THE SEASHORE

The wooden beach entrants or the accessible walkways to the seashore are typical examples of universal design at the beach.

The wooden pathways installed directly towards the beach are suitable for wheelchair users, baby strollers or other business strollers. It will never be easy to roll in sand with a wheelchair or strollers, thus, this walkway makes it easy, fast and safe to move as it eliminates obstruction by surface material (sand) and it also makes it easier for everyone to format the entrance faster.

The Kamari beach's accessible wooden pathways design also features ramps and wooden handrail for wheelchair users to lean on and easily access the beach (Greece).4

Accessible Walkways in Kamari beach (Greece)

Source: https://santorinidave.com/santorini-accessible-hotels

A mix of a ramp-access swimming pool and a beach boardwalk in Paraga Beach (Greece)

Source: https://santorinidave.com/mykonos-accessible-hotels

Beside, another Greece's beach in Sant Anna has an excellent combination idea when it features a ramp-access swimming pool with a beach boardwalk which extends almost to the water's edge.

Mechanical sea-access ramp in Kamari Beach (Santorini, Greece)

Source: https://santorinidave.com/mykonos-accessible-hotels

The remote-controlled wheelchairs on rails in Cyprus

Source:https://www.euronews.com/my-europe/2021/09/13/ermis-ii-the-project-helping-people-with-reduced-mobility-enjoy-the-beach

2.10.2 MECHANIC SUPPORT FOR WHEELCHAIRS AT THE BEACH 5

The SEATRAC is a mechanism consisting of rails, on which a specially designed seat moves, transporting the user from the beach directly into the water to a safe depth. Thus, people who are disabled can now enjoy the sea without a great deal of help, allowing people with disabilities to experience beach life like everyone else.

The remote-controlled wheelchair on rail SEATRAC also has a control button that moves freely to the user's hand so that they can arbitrarily stop or continue to move up or down at will.

The SEATRAC is made of stainless steel to resist the marine environment. The SEATRAC itself can be assembled and dismantled in a few hours, so they're practical to install. Besides, this equipment is also used by the elderly, pregnant women and other people who need safer, practical ways to get into the sea. Moreover, this innovation is powered by solar panels. This design upholds the equitable use principle of universal design.

5 SEATRAC. https://seatrac.gr/en/about-seatrac/#hero-video

2.11 ANIMAL FRIENDLY PUBLIC SPACES ARCHITECTS

2.11.1 PREGNANT LAMP

Street lights are such an integral part of the city, so obvious that they often go unnoticed.

The designers from Ultra Architects (Poznan) have built a lamppost that has an additional function: a bird nesting box. This product shows that its universality applies not only to human subjects but also to other living objects in the same environmental space. This design is often misunderstood as a design that adorns public spaces through the interior, but this is a demonstration of taking advantage of creativity in design to put it into practice.

Pregnancy lamp year 2010

Source: https://ultra-architects.pl/en/lampa-w-ciazy/

2.11.2 ANIMAL FRIENDLY PUBLIC DESIGNS IN CZERWONAK (POLAND)

In recent years, the Czerwonak commune has been initiating and actively participating in various projects and animal-friendly actions. There is a comprehensive program for the care of homeless animals, where Czerwonak commune put up signs informing about the presence of animals by communal roads and cooperate extensively in the action of protecting amphibians and reptiles. Czerwonak authorities have been supporting an animal shelter in Skałowo, organizing plenty of educational workshops, and they have built some biodiversity-friendly spaces. Below are activities in which the Czerwonak commune is involved in upgrading public spaces to support various species of animals.

ACTION - AMPHIBIANS!"

In 2018, volunteers and naturalists from the Society of the Friends of Karlik were summoned to the community in order to save the protected amphibians.
In the Czerwonak commune, large numbers of amphibians such as common toad Bufo, common toad Pelobates fuscus, common frog Rana temporaria, Rana esculenta, and even fire-bellied toad Bombina bombina, common newts Lissotriton vulgaris and great crested newt Triturus cristatus have been observed following the project.
For several years, the cooperation has resulted in the commune placing signs "Attention amphibians" on the roads in order to draw the attention of drivers to drive more carefully during the spring and autumn migration of these animals; further - morning and evening patrols, combined with their identification and examination, as well as erecting, in general social campaigns, fences to protect amphibians and reptiles from dangerous road crossing.
The main aim of the protection of amphibians in the Czerwonak commune is to enable them safe road crossing and access from wintering grounds to water reservoirs in the spring and enabling movement from feeding grounds to wintering grounds in the autumn. For this purpose, foil and wooden slats are used to prepare protective fences to prevent amphibians from entering the streets. Along the fences there are buckets dug into the ground at various distances into which migrating amphibians fall, later inventoried and carried by patrols in the right direction.
Each time, during such organized brewing with local residents, the adjacent areas, ditches and ponds to which amphibians migrate are cleaned. As part of cooperation with ecologists, citizens spread knowledge during nature walks about animals and plants.

Building fences for amphibians in the Czerwonak commune, ul. Dojazd/Okrężna in Czerwonak – 2020;

Source: Alina Ptak

Building fences for amphibians in the Czerwonak commune, ul. Dojazd/Okrężna in Czerwonak – 2020,

Source: Alina Ptak

All these activities increased the awareness of the inhabitants to such an extent that the amphibian culverts were constructed along the small Dojazd Street. It is still a unique event in the country, because technically and financially demanding amphibian culverts are usually built along motorways and provincial roads, and extremely rarely in cities or rural communes. Culverts, i.e. passages for amphibians under the roads under construction, are designed to maintain the continuity of the habitats and migration corridors of amphibians and, additionally, of small mammals, reptiles and invertebrates. These objects have a surface covered with a layer of soil with high water retention capacity. The crossings are located along the seasonal migration routes and should consist of a group of culverts covering the entire width of the route.

The reconstructed Dojazd street in Czerwonak with three culverts in the most sensitive places. Culverts for amphibians built under the street marked in Blue; marked in Green are fences for amphibians built as part of the action

Source: Spatial Information System, Czerwonak commune https://czerwonak.e-mapa.net/

**One of the culvert for amphibians, 400 mm in diameter,
under the Dojazd Street, Czerwonak - September 2022;**

Source: Alina Ptak

Building fences for amphibians in the Czerwonak commune, ul. Dojazd/Okrężna in Czerwonak - 2020;

Source: Alina Ptak

Dojazd Street under construction. On both sides there are visible black agrotextile fences for amphibians, Czerwonak - September 2022;

Source: Alina Ptak

"BEWARE, HEDGEHOGS"

Animal warning sign by the commune road in Poland

Source:https://newslubuski.pl/spoleczne/4950-zwolnij-jeze-nowy-znak-drogowy-w-zielonej-gorze.html

Animal warning sign by the commune road in Poland

Source:https://znaki.edu.pl/index.php/bloki-znakow/nieformalne

Following the mapped "amphibian trail" of the commune in 2022, after consultations with the residents, Czerwonak commune put up new signs protecting animals along the roads. This time the attention was focused on hedgehogs. These lovable animals are very much appreciated by gardeners as "cleaners of the earth" from plant pests, such as snails, and children are eagerly involved in building houses for hedgehogs to help them survive the winter.

EDUCATIONAL BOARDS AND BIRDHOUSES

Another project was to set up educational boards at the waters where wild birds live. The boards inform the allowed food that can be fed ducks in order not to harm their health and lives.The boards were installed in the Commune Area of Recreation and Recreation in Owińska and at the pond in Kicin.

In order to protect other species of birds, the Czerwonak commune commissioned the installation of bird boxes in the newly created marina in Owińska. Hanged boxes are dedicated to smaller birds such as tits, sparrows, mazurkas and starlings.

Moreover, investment works related to the felling of trees during the construction of a pedestrian and bicycle bridge in Owińska were supervised by the entomologist. It was necessary to move decayed tree trunks with the protected species of the beetle - hermit beetle (osmoderma hermit) to a safe place.

The educational board in Kicin

Source: Alina Ptak

RUN FOR DOGS IN CZERWONAK

The next investment which was carried out under the Participatory Budget, to which the inhabitants of the commune can submit their ideas every year, was the construction of a dog run.

Paddocks are extremely popular in cities and in highly urbanized areas, while in rural areas they are not so common yet. Country dogs, just like their local relatives, need a free range, fun and socialization. Apart from the run for dogs, it is practically impossible to let dogs loose in the public space. It is forbidden in forests, mainly due to the safety of wild animals, and not every dog is predisposed to long-distance running on a line with a handler. In towns and villages, on the other hand, if you do not look after your dog, you will have to pay a fine. Only dog parks are an ideal place to spend free time with your pet in the open air, so that the dog runs out at the same time.

The name of the commune run for dogs is “Dog Corners”. It is the first facility of this type in the Czerwonak commune, which is to be used by the pets to play, socialize with other dogs and activity.
The run for dogs was a response to social demand and was built on a grassy pitch in Czerwonak, next to recreational areas with a complex of apartment blocks. It is a large area, fenced with a double, safe gate, benches, a dog toilet, baskets, sand, slalom, hoops, footbridge, trunks, solar lamp. There is also a mechanic water drinker connected to the municipal water supply, rarely available to supplement the equipment.

Run for dogs “Dog corners”in Czerwonak

Source: Alina Ptak

SMALL SCALES DESIGNS FOR INSECTS AND BIRDS

In 2020 the Czerwonak commune organized a workshop with the theme of supporting nature for children, in order to create homes for insects. Those workshops were a part of the European Week of Sustainable Transport, co-organized by the commune, promoting public transport, Car Free Day and generally understood care for the surrounding nature. An interesting action, in which the employees of the office took part, was creating drinking water containers for wildlife which were placed by the building of the Czerwonak Commune Office.

The insect house was made as part of a municipal workshop

Source: from the archive of Czerwonak Commune Office

PARK "BUY AND RELAX IN KOZIEGŁOWY" - SUPPORTING BIODIVERSITY

At the end of 2021, the investment called "Buy and Relax in Koziegłowy" was completed. During the investment - the construction of a park in the center of Koziegłowy, over 2000 plants were planted, including many honey plants and native species to support commune biodiversity.

The attractions are also two ponds with aquatic vegetation serving the biodiversity of flora and fauna and an artificial river connecting them with a bridge and a luminescent path.
In the newly built park, there are also educational boards, a bicycle repair station, sheds and benches for relaxing in nature and photovoltaic lamps. The investment was implemented thanks to co-financing from the Marshal's Office, received under the Rural Development Program for 2014-2020.

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Park "Buy and rest in Koziegłowy" - biodiversity, May 2022

Source: from the archive of Czerwonak Commune Office

Pond in a park "Buy and rest in Koziegłowy"

Source: https://www.ekozieglowy.pl/skwer-w-parku-jana-pawla-ii-otwarty/

Pond in a park "Buy and rest in Koziegłowy"

Source: Alina Ptak

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Park "Buy and rest in Koziegłowy" - biodiversity, May 2022

Source: from the archive of Czerwonak Commune Office

Maintaining the continuity of the landscape and the free movement of animals and plants between the Zielonka Forest and the Warta River is extremely important, especially in the face of annual droughts that plague the environment. Almost all watercourses and most of the reservoirs in the Forest transform during the months of droughts in swamps with no sources of clean water. In such conditions, it is essential to provide the animals the access to drinking water from the Warta River. Therefore, the Czerwonak commune provides maintenance of ecological corridors in its spatial development plans, i.e. places of free, undeveloped movement of animals, e.g. along the village of Miękowo, lying between the Zielonka Forest and the Warta River.

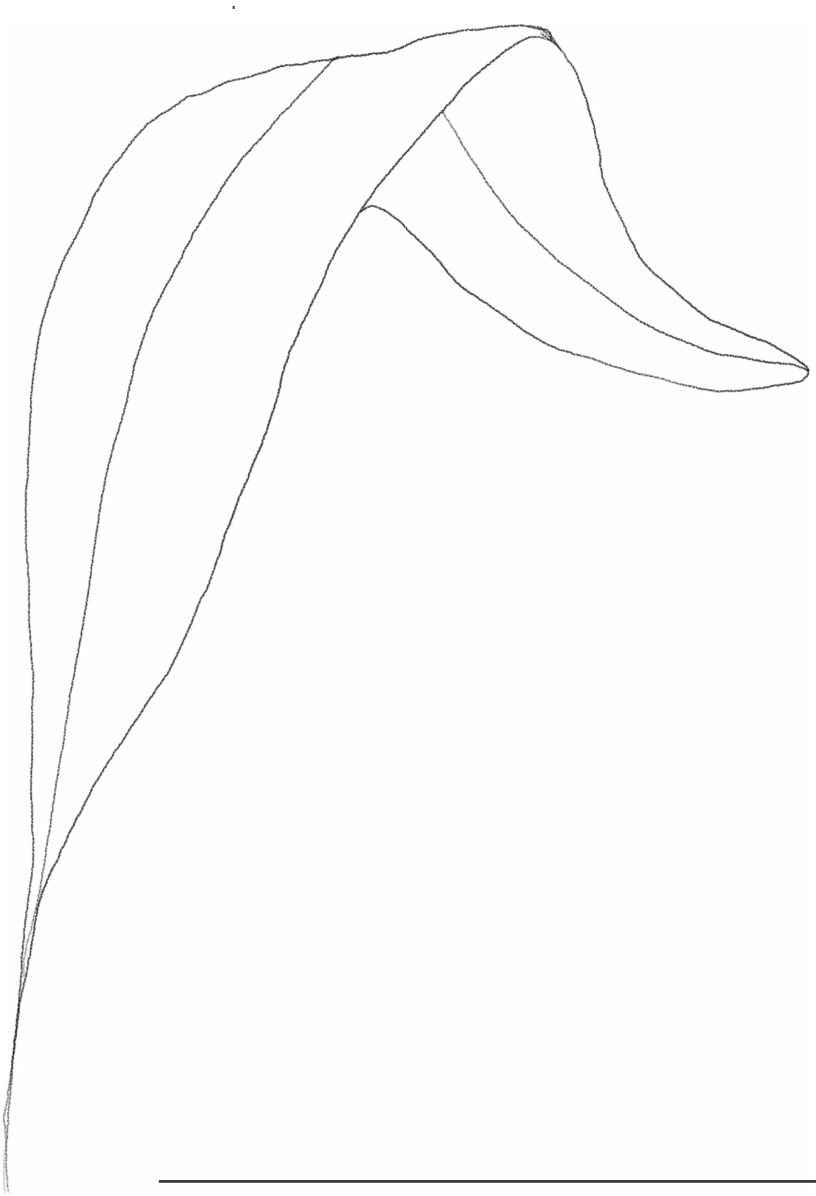
An important issue, apart from the preservation of migration corridors, is to leave as much wilderness as possible - inviolable. In the case of land belonging to the Czerwonak commune, it is mainly about meadows, e.g. of the protected landscape area in the buffer zone of the Zielonka Forest - Łąki Annowskie with the area of 315.19 ha, with a large number of animals including many species of insect pollinators.

All these activities are aimed at protecting the zone of green rings covering areas with important natural functions, which additionally constitute the basis of the natural system.

