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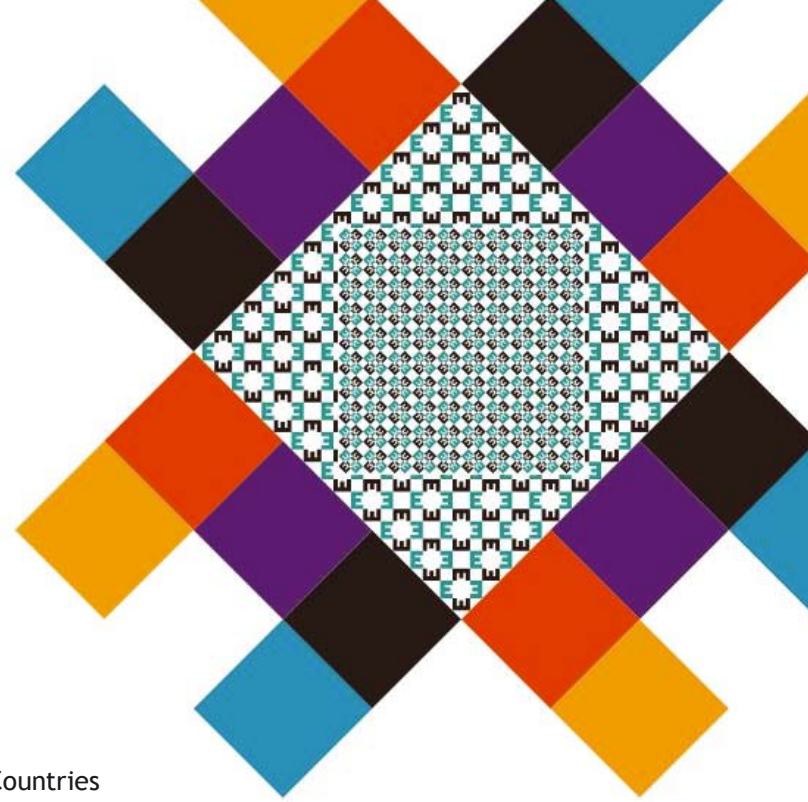
ADAPTATION BEST PRACTICES FROM THE VISEGRAD COUNTRIES

EDITOR:
ENERGIAKLUB CLIMATE POLICY INSTITUTE AND APPLIED COMMUNICATIONS



Adaptation Best Practices From The Visegrad Countries
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The research and its background can be found and downloaded from the website of Energiaklub Climate Policy Institute and Applied Communications: www.energiaklub.hu.

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EXECUTIVE SUMMARY

Local-level awareness of climate change is still at a basic level in Visegrad countries, and ways of adapting to climate change are not well known yet. On the other hand, some replicable initiatives and projects can be found, which may motivate local municipalities to go ahead with this issue and to implement climate adaptation projects.

Project-team has chosen 3 cases from each Visegrad country, respecting the diversity of solutions and of the population of implementing settlements. In this way, both smaller villages and bigger cities could find a suitable practice to follow, considering local particularities and the importance of participatory processes. Table here below could help to have a review on the cases.

Country	Locality	Size of the settlement[1]	Issue	Sector	Key words from description
CZ	MODRÁ	S	water management	landscape recovery	ponds, interactive exhibition,
CZ	HRADEC KRÁLOVÉ	L	green infrastructure	tools for effective and climate friendly operation	data gathering and monitoring of urban trees
CZ	MODRICE	S	adaptive buildings	buildings	passive, green- and climate-awared building for seniors
SK	TRNAVA	M	awareness raising	social	grant scheme to support projects of citizens
SK	KOSICE	M	adaptation planning	urban planning, revitalization	whole process was carried out
SK	KEZMAROK	M	flooding	adaptation planning	adaptation process for flooding
PL	KROSNICE	M	climate-friend urban places	urban planning, revitalization	revitalized, greened avenue, model for partnership
PL	MARKI	M	water management	education	rain gardens, education
PL	WROCLAW	L	green infrastructure	health	pocket parks
HU	SZEKSZÁRD	M	awareness raising	social	Climate Fund for citizen's climate actions, awareness raising programs and events
HU	FELSŐÖRS	S	complex	complex	water permeable covering, climate-garden
HU	PILIS	M	complex (health, water management, etc.)	complex	education and awareness raising, disaster management

Case studies are introduced in the same structure, presenting:

- basic information on the location and implementing actors,
- a short summary,
- local problems related to climate change,
- steps forward solution, mentioning success and limit factors,
- outcomes and lessons learnt,
- contact information and references.

Case studies in this collection were elaborated in the frame of the project 'Capacity Building for the V4 Region on Climate Adaptation', supported by International Visegrad Fund.

1 Basic classification of settlements after their population (S: villages, M-smaller cities, L: cities with population higher than 100.000)

TABLE OF CONTENTS

For key words, affected sector and main issue of the cases, please see the table of the executive summary.

1 ▪ Felsőörs (HU)

Implementing Municipality/Actor:
Municipality of Felsőörs, a green NGO and local citizens
Location:
Felsőörs, Hungary
Type of location:
Village with appr. 1600 inhabitants

1.1. SUMMARY

The Mayor of Felsőörs is an environmentalist who has participated at a training on climate adaptation and made use of the knowledge gained: with his leadership, the municipality – in cooperation with the local green NGO and villagers – has been and is implementing a number of development solutions with climate adaptation co-benefits. Particular projects presented hereby include the covering of streets with permeable surfaces to prevent perturbations caused by heavy rains, the usage of administrative means to protect the village's water resource area, the development of green surfaces including regular tree plantation and the establishment of the so-called "Living Fossils' Park" and ensuring energy supply for public purposes independent from the regional network.

1.2. PROBLEM

The village is currently affected by climate change and extreme weather events in a limited manner. The primary hazards it has experienced are heavy rains, flash floods and inland inundation, which – unlike in cities – cause perturbations especially in streets with unmetalled roads, by impeding transport.

Moreover, a part of the settlement, the Malom-valley (Malom-völgy) is not only a habitat for a number of native species and is full of geological values, but its only water resource area provides drinking water to the village (and to the village only). Given that this area is located in a bare karst landscape, the water resource is directly recharged by precipitation. This problem can be exacerbated by heavy rainfall from the side of climate change but also by economic activities pursued on the surface of the water resource area. As far as the quantity aspect is concerned, with climate change, summers get hotter and the region needs more drinking water. As a result, the regional water supply operator would intend to connect the wells of Malom-valley to the regional network, which might endanger sufficient supply to Felsőörs. The municipality strives to have guarantees that the wells would keep on providing sufficient water to the settlement both in terms of quantity and quality, which both are in peril because of the connection to the regional network and future climate change. Negotiations are also ongoing with them.

In addition, it also needs to be mentioned that there are a range of development measures carried out / to be carried out in the village, which needed/need to be examined from the aspect of climate change. These measures can be subject to potential effects of current and future climate change / extreme weather events or can improve resilience of the settlement. Such measures are in particular the following:

- future covering of an unmetalled road (affecting 16 households)
- greening of the settlement
- tourism development based on geological values
- installation of solar panels

Important internal and external actors:

- Balázs Szabó, environmentalist mayor
- municipal council (7 people)
- FÉK Fenntartható Élet és Környezet Egyesület, local green NGO with about 40 members
- local residents
- entities with adverse interests than the settlement

1.3. THE SOLUTION

The main objective of the presented measures has been the development of the village. The commitment of the Mayor has ensured that the aspect of climate change has been incorporated thereto.

Initiatives implemented:

Permeable covering of street: A development measure, namely, the covering of a street of 16 families was needed. The Mayor ensured that the aspect of climate change adaptation was taken into consideration in the planning phase – actually, he learnt about and proposed permeable covering to prevent flash floods in case of intense rain. Local residents were consulted about their opinion and preferences; they expressed the need for a pavement that can be easily removed and restored after later construction of ducts. Both expectations can be satisfied by the use of paving blocks.

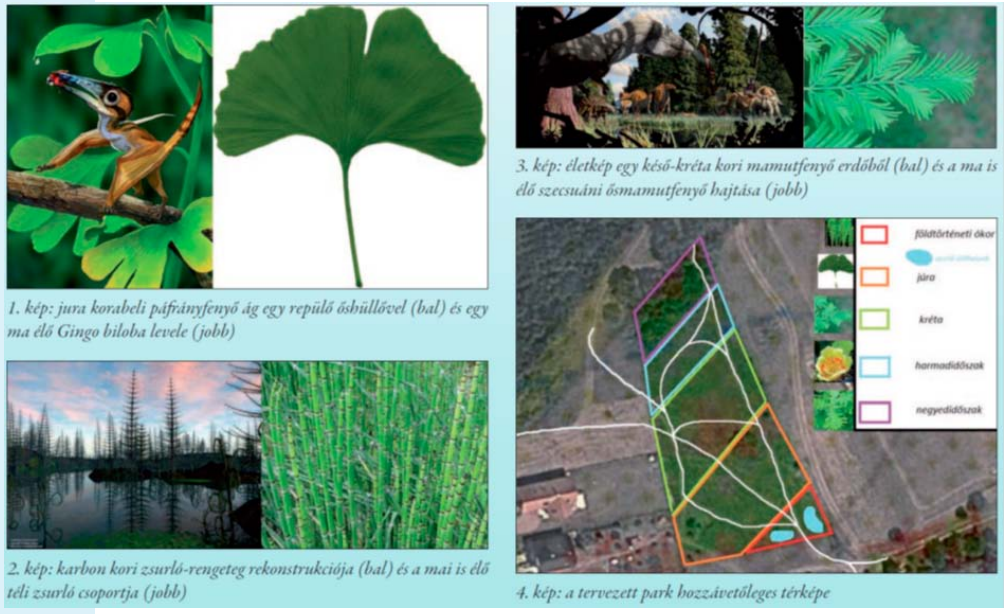
1. Figure:
Road with permeable covering
(Source: "A Klímaválasz tanfolyamokon szerzett tapasztalatok hasznosítása – Felsőörs alkalmazkodása a klímaváltozáshoz", presentation by mayor Balázs Szabó on 22 Sept 2016)

Administrative means to protect the water resource area: The regional water supply network operator obtained permission to use the wells in the Malom-valley in 1996 but didn't start production. The wells themselves have been under protection since 1999. At present the water supply network operator expressed its intention to connect Felsőörs' wells to the network. Local green NGO (FÉK) submitted a proposal in 2016 and after adoption, the municipality declared that the entire Malom-valley (130 ha of forest and pasture) becomes a protected area of local importance, so that the water can remain of good quality and in sufficient quantity. Negotiations with the entities with adverse interests – the authority of forestry and the water supply network operator – are still ongoing with the aim to find a win-win solution.

Development of green surfaces including regular tree plantation and the development

of the "Living Fossils' Park": The economic strategy of the village prescribes the development of green surfaces and plantation of trees both for mitigation of and adaptation to climate change. A park was developed in 2012 and certain areas (eg. the garden of the nursery) have been used to protect and create habitat for native species. Moreover, the Municipality has a yearly program of tree plantation in the village with a fixed budget (250.000 HUF or 820 EUR p.a.). The type of trees to be planted is determined together with the local residents year by year. It needs to be mentioned at this point that the village has two touristic sites that are specifically interesting from a geological point of view. Combining the ideas of tree plantation and the existing geological educational trails, an interested resident, whose hobby is geology, submitted a proposal to the municipality in 2015 to use the tree plantation program to develop a garden of plants of geological value. The Mayor has found out that this project can also be combined with awareness raising on climate change, by building on the theme of **'plants that have survived climate change'**. The Garden was developed from the municipal budget, the initiator resident provided the professional planning and organised the implementation and a number of local residents (at least 20 adults and several dozens of children) volunteered in the physical work to create the garden.