The preserved ecological corridor between the Zielonka Forest and the Warta River through the villages of Annowo and Miękowo

Source: https://czerwonak.e-mapa.net/

These are the so-called nodal areas of international, national and regional importance as well as ecological corridors of river valleys. These areas, due to their sensitivity, require protection against the intensification of settlement processes and shaping the investment space taking into account the need to maintain the function and coherence of the entire natural system. Because of the importance of these valuable areas for the environment, the Czerwonak Commune is successively including such areas with the provisions of the applicable local plans. In addition, the Study of the conditions and directions of spatial development in the Czerwonak commune is currently at the stage of public consultations and appropriate provisions with the Landscape Park Complex of the Wielkopolska Province and the Regional Directorate for Environmental Protection.ctions, which additionally constitute the basis of the natural system.



MANUAL 2: BEST PRACTICES II
THE TENDERING, TRANSPARENCY AND THE DECISION MAKING IN EUROPE

1. PROCUREMENTS

Public procurement is the process by which public authorities, such as government departments or local authorities purchase work, goods or services from companies.

Public procurement accounts for over 14% of the EU's GDP. It is regulated by law to maximize value for money for the public sector and ensure compliance with three key principles:
• equal treatment
• non-discrimination
• transparency

Government procurement or public procurement is attempted by the public authorities of the European Union (EU) and its member states in arranging to grant contracts for public works and for the buy of goods and services in understanding with standards determined from the Arrangements of the European Union. Such procurement has been the subject of expanding European control since the 1970s since its significance to the European single market.

According to a 2011 study arranged for the European Commission by PwC, London Economics and Ecorys, the UK, France, Spain, Germany, Poland and Italy were together responsible for almost 75% of all public procurement within the EU and European Economic Area, both in terms of the number of contracts granted through EU-regulated procedures and in value.

The basis of European procurement direction lies within the provisions of the European Union treaties that prohibits obstructions to intra-Union trade, prohibit discrimination on the basis of national origin and control public endeavors and public monopolies. But these rules, being restrictive in character, proved insufficient to prove insufficient to eliminate the protection afforded by the Member States to domestic enterprises by preferential procurement practices. For this, positive regulation through secondary legislation which harmonized the procurement laws of Member States appeared to be needed.

2. TENDERING IN EU: TED

For contract above a threshold—€ 209.000 for services and goods, € 5.225.000 for public work—European tendering is mandatory.6 For tendering purposes in the EU, there is Tenders Electronic Daily (TED) https://ted.europa.eu/ which is an online version of Supplement to the Official Journal of the EU (OJS). This website is dedicated for public procurement matters such as public procurement contracts, according to the EU rules on public procurements, of notices published in EU Member States, European Economic Area (EEA) and beyond. It provides information on procurement notices by country, region, business sector and more. It is the single official source of public contracts in Europe, where all the EU tenders are published and described.

TED is currently the primary source of information on Commission calls for tenders above the Public Procurement Directive thresholds, and also gives access to tenders of other public authorities in Europe. TED publishes 460.000 calls for tenders per year, for about 420 billion euro of value. TED publishes 746 thousand procurement award notices a year, including 235 thousand calls for tenders which are worth approximately €545 billion. Public authorities may also choose to publish notices on the TED portal when a contract is of lower value.7

TED provides free access to business opportunities from the European Union, the European Economic Area and beyond. Every day, from Monday to Friday about 2400 public procurement notices are published on TED. Information about every procurement document is published in the 24 official EU languages. All notices from the EU's institutions are published in full in these languages.8

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6 University of Twente (2021). European tendering. https://www.utwente.nl/en/service-portal/facility-services/procurement-preferred-suppliers/purchase-procedures-and-regulations/european-tendering#what-does-european-tendering-mean-in-practice
710 Your Europe (2021). Public tendering rules. https://europa.eu/youreurope/business/selling-in-eu/public-contracts/public-tendering-rules/index_en.htm#shortcut-4
8 Ted (2011). About TED. https://ted.europa.eu/TED/misc/aboutTed.do

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Contracts with a value less than 144.000 EUR for services and supplies and 5.448.000 EUR for works might not be advertised in TED, therefore they are not included in the Funding & Tenders Portal either. They can be found on the web pages of the Commission directorates. Ex-ante publications give you information on calls to be published in the near future and you can express interest on receiving an invitation to tender.9

The tender/seller could register to the website by creating an account and filling the registration form. The tender can register and set up a number of search profiles. The browser also allows visitors to have search profiles according to the needs, using a number of methods, including:10

• Business Opportunities: Here you can select the country or countries you are interested in supplying to as well as define whether you are looking for a 'contract notice' (published tender notice) or Prior Information Notice (PIN – basically a 'head's up' that a contract notice is likely to be published fairly soon). This will return absolutely everything that's been published in the last issue, but don't worry, I'll be explaining more about how to refine your search a bit later on.
• Business Sector: Using CPV 'Common Procurement Vocabulary' codes can help you narrow down your search to the types of service you wish to tender for. Each code relates to an overarching category, with sub categories each having their own code. This allows you to either search for an overarching category, e.g. 'construction', which would deliver many results and may be too broad and time consuming to trawl through, or be more specific,
e.g. 'Sanitary fixture installation', which sits under construction (a few layers of codes under, actually).
• Place of Delivery: NUTS codes (Nomenclature of Territorial Units for Statistics) allow you to narrow down your search to the country or region you are interested in tendering for.
This is useful if you generally provide services locally, or even nationally, and you want to avoid results for every other EU country.

9 TEuropean Commission (2021). Funding and Tender Opportunities. https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/tenders
10 UK Bid Writer (2020)

Conversely, if you are actively looking for contracts in other EU countries, you can do so easily.

• Heading: This gives you the option to search by a type of authority (sort of), e.g. by European Economic Area, Government Procurement Agreement, Member State and more. I don't use this option very often but it may be useful to you depending on your type of business.

EXAMPLES: POLAND

Market of public procurement in Poland is developing dynamically, which can be noted in the value of awarded contracts, estimated to circa 38 billions EUR per year. In a scope of a structure of contracts, development works have the highest share of value (about 50%).
Supplies and services vary around the same level (25%).

Entities obliged to take after the Polish public procurement rules are different types of the public finance sector units. Such awarding entities are obliged to award contracts due to the rules of fair competition and equal treatment of economic operators, impartiality and objectivity of persons preparing and conduction methods.

As an EU Member State, Poland is under the EU law regime. Thus Polish public procurement rules comply with the EU Treaties and Directives, including the implementation of the provisions of the three directives reforming the procurement sector were published on 18th April 2014 as follows;
• Directive 2014/23/EU on the award of concession contracts;
• Directive 2014/24/EU on public procurement in the ordinary sectors;
• Directive 2014/25/EU on procurement in "special sectors" (e.g. water, energy, transport).

The first two directives compared to previous 2004/18/ec and 2004/17/ec simplify the procedures and tend to harmonize regulations of special sectors with those of traditional sectors.

The financial thresholds above which the contracting authority is obliged to apply the national legal framework is EUR 30.000,00. Furthermore, the Polish law introduces specific legal regime that shall apply to the contracts above the EU thresholds:

• EUR 135.000,00 (net of VAT) for public supply and service contracts awarded by public finance sector bodies,
• EUR 209.000,00 (net of VAT) for public supply and service contracts awarded by other public bodies,
• EUR 418.000,00 (net of VAT) for utilities supply and service contracts and in the fields of defense and security,
EUR 5.225.000,00 (net of VAT) for construction works contracts.

EXAMPLE OF TENDERING IN MUNICIPALITIES

For Maintaining urban greenery and maintaining cleanliness and order in the Ursus district of the Capital City of Warsaw Of Warsaw project, these are the requirement of contractors who meet the conditions to participate in the tender:
a) ability to act in legal transactions;
b) the right to conduct a specific business or professional activity, as long as it results from separate regulations;
c) economic or financial situation;
d) technical or professional ability.

Specifically:

1) The contracting authority requires the contractor to demonstrate that in the last 3 (three) years from the date on which the deadline for submission of tenders expires, and if the period of business activity is shorter - during this period, it has performed or duly performs at least 1 (one) service in the field of maintenance, greenery care, area cleaning of an area of not less than 80,000 m2.
In the case of economic operators jointly applying for the award of the contract: — the condition specified in point Ad. 1d point 1 must be met by at least one of the economic operators jointly applying for the contract (one or each entity must have the required experience independently);
2) The contracting authority requires the contractor to demonstrate that the persons who will be directed by the contractor to perform the public contract, responsible for the performance of the subject of the contract, meet the following requirements:
• Green area maintenance manager with qualification certificate.

At least one person who has completed a course organized by industry scientific and technical associations, e.g. NOT (Supreme Technical Organization), SITO (Association of Horticultural Engineers and Technicians), EFPF (European Federation of Professional Florists) and other organizations, conducting courses and training in the field of care green areas, completed with an exam, on the basis of which they issue a qualification certificate "Green areas supervision inspector" and having at least secondary education in the specialization of gardening or landscape architecture in the supervision of the maintenance of urban green areas, to which the person intends to entrust the function of the manager for the maintenance of green areas

- Drivers - category B driving license - minimum 1 driver
- Employees for the maintenance of green areas - minimum 4 people.

For the open procedure tendering, there are several additional information on the electronic auction that should be provided:

THIS IS SEVERAL REQUIREMENTS OF THE TENDER:

1) In the contract award procedure in question, the contracting authority uses the Market-planet OnePlace platform, hereinafter referred to as the contracting authority's purchasing platform. The platform is accessed via the link: https://zamniane.um.warszawa.pl

2) The order is in Polish.

3) Questions and correspondence in this procedure should be asked via the purchasing platform of the ordering party via the link: https://zamniane.um.warszawa.pl. The instructions for using the system are available at the above-mentioned address, the contracting authority allows asking questions to the SWZ by email. Questions can be directed to the address of the ordering party ursus.wzp@um.warszawa.pl with an indication in the title of the number of the proceedings to which they relate.

4) The technical and organizational requirements for sending and receiving electronic documents and information provided using the contracting authority's purchasing platform are described in the Instructions for Contractors.

5) Requirements for registration rules and minimum technical parameters required from the contractor when using the system for electronic communication with contractors;

6) Submitting an offer requires the contractor to register and log in to the IT system available at: https://zamniane.um.warszawa.pl, in the order below.

7) The contracting authority in the table below indicates the information referred to in the Regulation of the Prime Minister on the method of preparing and submitting information and technical requirements for electronic documents and electronic communication means (Journal of Laws of 2020, item 2452), regarding the system available at address: https://zamniane.um.warszawa.pl,:

8) Requirements for registration rules and minimum technical parameters required from the contractor when using the system for electronic communication with contractors available at the address: https://zamniane.um.warszawa.pl (hereinafter referred to as the System).

3. TRANSPARENCY

Transparency and openness of Union decision-making procedures are foundational values of the EU and essential to a system under the rule of law.

Transparency in European government procurement is achieved through the publication, in the Official Journal, of three types of notices:

• Prior Information Notices (PIN) giving advance information of a proposed procurement, and details of the procurement procedure to be applied. The abbreviation "PIN" also refers to a periodic indicative notice issued for transparency purposes under Article 67 of the Utilities Directive of 2014 whereby "contracting entities may make known their intentions of planned procurement".

• Contract notices are the formal invitations to providers to tender offers which initiate the process of awarding a contract.

• Contract Award Notices (CAN) inform the public about the award of a contract to a successful tenderer, including the cost and the reason for the selection.

Transparency should improve price competition among suppliers, resulting in lower purchase costs, because publication makes more suppliers mindful of business opportunities, and they also know that their competitors will also have seen the opportunity.

CANs also send important price signals to the market. However, the increased competition may drive prices down to a level where poor quality or predatory pricing become concerns. It also wastes effort on the part of the many unsuccessful tenderers and of the authority who has to evaluate many tenders.11

4. DECISION MAKING PROCEDURE

4.1 EU'S DECISION MAKING PROCEDURE

The standard for the EU's decision making procedure is known as 'Ordinary Legislative Procedure (COD)' or co-decision. This procedure means that the directly elected European Parliament has to approve EU legislation together with the Council (the governments of the 27 EU countries). It gives the same weight to the European Parliament and the Council of the European.12 The vast majority of European laws are adopted jointly by the European Parliament and the Council.13

4.2 PARTICIPATORY SCHEMES FOR DECISION MAKING

4.2.1 PARTICIPATORY BUDGETING

Definition
Participatory Budget is a demographic tool that allows their citizens to have a say on how to spend a part of the municipal budget.
This tool gives the city leaders a good idea of what their inhabitants expect their city to look like. Besides, this tool's pro is to increase transparency, trust in policy making, and confront the witness of citizens; empowering citizens. Through Participatory Budgeting, the local authorities can have better allocation of the resources.

HOW DOES PARTICIPATORY BUDGETING PERFORM?

This process has these simple approach as follows;
(1) the city needs to decide how they want to give a voice to the residents and the percentages of the budget will be dedicated to citizen initiative. In this stage, the city needs to make sure they inform the citizen to ensure everyone participation
(2) the citizens come up with ideas and negotiate with the government to decide where to allocate resources.
(3) the city takes note of the citizen's aspiration and ensures the project is carried out.

EXAMPLES

(1) PARTICIPATORY BUDGETING IN TALLINN

Tallinn (the capital of Estonia) asked its residents to propose ideas on how to spend 1 million euros of the city budget. City residents had proposed adding more bike lanes, building community gardens and playgrounds, and installing an outdoor gym, adding benches and drinking fountains. All residents over the age of 14 have the right to vote to decide which projects they most wanted to be implemented in their county. The process of this Participatory Budgeting activities in Tallinn took place from August 2020 to January 2021 was implemented by cities for each district. This was a pretty quick and good example of Participatory Budgeting.14

(2) LISBON AND GREEN PARTICIPATORY BUDGETING (GREEN PB)

Lisbon was one of the early adopters of PBs since 2008, recently, with the effects of climate change, the city has switched to adopting a more green PB. In terms of enabling citizen cooperation, Lisbon and the Green PB process are assigned participatory council sessions to discuss proposals and vote on projects. Citizens were organized into a number of smaller discussion groups at random, and each of these groups was attended by a moderator from the Council who also facilitated discussion around the quality of the community offer.

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11 Wikipedia
12 15 European Union (2021). How EU decisions are made. https://europa.eu/european-union/law/decision-making/procedures_en#how-is-legislation-adopted?
13 16 European Parliament (2021). Legislative power. https://www.europarl.europa.eu/about-parliament/en/powers-and-procedures/legislative-powers
14 Plamen Petrov (2021). Talliin's 2022 participating budgeting focus on greenery, outdoor spots and recreation https://www.themayor.eu/en/a/view/tallinn-s-2022-participatory-budget-focused-on-greenery-outdoor-sports-and-recreation-9592#:~:text=Tallinn%27s%20Participatory%20Budget%20for%202022,on%20a%20district%27s%20population%20size.