2. Figure:
Park in Felsőörs *(Photo: Malatinszky, 2017)*



1. kép: jura korabeli páfrányfenyő ág egy repülő ősh üllővel (bal) és egy ma élő Gingo biloba levele (jobb)

2. kép: karbon kori zsurló-rengeteg rekonstrukciója (bal) és a mai is élő téli zsurló csoportja (jobb)

3. kép: életkép egy késő-kréta kori mamutfenyő erdőből (bal) és a ma is élő szecsuáni ősmamutfenyő hajtása (jobb)

4. kép: a tervezett park hozzávetőleges térképe

3. Figure:
Presentation of planted vegetation and plans of the Living Fossils' Park – with sectors developed according to geochronology *(Source: Felsőörsi Hírmondó magazine, October 2015. pg. 4)*

The municipality has installed solar panels to cover the energy needs of the water pumps that ensure the availability of drinking water in the settlement, public buildings (nursery, school etc.) and public lighting. As solar panels ensure independence from the regional power supply network, the **electricity supply is more resilient to climate change** hazards.
In addition, the village has a yearly budget with predefined rows that consider or can be associated with certain climate hazards (eg. envelopes for remedy of damages or tree plantation).

Role of actors in the solution

- the Mayor is an environmentalist: graduated as environmental engineer, was secretary of the local green NGO FÉK and is still a member today, has participated in a training on climate adaptation and carries on the environmentalist attitude in his everyday work. He ensures that the aspect of climate change and more specifically climate change adaptation are taken into consideration in the municipality's decisions.
- local residents can bring their ideas to the municipality as initiators. They also participate in the planning of a project and occasionally in the implementation as well. Most importantly, they benefit from the projects.
- the local green NGO can bring their ideas to the municipality as initiators. They often participate in the planning of a project and are active in the implementation (ensure labour and expertise).
- professional service providers have participated in the planning and implementation of some of the presented solutions (eg. park development etc.).

INDUCED INSTITUTIONAL CHANGE

There is now a well-established cooperation between the municipality and the green NGO. Moreover, local residents are provided a forum to express their views in the decision-making process.

FINANCING

The Municipality regularly submits applications for grants.
Most measures have been financed from municipal resources. The costs of some measures such as road pavement and the development of public lighting system are shared in a proportion of 50–50% by the Municipality and the relevant residents.

SUCCESS FACTORS

- Personal commitment of the Mayor
- Cooperation between the municipality and the green NGO, which provides enough critical mass for a project to be implemented, as one may not be enough without the other
- Direct cooperation between the local residents and the municipality. Ideas of the local residents are taken into consideration. In addition, many of them volunteer for municipal works, building the community at the same time.

LIMITING FACTORS

Regarding the protection of Malom-völgy: conflicting interests and long-lasting bureaucratic processes with other entities such as the regional water supply network operator and the forestry authority.

IMPLEMENTATION TIME AND LIFETIME OF THE SOLUTION

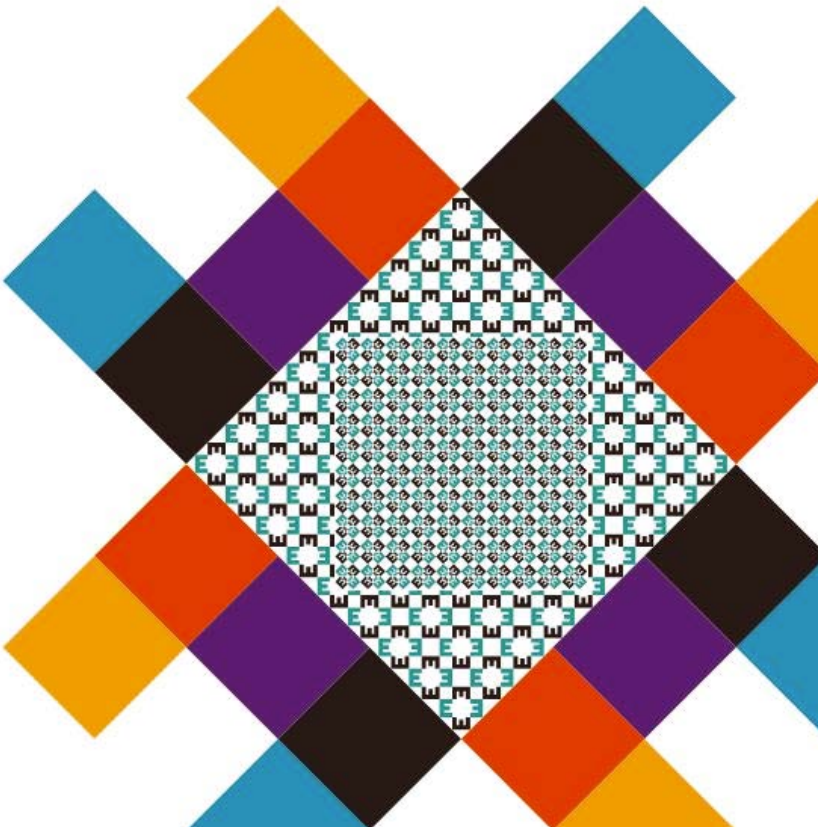
The presented solutions have different implementation times: recurring programs have the shortest implementation time, less than a year. It can be stated that the project with the longest implementation time out of the presented ones is the protection of the Malom-völgy due to the negotiations over conflicting interests.
Concerning the lifetime of the presented solutions, they all serve for long-term benefits.

1.4. OUTCOMES AND LESSONS LEARNT FROM CASE STUDY

This case is a good example how potential future climate vulnerabilities can be built into current development projects, also taking into consideration existing assets (eg. geological educational trails as a basis for the development of the Living Fossils' Park). It also emphasises the power of personal commitment and of cooperation with the local NGO and the villagers.

1.5. CONTACT INFORMATION, REFERENCES

Contact person: Balázs Szabó (mayor): +3670/320-6851
Felsőörsi Hírmondó magazine, October 2015.
Available online at www.felsoors.hu/hirmondo/id/678.



2 ▪ Hradec Králové (CZ)

Implementing Municipality/Actor:
Chartered town Hradec Králové
Location:
Královéhradecký Region, Czech Republic
Type of location:
Capital city of the Region with approx. 100 000 inhabitants

2.1. SUMMARY

The local authority and the department of the environment have been aware of the importance of greenery for local climate and the necessity of a long-term and systematic care for greenery in the town. Therefore, expert departments and other specialists have been invited to join in cooperation on researching functions and management of greenery in the town. The conceptual system of managing and renewing greenery has been prepared with their help, including effective monitoring and maintenance which ensures a long-term perspective of quality functioning in terms of public greenery.
The basic information source is the "passport of municipal greenery" linked up with the data on the physiology and health of all trees in the town as well as other information, taking into account the potential risk factors including the effect of climate change impacts. It is an innovative and complex approach, using GIS as a totally objective tool for ensuring long-term effective and quality care for greenery in their administration.

2.2. PROBLEM

1) Big town with a significant share of reinforced areas is prone to overheating – especially when there are heat waves
2) Long-term deteriorating condition of some tree-alleys and green areas with an unclear perspective and an unknown way of optimal reaction to the actual situation
3) In this town there is no comprehensive evidence, monitoring and conceptual care for public greenery in line with development of climate conditions and character of individual localities

Important internal and external actors:

- Management of department of the environment of the municipal authority
- Other departments of the municipal authority, e.g. GIS
- Municipal authority
- Partner organizations, experts from research institutions and universities

2.3. SOLUTION

Approximately ten years ago, the Department of the Environment along with the self-government authorities were aware of the need for long-term conceptual work to support the functions of greenery in the urban environment.
The analysis of practical approaches to greenery in other towns/cities and scientific institutions took place at the beginning. Using GIS was a part of the considered solution method - along with experts in GIS from the municipal authority, the search for an optimal platform to create a logical and clear information system was carried out, which would create a prerequisite for the comprehensive use of conceptual materials. It has been decided that urban environment information shall be processed in individual layers of GIS, which will subsequently allow for

geo-spatial information to be effectively compared and possibly combined. The system, which is designed in this way, even allows for interdisciplinary data interconnection and the creation of a transparent objective information system.
The Department of the Environment has commissioned processing of the so-called green passport in the GIS layer (register, or special database – every tree etc. has its own „identity document" with all important information). Using the Mobile Mapping method, the passport of greenery has located all public greenery (all trees and shrub items, including grasses, public playgrounds and outside equipment) with great accuracy.
Other layers (such as a digital technical map, or information system in water management, or the so called study on run-off (drainage) conditions of the town Hradec Králové can be displayed in the system under the green layers.

For the purposes of the concept work with public greenery, the **passport of greenery** was complemented by additional data – the type and size of the woody species, its health condition, vitality and stability. These are the data which present the prepared greenery standard. The data processed in this way – information about individual trees on the base layer of the greenery passport are called "inventory of greenery". Hradec Králové has evaluated almost 48,000 trees in this way so far.

Systematically **applied research on the influence of greenery on the microclimate** of the town and other surfaces on the temperature and humidity conditions of the town Hradec Králové have been carried out since 2010. The partner institutions are the Mendel University in Brno, the Czech Globe Institute for Global Change Research of the Czech Academy of Sciences, the Czech Hydrometeorological Institute and other expert associations.

Automatic measurement of air temperature and humidity is carried out in 10-minute periods from seven measuring stations placed in the town. Data are also collected by regular aerial photography (orthophoto maps) and infrared scanning, which enables the municipal authority to evaluate the health condition of the greenery. Analysis of infrared greenery image data indicated e.g. long-term deterioration of some alleys. The town of Hradec Králové could proceed with the **gradual revitalization of some tree alleys** and town parks without significantly affecting microclimate conditions.

On the basis of specific research findings in 2016–2017, for example, there was a complete reconstruction of the tree alley on busy roads of the town ring, where the chosen reconstruction method and newly planted trees (this is the original Czech cultivar of plane tree) take into account the conclusions of the climate research in the town as well as the character of the locality.

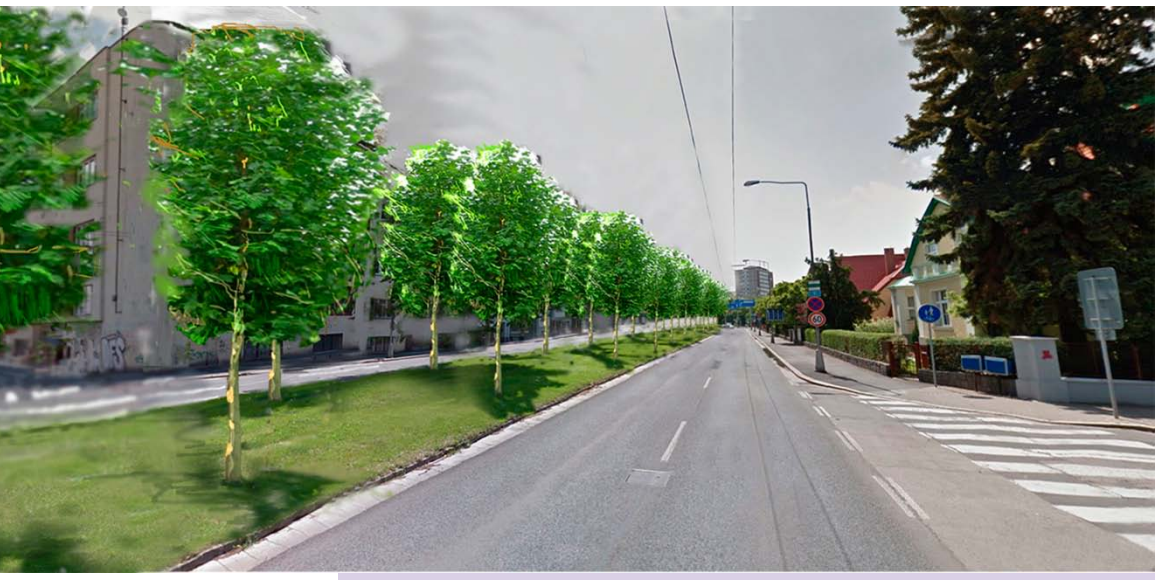


Figure 4.
Reconstruction
of the tree alley
– visualization of the result
(source: Municipality of Hradec Králové)

OVERALL BENEFITS AND ASSETS OF IMPLEMENTATION FOR THE CITY

Based on objective data from particular research tasks it is possible to actively and from the long-term perspective influence the microclimate in the town through optimal care for greenery. This data also serves the purpose of gradually changing the urban environment – developing and planning new greenery into places which are unfavorable from the climate point of view. This information has been newly used in the development of the new territorial plan of Hradec Králové.

Risk analysis has made it possible to preventively deal with the risk of emergency failure of certain trees in poor health condition.

FINANCING

Researches of external organisations were financed from national and European grant sources, the costs of the municipal authority were financed from the town´s budget.

2.4. OUTCOMES AND LESSONS LEARNT FROM CASE STUDY

The collected spectrum of the data on all public greenery is a valuable data source which enables its system processing, including analysis making. Based on GIS data analysis and green inventory (health condition, analysis of greenery risks and others) it is possible to plan in the long-term and implement gradual revitalization of greenery.

One of the conclusions is that the green areas, especially trees, very effectively cool the surrounding public spaces. The obtained information and outputs from analysis also serve as an objective and coherent **basis for political decision-making** of town management, subsidy applications, communication with public, and other purposes – based on clear data and analysis it is possible to justify, plan and defend the necessary revitalization of the greenery.

In the area of state administration it is also possible to objectively assess and justify the decisions on application for woody species felling because the environmental department has comprehensive information and materials on all trees and shrubs in the town.

The intention of the ongoing research and findings from the practical application of SMART care for greenery in the town is to make Hradec Králové a model example for other towns and municipalities.

2.5. CONTACT INFORMATION, REFERENCES

Specialized publications:

- Bioklimatologická charakteristika mezoklimatu města Hradec Králové pomocí teploty a vlhkosti vzduchu s využitím účelových měření v letech 2012 – 2014. RNDr. Tomáš Litschman, PhD., Ing. Tomáš Středa. Ph.D., Ing. Bc. Hana Středová Ph.D.
- Studie vlivu zeleně a dalších povrchů na teplotní a vlhkostní poměry území. RNDr. Ing. Jaroslav Rožnovský CSc., Ing. Tomáš Středa. Ph.D., Ing. Bc. Hana Středová Ph.D.
- Rozklad pro Magistrát města Hradec Králové k termoviznímu snímkování a úloze zeleně v klimatu. Doc. RNDr. Jan Pokorný CSc.
- Úloha vegetace v lokálním klimatu. Komentář k termovizním snímkům z 22. 7. 2015 a odhad hodnoty tří ekosystémových služeb lesního parku Severní terasy. Doc. RNDr. Jan Pokorný CSc.
- Krajina a klima ve vzájemných souvislostech. Mendelova univerzita v Brně 2016. Doc. Ing. Bc. Hana Středová Ph.D. a kol.
- Sborník: Úloha zeleně v mikroklimatu města – aplikace a praktické zkušenosti v Hradci Králové, konference 20. 10. 2016

Contacts:

Municipal Authority of the town Hradec Králové

Ing. Iva Šedivá, Head of the Department of the Environment, iva.sediva@mmhk.cz

Ing. Libor Rak, Head of the Environmental Protection Unit, libor.rak@mmhk.cz

3 ▪ Kezmarok (SVK)

Implementing Municipality/Actor:
City of Kezmarok
Location:
Kezmarok, Slovakia
Type of location:
small city – ca. 17 000 inhabitants

3.1. SUMMARY

City of Kezmarok has been badly affected by floods in recent times. The damage caused was considerable. The repeating character of extreme weather events in concurrence with pressure from citizens made City administration to act in a proper manner. The City leadership decided to deal with this issue in a systematic way. The answer was the elaboration of comprehensive adaptation strategy to more frequent intensive precipitations.
The idea was based on that adaptation to climate change impacts is not finite endeavor but rather never-ending inclusive dynamic process. It must be systematic, coordinated between several sectors and focused on such solutions, which take into consideration its necessity, effectiveness and efficiency. Only such an approach can guide the city towards sound use of limited sources. Thus, the reduction of negative impacts of climate change and other related benefits can be achieved.
The process of strategy elaboration began with a thorough vulnerability assessment of the City. Climatologists analyzed the exposure of climate change effects on the city territory. Broad group of all relevant experts examined sectors of sensitivity and adaptive capacity. Based on that the solutions were proposed in the form of Adaption plan consisting of various programs aiming to reduce sensitivity and increase adaptive capacity. The effectiveness and efficiency of green and blue adaptation measures was demonstrated via detailed calculations of their retention capacity in selected pilot areas of the city.

3.2. PROBLEM

Between 2005 and 2014 seven major flood incidents occurred in the City of Kezmarok. The overall damage was more than 4 million Euros.
The most devastating was the flood in 2010. It caused considerable damage (over 3.5 million Euros) on 130 houses, 157 garages, 30 apartment buildings, 180 cellars, 15 businesses and 8 schools. In 2014 the flood caused major power outage and breakdown of drinking water distribution. On top of that the transport infrastructure (roads, bridges, bus stations) and other parts of public infrastructure (football stadium, ice rink, gardens, gas stations, small dams, storage facilities etc.) are regularly affected as well.
The complexity of the situation is compounded by the fact that Kezmarok is prone to fluvial and pluvial floods at the same time caused by torrential rains, long-term precipitation and rapid melting of snow and ice.

3.3. SOLUTION

The city administration was aware of and recognized floods as a major issue which must be dealt with. However, they lacked required expert background for necessary action as well as financial sources. The solution was found outside the city environment. The project *LOC-CLIM-ACT: Local acting on climate change impact* provided such a chance. The lead organization of the project, Carpathian Development Institute from Kosice, offered desired expertise and funding.

As a prerequisite, experts prepared tailor made methodology to the whole process of adaptation strategy elaboration. The strategy itself began by **climatological assessment**. The analysis provided information about past, present and future (based on scenarios) developments of climate in Slovakia and especially in the territory of Kezmarok City. The conclusion, unsurprisingly, listed more frequent and intensive rainfalls as the most urgent climate change impact to be dealt with.

Based on these information and knowledge of past occurrence of floods and caused damage the **vulnerability assessment** continued with analysis of factors, which provide platform for the measurement of sensitivity and adaptive capacity. The following factors were identified and examined:

Sensitivity
- Inundation areas
- People living in inundation areas
- Existing hydrotechnical measures and condition of drainage
- Buildings and infrastructure at risk
- Impermeable surfaces
- Green infrastructure in urban environment
- Diversification of land-cover, forestry and agriculture in relation to flood protection
- Landslides
- Soil erosion

Adaptive capacity
- Mobile anti-flood barriers and available rescue personal
- Social and economic conditions of the city to deal flood consequences
- Warning system and information activities
- Rescue works

All above mentioned factors were narratively described and projected into maps (where possible). Each map was divided by grid network of 200 × 200 m to show the most vulnerable areas within the city. Finally, the combination of all factors produced the overall vulnerability map of the city.

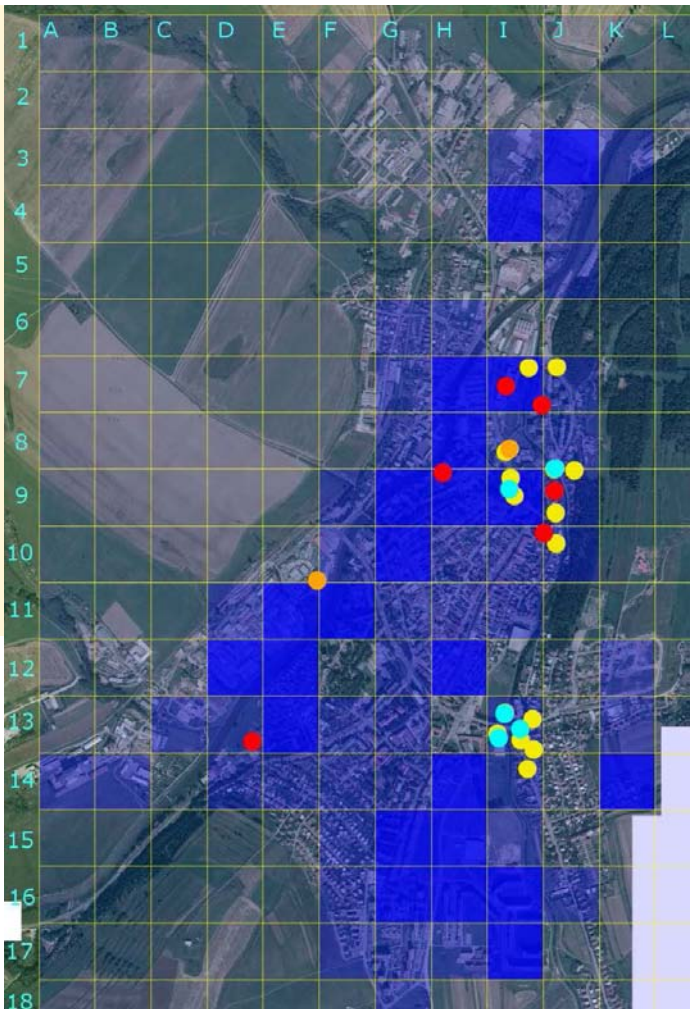


Figure 5.
Summarized vulnerability assessment map with risk buldings (color dots)
(Source: Kezmarok Adaptation Strategy to increase of frequency of intensive precipitation)

As the most important findings of the vulnerability assessment shall be mentioned:

- According to the Slovak Water Management Enterprise there are 10 200 inhabitants at risk of flooding in City of Kezmarok together with the close village of Lubica, the majority of them are residents of Kezmarok.
- More than half of the city area with the highest concentration of population is located in an inundation area of the Q100 waterflow (maximum waterflow occurring once in 100 years) and of the Q1000 waterflow (maximum waterflow occurring once in 1000 years), what leads to the increased sensitivity of the inhabitants to the fluvial floods.
- The city is not prepared for floods – hydrotechnical measures to intensive precipitation are built only on some parts of the watercourse.
- In the inundation zone of the Q100 waterflow there are located bridges carrying water and gas supply infrastructure and transformer stations, which are not adjusted to resist such a large volume of water. Thus, the inhabitants are threatened by shortfalls in case of a crisis.
- In recent years, forest management and agricultural practices were not realized in accordance with the principles of flood protection. Therefore, current state of forests increases the outflow of water in the basin, causing even higher amount of water entering the Kezmarok during rainfall.