These proposals went through the assembly processes carried out by the board (filtering, analyzing and merging into civic projects, including that of the proposal submitted online). The adapted climate proposals will then be delivered to the voting process, and the proposal project with the most votes will be presented publicly at a public event.

The application of PB with the participation of the people helps to place responsibility on them personally for issues related to important civic projects, increasing the democratization of public participation. In addition, it encourages greater dialogue between citizens and officials about increasing transparency and accountability around the council. As a result of this, in the first two years (2009, 2010), all the participants (26-35 years old) obtained degrees in higher education, the Green PB project in addition also aims to reach the elderly, migrants or economically disadvantaged citizens, integrating them into voting and referendums that can improve people's lives and have better access to these subjects.

This tool has continuously facilitated the transition towards the Green seal of Lisbon and green PB, the balance between continuity and change has been achieved with annual innovations tested through pilot initiatives. All of this has helped Lisbon after 10 years of application, continuous updating, to become a European Green Capital 2020 and a tourists' favored city.

The process of votes counting in Tallinn's Participatory Budgeting

Source: Tallinn City Council

Participatory Budgeting Activity in Lisbon

Source: https://participedia.net/case/4967

(3) PARTICIPATORY BUDGETING IN POLAND

In Poland, Participatory Budgeting was first introduced in Sopot (2011), now it's being applied by many cities around the country such as Warsaw, Lodz, Krakow, etc.

A project to fulfill the wishes of the people through PB was carried out in response to the lack of fresh fruit and vegetable resources in an area of Warsaw. A market with fresh vegetables and fruits of local farmers was born. It is open twice a week, from March to October to meet the needs of the people and create good living conditions. more for them.15

Another project implemented through the PB method was also carried out in the center of Warsaw (Poland). With the aim to add green grass, conserve precious water and increase habitat for bees, butterflies and birds, Flowery Meadows was born and is now scattered in many areas of the city center. city. This project is cheap, easy to implement and effective, with a very good ecological impact on the urban public spaces.

The outdoor fresh Vegetable Market in Warsaw

Source:https://www.facebook.com/Targ-Miejski-Zielony-MDM?_rdc=1&_rdr

Flower Meadows in Warsaw city center

Source:https://europe-cities.com/2022/04/26/warsaw-will-drown-in-flowers-meadows-were-built-in-the-capital/

15 https://www.facebook.com/Targ-Miejski-Zielony-MDM?_rdc=1&_rdr

4.2.2 THE E-TOOLS

DEFINITION

Public consultation is a formal mechanism of social participation where the government invites their citizens to participate in policy making. Nowadays, a large number of public consultations are being moved to online due to its convenient, cost-effective as well as social restriction caused by Covid-19. Thus, the consultative E-tools was born, which is a way of electronic civil surveillance that leverages a combination of modern Internet tools (ICT) as a way to empower communities.

EXAMPLES

(1) **FIX-MY-STREET**

A good example for E-tools is “FixMyStreet”, this tool is primarily for reporting things which are broken or dirty or damaged or dumped, and need fixing, cleaning or clearing, like graffiti, dog fouling, potholes or street lights that don't work.

The citizen will use this website to write their report and these reports will be sent to the council and these information are also published on the website to avoid being duplicated and the council will respond directly to the reporter. This tool created a snapshot for local communities so it's easy to see what the common problem in the given area is and to update how quickly they get fixed, the website also allows other residents to read comments regarding the reported problem and offer a solution.

BEYKOZ

Another “fix-my-street" formula tool was also created under a project by Development Policy Foundation in order to support creating a better accessible and friendly public space in Istanbul.

This is an electronic tool displayed as a website, this tool allows citizens to mark the location along with informing its existing problem, therefore, the local authority can interfere to solve the struggling issues, then, this platform also visible the status of the interfering process.

This tool offers a solution to improve the state of civil society dialogue, increase decision-making capacity and equality in participation in improving the local common space environment, especially for those young people deprived of citizenship rights, in Istanbul and Adana, this tool provides local young people a means by which they can actively contribute to building the safer and more accessible local public spaces.

(2) **“WRITE TO THEM” (WRITETOTHEM.COM)**

An E-tool is run by ‘mySociety’ - a non-profit group from the UK that is pioneering the use of online technologies to empower citizens to take their first steps towards greater civic participation. “Write To Them" is a free service for residents to connect with local government, the connection takes place in the form of letters to all their local representatives or to local councilors visiting their parliamentarians.

Their messages will be answered by the above subjects directly via their private email about their questions, or complaints. Through this tool, people are able to fully participate in shaping the decisions that impact their lives, contribute to flourishing communities and hold power to account wherever it may lie, to empower people everywhere to become informed and active citizens.

4.2.3 CHARRETTES CONSULTATIONS

DEFINITION

A Charrette is an intensive planning session where citizens, designers, experts and others collaborate on a vision for development. It provides a forum of ideas and it offers the unique advantage of giving designers immediate feedback, this is extremely useful when time is limited.16

We use Charrette when there are many people involved in the brainstorming process and there are more than one topic that need to be discussed. Thus, it allows all participating parties to share the same title as the author of the plan.

The team of design experts and consultants sets up a full working office, complete with drafting equipment, supplies, computers, copy machines, fax machines, and telephones. Formal and informal meetings are held throughout the event and updates to the plan are presented periodically. Through brainstorming and design activity, many goals are accomplished during the charrette.

First, everyone who has a stake in the project develops a vested interest in the ultimate vision.

Second, the design team works together to produce a set of finished documents that address all aspects of design.

Third, since the input of all the players is gathered at one event, it is possible to avoid the prolonged discussions that typically delay conventional planning projects.

Finally, the finished result is produced more efficiently and cost-effectively because the process is collaborative.

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16 Community-Planning-Zoning (2019). Charrette Use in the Planning Process https://community-planning.extension.org/charrette-use-in-the-planning-process/

EXAMPLES

(1) CHARRETTE IN INDONESIA

Recently, in an ongoing project's idea by Development Policy Foundation, we held community consultation Charrette sessions in markets in Indonesia, to listen to and get opinions of the people, to use as a basis for the adjustment and sustainable development of the market in Indonesia.

This charrette offers the clearest and most realistic view, uptake of local market traders' (citizen) expectations/aspirations from local authorities. In combination with the needs of the people, governments and experts in the field of sustainable development also have the opportunity to voice their professional opinions, related to feasibility, budget for the project, through that, local traders also have a deeper insight into the realization of their wishes.

The outcome of the Charrettes session will bring the best results for the project regarding all aspects, because it will meet the expectations and capabilities between the local authorities, the users and the environment.

(2) CHARRETTE IN ADANA (TURKEY)

In November 2019, Development Policy Foundation organized Charrette under the project aimed to discuss the design and structure of urban gardens for Yalı Bostanı (Yali Urban Garden). With the participation of the project partners, local authority representatives, youth members (including children), community members, designers and architects, representatives of other NGOs, in order to share ideas and provide all the participants enough information to make collaborative decisions during the planning process for Yalı Bostanı.

This Charrette has been organized as a friendly atmosphere, with drinks and snacks prepared for the participants to facilitate their participation. Together they participate in the design of manuscripts, drawing figures of what they dream of, especially drawings that come from children that are very noticeable to designers and experts.
The output of this charrette addressed the difficult problems of an urban garden, the needs of the local people along with proposed solutions. The Charrette not only provided technical adjustment, but it also provided connectivity between people of different ages, gender, ethic groups. It gave people chances to express personal ideas and charrette itself also turned into a training workshop for young architecture students.

(3) CHARRETTE WORKSHOP IN TBILISI (GEORGIA)

The idea of the Charrette event, carried out by the Development Policy Foundation in 2016, involved the participation of local people including elders and parents. The consultation session collects reports and collects opinions on the desire to adjust relaxing public spaces and safe playgrounds for children and young people.

The Charette is the result of the birth of a modern, ecological playground created in the multi-ethnic and culturally diverse suburbs of Tbilisi.

4.2.4 LIFELAB

DEFINITION

LifeLAB is a chief social capital enhancement methodology - boosting the community involvement in the decision-making process - further empowering the inhabitants as the future change makers.

In practice from several projects related to the quality of public space, an architectural workshop or life lab is being used as an effective social capital boosting working method ensuring residents' involvement into the decision-making process to empower them as future urban change makers. The universal design is frequently mainstreamed and promoted in these kinds of workshops.

EXAMPLES

(1) THE YOUTH URBAN ACTION LAB IN TBILISI

In 2016, a LifeLab or an architectural workshop used by the Development Policy Foundation as an effective method of promoting social capital, creating urban change in public spaces in Tbilisi (Georgia).

This architectural workshop appeared during 5 days including the participation of architecture students, experts, teaching assistants, architects, designers of public spaces. This same workshop provided architecture students with additional knowledge on ways of adapting city public spaces from experienced architects, and also allowed students to share their ideas to contribute to adjustment efficiency. The goal of this LifeLab is to make adjustments that apply universal design, to create a public space that suits the needs of the elderly, children and especially people with disabilities; help increase safety when living and improve accessibility to public areas.

(3) THE ARCH URBAN ACTION LAB IN ADANA (TURKEY) AND BEYKOZ (ISTANBUL)

Two similar projects on the regulation of public spaces at Adana and Beykoz took place as architecture workshop sessions and were carried out by a combination of Turkish architecture students with Poland architects team (Adana); and Istanbul architecture students with a team of Polish architects (Istanbul).

Both projects organized Tutoring Lab sessions and Practical Lab sessions to convey ideas and selection of materials to adapt the children's play area in Beykoz and upgrade the green space in Adana.

Tutoring LAB in Beykoz

Practical LAB in Adana

Greenery space in Adana

LiveLab session of Beykoz Children Playground

4.2.5 SPATIAL PLANNING

DEFINITION

Spatial planning refers to the methods used largely by the public sector to influence the future distribution of activities in space. It is undertaken with aims of creating a more rational territorial organization of land uses and the linkages between them, balancing demands for development with the need to protect the environment, and achieving social economic objectives.

Spatial planning embraces measures to co-ordinate the spatial impacts of other sectoral policies, to achieve a more even distortion of economic development between regions than would otherwise be created by market forces, and to regulate the conversion of land and property use.17

It is also considered as an important tool to drive proactive, preventive adaptation of human settlements to the hazards caused or exacerbated by changes in climate patterns and extreme events.

On the Member State level a wide variety of systems distributing the formal competences in spatial planning exists. These systems are rooted in national planning tradition and custom and differ significantly from each other.

EXAMPLE

(1) For example, there are 4 levels of organization of spatial and land-use planning in Poland18, including:
A. National spatial development concept
B. Regional spatial development plans
C. Municipal studies of conditions and directions of spatial development
D. Local spatial development plans

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17 Europa. Spatial Planning New Urban Agenda. Name (europa.eu)
18 OECD. Land use Poland. https://www.oecd.org/regional/regional-policy/land-use-Poland.pdf

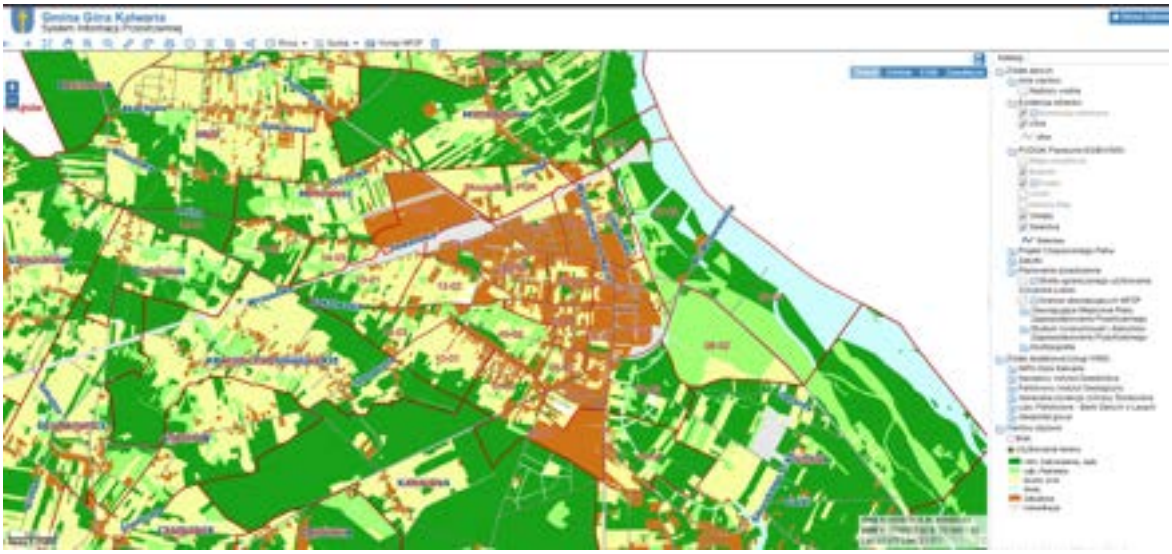
The national government has a direct role in spatial planning for developing a national spatial development concept. National government influences land use through its responsibility for large infrastructure.

Compared with the national level, the regional level plays a limited role in spatial planning through Regional Spatial Plans, which spell out regional development strategies and provide guidelines for local land-use plans. In this level, they can also distinguish restricted areas (military bases), flood prone areas, mining areas.

Municipal level has small functions related to planning, the head of the municipality can give non-binding opinions on local plans and in some circumstances, they can establish an architectural commission. Municipalities are responsible for issuing planning permissions in those areas, however, they are limited in making decisions in influencing land use.

The main actors in land-use planning are local governments, they have responsibility for creating and approving Local Spatial Development Plans, which are the only legally binding zoning plans in Poland even though large parts of cities are not covered by them.

At this local level, people may also prepare Spatial Studies that provide visions and non-binding concepts for areas of varying size.



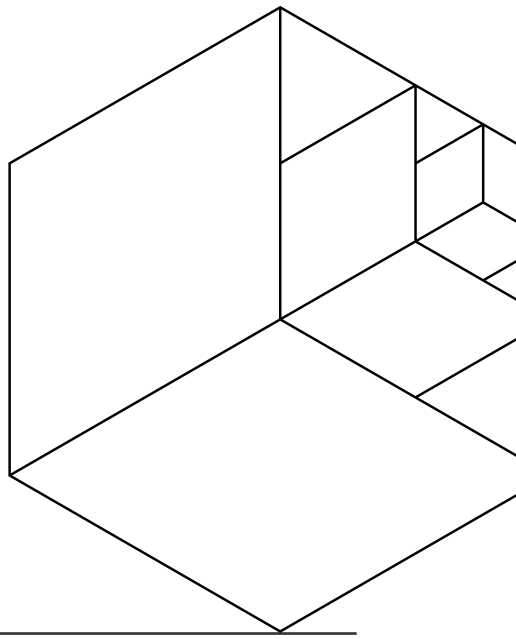
EXAMPLES:

The municipality of Góra Kalwaria (Poland) presented a GIS spatial information system portal for identifying, locating and visualizing the cover and spatial distribution of resources and uses in the form of maps.