The vulnerability assessment served as a basis for the **elaboration of adaptation plan** with aim to reduce the vulnerability of Kezmarok City to more intense and frequent precipitations. The following thematic program was created, to reduce sensitivity and increase adaptive capacity:

- Hydrotechnical measures
- Adaptation measures outside of buildup areas
- Green and blue infrastructure within buildup areas
- Transportation namely: via improvement of drainage of transport infrastructure and Increase of the infiltration capacity of parking spaces
- Elimination of landslides and water erosion
- Development of correct behavior patterns during intensive precipitations via information activities through web, city journal, info panels
- Stimulation of citizens via cost free advisory and consultation services and grant scheme
- Buildings at risk
- Good decision making

Each program contained specific adaptation measures and activities localized at various areas of the city. A few examples of their effectiveness and efficiency were provided as well, based on mathematical calculations.

ROLE OF ACTORS IN THE SOLUTION

- Public created pressure on city administration to act
- City leadership provided political backing
- Carpathian Development Institute provided methodology and expert leadership
- Various city departments (mainly Department of Spatial Planning, Environment and Building code) provided necessary data and local expertise
- Selected institutions provided expertise in relevant sectors – Slovak Water Management Company, Slovak Hydrometeorological Institute, State Forestry Agency – local branch, State Environmental Protection Agency etc.

FINANCING

Funding was provided through the project *LOC-CLIM-ACT: Local acting on climate change impact* within the scheme Hungary-Slovakia-Romania-Ukraine ENPI CBC Programme.

SUCCESS FACTORS

- Willingness of all stakeholders to tackle this issue in a proper way
- Comprehensive approach to strategy elaboration
- Integration of adaptation strategy with other strategic documents of the city (e.g. Development Plan)

LIMIT FACTORS

- The change of political leadership might shift the attention to other issues
- There was an imperative to reconcile interests of upstream and downstream villages and the city when proposing adaptation solutions (at the moment it is not a routine procedure)
- Successful implementation of adaptation strategy depends on availability of external financial resources

IMPLEMENTATION TIME AND LIFETIME OF THE SOLUTION

The elaboration of adaptation strategy lasted one year, from 2014 to 2015. It is open and live document, which should be regularly monitored, evaluated and updated. It should serve up to 10 years.

3.4. OUTCOMES AND LESSONS LEARNT

The city of Kezmarok substantially increased its preparedness to deal with more intensive and frequent rainfalls, which cause floods. Every stakeholder gained new information and experience in a new but pressing topic. In the long-term perspective, the quality of life in Kezmarok is expected to be significantly better. Tailored made systematic approach can also serve as an inspiration to other cities' leaders, who could apply it to their specific environment and conditions. And last but not least, the adaptation strategy will also serve as a necessary precondition in obtaining external funding since adaptation to climate change is one of the most essential areas of support from various donors and schemes.

3.5. CONTACT INFORMATION

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4 ▪ Kosice Zapad (SVK)

Implementing Municipality/Actor:
City Borough Kosice Zapad
Location:
Kosice, Slovakia
Type of location:
city borough – ca. 40 000 inhabitants

4.1. SUMMARY

As climate change intensifies, urban areas will need to conform to different challenges, associated with grater variability in temperature and precipitation as well as increases in the intensity and frequency of storms, floods, droughts, and heatwaves.
However, many city managements are still inactive in this field. It is caused mainly by lack of information, low awareness and knowledge, and absence of positive good examples. On the other hand, an increasing number of cities around the world have begun to plan for climate change by developing stand-alone climate plans or incorporating climate considerations into existing plans, policies, and projects to become more resilient towards existing and future climate impacts, thereby limiting their magnitude and severity.
City of Kosice, Slovakia, namely its largest city borough Zapad in cooperation with the research institution Carpathian Development Institute had implemented (as one of the first in Slovakia) the process of climate change adaptation in order to be better prepared and adjust proactively for the heat waves as the critical climate change impact on the city borough residents. The adaptation strategy is built on the principle “low cost quick win” based on assumption that increasing resilience requires not only robust decision making and big investments, but also a strong web of institutional and social relationships that can provide a safety net for vulnerable populations. Through both formal planning activities and concrete measures preparations, city is building their capacity to adapt effectively to existing and future climate impacts, while also experimenting and innovating in policy making and planning.

4.2. PROBLEM

While urban areas will generally experience the same exposures to climate change as surrounding regions, the urban setting can alter these local impacts. The replacement of natural vegetation with artificial surfaces and buildings creates unique microclimates altering temperature, moisture, wind direction and rainfall patterns. Moreover, cities form difficult dynamic systems with high density of people, hub of services and infrastructure so the climate change impacts have and will have potentially serious consequences for human health, livelihoods, and assets and ultimately influence the development of the entire city and its surroundings.

Protection of urban areas against climate threats can pay for itself even in cases where extensive investments are required. Kosice city will also be affected by global climate change. It is therefore important for the city to be prepared for the climate of the future.
However, many city leaders are still inactive in this field. It is caused mainly by lack of information, low awareness and knowledge and absence of positive good examples.On the other hand, an increasing number of cities around the world have begun to plan for climate change by developing stand-alone climate plans or incorporating climate considerations into existing plans, policies, and projects to become more resilient towards existing and future climate impacts, thereby limiting their magnitude and severity.

Kosice, particularly self-government of city borough Zapad as one of the largest city parts of Kosice having more than 40.000 inhabitants had decided to prepare the climate change adaptation plan. This part of the city is a relatively homogenous residential area – mainly blocks of flats, so far considered as the greenest part of Kosice city.

To date climate change impacts on the city of Kosice, elaborated by climatologists:

- Increase of average temperature (1881–2010) – 1,6°C
- 10 hottest years in the last 150 years since 1990
- Number of tropical days (≥ 30° C) have increased in the last 20 years from 12 to 20 days (in the year 2012 it was 37 days) and maximum levels exceed 34° C very often
- Number of icy days decline deeply under 40 while in the 1950–60s this level was exceeded very often
- There are very variable (in comparison with the 1980s) rainfalls while total amount of precipitation has not been changed significantly (more torrential rains causing floods)
- In the last 20–25 years Kosice and its vicinity are affected by long-term droughts

Based on the above-mentioned facts and climate data heatwaves was selected as the main climate change impact to be dealt with.

4.3. SOLUTION

Adaptation process to heat waves has had 3 stages:

1) Setting the scene

To maximize the success and effectiveness of adaptation actions there should be a joint understanding between people within communities, local authorities and other key stakeholders. This helps all parties to work together to develop adaptation pathways which are based on a mutual understanding of the issues relating to climate change, hazards and risk, and the needs of the different participants. Adaptation is a shared responsibility and partnerships are critical i.e., it is not something that any council or particular agency, community or discipline can do alone. Therefore the next steps have been followed in the City Borough Kosice Zapad:

- Detailed description of climate change impacts on selected territory (understandable not only for specialists but also for decision-makers and public)
- Education and other activities for gaining political and professional support of public authorities, support and participation of public
- Selection of leader organization, that will lead the process
- Creation of a cross sectorial, cross institutional, interdisciplinary expert group

2) Vulnerability assessment

In case of City Borough Kosice Zapad, the vulnerability-based approach was used to assessment, which evaluates climate change in the context of current stresses, placing and emphasis on social factors associated with exposure, sensitivity and adaptive (coping) capacity. Inherent in this approach is the recognition that the nature of climate risk is shaped by development context and the climate vulnerability is linked to both development patterns and government behavior.

Exposure to heat waves was assessed in three ways: continuous temperature measurement using professional thermometer; driving a car on the streets according to prescheduled route during a hot day and late evening; discrete measurements on selected city spots. Comparing all three types of measurements we can state, that Kosice-west in general is equally exposed to the high temperature during the day (relatively flat results caused by mixing air) but in the night the west part is in better situation (result influenced by the katabatic wind stream and better air circulation). The spot measurements showed that the general picture is significantly different in details (in the park, parking lot, urban forest, at the water area, blocks of flats without air circulation).

To assess the sensitivity crucial factors have been selected (e.g. density of the most endangered residents – 75+; 4-; green and blue infrastructure, including its quality; extent of paved/hard surfaces; surface roughness preventing air-circulation, people living in underroof flats with low thermal insulation etc.) To assess the selected adaptive capacity, important relevant factors have been collected (e.g. accessibility of green areas/cover of trees more than 60%, public transport, health emergency services, behavioral patterns of people etc.) All factors have been weighted in terms of their seriousness for human health. Data were subsequently projected on the maps and/or narratively described. Finally, the combination of all factors produced the overall vulnerability map of the borough.

3) Elaboration of Adaptation strategy to address heatwaves

The main goal of the strategy aims at reducing vulnerability of people living or working in this part of Kosice city via decreasing sensitivity and increasing adaptive capacity. The basic principle is to concentrate on localities with the highest degree of threats considering existing limitations. Strategy is elaborated in following programs:

- Shielding program (by vegetation, by artificial shields)
- Cooling program of public spaces (increase of green areas, exploitation of climate appropriate trees, converting and reducing of paved/hard surfaces, channeling higher ventilation of the area, introducing blue elements etc.)
- Program of cooling indoor public spaces (thermal insulation, vertical greenery, shielding of transparent openings/windows/displays, green/reflecting roofs, air conditioning...)
- Program for developing good patterns of behavior during heat waves (informative and educational activities for citizens)
- Program to enlarge and improve refreshing places (revitalization of existing parks, increasing number of parks, introducing new fountains with water spraying, places of potable water...)

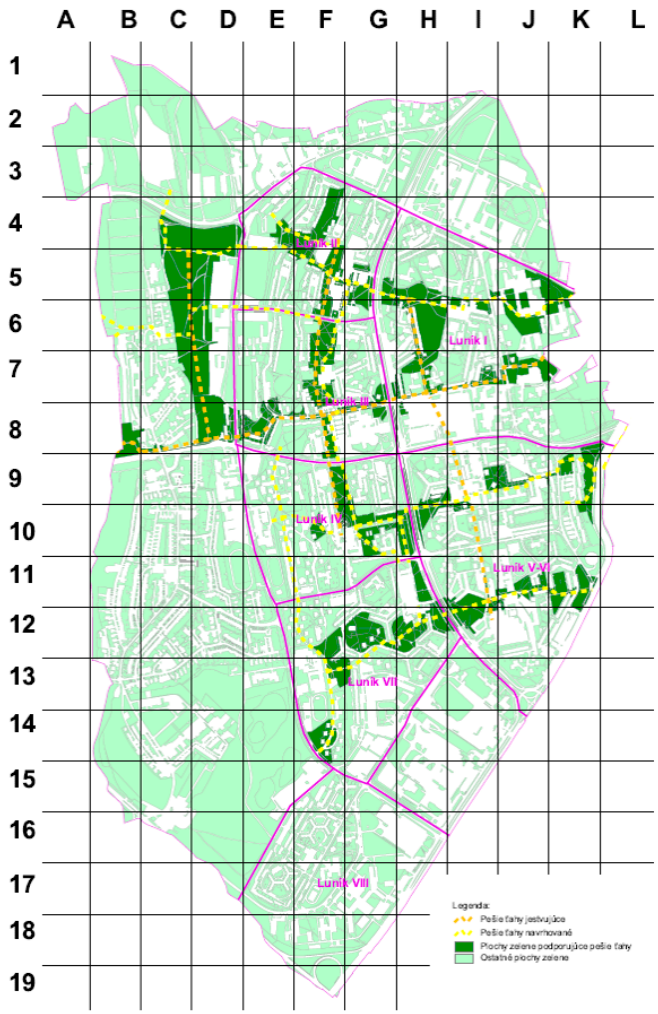

Figure 6:
Example of adaptation measure
- new walking tracks (yellow dashed lines) with sufficient shading
(Source: City Borough Kosice-West Adaptation Strategy to heatwaves)

ROLE OF ACTORS IN THE SOLUTION

- Borough leadership provided political backing
- Carpathian Development Institute provided methodology and expert leadership
- Selected borough personnel provided necessary data
- Selected institutions provided expertise in relevant sectors – Slovak Hydrometeorological Institute, Regional Office of Public Health
- Public was involved via survey mapping their awareness and behavioral patterns

FINANCING

Funding was provided through the project *Climcross Development: Partnership for addressing climate change impacts on development* within the scheme Hungary-Slovakia Cross-border Co-operation Programme 2007-2013.