(2) Another example from the Nordic countries is that Norway has only 2 levels of spatial planning, including;
A. National level
B. Regional and local level

At the national level, there are four different national planning instruments related to city and regional planning management. The central government planning guidelines are also intended to guide regional and local plans and address issues of particular national importance. The central government's land use plan can be established as a detailed regional plan or as part of a city plan.

The regional and local area level has 5 planning tools. Regional governments are responsible for developing regional plans, guided by regional planning strategies but also in line with national expectations and guidelines from ministries.



MANUAL 3: CASE STUDIES I
THE SUSTAINABLE GREENERY FOR PUBLIC SPACES UNDER THE DRY CLIMATE

The following are example documents used by local governments in the European Union area. The following examples can be considered case studies on how public procurement works regarding the maintenance of the public green in a dry climate context.

1. ATHENS (GREECE) AND ITS INTEGRATING WITH CLIMATE ACTION PLAN 19

BACKGROUND

The city of Athens faces impacts caused by climate change such as an increase in heat waves, causing extreme hot days, droughts and flash floods. Climate change has had a direct impact on the lives of Athenians, with the region's mortality rate (2000-2012), increasing by 5.2% for every 1˚C increase, maximum daily temperature days up to 31.5˚C.

Athens has links with major city networks such as C40 and 100 Resilient Cities, so it greatly benefits from exchanging experiences with neighboring cities to deal with common problems of the whole EU.

Nea Smyrni Park (Athens)

Source:https://www.athensinsider.com/a-breath-of-fresh-air-five-great-green-spaces-in-athens/

19 C40 Cities (2017). Athens becomes the first city in Greece with an integrated Climate Action Plan.
https://www.c40.org/news/athens-becomes-the-first-city-in-greece-with-an-integrated-climate-change-action-plan/

In response to the above harms, Athens is one of the leading cities in the country in taking actions to limit global temperature rise, save on energy costs, protect groups of vulnerability and protect the quality of life in the city.

The Athens Restoration Strategy began in 2017, featuring a Climate Action Plan set out to address climate change directly through changing public spaces.

The Resilience Strategy was developed in partnership with residents and local government stakeholders to prioritize actions to help the city respond to the crisis, responding well to the needs of the public. People, supporting sustainable development, making Athens a climate-resilient city, a city liveable, attractive and innovative.

With support from other major city networks such as C40, 100 Resilient Cities mentioned earlier in the Background of cities, the climate action plan in Athens also receives support for knowledge exchange in constant consultation with colleagues and experts from this network. They helped the city to come up with a comprehensive plan that is consistent with the city's operational program, the plan for integrated urban interventions, the urban sustainability strategy, but also the Resilience Strategy of Athens.

The plan includes all short-term and long-term actions, according to the following specified key objectives:
For adaption
• Green and blue infrastructure:
- Maintain and increase green spaces
- Greening through vertical green techniques
- Benefit water elements in urban planning
- Working with WWF Hellas for expanding cool spots network within the city
• Built Environment :
- Use sustainable and cool materials for public works, e.g: to create cool pavements.
Use materials with low embodied energy
- Bioclimatic design to reduce ambient air temperatures and improve microclimatic conditions

• Public information and awareness campaign
- About the heat risks facing the city and its people
- Handbook on ways for people to protect themselves to prevent heat-related illnesses and death
- Increase the level of preparedness of city services
- Implement energy education programs at schools.

FOR MITIGATION

• Reducing energy consumption in residential buildings, administrative buildings, business complexes and city facilities
• Reducing raw fuel use in city buildings and fleets by connecting city buildings to the natural gas network and avoiding the use of diesel,
• Raise public awareness about rational energy use and low cost and low cost measures in households.

Athens

Source:https://capitalscoalition.org/athens-bets-on-green-infrastructure-biodiversity/

RESULTS

FOR ADAPTION

Planting trees and installing green roofs: more than 3,733 trees and about 30,000 bushes have been planted, “pocket parks”20 adding greenery to the surrounding areas and more oxygen to the city. All seven of the city's boroughs, the greenery is enhanced with trees that are in perfect harmony with the environment of Athens: bitter orange, acacias, hibiscus, olive tree, plane tree, mulberry tree, oleander and pine trees are some of the most iconic trees that beautify the city, provide a breath of fresh air and contribute to its sustainability.

Taking into account the intensity of the heat wave in recent years (until May 2022), the enhancement of trees in the city that contributes to the improvement of the microclimate, reducing the high and unbearable temperatures is the dominant purpose.

Fruit trees on the streets of Athens

Source:https://sites.udel.edu/globalblog/2018/03/greece-streets-of-athens/

20 CityofAthens (2022). Στον Νέο Κόσμο το 90 πάρκο “τσέπης” της πόλης - Κ. Μπακογιάννης: «Συνεχίζουμε να απελευθερώνουμε χώρους και να γεμίζουμε πράσινο την Αθήνα» https://old.cityofathens.gr/node/37961

Maintaining the fountain network:
As of June 2022, Athens has successfully built the first 30 "fontana" fountains of Athens, not only for historical and culturally related purposes, tourism, the construction of these fountains is still a source of coolness, vitality and value for the people of the area, as a measure to reduce the pressure of the region's global warming, improve people's living standards.21

FOR MITIGATION

Reduced power consumption for public areas by replacing outdated public lighting with LED lights, which helped save electricity in city public areas, with better lighting performance.

75% of the city's road network has been remodeled in the asphalt reconstruction program, with new asphalt being replaced with cooler, higher quality that is more sustainable over time.21

NFC tags placed everywhere on city buildings to provide information on urban temperatures, cool spots, and the Treasure app. Popularise EXTREMA Global applications for personalized risk during heat waves. Implement Meteo heat warnings by the National Observatory of Athens (NOA).

Mavili Square - Athens. http://wikimapia.org/7950369/Mavili-square#/photo/4631446

21 City of Athens (2022). 34 σιντριβάνια στην Αθήνα αποκτούν ξανά ζωή - Κ. Μπακογιάννης: «Δίνουμε στους κατοίκους και τους επισκέπτες της Αθήνας τις ανάσες που έχουν τόσο ανάγκη». https://old.cityofathens.gr/node/38013
21 City of Athens (2022). Σύγχρονοι, ασφαλείς και με νέα άσφαλτο 785 μικροί και μεγάλοι δρόμοι της Αθήνας - Κώστας Μπακογιάννης: Επουλώνουμε τις διαχρονικές πληγές της πόλης, δημιουργώντας σύγχρονες και ασφαλείς υποδομές https://old.cityofathens.gr/node/37982

2. LISBON (PORTUGAL) - THE GREEN CORRIDORS NETWORK

as the background of a NBS approach23

BACKGROUND

Lisbon is transforming rapidly, thus, it's suffering the consequences of its car-centric development model and urban sprawl. This has certainly affected parts of the regional ecological continuum with trends spanning more than 60 years now; even nowadays the Lisbon Municipality is still a cluster of 18 municipalities that do not operate under a coordinated planning vision. For a number of reasons, it has become difficult to protect the ecologically important areas in Lisbon from urbanization. Remaining areas of natural habitat are of particular importance in strengthening the network of green corridors, benefiting from the fact that much of this land remains in the ownership of the property of the urban. The “Lisbon Green Plan” published in 1996 laid out the approach used in 2008 to implement safeguards to protect ecological structures that were threatened at the time.

Lisbon Green Corridors

Source: https://oppla.eu/casestudy/23360

23 Duarte, d´Araújo Mata (2020). https://networknature.eu/casestudy/23360

PROJECT DESCRIPTION - RESPONSE PLAN

For the crises Lisbon is facing, it triggered an update to the Lisbon Master Plan at a time when climate issues are high on the agenda alongside the development of the Biodiversity Strategy to 2020 for Lisbon, triggering a related policy to apply ecosystem services. This led to the approval of the Local Biodiversity Action Plan.

The first green corridor implemented in Lisbon (2012) connected the Parque Eduardo VII (central green park) with Monsanto Forest Park along 2,5km. Derelict land previously used for random car parking was refurbished, allowing for the implementation of a range of NBS such as Biodiverse Meadows, Urban Allotment Gardens and Massive Tree Planting, among others."

Lisbon's Green Corridor

Source: https://oppla.eu/casestudy/23360

ACTION

The Lisbon Master Plan, which received the ISOCARP Award of Excellence in 2013, has identified the most ecologically sensitive areas for conservation. It also promotes ecological sustainability, biodiversity and the quality of green public spaces, through a network of green corridors to be built over the next decade (2012/2022). The plan predicts a >19% increase in green space (defined as over 400ha), with a target of 25% green space across the city. The scale of green corridors is determined to connect with the Lisbon Metropolitan Area, where possible. Overlapping the most ecologically sensitive areas of the land, this multi-benefit Green Infrastructure (GI) network proposal meets the recommendations of several studies looking at climate change scenarios including increased frequency of floods, heat waves and droughts.

The creation of green corridors in Lisbon has provided larger and more connected areas of intervention, along with the opportunity to take a holistic NBS approach, involving a wide range of habitat types. Science and natural capital play an important role in the resilience of ecosystems. This also allows for the consolidation of diverse green infrastructure, where forests, biodiversity grasslands and urban distributed gardens come together, introducing new and existing green spaces wherever they are. Some examples are the development of urban distributed gardens, natural drainage systems, rain-irrigated biodiversity grasslands, and large tree planting.

POTENTIAL IMPACTS AND BENEFITS

These evolving green corridors and ecosystem service policies provide important, direct responses through which cities can act to address the impacts of climate change. Address heat wave effects using shade, mitigating water scarcity situations. Thereby, it has contributed to prolonging and balancing the water source through the process of charging and keeping groundwater. From there, organisms and microorganisms can regenerate and have a better living environment. In addition, the mental benefits of beautiful green patches also help promote physical health and mental health.

The most important thing with greening lies in the removal of air pollution, which is the space/lever to develop sustainable mobility through the bicycle network. Reduce costs for maintenance and protection of natural water sources, increase permeability and storage. The sewer system through that also lightens the burden somewhat.

• NBS benefits

- Developing climate change adaptation; improving risk management and resilience
- Restoring ecosystems and their functions
- Enhancing sustainable urbanization

Lisbon's Green Corridor

Source: https://oppla.eu/casestudy/23360

The green corridors of Lisbon 2012-2022 (Mata, D. adapted from Lisbon Master Plan).

Source: https://oppla.eu/casestudy/23360

3. POZNAŃ (POLAND) - A FRIENDLY, MOBILE CITY 24

A NBS Case study

BACKGROUND

The main objective of the city strategy (Development Strategy for the City of Poznań 2030) is to improve the quality of life for all residents, in such a way that everyone feels they have a role to play in co-creating the city. One of the five strategic goals of the city strategy - 'A green, mobile city' - sets out the goals of the NBS, while the other strategic goals, including: 'Friendly housing estates' and 'The spirit' of community and social dialogue' contains elements of the NBS .

The NBS goals are also incorporated in complementary spatial planning and strategy documents (Development Strategy for the River Warta in Poznań 2012–2030, Environmental Protection Program for Poznań 2013-2016 looking ahead to 2020), for the purpose of restoring and green protection of wedge areas along the Warta, Cybina and Bogdanka rivers. These goals are to protect green areas from new development, preserve existing parks and green areas, and create new parks and recreation areas. The Warta River Development Strategy in Poznań 2012–2030 aims to create more space for the Warta River, deepen the Bogdanka River bed, build more river channels, and enhance river recreation activities. In addition to the NBS-related goals mentioned above, the NBS is recognized as a contributor to social goals in all of the city's strategic documents (developing environmental education, supporting and creating new open) public spaces, making the city family- and senior-citizen-friendly, supporting cultural and sporting activities for social development and improving the health of residents.

ACTION PLANS

Poznań's green areas currently account for about 27% of the city's area, mostly used by communal forests (2 580 ha) and parks (more than 526 ha). The city government is focused on the effective management and restoration of the green wedge system, while creating new sites despite the limited available space. In recent years, 18 000 trees have been planted only along the roads. Efforts have been made to prioritize green space over concrete areas through transitional elements, such as containers with a variety of seasonal flowers, to improve the urban spaces.

Parking lots in sealed areas have been converted into green areas, such as the square at Poznań Town Hall and at Kolegiacki Square; this has improved soil quality and conditions, climate and water.

In the city center, a new park - Stare Koryto Warty Park - has been built on a 3.5-hectare site that previously consisted of dense vegetation, including playgrounds, exhibition spaces, amphitheater and fountain.

On the Warta River, four seasonal beaches have been created, where locals can relax in the summer. Community gardens (traditionally 3.1% of the city) have also been established, with the aim of maintaining citizen participation.

After a pilot phase of building schoolyard gardens, the city government now intends to attract retirees as well. In the program, the government provides people with plants and gardening tools. Furthermore, the city government is planning to identify more areas available to residents to develop gardens.

Smart part in Poznan

Source: https://www.lepszypoznan.pl/i-pieknie-jest-nad-warta-26-08-2016.html

24 Roman Przybylski, Department of Transport and Greenery, Poznań (2020). https://oppla.eu/casestudy/19452

LESSON

The crucial motivation for implementing NBS was the need to keep people in the city together to fight against the air pollution and global warming.

In addition, it is possible to detect a trend of change in people's behavior, when people ask for more green investments and begin to actively plan and implement these projects themselves. This shows that when there are financial possibilities for the people (in this case under the Poznań Civic Budget), people will propose and then select projects, i.e. which project to improve the quality of life.

Due to the lack of space in the inner city, sometimes the only opportunity for greening is along roads and streets. There is conflict here with underground and other infrastructure and in many cases greening is difficult. Space planners and designers are very interested in creating green areas in the city. However, in reality, large green spaces are not in the interests of developers, which often leads to conflicts between planners and investors.

The key lesson here is to engage more in dialogue with other responsible industry professionals, demonstrating the many benefits of NBS and using technical solutions to enable NBS.

INVESTMENT

The city budget provides the largest share of financing for green investments, followed by the national fund for environmental protection and EU funding. Funds to maintain and establish green areas mostly come from the city budget. EU funding is available for certain projects and activities, for example EU funding is used for an existing development project involving a 14 hectare park and purchasing native trees for the park.

CHALLENGING

According to city officials, the main social challenge facing the municipality of Poznań - Poland's fifth largest city (with about 550 000 inhabitants) is to develop a resident-friendly space where residents will want to live and spend quality time in the downtown area, thus reversing the trend of residents moving from the inner city to the suburbs.

Another challenge is preventing air pollution and mitigating the effects of climate change, including extreme weather (droughts and heat waves). The main way to solve these problems is to keep the city green and continue to develop spatial layouts for green areas. However, it is hard to develop spatial layouts due to limited space to turn into trees, large areas being sealed off, pressure from new investments and parking. Furthermore, there is little public awareness of environmental issues and the benefits of nature-based solutions.

IMPACTS AND RESULTS

The impact of having an expansive green wedge system extending across the city and investing in green infrastructure can be seen by the fact that 55% of cities have high cooling capacity according to recent research carried out in MAES (Mapping and Assessment of Ecosystems and their Services) urban project. In Poznań, 69% of green infrastructure is available within 300m, which can help maintain a dynamic urban population.

According to city officials, these actions have increased the green space in both quantity (area) and quality (biodiversity, connectivity), helping to improve the quality of public spaces.

The conversion of parking lots into green areas (along with the new cycling system and pedestrian areas) could have helped to reduce vehicle use in the city center. A large number of people choose to walk or cycle, increasing sustainability in mobility.

The 30km riverside area with seasonal beaches is also used more frequently - thousands of people now use these sites, which were formerly wasteland. There is also a knocking effect among the residents. When locals see the results of investing in green spaces in other streets and neighborhoods, they demand the same investment for their areas.

Participative Budgeting good impacts: This can be seen through individual requests from residents to the city government or through the Poznań Citizens Budget (an initiative whereby citizens submit project ideas to the local authorities, followed by a public vote and implementation of the most popular projects), where many of the project ideas are related to urban green.

• **NBS project 1: Maintaining the green wedge system**

The green sealing system helps to improve climate conditions, improve air quality (cooler air), reduce the effect of heat shock for people, and reduce the potential risk of harm to health. In addition, the social interaction effects between age groups are also noted to be long-term improvement, especially under the current Covid-19 epidemic situation.

• **NBS project 2: Planting 18 000 trees on the roadside and using urban green elements**

The increase of trees and the use of mobile plant containers on concrete surfaces can help increase aesthetics, better microclimate conditions, reduce thermal shock effects and increase storage and permeability of water sources.

• **NBS project 3: Transforming car parks into green areas**

Parking lots were converted to green areas that improved water retention and soil function in metabolism. The reduction of vehicle use is an advantage, leading to a reduction in noise indicators and improved public air. In turn, human health will be further enhanced by better air quality.

• **NBS project 4: Community gardening**

The main highlight is the urban garden increasing urban biodiversity. Local food production also promotes physical and mental health from the outside.

• **NBS project 5: Creating seasonal beaches**

The creation of seasonal beaches helps to increase "availability" to cater to everyone, helping to increase the attractiveness of the city, increasing the number of visitors, the stay, the promotion of local tourism.

4. GDAŃSK (POLAND) - THE WATER RETENTION - RAIN GARDENS [25]

A NBS Case study

BACKGROUND

Gdańsk is known as a popular coastal city in the north of Poland, where in 2016, there were serious flooding events that caused significant damage in the city.

The local conditions in Gdańsk has 3 altitude zones: from depression to a plateau, which results in a steep slope and large and fast outflows to the lower terrace of the city. In there appeared a dense network of erosion valleys of multiple sizes, combined with the influence of the sea condition on water receivers and mountain streams encountering multiple roads and railway, leading many regional water sources to be polluted and contaminated with heavy metals.

Taking all into consideration, the locality has proposed a solution to capture clean water to deal with water pollution, by introducing a variety of rain gardens in public areas in the city.

SOLUTION

The Pomeranian region is known in Northern Europe as a forerunner in innovative stormwater management and the development of engineering solutions that can be easily replicated, transferred, and applied in existing urban spaces in other countries.

With problems related to flooding and water pollution, rain gardens began to be born and were first created in Gdańsk in 2018, helping to increase the local reserve of clean water resources.

WHAT IS A RAIN GARDEN?

A rain garden is a garden of native shrubs, perennials, and flowers planted in a small depression, usually formed on a natural slope. It is designed to temporarily hold and soak up rainwater flowing from roofs, driveways, patios or lawns. Rain gardens are effective at removing up to 90% of nutrients and chemicals and up to 80% of residues from stormwater runoff.

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25 Kasprzyk M., Szpakowski. W., Poznanska E., Boogaard F. C., Bobkowska K., Gejewska M., (2022). Technical solutions and benefits of introducing rain gardens - Gdansk case study. Technical solutions and benefits of introducing rain gardens – Gdańsk case study - ScienceDirect

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Furthermore, compared to a regular lawn, a rain garden allows 30% more water to infiltrate the soil.

A rain garden is not a water garden, nor is it a pond or a wetland. On the contrary, a rain garden is dry most of the time. It usually only holds water during and after rain. Since rain gardens will drain within 12-48 hours, they prevent mosquito breeding.

Native plants are recommended based on their relationship to local climate, ground and moisture conditions without the use of any fertilizers. In particular, a rain garden slows down precipitation, which is drained and stored for a certain period of time, then seeps into the soil and improves groundwater quality.

In the design of a rain garden, typically six to twelve inches of soil is removed and changed by tilling, compost, and sand to increase water infiltration.

A rain garden is a concave structure (natural or man-made), the base of the rain garden should be characterized by good permeability (e.g. coarse sand) and porosity (e.g. limestone, volcanic rock), it will work correctly if proper drainage is provided, including gravel, sand and potting soil. The soil should be permeable, however, clay-rich soils can be mixed with other materials (sand, etc.) to improve permeability and infiltration rates. Large rain gardens are better than small ones though most sizes will provide opportunities for flow control, wildlife habitat and enjoyment.

In addition, the rain garden incorporates native vegetation; therefore, there is no need to fertilize and after the first year, the cost of normal maintenance is reduced.

Gdańsk has been developing a small urban storage system, consisting of more than 50 reservoirs and more than 30 rain gardens. Depending on the location, the rain garden will have designs combined with different techniques to optimize the collection of water in the soil.

HOW DO NBS RAIN GARDENS WORK?

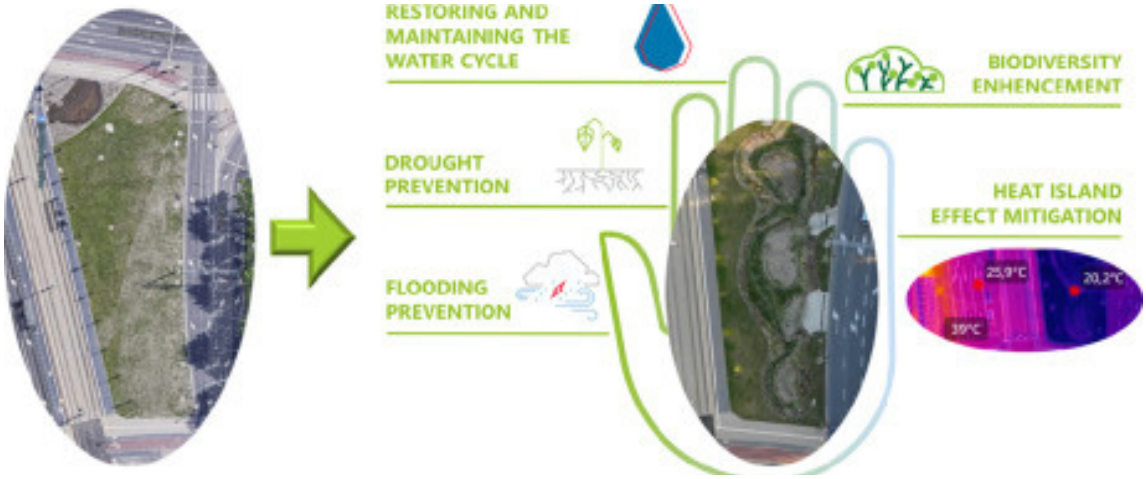
Nature-Based Solutions (NBS) are evolving as innovative multifunctional tools to maximize urban ecosystem services such as stormwater conservation, runoff mitigation and flood control, prevent groundwater pollution, enhance biodiversity and control microclimate.

Gdańsk was one of the first Polish cities to widely introduce rain gardens (an example of NBS) in different areas such as parks, city centers, main intersections and car parks.

Various types of rain gardens can be created depending on location characteristics such as hydrogeology, as well as local conditions and needs. Furthermore, each of them can be equipped with specific technical solutions to improve rain garden functionality - for example, an oil separator or sump can be included to absorb runoff. Initially, the most polluted. During the winter, large amounts of sodium chloride are commonly used to grind sugar which can be the biggest threat to biodiversity and plants. These installations were incorporated into a large rain garden in Gdańsk, located in the heart of the main streets in the city center.

The NBS as rain gardens have a wide capacity in regional implementation, they can be incorporated into existing urban spaces such as residential areas, major downtown intersections, and even old towns.

The timing of water levels in NBSs such as rain gardens depends on many factors, including the storage area, the geological structure of the soil, the amount and type of vegetation used (the evapotranspiration area), and the level of transpiration rate, and usually lasts from a few hours to several days. Additional osmotic processes allow the maintenance of moisture in the top layer of the soil and the normal functioning of the root systems of plants, which, thanks to water, absorb the nutrients necessary for proper vegetation. The process of photosynthesis in plants, which relies on the absorption of water and carbon dioxide (removing excess gasses from the atmosphere) with the participation of light, produces the oxygen necessary for life on Earth.



Precipitation and seepage rates are then estimated through the installation of pressure transducers. Furthermore, urban heat island mitigation is analyzed based on remote sensing, and biodiversity enhancement is estimated as one of the functions of ecosystem services.

Over the past few years, the approach to stormwater management in Gdańsk has changed, especially in terms of design recommendations. The first rainfall (up to 30mm) should be kept by urban greenery. Rainfall over 30mm is directed to rainwater harvesting tanks. Finally, rainwater is directed to the city's stormwater drainage system.

THE INSTALLING RAIN GARDENS AND THEIR OPERATION STRUCTURES IN GDAŃSK

• Rain garden no. 1 – 3 Maja St: with a width of about 2 105 m^2. This rain garden was built in 2020 and consists of three basins connected in a cascade to manage (retain) excess rainwater. In order to divert rainwater from the traffic route to the green belt located in the road layout, three inlets were made along the length of the curb bordering the land, separating the driving lanes of Street 3 Maja from the green area.

• Rain garden no. 2 – Bishop O'Rourke Square: with a width of about 3 145 m^2. The rain garden located in the district of Gdańsk Wrzeszcz was built in 2018. This small storage object is a system of storage basins connected by a system of overflow and treatment of water flowing from the sidewalk and parking lot, and drains. It is equipped with an emergency overflow at the inlet of the stormwater system. The catchment area (type of impermeable pavement and their area) is a street with asphalt pavement and surrounding concrete pavement.

• Rain garden no. 3 – eMOCja Center: Built-in 2020, has two area gardens. The first is a multi-step raised planter to treat rainwater from the roof area with a catchment area of about 75m^2. The second is a typical above ground rain garden to manage rainwater from rooftops and impervious sidewalks near the building.

• Rain garden no. 4 – Lastadia st: In the area of Lastadia buildings, surface management in the form of 'dry' rain gardens has been designed for rainwater from impervious surfaces in small urban storage systems.

It was built in 2020. The road system has been designed in such a way as to facilitate the attractive flow of water from enclosed surfaces - i.e. vehicular traffic, pavement surfaces, and parking lots - and The curb has been cut to redirect rainwater to green areas. Rainwater is managed in low-lying areas to a maximum depth of about 30 cm and flows down accumulating in catchments (surface holding) where it will be used by existing vegetation. An emergency exit is also designed and excess rainwater is channeled into the stormwater drainage system.

Rain garden Bishop O'Rourke Square (Ogród deszczowy Plac Bpa O'Rourke)
Source:http://www.gdmel.pl/mala-retencja/przykladowe-realizacje/47-mini-park-retenyjny-przy-ul-oraz-na-placu-bpa-o-rourke

• Rain garden no. 5 – Kaczeńce st: This particular rain garden is the first of a small urban water retention system in Gdańsk and was developed on the premises of the Gdańskie Wody water company's flood control depot as an example of good practice. It is an emergency spillway-connected catchment system designed and connected to an existing stormwater drainage system, with a total catchment area of approximately 2 700 m^2, and includes a parking lot with cobblestone surface, lattice paving blocks, and warehouse roof area. Precipitation is measured through an advanced weather monitoring system by the water company Gdańskie Wody.

Rain garden – Lastadia st (Ogród deszczowy przy ul. Lastadia)
Source:https://www.trojmiasto.pl/wiadomosci/Ogrod-deszczowy-w-centrum-Gdanska-Uchroni-przed-powodzia-n150073.html

The Gdańsk complex is equipped with 26 stations due to rain spread across each district In Gdańsk, the basic assumptions of the installation of rain gauges are the consistent quality of data obtained, appropriate location, operation appropriate, periodic calibration of the sensor, and how to deal with equipment failure.

Specific precipitation data were analyzed from a monitoring station (Stogi/Kaczeńce), located closest to the two rain gardens (eMOCja and Kaczeńce centers), where the 10-day pressure probes were located. The analysis took place from 15 to 24 November 2021. Precipitation was monitored every 1 minute. Total rainfall during that period was 7.62 mm

CHALLENGE

The project required various engineering considerations and their impact on the effectiveness of stormwater treatment, the ecosystem functions provided by rain gardens operating across technologies and different surrounding environments, as well as urban traffic challenges.

The project identified two of the most important challenges faced by rain gardens:

I. Ability to remove emerging pollutants such as microplastics, per - and polyfluoroalkyl.
II. How to develop a green infrastructure network with rain gardens in urban areas.

The two challenges are equally related: planning during the design process with appropriate and appropriate design, as well as developing a process of participation and social acceptance of rain gardens.

Emergency overflow

Source: sciencedirect

• Preventing flooding and reducing drought: The penetration rate between rain gardens is strongly demonstrated by the measured infiltration rate ranging from 0.420 to 0.707 m/day and is comparable with international values for the infiltration capacity of rain gardens. This hydraulic performance of the natural substrate of the Gdańsk rain garden is enough to store 30 mm of rainfall in time to prevent flash floods and mitigate drought.

• Reduce the 'Urban heat island': Rain garden systems contribute to the improvement of the local microclimate through increased soil and air moisture (transpiration), resulting in lower temperatures, and cooling the air and thus minimizing the phenomenon known as urban heat islands.