SUCCESS FACTORS

- Strong commitment from the borough leadership.
- Seven thematic programs were prepared (Public spaces shadowing, cooling public spaces, cooling public buildings, behavior patterns during heatwaves, blue infrastructure, climate friendly decision-making and stimulation of citizens).
- Adaptations measures have been projected into the spatial and socPilot measures have been implemented and implementation process of adaptation strategy is ongoing.

LIMIT FACTORS

- The change of political leadership might shift the attention to other issues.
- Successful implementation of adaptation strategy is dependent on availability of external financial resources.
- City governments mutually and central government agencies acting in or around the cities may struggle to coordinate among each other.
- City leaders and city administration are overwhelmed by the “day job” of immediate service delivery.

IMPLEMENTATION TIME AND LIFETIME OF THE SOLUTION

The elaboration of adaptation strategy lasted 13 months, from early 2013 to mid-2014. It is open and live document, which should be regularly monitored, evaluated and updated. It should serve up to 10 years.

4.4. OUTCOMES AND LESSONS LEARNT

With the climate adaptation plan we wanted to outline the challenges the city faces in short and medium terms, because of changes in future climate. At the same time, it also intended to identify solutions, based on our present-day knowledge, appear to be most appropriate and reveal the opportunities for development. Despite leaders do not yet know all the consequences climate change will have for Kosice-Zapad, they are committed to continuously implement the measures required for their city part to make it climate safe and attractive for living and spending time in.

The adaptation plan on the Kosice-Zapad level was based on the following criteria

- Evaluation of adaptation measures (efficiency, costs, applicability to local conditions) in relation to vulnerability assessment
- Taking into considerations existing limits (disposable time, resources) so the strategy would be feasible

- Agreement on the selection of adaptation measures, which will be realized in the territory, communication with elected representatives of public authorities, other institutions and public.
- Elaboration of implementation plan (responsibilities, financing, time plan, monitoring and evaluation).
- Integral inclusion of goals and measures of local adaptation strategy into relevant development plans

4.5. CONTACT INFORMATION

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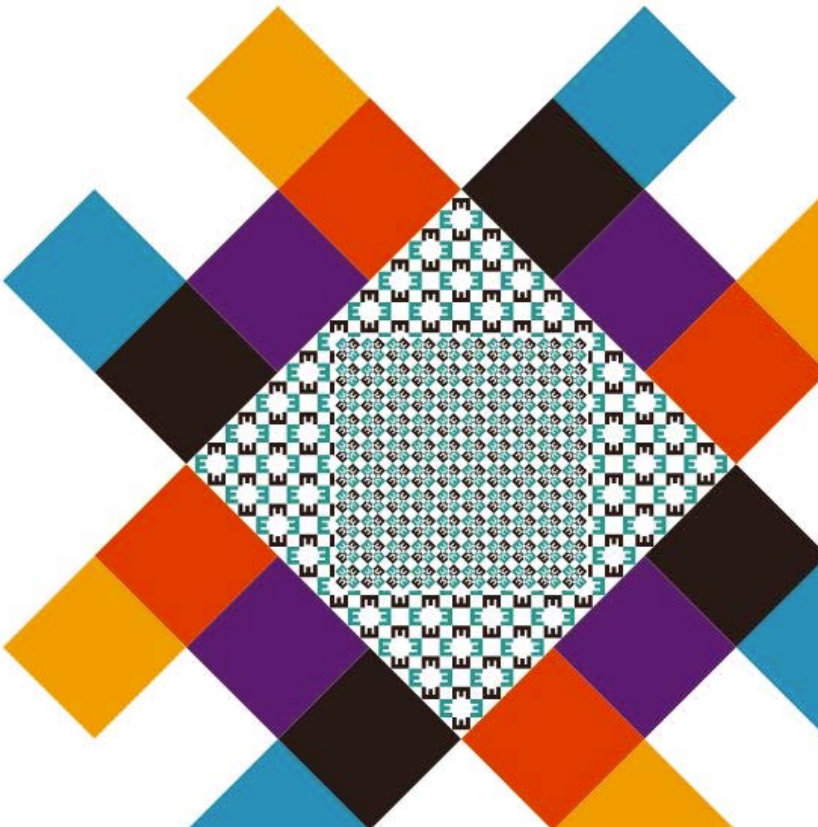

5 ▪ Krosnice (PL)

Implementing Municipality/Actor:
Municipal Office of Krośnice
Location:
Krośnice near Milicz
Type of location:
Town with less than 100 000 inhabitants

5.1. SUMMARY

The reconstruction of an avenue running from the village of Wierzchowice to Dziewiętlin in the municipality of Krośnice near Milicz in the Lower Silesian Voivodship is nice example of successful local actions.
The campaign "We plant oaks in the Barycz Valley" led by the Eco-Development Foundation inspired local actors, namely Joanna Jasięga – a teacher from the School and Kindergarten Complex in Krośnice to recreate the alley.
The concept of the avenue, which takes into account the natural, landscape and social aspects, was developed by Joanna Jasięga and Henryk Włodarczak, the head of the road department of the District Office in Milicz. Eco-Development Foundation has supported this initiative from the beginning with advice and active participation. Students were also attended in the project from a school in Krośnice and the School of Forestry in Milicz.

5.2. PROBLEM

The problem is related to landscape and environmental protection, water and climate management and biodiversity. Social aspects, like human health or road safety are also linked to the project.
The increase in car traffic and the subsequent development of road infrastructure put into question the survival of roadside trees in Poland. Tree felling could not stop by protests. At today's transportation tendencies, not all roadside trees can be preserved. However, at many roads, trees can be left or replanted, without detriment to the road safety and modernization needs. The reconstruction of Wierzchowice-Dziewiętlin Avenue is an example for that.
Trees favorably affect climate and microclimate by reducing pollution, greenhouse gases and cooling the environment as a result of transpiration. Trees also help to maintain proper groundwater level and reduce the risk of flooding, which is very important in the view of water management. Roadside alleys shape the local landscape and increase its attractiveness. Trees increase biodiversity, they offer habitat for many valuable species. Another advantage of roadside alleys is the purification of water and soil from contamination in agricultural, urban and industrial areas. Local community representatives, local governments and NGOs recognized all these advantages and took part in the alley renovation project. For this reason, a comprehensive avenue concept has been developed. It takes into account various aspects and functions of the alley.

The main participants were: Joanna Jasięga, the School and Kindergarten Complex in Krośnice, the Road Department of the District Office in Milicz and the Eco-Development Foundation. Joanna Jasięga was the originator and organizer of this initiative. She also involved her students and other teachers from her school in the project. The Road Department of the District Office in Milicz supported her, especially Henryk Włodarczak, who helped her to create the avenue concept. The Department as a road manager made available lane road, indicating places where trees can be planted. The Eco-Development Foundation supported the action by encouraging, advising and taking active part in it.

5.3. SOLUTION

People wanted the authorities and the contractors to pay attention to the necessity of taking care of trees. Especially those authorities, that responsible for repairs, modernization and construction of roads. The main aim was preservation and reconstruction of the alley as an example of cooperation between local government, local people and non-governmental organizations.
The action began in 2008 when teacher Joanna Jasięga noted that the chestnut tree alley leading from Wierzchowice to Dziewiętlin was in poor condition. The cause was pest infestation. Previously, the teacher and her students used to collect chestnuts along the avenue, so she decided to do something to save it.

On March 5, 2008, the first 20 oaks were planted by a group of students. Later, they took care of planting and gradually extended the avenue. The initiative to renovate the avenue was so interesting and thoughtful that the County Road Department of the District Office in Milicz as the road manager provided the roadway, indicating where the trees should be planted. In the place of removed, tilting trees oak trees were planted, on average 3 m from the edge of the road, on the outside of the ditch linden. The seedlings were donated by the Forest District of Milicz from the forest nursery in Świętoszyn. They supported further actions by giving not only trees but shrubs as well as bird breeding boxes. In addition, forest workshops have been organized for children in the forest nursery.

The students of Wierzchowice Primary School, the School and Kindergarten Complex in Krosno, the inhabitants of Dziewiętlin, Wierzchowice and also Wroclaw and Milicz participated in this initiative. The students of the School of Forestry in Milicz played an important role by teaching others how to plant trees and how to select growing small trees beside a road.

Figures 7-8.
The students of the School of Forestry in Milicz planting trees with students from Krośnice school *(www.tlmilicz.pl/2014/05/sadzimy-deby-w-dolinie-baryczy/, http://zslmilicz.nazwa.pl/_zslmilicz/Image/20100504191245/slides/deby4.jpg)*

There were also volunteers from Armenia, Turkey, Romania, students from the German High School, staff from the Wroclaw branch of Gazeta Wyborcza, ecologists and naturalists, employees of the Barycz Valley Foundation and Piotr Tyszko-Chmielowiec as a coordinator of cooperation. At the last part of the avenue from Wierzchowice's side lindens were planted by the Eco-Development Foundation thanks to the subsidy of the Operational Program Infrastructure and Environment and the National Fund for Environmental Protection and Water Management.
The planting program was finished in the spring of 2014. In total, 394 trees were planted including oaks, lindens and maples.

Figure 9.
Students and teachers after planting trees *(www.aleje.org.pl/pl/o-alejach/dobre-praktyki/403-odtworzona-aleja-wierzchowice-dziewietlin)*

SUCCESS FACTORS:

The main success factors were good partnership with road managers in Milicz and the involvement of the local community.

5.4. OUTCOMES AND LESSONS LEARNT FROM CASE STUDY

The initiative was a good example of cooperation of the local communities, road managers and NGOs. Such cooperation can be successfully conducted in many other places.

In order to carry out such an action it is necessary to discuss the activities and cooperate with road managers. No less important is knowledge how to introduce plantings and how to cultivate them later.

With support from local authorities, grassroots initiatives can be implemented and may be more successful. In turn, residents' initiatives inspire local government to act.

The hardest thing was to work with young children who did not have much strength to do physical work, so it was necessary to support them by older students and adults. To this end, ecological classes were conducted at the Krośnice School, which encouraged the junior high school students to take part in the restoration of the alley. The classes also work on other fields (planting trees and bushes in the surrounding park, setting up bird breeding boxes) and fulfill an important educational function.

Thanks to the social campaigns and education in which NGOs are involved, examples of good actions and local initiatives can be spread to a wider area. In the case of the reconstruction of the Wierzchowice-Dziewiętlin Avenue, cooperation with the road managers was so successful that it inspired the creation of a much larger project "Roads for nature" by the Eco-Development Foundation.

5.5. CONTACT INFORMATION, REFERENCES

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References:

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6 ▪ Marki (PL)

Implementing Municipality/Actor:
Marki, City Hall
Location: Marki, Poland (Warsaw agglomeration)
Type of location: Town with less than 100 000 inhabitants

6.1. SUMMARY

On May 24, 2016, at School Complex no. 2 in Marki, rain gardens were built within the project "EkoMarki – local civic initiatives for the environment". It was realized by Sendzimir Foundation in cooperation with Marki City Hall.

6.2. PROBLEM

The problem is mainly related to water management. It also applies to education and awareness of the local community.
Climate change projections indicate an increase in the frequency of heavy precipitation that will certainly be a problem in cities, where we find a high proportion of impervious surfaces. Therefore, it is important to increase the retention of precipitation water. Rain gardens collect, retain and purify rainwater flowing from impermeable surfaces. They help to reduce the risk of local flooding during major precipitation.
School Complex no. 2 has submitted a project proposal for the design and construction of rain gardens on the school grounds.
The initiative aims to reduce the risk of flooding in school, by creating rain gardens that will retain and clean up the water comes from the roof of the school building. In addition, the garden will be a demonstration solution and educational tool for students.

ACTORS

The main role in the project was played by the Sendzimir Foundation and Marki City Hall. Partners organized the project called "EkoMarki – local civic initiatives for the environment", a competition for the best local initiatives submitted, and then chose and supported twenty of the initiatives. The Sendzimir Foundation has coordinated the project, built rain gardens with children, and organized workshops. This project was financed by the National Fund for Environmental Protection and Water Management. No less important was the involvement of the school and the students.

6.3. SOLUTION

Marki City Hall and Sendzimir Foundation invited non-governmental organizations and informal groups of citizens to participate in the project "EkoMarki – local civic initiatives for the environment". The school reported its initiative to the project, which was chosen from many others and then implemented. The competition criteria were:

- Is the local community involved in the implementation of the action?
- Does the planned action address some significant environmental and local community problem?
- How many people will benefit from the action?

What benefits will result from the planned actions:

- for the local community,
- for the environment
- for direct participants in the action?
- Is the activity attractive to the audience?

The Sendzimir Foundation has selected 16 initiatives that meet the criteria. One of them was the building of rain gardens.

The creation of rain gardens aimed to reduce the risk of school flooding as well as the purifying and retention of the water from the roof. In addition, the garden will be a demonstration solution and educational tool for students.

The planting of gardens was preceded by training workshops, titled "Rain Gardens" and "Blue Blood of the City". These workshops were organized for 2 groups - a total of about 40 students. During the training the students learned about the principles of raingarden planning and construction, the way plants should be selected and planted, and the role of water in the city. The workshops took place on April 28, 2016 and were run by Mrs. Elzbieta Urbaniak, architect – designer and contractor of gardens and Mrs. Katarzyna Biejat from the Sendzimir Foundation.

On May 24, 2016 Foundation workers and students built two types of rain gardens next to the school building. They constructed a garden in a chest and in the ground as well. Garden bed was prepared to stop the pollution from the water. They planted primaly hydrophytic plants which are able to capture the pollution from the water. This activity raised the students' interest in the topic and involvement in the project.

Figure 10.
Raingarden in the chest
(source: www.sendzimir.org.pl/node/838)

Figure 11.
Raingarden in the ground
(source: www.sendzimir.org.pl/node/838)

FINANCING

The project was financed by the National Fund for Environmental Protection and Water Management. The cost of setting up a rain garden was about 115–170 euro/m^2.

LIMIT FACTORS

The main limit factor was time, because there was a lot of earthwork to do and children weren't able to work as fast as adults. Additional help was needed. The organizers will take this factor into account next time.

Despite that, children made work easier, because of their commitment and willingness. Besides, many children involved in the project and it was also helpful.

The solution was implemented during one day, and it has been functioning for more than a year. Other examples show that rain gardens fulfill their functions even longer than 3 years or maybe more.

6.4. OUTCOMES AND LESSONS LEARNT FROM CASE STUDY

For transferring this solution, the knowledge is essential about the construction of raingardens and the selection of plants which are the best for this purpose. For example, canes (Carex), irises (Iris) or mud violets (Viola palustris) can be found in the rain garden. Everyone, who has basic knowledge on this issue, is able to build such gardens. Knowledge can be gained by acquaintance with instruction brochures – "Rain Gardens" made by Sendzimir Foundation. Suitable materials, tools and sources to purchase them are also needed.

Local authorities should cooperate with Non-governmental organizations and support bottom initiatives of the citizens.

The process of this solution shows that before proceeding with any project, it is necessary to gain knowledge of the field, just like children during the workshop.

Issue of adaptation could be mainstreamed with local media and educational campaigns but the most effective way of communication is social media, especially among young people.

6.5. CONTACT INFORMATION, REFERENCES

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Electronic correspondence with Mrs. Katarzyna Biejat from Sendzimir Foundation, e-mail: katarzyna.biejat@sendzimir.org.pl

7 ▪ Modrá (CZ)

Implementing Municipality/Actor:
Local authority of Modrá
Location:
Modrá (nearby Uherské Hradiště), Czech Republic
Type of location:
village – approx. 700 inhabitants

7.1. SUMMARY

A small municipality Modrá in eastern Moravia (the region of Zlín) is located in a hilly agricultural area, which is ecologically unstable. There have been problems with soil erosion, threats of flooding on one side and threats of droughts on the other side. Therefore, the local authority has agreed to prepare its own plan of landscape renewal within the municipality long-term development policy, which has also been implemented from the long-term perspective. Despite the fact that the intention was inspired especially by the effort to improve the environment and landscape attractiveness in the surroundings of the municipality, these measures have had an impact on water retention and are significantly instrumental in adaptation of the municipality area in terms of climate change.
The municipality Modrá has gradually built and renewed a range of water bodies over the past decades (reservoirs, ponds and wetlands) as well as greeneries in its nearby surroundings. Particularly smaller ponds in the woody part of the Modřanský Pond valley are valuable and beneficial for the landscape water regime. The municipality Modrá has also built an interactive educational trail "Living Water" as a follow up to the measures in the landscape; this trail shows important local natural biotopes (aquatic and terrestrial) including a natural swimming pool.

7.2. PROBLEM

1) Municipality without natural water features, its territory which badly withstands extreme climate events – threats of flooding on one side and lack of water in the landscape in the drought period on the other side causing e.g. lower vitality of forest vegetation.
2) Larger scale farming in the surrounding landscape – problems with erosion, landscape with low biodiversity due to lack of greenery and water biotopes.
3) Missing areas which are close to nature as well as infrastructure/facilities for leisure activities, recreation and for raising public awareness.

Important internal and external actors:

- Initiator Miroslav Kovářík,the Mayor of Modrá
- Experts – forest managers, water management experts and others
- Cooperation with neighbouring municipalities, directly connected to the municipality of Velehrad with stakeholders
- The municipality of Modrá has engaged in the nationwide initiative "Rural Renewal Program" – a tool for harmonious municipality development

7.3. SOLUTION

The goal of the current mayor ever since 1990´s when he assumed the office, is to renew vanishing culture and traditions and to gradually create the municipality´s image and its surroundings in mutual harmony of building development with nature and the environment.

Vision: uniting landscape with traditional rural buildings and typical local greeneries “Landscape Renewal Plan” was prepared on the outset; consequently including areas for landscape forming features (water, greeneries) into the municipality local plan. Key parts are:

- Creating new ponds and wetlands, which protect against flooding and favorably influence municipality climate
- Grassing the areas which were damaged most by erosion
- Gradual renewal of former cart tracks with planting greeneries

Figure 12:
Educational site “Living Water”
(source: Municipality of Modrá)

Gradual implementation of **water bodies which can be exploited to fight both big water and droughts** (altogether 7 implemented water bodies between 1990 and 2000 in an extent of 60.000 m^2) was carried out. The first of these as an introductory impulse and for motivational demonstration of outcomes was financed from the financial means of this municipality (back then there were no subsidy schemes for this purpose).

It was possible to take advantage of implemented areas of green and blue infrastructure for leisure, recreation and raising public awareness – a new educational trail was established leading through the valley around the newly built ponds which are used e.g. for fishing.

A cross-border project “Living Water – Living School” supported from the EU funds was prepared in order to **raise public awareness** about significance of water and richness of natural biotopes. An interactive educational trail in natural environment was established on the site at the edge of municipality (where there is an archaeological open-air museum showing settlements from the period of Great Moravia), which shows local significant biotopes and fresh-water animals. A fresh-water reservoir presents a central part of the exhibition – majority of domestic species of fish in their natural habitat can be seen here. There is also a lagoon with natural banks which is suitable for bathing in natural environment.

ROLE OF ACTORS IN THE SOLUTION

Local inhabitants have supported visions and plans of the mayor concerning landscape renewal and possibilities of recreational activities on the area of the municipality in long term.

The municipal council has fully supported mayor’s proposals.

Local experts have participated in planning and implementation of the presented solutions.

People from the closer vicinity have found interesting jobs in the newly built exhibition “Living Water” (and also in related tourist services and facilities).

OVERALL BENEFITS AND ASSETS OF IMPLEMENTATION FOR LOCAL INHABITANTS

People from the municipality can use established ponds for recreational purposes and they are allowed to visit the educational exhibition as well as the swimming biotope all year round for a small fee. Moreover, fish can be caught in the ponds after purchasing a fishing license.

Implementation of water bodies and vegetation features has contributed to increase biodiversity, ecological stability of the landscape and the environment resilience and to the overall attractiveness of housing and living in the municipality.

Educational exhibition of living nature devoted especially to the significance of water and its inhabitants allows natural and amusing education of children and the young generation.

Tourism attractiveness and appeal of the area has increased substantially thanks to the infrastructure and facilities built; new jobs have been created and possibilities to find jobs in related services for local inhabitants have emerged.

FINANCING

Municipality has financed a substantial part of its activities from subsidy sources. As for realization of water bodies total costs amounted to approximately 10 million CZK (400 thousand EUR). In terms of the site "Living Water"- fresh-water and botanical exhibition, the total costs amounted to 26 million CZK (1 million EUR).

SUCCESS FACTORS

- Long-term vision, the mayor´s initiative supported by both the local authority and the community
- Cooperation with other municipalities and external experts in preparing and implementing projects
- Exploiting strengths of the municipality, which were taken into consideration when preparing the concept and content of individual projects (particularly natural conditions, history and tradition of the territory; location in the vicinity of tourist destinations / especially the pilgrim site Velehrad)

LIMITING FACTORS

- Lasting problems with erosion on sloping agricultural plots of land due to a large share of arable land in the municipality´s land register. Anti-erosion measures and planting other greeneries have been ongoing. Limited possibilities of the municipality to influence the situation (lack of funds and plots of land).
- Municipality management does realize possible threats of shortages in drinking water supplies in case of extreme droughts – for this reason the municipality is considering building a reservoir for fresh water, which would be located above the municipality for emergency supply. But the suitable land for reservoirs belongs to private owners, so it is only vision for the future.

IMPLEMENTATION TIME AND LIFETIME OF THE SOLUTION

Implementation of the measures has taken place since 1990 and development of the described issues, activities and measures have been ongoing until nowadays including continuous maintenance. Implemented measures and especially water projects are intended as permanent with non-delimited operation time.

7.4. OUTCOMES AND LESSONS LEARNT FROM THIS CASE STUDY

Establishing water bodies around the municipality has had a visible, positive influence on the condition of forest cover/vegetation (enhancing microclimate in the entire valley of the pond) hereby on the resilience of the area; the entire area is also used for recreation purposes.