Inlets

Source: sciencedirect

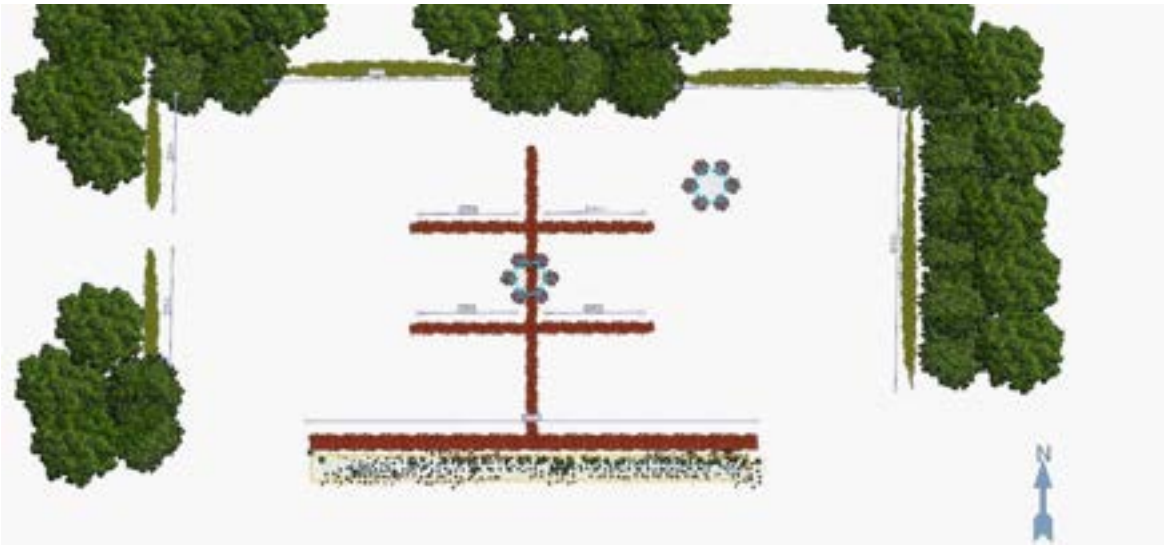
5. CZERWONAK (POLAND) - THE WATER RETENTION - RAIN GARDENS

BACKGROUND

Rain gardens are one of the indispensable elements in line with the idea of a sustainable city. Designing and constructing rain gardens leads to the improvement of the ability to accumulate water resources, i.e. to retain excessive amounts of water. In recent years, we have been struggling with the problems of drought, as well as storms, which harvest a lot of damage. Excessive rainfall in a short period of time causes that our storm drains and the entire sewage system cannot keep up with the collection of water, which causes numerous failures such as flooding roads, collapsing sidewalks, flooding basements, as well as single-storey houses. Last year, such a storm took place in Greater Poland. The Czerwonak commune also suffered, as did the neighboring city of Poznań. Roads, tracks, pavements, as well as some hospitals and shopping centers were flooded.

In order to avoid the negative effects of unexpected atmospheric phenomena, it is necessary to look for solutions that will affect the retention of excessive amounts of rainwater, and will also be a golden measure for the growing problem of drought in our country. One such approach is to use rain gardens in areas where water accumulates in greater amounts. These are usually areas with a lower height level in relation to the adjacent areas. Their main task is to collect and manage rainwater that occurs in the surrounding areas, as well as the paved usable area. Rain gardens can collect water from other infrastructure such as roofs of buildings, stops, garages, sidewalks, parking lots, and other features where water accumulates in excess. Throughout the process of collecting water, the rain garden becomes a kind of storage, which then, thanks to plants and the substrate, which are its components, filter the accumulated rainfall. It is a natural process, so it is another plus for our environment.

In the Czerwonak Commune, there are many places where such gardens could be created. In order to use water retention, in the future, it would be necessary to select the locations that could be the largest rainwater storage facilities and to design the size and vegetation that would be there. This year, one of such places in the Czerwonak Commune was indicated and a basic concept for the management and selection of plants was created. The following years of work of the local government will try to implement tasks or at least to create an outline of activities.



Concept of rainwater management by introducing a rain garden in the Czerwonak commune

Source: Project engineer: MA Katarzyna Hanuszewska

MATERIALS AND TECHNIQUES

To create a rain garden, you need to choose the right place, and then use the vegetation characteristic of the habitat. The shape of the garden can be different, so we can use the natural relief, but it can also be modified. The area must be below the level of the surrounding areas so that water can flow freely to it and accumulate there. Before setting up a garden, it is best to check what type of substrate we are going to work with, i.e. whether it is more or less permeable, which will give an indication of how the area should be designed. A good choice is also the selection of a place in terms of sunlight - an area with strong sunlight is the best for this type of project. However, if the place is not strongly sunlit, but meets other criteria, it can also be used for water retention. We divide the work in stages. After choosing the place and preparing the basic concept, you should create the best possible soil conditions for the newly emerging garden, i.e. prepare the ground for new plantings.

Rainwater that will run off such surfaces as roofs, sidewalks, parking lots can be calculated according to statistical data, this way we can more or less determine what size the rain garden should be. The first step will be to deepen or use a given depression in the field and to secure its bottom with aggregate that will help with infiltration. Then fertilize the fertile soil, which will be a good substrate for the planned plants. It is worth remembering that when choosing plants, we should be guided by the selection of native plants.

Plants will be exposed to many factors, including the occurrence of drought and sudden extreme weather conditions, so when selecting them, remember that they should be resistant to excessive flooding as well as to hydrological drought. Thanks to the properties of plants and soil, the water that will be introduced into the rain garden will be filtered and the purified water will go to the deeper layers of the soil. Vegetation has the ability to phytoremediation, i.e. the ability to remove pollutants.

VEGETATION OF RAIN GARDENS

A characteristic group of plants selected for rain gardens are wetlands. Recommended plantings are, for example: Sedge - Carex hirta L., Sedge - Carex nigra Reichard, Turzyca - Carex pendula, Swordfish - Sisyrinchium angustifolium, Sit spread - Juncus effusus L., Lily of the valley - L. Lythacrum salicaria yellow - Iris pseudacorus L., Siberian iris - Iris sibirica, Ophiuchus knotweed - Polygonum bistorta L., Lysimachia nummularia, Dotted poison - L., Billy goat - Valeriana officinalisna - Mannendula moth, Glyceria maxima (Hartm.) Holb., Mud-forget-me-not - Myosotis scorpioides L., Tragic beetle - Molinia caerulea. Rain gardens have different flood heights. This means that some of them must be planted in a drier, less flooded area, and others should be planted in areas that are periodically flooded with water, e.g. up to approx. 30 cm. For design, you can also use typical aquatic plants, which we plant in water deeper than 30 cm, such as: Yellow water lily - Nymphaea lutea, White water lily - Nymphaea alba L., Floating frogs - Hydrocharis morsus-ranae L., Fine duckweed - Lemma minor L .. If the site allows it, trees and shrubs can also be used in rain gardens, which will also contribute to the storage of rainwater in the rain garden area. A good solution will be to plant trees at appropriate distances and densely, such as: Black alder - Alnus glutinosa (L.) Gaertn., White willow - Salix alba, Poplar black willow - Populus nigra L. and shrubs, e.g. Gray willow - Salix cinerea, Willow iwa - Salix caprea L., Purple willow - Salix purpurea, or laurel willow - Salix pentandra. The plants listed above meet all the requirements for rain gardens. In addition, by creating a rain garden composition, we strongly contribute to environmental protection, because there are good conditions for many creatures looking for a shelter and food. This has a positive effect on the biodiversity of the area. Plantings also protect the substrate against removal, thanks to the roots that stabilize the area.

Petasites hybridus

Source: Katarzyna Hanuszewska

Rains garden flowers

Source: Katarzyna Hanuszewska

RAIN GARDENS IN CONTAINERS

Rain gardens can also be designed in containers using rainwater from the roofs. They are most often used in office buildings, schools, large city buildings, in the vicinity of rain gutters. The containers themselves should be slightly away from the walls of the buildings, i.e. about 30 - 50 cm. The containers should be equipped with a foil or other material securing the bottom, a drainage layer, e.g. expanded clay, sand, a substrate dedicated to planted plants, a drainage pipe, an overflow pipe.

HOW DOES THE CZERWONAK COMMUNE MAINTAIN ITS RAIN GARDENS?

Proper maintenance of a rain garden is very important at the beginning of its implementation. Care should be carried out regularly during the first months after creating such a place. It is recommended to pay attention to the issue of weeding so that other species do not displace the plants planted there, and the role of the garden is preserved. When the garden is fully adopted, the maintenance can take place twice a year in spring and late summer or at the beginning of autumn, preparing them for the winter period.

Designing and implementing projects related to the construction of rain gardens in urban spaces is another big step towards the rational management of rainwater. They counteract the negative effects of bad weather conditions, such as flooded cellars, flooded roads, broken pavements and many, many more. By creating a rain garden, we contribute to environmental protection and create ideal conditions for the retention of rainwater. Another great advantage of such projects is the creation of new habitat conditions. Birds, mammals, insects, etc. find a new place to live in them and find shelter in urban areas. An important environmental aspect is that rain gardens have a good impact on reducing the urban heat island phenomenon, which plagues urbanized cities. The economic issue is also an advantage, because it is an investment that does not bring large financial expenses, because it is actually self-sufficient. Funding for watering is also unnecessary, because well-designed gardens are characterized by the correct selection of plants that are resistant to drought and flooding. There is also no damage caused by sudden heavy rainfall, as the water is largely absorbed. The efficiency of rain gardens is estimated at 30 - 40% greater efficiency of rainwater absorption than the same lawn area.

Summing up and bearing in mind the above - Rain gardens are the future that should be used in urban and more urbanized rural areas.

Rain garden in pots in front of the Czerwonak Commune office

Source: Katarzyna Hanuszewska

6. CZERWONAK (POLAND) - URBAN GREEN CORRIDORS IN TERMS OF TRANSPORTATION IN POLAND

SUSTAINABLE DEVELOPMENT CONTEXT AND NEW SOLUTIONS

Sustainable development of cities affects many levels of everyday life of every resident who lives in highly urbanized areas. Every day, as a result of the heavily built-up infrastructure of cities, roads, the number of cars on the roads, the operation of factories, etc., many pollutants affect the environment, which have a negative impact on the functioning of the society. The environment is harvesting the negative effects of urbanization, therefore cities should start increasing efforts to implement sustainable development. To solve these problems, we should focus on topics such as green transport corridors, green city corridors and liner parks.

GREEN CORRIDORS IN TERMS OF TRANSPORT

One of such solutions is the introduction of Green Corridors. This concept was mentioned for the first time on October 18, 2007 in the European Commission Communication "Freight Transport Logistics Action Plan". It discusses in detail the issues of control, organization and freight transport management. Green Corridors would be aimed at integrating the existing transport so that it has the least possible impact on the environment. All modes of transport, i.e. road, rail, water, were combined so as to reduce transport on the main communication routes, which would have a good impact on the environment. Transport is to become more efficient and safe on a global scale.

In order to create Green Corridors, it would be necessary to present places for the free handling of goods in a safe and environmentally friendly way. This could be an ideal combination of water and rail transport. It would also seek to ensure that transport routes consist mainly of water and rail transport. The concept shows that the negative impact of rail transport on the environment is lower than in the case of road transport. According to statistical data, apart from the fact that rail transport is greener because it does not have such a drastic impact on the environment, the share of operating costs is also much lower than road transport. The introduction of green transport corridors would, of course, mean an increase in the share of green areas in order to, for example, reduce noise, collect dust by plants, collect rainwater, etc. Everything related to the sustainable development of cities.

INTRODUCING GREEN CITY CORRIDORS IN POLAND

Green corridors are involved not only in the aspect of transport, but also in the sustainable development of cities. In Konin in the Wielkopolska Region, a project was created: "Green city corridors - climate awakening in Konin", which is implemented under the Operational Program "Environment, Energy and Climate Change", financed by Norwegian funds, EEA FM 2014 - 2021, state budget and own funds of the city of Konin. Partners in the process of creating and implementing the task are the Polish Association "Green Roofs", Wrocław University of Environmental and Life Sciences and the Norwegian Green Infrastructure Association. The project is implemented from September 1, 2021, and its completion date is April 30, 2024. The aim of the task is to improve the quality of life in the city, increase the share of green areas in the city's infrastructure, remove some parts of paving stones and concrete slabs in favor of pocket parks, etc. This will raise public awareness of how important it is to take care of the environment and raise the topic of climate change these days. The introduction of new solutions will have a positive impact on reducing greenhouse gas emissions by introducing green enclaves on the map of Konin. As part of the project, as many as 23 sections of green corridors will be completed, which will give a total length of 17 kilometers. In addition, 2 pocket parks, 7 city yards and 3 graduation towers of the area will be created. City yards will have their leitmotifs, i.e. each of them will be related to something else, e.g. water, air, human, etc. After the completion of the work in the created enclaves of greenery, educational activities for children, adolescents and adults will be conducted to further spread environmental awareness. Pocket parks, green corridors and city yards will fulfill a very important social function, because working together at green initiatives will establish bonds between the residents.

The city of Konin is already called one of the greener cities on the map of Poland, and after the implementation of the project entitled "Green city corridors - climatic awakening in Konin" it will be even more visible. Green city corridors will create communication routes in harmony with nature. They have been very meticulously analyzed and designed to meet the needs of the inhabitants and in line with the sustainable development of cities. Not only do they include streets, but also shortcuts through housing estates, paths of great landscape value, and interesting routes to walk or cycle by bike.

They have been designed so as to influence the users of the indicated communication routes, connect them with the main housing estates and have a positive effect on them. Green corridors connect communication routes with sustainable greenery and create new habitat conditions. Functions of the green urban corridors of the city of Konin fulfill social educational, leisure, recreational and health-related functions. In their creation, greenery appropriate to the given habitats was used in order to use the potential of water and retention conditions in a given area, etc.

The project of revitalizing the city of Konin and enriching the area with new plantings is worth following by other cities in our country. The main task for all administrative units is to educate them so that as many of these types of tasks can be performed as possible.

Project of green city corridors in Konin

Source:https://www.konin.pl/#lg=1&slide=18 , https://www.konin.pl/index.php/jeden-news-1432/zielona-rewolucja-w-koninie.html

Green city corridors in Konin

Source:https://zapatrzeniwkonin.pl/zielone-korytarze-miejskie-klimatyczne-przebudzenie-w-koninie/

In the Czerwonak Commune, the idea of Green Corridors includes the emerging pedestrian and bicycle path connecting Poznań with Owińska, which is part of the Czerwonak Commune. This path will lead through a footbridge over the Warta River. Thanks to the combination of these two places, road traffic will decrease, and more people will change their means of transport to a bicycle or choose a walk to visit the village of Owińska, the Cistercian Monastery, which is located in the immediate vicinity of the pedestrian and bicycle bridge, as well as green areas surrounding communication routes. In the future, solutions will be implemented here, using the potential of landscape values, to spend more leisure time in the Czerwonak Commune, and it will also have a positive impact on the biodiversity of this area. These solutions will have the character of liner parks, as they will be located along communication routes and water.

A pedestrian and bicycle bridge under construction, connecting Poznań with Owińska - the Green Corridor.

Source: Marcin Deckert

Green corridors is a very broad concept. It is used in international transport, local solutions in cities, as well as in areas left after former investments. Green corridors can be called liner parks, which have also developed a lot in recent times. A liner park is characterized by a large length, e.g. along old routes or as a result of reconstruction of old infrastructure. Liner parks began to appear at the end of the last century, and their popularity is increasing every year.

The topic of liner parks and the reconstruction of the former city infrastructure is also beginning to develop in Poland. One of such examples is the idea of building a linear park along the Vistula Boulevards. In Poland, there is a liner park in Krakow. In the future, the concept of green corridors will certainly develop with the reconstruction of transport routes.

The aim of green corridors is to integrate the entire surrounding infrastructure, i.e. they are to connect different points on the city map. Introducing greenery, reducing the percentage of road transport, as well as introducing solutions in the field of rainwater management increases the biodiversity of the area. The greenery of green corridors and its infrastructure are to be part of everyday life, i.e. to improve living conditions.

A pedestrian and bicycle bridge connecting Poznań with Owińska - the Green Corridor.