Due to uniqueness and originality (there is e.g. Europe´s biggest fresh-water tunnel located in nature), the educational site "Living Water" has become a major tourist destination for children, student and adult visitors not only from the region but also from all over the Czech Republic and abroad.
A nearly natural reservation has been established through creating suitable environment where there are kingfishers, herons, black storks and various precious amphibians including newts. Different kinds of fish have been put in ponds and the municipality takes care of fish farming.
"Water projects" in the operation stage are financially sustainable thanks to elaborated contents of implemented measures and conception of their operation. Revenues from ponds and from the exhibition Living Water cover necessary costs in terms of maintenance and operation.

Key pre-conditions for inspiration to manage similar solutions/projects in other municipalities are:

1) participation and support of competent, long-term active personalities (municipality management and experts with knowledge of local issues) and local community.
2) long-term solution/project conception and selection of project structures based on strengths of particular municipality, natural conditions and other possibilities of developing the entire territory.

7.5. CONTACT INFORMATION

CI2, www.ci2.co.cz, info@ci2.co.cz
Municipality of Modrá – www.obec-modra.cz, modra@uh.cz
Educational site "Living Water" – www.zivavodamodra.cz

8 ▪ Modřice (CZ)

Implementing Municipality/Actor:
Local authority of Modřice
Location:
Modřice (nearby Brno), Czech Republic
Type of location:
town – approx. 5000 inhabitants

8.1. SUMMARY

The premises of block of flats for elderly people located in Modřice nearby the city of Brno is a set of buildings realized in a passive energy standard and applying principles of green and blue infrastructure. This is an example of a developing project realized by the municipality where during the preparation all available constructing and operating measures were already implemented into the final stage of the solution for climate protection of Earth (mitigation) and simultaneously through practical adaptation of the concerned building and the plot of land in terms of expected climate change. This project, which has been awarded several prizes, is an excellent showcase of advanced energy management, high quality of interior setting as well as environmentally friendly approach to nature and a showcase of applying adaptation measures for climate change including treating rain water.

8.2. PROBLEM

The need has arisen to develop communal flats for elderly people providing comfortable housing in a nice environment in the framework of municipality´s developing projects. The energy efficient and climate-friendly constructing methods and procedures of architecture which could meet the requirements of a municipality construction have not been spread and known in the region.

Important internal and external actors

- Initiator: deputy mayor of the municipality of Modřice
- Local self-government authority
- Senior citizens of the town
- Engaged experts in sustainable architecture

8.3. SOLUTION

The initiator of the project was deputy mayor of the municipality who was closely in touch with eminent experts in the field of sustainable building, she attended excursions and field trips, was interested in the issue and she consulted available solutions.
There were long-term discussions about the shape and form of the house. Former available experience with passive houses was exploited. At the same time this is also a social measure; the shape of the designed premises allows good social contacts and to involve the residents in the municipality life.
Eminent architects and project architects were invited to take part in the project plan of the block of flats premises and in creating the building project; they subsequently introduced the project to a wider expert public and to representatives of the local authority.
At the time of its opening (2014), this project became the biggest building to be built and financed by municipal authority, which corresponded to passive energy standard in the Czech Republic. The total capacity of the building is 41 apartments (32 one-room and 9 two-rooms).

The premises are made up of three buildings which through their layout make a border of a pleasant atrium, i.e. a quiet “courtyard” or a secluded place, which is publicly accessible contrary to common conventions (this is one of the features for social integration of residents of the flats in the municipality life). Moreover, the non-built-up part of the plot of land where there is a small pool, full-grown greenery and vegetation and lawns was used for the very layout solution along with principles of green and blue infrastructure.

Figure 13:
Green and blue infrastructure for rainwater retaining in the area of the building
(source: Municipality of Modřice)

The construction – technical realization of this project prefers retaining rainfall water on the plot. Furthermore, all flat roofs are made as green vegetation roofs allowing for slowing down the rain water run-off. Extensive greenery/vegetation on rooftops allows not only to retain parts of rainfall but also its evaporation, by means of which this contributes to climate enhancement at the site of the building. Some water which cannot be retained by green roofs flows to underground tanks (volume approx. 15 m^3) located in the atrium area. Water from the tanks is used to flush toilets in all premises on site and can also serve to water the garden. In case the tank is full, the rain water is drained through overflow to the pool in the atrium. If, on the other side, there were not enough water for flushing toilets from rooftops, water supply is supplemented by water from water pipeline. Water management is not left to chance even outside built-in plots of land. Strengthened areas located in the surroundings of the building are mechanically compacted (without concrete), hence allowing for soaking in rain water directly on the plot.

FINANCING

Total costs reached 85 million CZK (3,4 milion EUR), subsidy covered 6,2 million CZK (250 thousand EUR) from Green savings Fund, the rest was financed by the local authority.

SUCCESS FACTORS

- Clear vision and long-term initiative of the deputy mayor when searching for the best available solution and its communication for the community
- Overview of trends and possibilities of building development, consultations with eminent experts and quality team of the building´s authors (architects)
- Savings calculation which will be brought by the building operation in comparison with conventional building development

LIMITING FACTORS

- Project materials which are detailed and well thought over allow better planning of real costs and decreasing costs in terms of more work in the course of the building process and to select the best-quality supplier of the building
- Limited subsidy sources with complex conditions (for this kind and the purpose of the building development)

IMPLEMENTATION TIME AND LIFETIME OF THE SOLUTION

Initiating preparation since February 2009, followed by project preparation and application for subsidy. The actual building development was carried out between 2012 and 2014 and the first residents have been here since the mid-2014.

8.4. OUTCOMES AND LESSONS LEARNT FROM CASE STUDY

Preparation of a necessary new public beneficial building by a municipality is a significant opportunity, which requires expert knowledge to be taken into consideration – during planning and operation as well.

Therefore, the management of local authority was in touch with eminent Czech experts in sustainable and efficient building development, thanks to which the local authority became aware of current trends in sustainable civil engineering. Similarly, the municipality acknowledges the issue of climate change which will significantly affect future life in the municipality as well as the operation of buildings owned by local authority.

Flats have low costs in terms of energy compared to a common blocks of flats – when exploiting possibilities and available technologies in comparison with a common housing co-operative (like ventillation, heating and such, i.e. residents of individual flats regulate these independently). Thus, lower operational costs made it possible for the municipality to set a lower rent for the residents, which is simultaneously a social measure towards elderly people with lower incomes.

The importance of the role played by municipality´s authority on raising public awareness proved to be essential when preparing and realizing this project; the well-prepared, compact, inspiring and quality solutions of the project have set an example to other municipalities and other potential private investors. In the course of construction as well as after finishing the building, there were several excursions organized to the building for interested visitors (particularly for university students of relevant fields).

8.5. CONTACT INFORMATION

Town of Modřice, www.mesto-modrice.cz, podatelna@mesto-modrice.cz

9 ▪ Pilis (HU)

Implementing Municipality/Actor:
Municipality of Pilis
Location:
Pilis, Hungary
Type of location:
Settlement with appr. 12 thousand inhabitants

9.1. SUMMARY

Pilis, a city of 12 thousand people, joined the National Alliance of Climate Friendly Municipalities in 2008 but had lost its Climate Club by 2014 and does not have a green NGO ever since. The current leadership of the town has tried to save and revive the most important **educational and awareness raising climate related programs. The aspect of adaptation of the settlement to climate change is nevertheless mainly dealt with in the form of disaster management, in which a number of good examples can be presented**, eg. regional cooperation of mayors in learning, regular disaster management training, the development of an internal, non-official emergency plan, and communication with stakeholders on Facebook.

9.2. PROBLEM

The settlement joined the National Alliance of Climate Friendly Municipalities in 2008, with about a hundred volunteers. The Climate Club worked for several years but it has dissolved by 2014.

Pilis is affected by climate change in a number of ways:

- It happened once that an intensive storm damaged the phone network so much that no contact could be taken with the helpers.
- Extensive exposure to the sun and UV radiation damages horticultural production.
- Severe hails damage horticultural and agricultural products as well as vehicles.
- The town is rather green although with more green surfaces (with lawns) than green areas (with trees and shrubs). Intense storms bring down trees and shrubs, and the disposal of green refuse is problematic for the local residents.
- Many of the transformers and wooden pylons are out-worn, making the power supply system sensitive to the more and more frequent intense storms and thus causing power-cuts.
- Heat-waves endanger the health of the residents.
- Heavy snowing and ice endanger transportation, increasing the risk of accidents.
- The railway station is the only one in the close region so it is of central importance to people from several nearby settlements. Train accidents are rather frequent in the area and in case of an extreme weather event, it is Pilis Municipality's responsibility to take care of the people not only within the accident but those who are stuck in a train due to the accident.

Important internal and external actors:

- Csilla Hajnal, mayor
- Urban Management Company
- Disaster Management Authority
- Government Office of the District
- political parties and NGOs, grouping the majority of local residents
- local schools and nurseries
- benevolent economic entities
- local residents

9.3. SOLUTION

The settlement **joined the National Alliance of Climate Friendly Municipalities** in 2008, with about a hundred volunteers. The Climate Club worked for several years but it has dissolved by 2014. Today, Pilis does not have a green NGO or other grouping. Some programs directly associated with the theme of climate change have been saved and revived by the current leader of the settlement. These programs are mostly about **environmental education and awareness raising**.

- The settlements' **nurseries and schools** have obtained the award of **"Green Institution"** by the Ministry of Agriculture on the basis of a vast range of requirements.
- 'Négyszögletű Gyerekerdő': The local **Forestry Company has offered trees for plantation**. A **tree is planted dedicated to each child of the settlement**. The children and parents are involved in the maintenance work and reminded of the need for environment protection.

Figure 13:
Négyszögletű gyerekerdő.
Source: www.gubanyi.hu

- The mayor invited **as many local groupings as possible** – including political parties, minority governments, sport clubs and pensioners' clubs – to participate in the Earth Hour initiative. With cooperation from all, Pilis won the 'The Earth Hour Capital Challenge 2016'. The mayor thanked for all of them for their participation in the local magazine. It is an interesting result that the pensioners' club celebrated the award with cooking an organic dish – which proves that their awareness of the environment had indeed been raised successfully.

The **Government Office of the District and the Disaster Management Authority organise a regular training for the mayors of the District**. The training provides **theoretical** background on the one hand and **practical exercises** on the other hand on handling emergencies. Mayors learn about the preparation of plans and each of them are put into imitated problem situations that become more difficult every 5 minutes. These practical situations are then examined and assessed together by all mayors and the organisers.

Mayors from the same district have a very good working relationship and are used to call each other in problematic situations to find out if the others have had such experience and to **learn from each other**.

The municipality has not only the **obligatory emergency plan** required by the Disaster Management Authority but **also a 'non-official' one in parallel**. The non-official emergency plan has been developed on the basis of experience from life, ie. after a negative situation, in order to avoid that it is ever repeated, the mayor, the head of the urban management company, a representative of the disaster management authority and other professionals examine and assess the situation and the solution ex-post and **build the lessons learnt into the plan**.

The Mayor of Pilis has served since 2014. She operates **several communication channels** with the local residents such as an **innovative Facebook page** for the municipality (with appr. 1500 followers, which amounts to nearly 13% of the population), the webpage of the municipality, a weekly spot on the radio and a local magazine published every two months. Besides, the traditional communication channels of several bulletin boards over the settlement are also available. These communication channels can be **used to inform people about (possible) emergencies and educate them how they can prevent or mitigate adverse effects of extreme weather events**.