Source: Marcin Deckert

CONCLUSIONS

From year to year, more solutions in the field of sustainable urban development are created. Therefore, one should bear this in mind and introduce such solutions to the green infrastructure of the landscape of our cities. The Czerwonak Commune will be guided by solutions related to sustainable development. In the coming years, it will develop the subject of green transport and city corridors, liner parks and rain gardens. This will make a big step in the development of the commune, and will also have an impact on the awareness of society on such an important topic as environmental protection.

Green corridor in the Citadel park in Poznan

Source: Katarzyna Hanuszewska

MANUAL 4: CASE STUDIES II
WATER HARVESTING TECHNIQUES

Arid desert cities like Walvis Bay suffer from general shortages of water, weakened natural water resources, and overexploitation of water due to high demand. Therefore, it is extremely important and urgent to pilot and apply innovative methods to collect water directly from humidity, fog, etc.

Following are some examples of water harvesting techniques from countries also experiencing drought due to climate change that have been successfully applied around the world.

1. THE FOG COLLECTING AND WATER RETENTION TECHNIQUE TO SUPPLY WATER TO TREES IN RESPONSE TO DROUGHT IN SOUTHERN EUROPE 26

BACKGROUND

Scientists in the Canary Islands and Portugal are collecting water from the fog so they can reforest in degraded landscapes.

One of the summer fires has continued to ravage large swaths of forest in Spain, France and Portugal, while drought raging in Europe and the UK has put tens of thousands of acres of land at risk. In the event of desertification, some scientists are busy collecting fog.

1.1 FOG COLLECTORS

Project 'Life Nieblas' (Nieblas in Spanish is 'for fog') is using fog collectors in Gran Canaria in the Canary Islands of Spain and Portugal, to improve degraded landscapes and reforest for fuel.

Vicenç Carabassa, the project's Head Scientist - Fog collectors, said that as wind blows fog through the mesh, water droplets collect and fall into the containers below.

26StephenBurgen(26/08/2022): https://www.theguardian.com/environment/2022/aug/26/fog-collectors-reforestation-trees-canary-islands-portugal-eu-aoe

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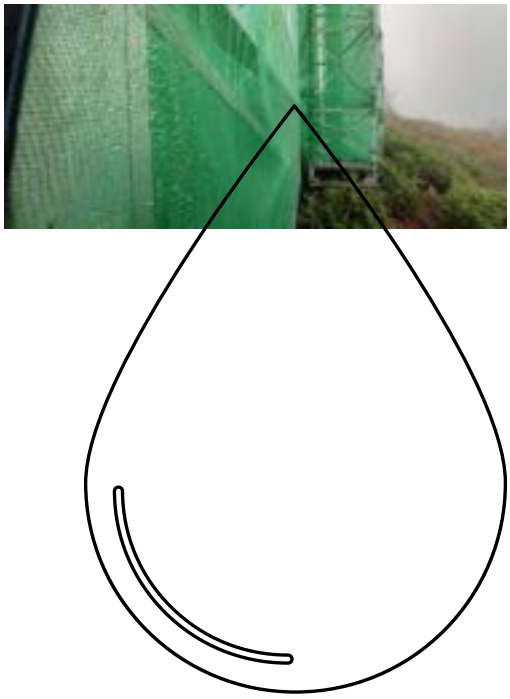


The fog collectors in Gran Canaria in the Canary Islands of Spain

Source: Courtesy of Life Nieblas

"Fog collection is particularly applicable in restoring the Canary Islands' laurisilva [laurel forests], which themselves exist by collecting fog water," said Carabassa. The water droplets from the fog condense on the trees' shiny, waxy leaves. "The system allows saplings to flourish until they are mature enough to capture water themselves," he added. Laurisilva is sub-tropical rainforest populated by evergreen species, though not necessarily the familiar laurel trees found in parks and gardens.

To function properly, fog collectors need both fog and wind, conditions that exist in the Canaries and Portugal, but less so in the Mediterranean, where wildfires and desertification are a problem increasing day by day.

In Gran Canaria, the goal is to capture 215,000 liters of mist and mist per year to regenerate 35 hectares (86 acres) with 20,000 laurel trees in the Doramas forest, an area at high risk of desertification. The replanting will be done with features of Laurisilva, including mulberry, strawberry and morning glory (Apollonias Barbujana). These trees have very good cooling capacity, this has been certified in a project to increase the resilience of water absorption in Greece before.
To learn more about the fog collectors:

How scientists are harvesting fog to secure the world's water supply
Youtube:HYPERLINK"https://youtu.be/NBhFxXT9mUQ"https://youtu.be/NBhFxXT9mUQ

1.2 THE COCOON

Another device being tested with a fog collector is the “cocoon”, a donut-shaped, biodegradable container made of recycled cardboard that surrounds the hole where the seedlings are planted and can hold 25 liters of water. It provides water and shelter to the seedlings for at least the first year, often the most critical.

The cover reduces water loss from the bowl and the cocoon also protects the seedlings from small herbivores. The cocoons are buried in the ground and initially filled with water manually, then with precipitation and in the Canaries and Portugal with water from fog collectors.

The cocoons were tested in Spain, Italy and Greece where they were grown in a variety of soils and climates along with a control group grown in the conventional way. Both groups were initially supplied with the same amount of water and did not require additional irrigation with seedlings followed for two years. Compared with conventional growing systems, cocoons increase seedling survival, especially under dry growing conditions.

With extreme weather likely to lead to more fires, it is hoped that these techniques will speed up the decades-long process of reforestation. “We are tackling reforestation in a more viable and effective way, acting in areas that are particularly vulnerable to climate change and desertification,” says Carabassa.27

A cocoon can hold 25 litres of water and also provides shelter for the seedling.

Source: Courtesy of Life Nieblas

27 Land Life Company. Planting Cocoon trees at scale. https://youtu.be/sll6IO65vPg

2. THE AQUAWEB: RENEWABLE WATER FOR SUSTAINABLE FOOD IN US[28]

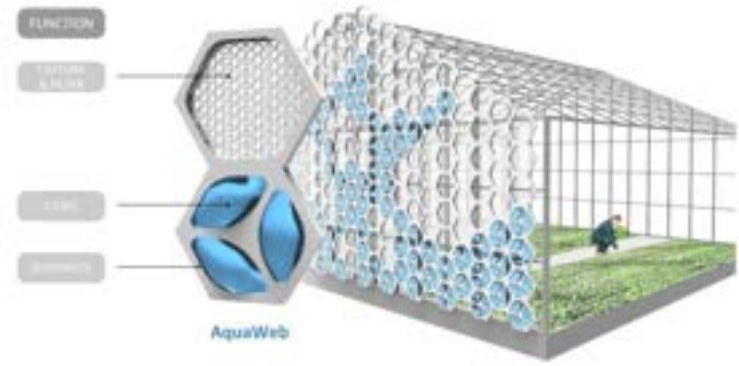
BACKGROUND

The issue of the need to use and reuse clean water for food crops is urgently needed today in hot coastal countries at risk of drought, and arid and saline soils.

The growing demand for local food means an increasing demand for water. Agricultural infrastructure must evolve to use water more efficiently, especially in water-stressed areas and rapidly growing cities. It's up to humans to rethink urban systems to be more local, and self-sustaining by harnessing water from atmospheric sources such as rain, fog, and humidity.

Therefore, a water invention of NexLoop designs biomimetic products and systems to collect and integrate into situ atmospheric water sources into sustainable and affordable urban food production. They are developing a product called the AquaWeb to help urban food producers collect, filter, store, and distribute atmospheric water with a modular, biomimetic, all-in-one water sourcing and management solution.

NexLoop's product called AquaWeb can capture, store and distribute water into local food production. Using bio measurement, regenerative innovation is inspired by nature. They have built products and systems based on biological and ecological functional principles and strategies.



AquaWeb

Source: https://www.designindaba.com/articles/creative-work/nexloop-looks-nature-create-remarkable-water-generator

28 NexLoop: https://nexloop.us/

INTEGRATED MODULE CONCEPT

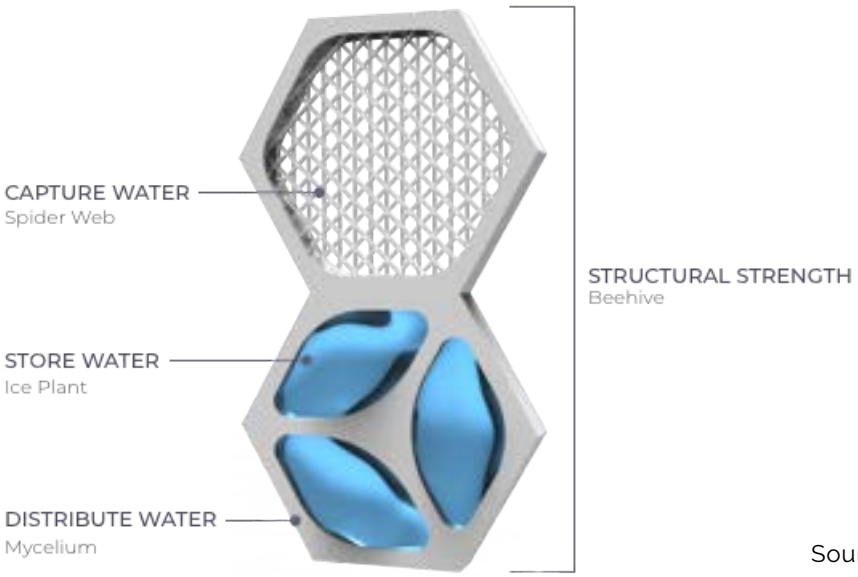
Source: https://nexloop.us/

DESIGN

Designed using the Biomimicry method.
AquaWeb's overall water management strategy reimagines epiphytes, including mosses, lichens, and ferns. These are non-parasitic plants that grow on the surface of other plants. Epiphytes draw moisture from the air and make that water accessible to neighboring organisms. Similarly, AquaWeb acts as an infrastructure that absorbs atmospheric water in the built environment.

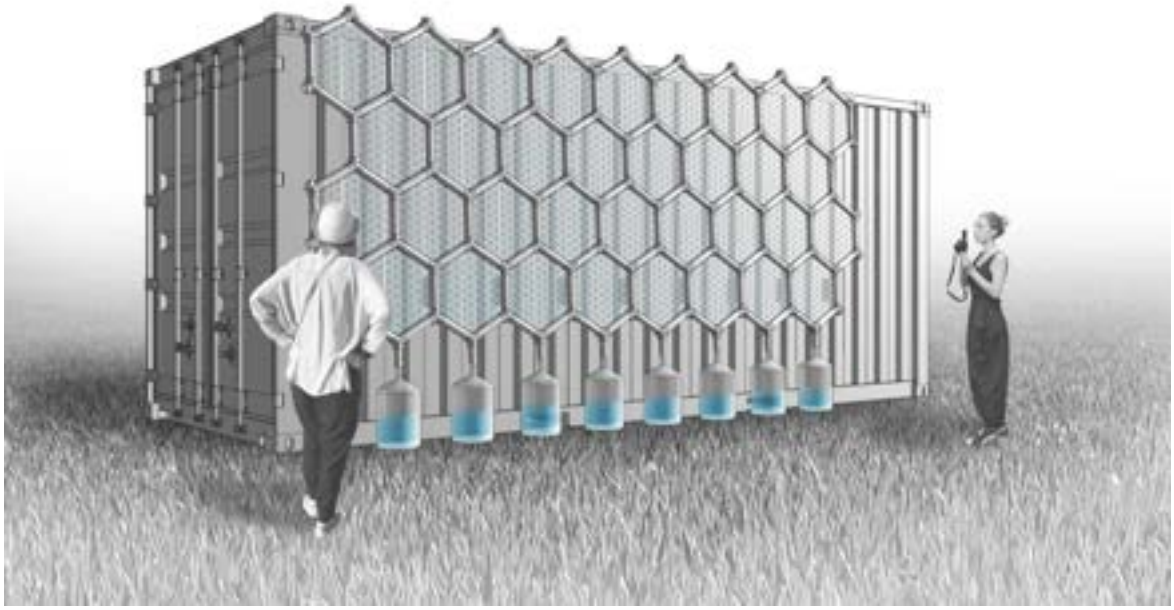
In terms of structure and function, their system uses a variety of biological strategies including how the web spider retains water, the common ice plant's distributed water storage technique, and how the mycelium transports water to the roots.

The project was implemented on Governors Island, New York in 2019 and has been generating 5 gallons of water per day.



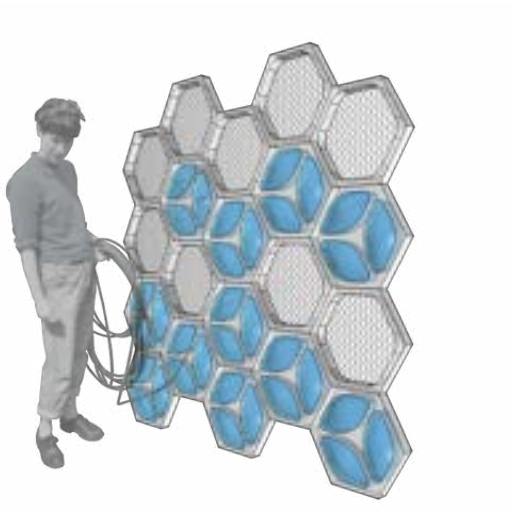
MODULE CONCEPT

Source: https://nexloop.us/



THE LOOP PILOT

Source: https://nexloop.us/



Modular components Kit-of-parts system is lightweight and easy to assemble

Source: https://nexloop.us/

3. ZERO MASS WATER - RENEWABLE DRINKING WATER

ATMOSPHERIC WATER HARVESTING

BACKGROUND

With drought threatening many parts of the world, discover technology that sucks water out of thin air. After three years of drought, in January 2018, the South African city of Cape Town was just 90 days away from turning off the taps. Officials warned that residents would then have to collect a limited supply of water from 200 centralized water supply centers. The campaign slogan 'if it's yellow, let it mellow' has cut back on domestic usage. The imposition of agricultural water use quotas and the return of rain in the area also helped replenish the City's reservoirs.

Scientists estimate that 4 billion people already live in areas with severe freshwater shortages for at least a month each year. This number is projected to grow to between 4.8 billion and 5.7 billion by 2050. Reasons include climate change, polluted water supplies and increased demand due to population growth as well.

A challenge in convincing consumers to reduce their consumption is the perception that water is all around us. More than 70% of the Earth's surface is actually covered with water. However, only about 2.5% of it is fresh water, the rest is salt water. Most freshwater is trapped in permanent ice caps, glaciers and snow and now less than 1% of the water on Earth is available for drinking.

Zero Mass Water

Source: https://www.solarquotes.com.au/blog/source-air-solar-water-mb0312/

SOLUTION

Technical solutions are increasingly sought to provide for our ever more hungry world. Desalination plants, which remove salt from seawater, are experiencing a major benefit. But another, lesser-known group of technologies is also starting to grow in popularity: atmospheric water harvesters.

As their name suggests, these devices draw water from the atmosphere. These include technologies that can capture both gaseous water (vapor) and liquid water (droplets) from the air around us.

Most commercially available atmospheric water harvesters mimic the way dew forms on vegetation early in the morning and the way condensation forms on coolers when we take them out of the refrigerator. When warm air comes in contact with a cool surface, it is quickly cooled. If this temperature is lower than a certain temperature, called the dew point, the water vapor in that air will condense into a liquid phase. Then the water droplets formed on the surface are obtained.

Hydropanel

Source: https://arena.gov.au/blog/how-do-hydropanels-work/

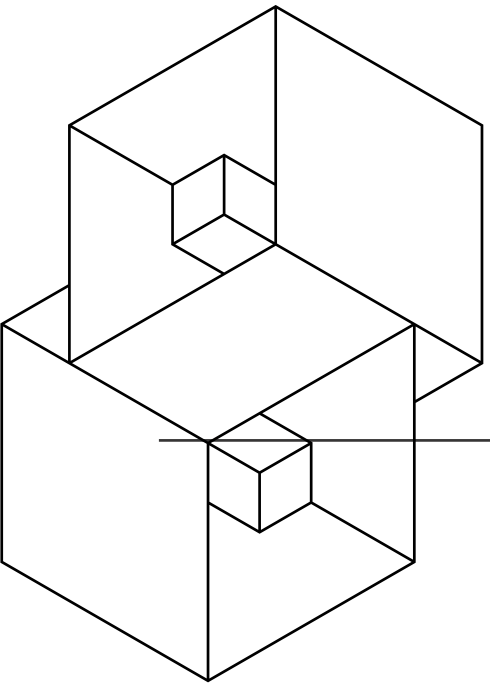
GENERATE YOUR OWN ULTRA-PURE WATER WITHOUT A WELL?

Zero Mass Water took seven years to develop and it's using some nifty science to squeeze drinking water from the air and solar energy, a single system can produce enough drinking water for two to three people every day - even in desert conditions.

The startup's Source system is based on a super-absorbent material that collects water at a concentration 20,000 times that of the air around it. The setup is powered by solar panels, so it has no carbon emissions, and is an eco-invention for the environment.

Their standard two-panel system produces about 10 liters of water per day, which equates to about 20 bottles - usually enough for a family of four. Friesen - the founder of Zero Mass Water noted that the water is reserved for drinking, as bathing or watering your lawn will drain the source just in minutes.

The global water usage is changing as many clean water areas are not available. Zero Mass Water works in both wet and arid climates. They have installed systems in areas of South Africa, Ecuador, Jordan, Mexico and the Philippines that lack infrastructure for drinking water. After Hurricane Maria, several charities funded installations at a fireplace in Puerto Rico, where locals can now come to refill their containers.



4. WATER RETENTION TECHNIQUES IN THE CZERWONAK COMMUNE

LOCATION OF THE CZERWONAK COMMUNE

The Czerwonak Commune is a rural commune belonging to the Poznań County. It is located in the northern part of the Wielkopolska Province, in the Wielkopolska Lowlands. It borders the city of Poznań to the south, the Suchy Las commune to the west, the Murowana Goślina commune to the north, and the Pobiedziska and Swarzędz communes to the east. The Warta River flows through the Czerwonak commune.

CLIMATE CHANGES - STEPPE FORMATION IN WIELKOPOLSKA

Water resources in Poland are similar to those in Egypt. Wielkopolska is the region of our country most affected by drought. Fires, poor-quality crops, lack of water in nearby rivers, low water pressure in taps, and even sandstorms are problems that we face more and more often. Long-term atmospheric and hydrological drought causes: soil drying, reduction or complete destruction of plant crops, reduction of drinking water resources, and increased probability of catastrophic fires.

In terms of the abundance of surface waters, the area of the Czerwonak commune is poor. The Warta River, which forms the western border of the Czerwonak commune, plays a leading role in its area. The Warta River is the third longest river in Poland (808.2 km). The average depth of the Warta River is 1.5-4.1 m, and its length in the commune is 15.5 km. There are no other large watercourses in the Czerwonak commune.

There is one natural lake in the commune. It is the Bolechowskie Lake (area: 6.0 ha). In the commune there is also a pond in Trzaskowo (area 20 ha), a pond in Kicin, ponds in Owińska and many other ponds.

RETENTION ACTIVITIES IN THE CZERWONAK COMMUNE

Every year, the world's drinking water reserves are shrinking dramatically. Poland is also experiencing problems related to the drastic drought and drying up of retention reservoirs.

Currently, the level of retention water, i.e. water accumulated in small natural and artificial reservoirs and in the beds of small rivers and streams, in canals and ditches in Poland, is only 4-6%, which is the lowest result among all European Union countries. Average level of retention waters in the remaining countries of the Community oscillates between 45-55%. In addition, the amount of precipitation for Poland ranges from 500 to 1000 mm / year. In the Czerwonak Commune it is the lowest in the country at 500 mm / year (data from the Institute of Meteorology and Water Management).

Due to very large droughts in the voivodeship and the Czerwonak Commune, communal water collection activities focus on:
a) maintaining local natural water reservoirs,
b) maintenance and construction of drainage ditches, including the largest one, Struga Kicińska,
c) maintaining a small backyard retention,
d) taking care of the condition of the Warta River.

MAINTAINING NATURAL WATER RESERVOIRS

Actions taken to maintain natural water reservoirs include the retention of surface and ground water in forest areas, lakes, ponds and ditches while maintaining and supporting the development of the natural landscape.

MAINTENANCE AND CONSTRUCTION OF DRAINAGE DITCHES

The modernization of the existing drainage systems in order to inhibit the outflow of water, e.g. devices such as monks, culverts and gates, gives great opportunities for water retention. These activities are to prevent drought, perform flood control functions, restore natural bogs and wetlands, maintain the level of groundwater and groundwater, and create waterholes for wild animals. The joint organization of retention works, consisting in the construction of a monk, by the Łopuchówko Forest Inspectorate, local naturalists and the Czerwonak Commune resulted in the modernization of drainage ditches while maintaining the possibility of natural migration of amphibians that are often found in this area.

TROUGH RETENTION

It takes place by designing and modernizing the existing reservoirs and building new retention reservoirs by flowing watercourses (drainage ditches).

MODERNIZATION OF THE EXISTING RESERVOIRS

Retention reservoirs, including the pond in Kicin, collect water during periods of heavy rainfall and constitute a reservoir of water during drought. This allows aquatic plant and animal ecosystems to survive, and significantly slows down drought processes. Retention reservoirs also reduce the risk of flooding. The construction of small and large water reservoirs is critical to reducing the effects of the extreme hydrological phenomena we are currently experiencing as a result of climate change.

The renovation of the pond in Kicin will contribute to the preservation and improvement of the water environment. Removal of unnecessary vegetation will increase the retention area of the pond about 2,500 m^2. Maintenance works will restore good parameters of the pond, and improve water and retention conditions. The amount of water in the pond will increase and the pond will overgrow with reeds and silting of the bottom will be stopped. When implementing an investment related to the improvement of retention and the cleaning of the pond will improve the quality of the surface water.

A pond at Wiejska Street in Kicin

Source: from the archive of Czerwonak Commune Office

CONSTRUCTION OF NEW RETENTION RESERVOIRS BY FLOWING WATERCOURSES (DRAINAGE DITCHES)

We have a project to build a new storage reservoir, consisting of three smaller reservoirs with a total area of approx. 0.15 ha, on the Struga Kicińska, which is a small tributary of the Warta with numerous natural meanders. The idea behind the construction of the reservoir is to locally retain (slow down the runoff) of water to improve soil irrigation, which will protect the species of animals and plants found there, and their habitats. Retention reservoir and its surroundings will play a tourist, recreational and educational function.

The scope of the planned investment includes at least:
- construction of the retention reservoirs with leveling and leveling of the slopes of the reservoirs with different slopes,
- construction of earth dams with appropriate security measures,
- construction of emergency surface overflows,
- construction of a dam on the Struga Kicińska,
- construction of a water supply ditch (lead-in) to the reservoir (zone B - see the design drawing),
- construction of anti-erosion fortifications at the outlet of the water from the reservoir (zone A - see the design drawing),
- sectional cleaning, desludging and strengthening of the bottom and slopes of Struga Kicińska
- leveling and leveling of soil masses in the immediate vicinity of the retention reservoirs.
- surface hardening constituting communication routes in the vicinity of the designed reservoirs.

Construction project of a complex of three ponds at Struga Kicińska in Czerwonak

Source: from the archive of Czerwonak Commune Office

The main goals of the construction of these reservoirs are:

• increase in the volume of retained water (as channel retention) at the local and regional level,
• the ability to regulate the amount of water and mitigate the effects of drought. Thanks to this, the implementation of the task will have a positive impact on the environment, as it will contribute to the retention of water in it.

Multifunctional water reservoirs help to alleviate the effects of drought as well as and flood. Small and large - they improve the water balance in their area. In view of the increasing climate change, it is the most effective solution to ensure the right amount of water necessary for people, the economy and the environment.

SMALL RETENTION IN THE CZERWONAK COMMUNE

Due to the poor resources of surface water, residents themselves try to retain water by keeping it in reservoirs of various sizes (from rainwater barrels to large ponds).

For several years, a subsidy program for the purchase of rainwater tanks has been carried out in the commune, which is very popular among the residents, which is confirmed by about a conscious approach to climate change and progressive drought and the need to contribute to reducing its effects. The basis of the rainwater utilization system is a reservoir for their safe storage. The tank is selected based on the volume of rainwater stored.

Naturally meandering Struga Kicińska - winter 2020

Source: from the archive of Czerwonak Commune Office

Private pond in Promnice

Source: from the archive of Czerwonak Commune Office

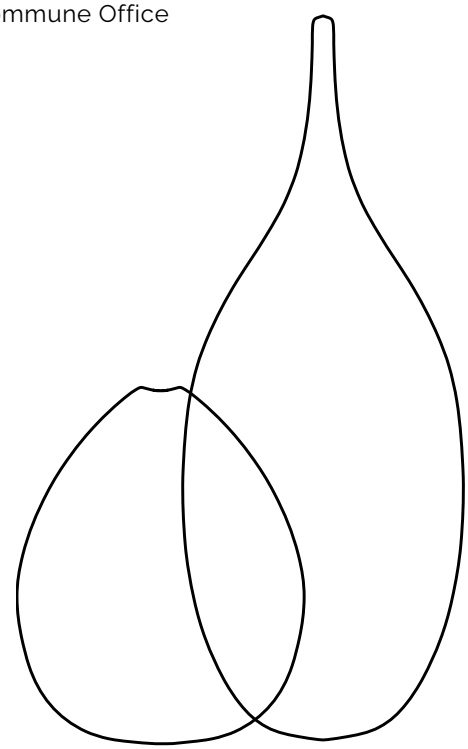
Private pond in Czerwonak

Source: from the archive of Czerwonak Commune Office

The collection of water into containers is usually done by collecting rainwater from the roofs using the gutters attached to them. Water is introduced through the gutters to the tanks in which it is stored. The tanks are usually made of plastic. The stored water is drawn by the resident to water the tweedy garden when he deems it necessary during prolonged dry days. This way of collecting rainwater is most effective, although you can also simply place a barrel without a lid in the garden to collect rainwater directly.

Rainwater tanks - Miękowo, Czerwonak commune.

Source: from the archive of Czerwonak Commune Office



Comparative calculations of water obtained from rainwater tanks and rain, and a mesh that collects water from fog

Below we present the calculations of obtaining the average amount of rainwater collected from the roofs through gutters to our tanks according to the universal formula:

$Q = H \cdot A \cdot \Psi$ m3/year

where: H - precipitation height for a part of the Czerwonak region: 500 mm/year
A - roof area in the horizontal projection - average roof area in the commune: 108 m^2
Ψ - runoff coefficient, characteristic for a given area: 0.86

Q = 500x108x0.86 = 46.440 l / year (liters/year)

By assuming only runoff to 1 reservoir with approximately 30% of the roof area - for 1 building the commune reach the value of 13930.8 liters of rainwater collected per year.

Over a period of 3 years, the Czerwonak commune granted subsidies for the purchase of a rainwater reservoir for 270 property owners, which gives:

13930.8 l/year x 270 = 3 761 316 l/year of saved water for residents who installed tanks with an average capacity of 360 liters.

The water requirement for watering gardens is about 10 liters per 1 m^2, that is each of our residents can water around 1.393 m^2 of area throughout the entire period without paying for water intake.

PLANNED WATER EXTRACTION FROM SMALL BACKYARD RETENTION:

- there are approx. 3882 residential buildings in the commune,
- plan to grant one hundred subsidies a year, which gives 100 tanks,
- for 5 years the commune wants to grant around 500 subsidies, which together with the current tanks: 770 tanks installed on 770 properties.

Result: 770 x 13930.8 l/year = 10726,716 l/year of free rainwater collected in rainwater containers and used for watering gardens.

A COMPARATIVE ANALYSIS OF THE USE OF FOG FOR WATER EXTRACTION IN RELATION TO THE METHODS RELATED TO POINT COLLECTION OF RAINWATER

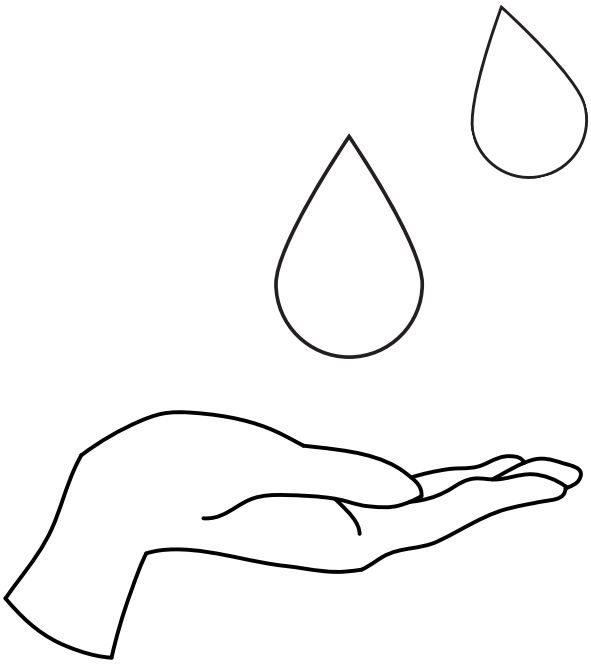
In the local Czerwonak commune climate, it would be possible to get 1 m of a net for obtaining water from fog, approximately 6 to 8 liters of water per day.

Taking about 30% of favorable wet and rainy days, or 110 days a year x approx. 5 m^2 x 8 liters gives 4400 liters of fog water for 1 property in the Czerwonak commune.

110 days x 5m2 x 8 liters = 4400 liters of water, mist

Summing up, collecting water through point retention in the areas of Western Poland gives a ratio of 3,2 times more water per year from rainwater collection to rainwater and rainwater tanks than the methods associated with collecting water from fog, such as in Namibia.

This proves that in the Western Poland's climate, and more precisely in the Czerwonak commune, it is more effective, in terms of small retention, to collect water for rainwater and rainwater tanks than to install installations using nets to collect water from fog. At the same time, this does not exclude the use of this innovative method in an adequate municipal area in the future.



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