In case of emergencies, the **Mayor shows example by proactively working on the field herself** – eg. eliminating fallen trees from roads with rangers. She constantly carries several tools and instruments in her car that can be useful during such an action. She is also **not reluctant to go ahead with works that can be efficiently solved within the municipality's competences, even if they are not responsible for resolving a problem**. For instance, the municipality cleans away the snow from the railway station, from bus stations and the main roads even if it would be the responsibility of other authorities, the large organisation and/or lack of capacity of which does not allow for so rapid actions.

The municipality has a **heatwave plan,** which uses the above-mentioned communication channels in case of a heat alert. In case of a heatwave, besides the awareness raising and education of the people, the municipality takes also an active role: it turns some fire hydrants into drinking-fountains (close to the doctor's office and playgrounds), and they also offer climatised room in the municipality's building for those in need and widely announce the opportunity.

In case of a train accident when people are stuck in a train, including when there is an extreme weather event, the **municipality offers accommodation in public buildings** as well as provides water.

A local horticultural shop decided to help those people who suffered loss in their horticultural or agricultural production due to a certain hailstorm **by donating a uniform package of new plants (for free).** They contacted the Municipality with the proposal. The Municipality had exact information on where the hailstorm destroyed gardens, which rendered it possible to identify the people in need by their registered addresses.

The Municipality can mainly help local residents who suffer a loss due to extreme weather events by **assisting them with administrative issues** eg. managing the contact with the insurance company. After storms, the Municipality ensures **additional bags for green refuse** that is then taken away by the waste management company.

Figure 14.
The settlement is rich in trees and shrubs that can fall down in a storm.
Source: Malatinszky, 2017.

ROLE OF ACTORS IN THE SOLUTION:

- the **Mayor** and her special disaster management deputy **ensure coordination of actions in case of an emergency**. They regularly participate in trainings to **educate themselves** and **develop emergency plans**. The Mayor also is a **supporter and sometimes initiator of environment-friendly and climate-friendly initiatives** in the settlement. She also personally **operates communication channels** toward the local residents
- the **municipality, the Urban Management Company and Service Providers cooperate** within their fields of competence for the seamless operation of the settlement's urban systems
- **green local economic entities with munificence** may initiate their own programs or support the settlement's already existing green programs in cooperation with the municipality
- the **local political parties and NGOs group together and possibly mobilise local residents**

INDUCED INSTITUTIONAL CHANGE:

There is a circle of stakeholders assessing emergency situations for the development of the non-official emergency plan.

FINANCING

The Municipality lacks the opportunity for grants for hard climate adaptation instruments due to the fact that the settlement is located in the same county as the capital, and this vicinity results in the capital taking all development money in the region.

SUCCESS FACTORS

- **Personal commitment** of stakeholders including the Mayor, the management of the District and the local representatives of the Disaster Management Authority, the personnel of the Green Nurseries and Schools as well as the benevolent economic entities
- **Regular trainings for emergency situations,** ex-post **assessment of real situations**
- **Appropriate communication** channels between active actors and towards local residents
- **Cooperation between groupings** neglecting differences in political view

LIMITING FACTORS

- **Taking over an action from the responsible entity may delay the performance of those tasks that actually are the own responsibility** of the municipality. However, the priorities are set based on a rational consideration.
- **Lack of financing**: lack of dedicated grants within the region due to the vicinity of the capital city hinder the development and implementation of a comprehensive adaptation strategy.
- **Conflicting political** views might prevent certain groupings from cooperation
- If the **IT/phone system** is broken due to an extreme weather event, other means have to be found to communicate with the helpers (eg. personal meetings, radio based devices).

9.4. OUTCOMES AND LESSONS LEARNT FROM CASE STUDY

Although the settlement has no comprehensive adaptation strategy and lacks financial resources, the case proves that personal commitment in leadership as well as cooperation from the wider society can achieve major successes. It is also a good example how continuous learning and reflection must be built into activities to effectively tackle emergencies including events occurring due to climate change.

The regular emergency trainings initiated by the Government Office of the District need to be highlighted as an innovative tool to contribute to keeping the settlements' functionality and the population's safety.

9.5. CONTACT INFORMATION, REFERENCES

Contact person: Csilla Hajnal (mayor): +36 20/575-5969

10 ▪ Szekszárd (HU)

Implementing Municipality/Actor:
Municipality of Szekszárd, a green NGO and the local Climate Club
Location:
Szekszárd, Hungary
Type of location:
City with 30.000–100.000 inhabitants

10.1. SUMMARY

Szekszárd, a city of 33 thousand people, joined the National Alliance of Climate Friendly Municipalities in 2008 and committed to deal with climate related issues including both mitigation and adaptation. The city has developed a local Climate Change Strategy in 2010, which is implemented through a number of activities each year. By 2017, **10% of the local residents** (about three thousand people) **have been involved as active participants** in these activities.
The current case study presents the process how climate change has become an issue to deal with at municipality level, how the organizational structure has developed and how the residents have been mobilized.

10.2. PROBLEM

Szekszárd is a city in a valley, surrounded by a hill. All households used to have vineyards, today about 1 out of every 3 households still have their own. As climate change evidently affects the local **agriculture**, i.e. the wine production (changing pests and diseases, increasing irrigation needs, decreasing quality and quantity of products, soil degradation), many of the residents clearly experience the negative impacts of climate change.

Moreover, according to a survey conducted in 2009, **about 50% of the local residents had had personal experience related to climate change** (citing changing seasons, hotter summers, more intensive storms and damages resulting therefrom, health problems, hail damage etc.).

A **representative from the local government**, namely, the head of the local Economic Committee – László Kővári, himself an agricultural producer, who had previously worked at the pest control authority, the chamber of agriculture and is an amateur meteorologist for forty years – **realized in 2007 that the issues of climate change should be addressed at municipal level**.

Important internal and external actors:

- Initiator László Kővári, representative of local government
- Zöld Társ Alapítvány, local green NGO active since 2004
- local organisations, schools, interested residents

10.3. SOLUTION

Having realized that climate change should be tackled at municipal level, László Kővári made Szekszárd join the National Alliance of Climate Friendly Municipalities in 2008. This meant that the city committed to pay membership fee thereto, **employ a 'climate coordinator', prepare a strategy on climate change and establish a dedicated fund**.

Trial and error: The local government established the Climate Group (in 2009) involving representatives of relevant local actors such as the local government, various authorities (disaster management, soil protection, animal health authorities), public utility companies (district heating, public transport) and important local economic actors (eg. manufacturing company).

The representatives in this group were appointed by their employers (lacking real personal commitment) and the operation of the Climate Group did not work out.

As an alternative, the local government contracted the local green NGO Zöld Társ Alapítvány (herebelow: ZTA) to be the Climate Coordinator of Szekszárd, which was a task **smoothly compatible with their ongoing activities**. They have been coordinating all related activities since then.

ZTA conducted a **survey** among local residents on their attitude towards climate change as a starting point. The questions mapped: 1. awareness of climate change 2. expectations on climate change 3. personal concerns 4. causes of climate change 5. responsibilities 6. personal willingness to act 7. role of the local government 8. willingness to pay.

ZTA searched for local people interested in the topic to form a **social basis for their activities**. (Relevant movies[1] were shown in a free festival to the **residents**, to **employees of the municipality** and **in schools** (in working hours), followed by discussion.) A database of interested people was built. **Active personal contact** needed to be established. Szekszárd's Climate Club was established in an Opening Plenary with about 65 members, active in 5 (today 6) working groups.

Climate Strategy was developed by ZTA and the Climate Club's working groups. Comments from residents were also published on the website and incorporated. The Strategy was then adopted in 2010.

The **Climate Strategy is implemented** through (originally) yearly **action plans**, in the form of a number of regular and new activities (including own programs and grants for local initiatives **financed from the Climate Fund)**. Activities include (non-exhaustive list):

- small studies on several local aspects
- awareness raising sessions and tours showing local values prone to climate change
- calling residents to share their experiences of climate change on ZTA's website
- a database of the local meteorological data from the last 40 years available at ZTA's webpage with comparison to and short assessment of today's situation
- promotion of eco-friendly transportation
- innovative (agricultural adaptation) solutions are tried, popularised and occasionally their spread is supported (eg.: terrace cropping, raised beds, composting) planting program

Figure 15.
Awareness raising tours showing local values prone to climate change
(Photos: ZTA presentation 9 June 2017)

[1] Inconvenient Truth, Six Degrees could change the world, The Age of Stupid

Figure 16.
Terrace cropping as one of the agricultural adaptation solutions tried and popularized by ZTA
(Photo: ZTA presentation 9 June 2017)

ROLE OF ACTORS IN THE SOLUTION

- The **local government** appoints the heads of the working groups of the Climate Club, co-decides (approves) on grants for given activities and takes overall responsibility for the programs.
- **ZTA** (a team of 5 people who work part-time on Climate Coordination) coordinates the overall activities, ensures effective workflow and monitoring, and reports back to the local government. Their job requires meticulous meetings with all relevant actors. The NGO co-decides on grants for given activities and also carries out certain programs.
- The **plenary of the Climate Club** sets further directions of implementation and discuss planning of activities. The **working groups** assess and recommend grant applications for approval.
- **Local organisations and private residents** could provide comments to the Strategy. They can participate in the work of the Climate Club. Moreover, they can **apply for a grant for activities in line with the Climate Strategy** on a yearly basis.

INDUCED INSTITUTIONAL CHANGE

- ZTA covers the task of the city's Climate Coordinator in the framework of a yearly renewed contract of services with the local government.
- The Climate Club has been established: it actively participates in forming the vision of the city and is a channel to local residents' voice.

FINANCING

The local government decides on the **Climate Fund as a row in the standard municipal budget** on a yearly basis. The Fund covers ZTA's contract fee (monthly 100 thousand HUF; ~320 EUR) and ensures financing of the grants.

The Fund used to start with a total amount of 4 million HUF (~13 thousand EUR) for 2011. Since then, the amount has shown a decreasing trend. For 2017, the budget is 1.5 million HUF (~5000 EUR).

SUCCESS FACTORS

- **personal commitment of a prominent local representative and all active stakeholders** (cf: paragraph on 'Trial and error' in section 'Steps toward the solution')
- **consistency, continuity**: strategic approach, not a project-based solution. Long-term planning and regularity of certain activities – supported by continuous media work – are of key importance. The fact that the implementation is done by a permanent actor renders it easy for the local organisations and people to contact them in case they have a proposal or seek for a solution, or for the local media if they are interested to know more about climate change.
- **mobilising** local organisations and residents – creates wide commitment and adds implementing capacity (about 30 organisations have organised the various activities)
- **cooperation**: continuous **professional discussions** (including with National Alliance of Climate-Friendly Municipalities), taking on board **residents' views**

- small community – even if politics change and the initiator representative László Kővári will get out of the local government, many of the representatives and employees of the municipality know the situation by now and already have **contact** with ZTA
- **simple** grant process (including documentation)

LIMITING FACTORS

- lack of being able to plan appropriately: It is common that **politicians** make ad-hoc decisions based on their actual preferences.
- **uncertainty**: Actual decision on the local government's budget is made in March, while money is available by September for the actual calendar year – as a result, the NGO has to either implement all activities between September and December for the year, or finance the activities upfront without a guarantee for the amount they would receive
- it is also a disadvantage that the implementation is not done in-house of the municipality as it results in the fact that the bulk of the work consists of **meticulous meetings needed to take place** with different employees of the municipality and fora (committees, mayor, etc.) of the local government on a constant basis, and also with new leaders every 4 years over again, which is very **time consuming and tiring** – however, with time this process is getting easier as ZTA and the processes have gained reputation over the years and to a certain extent got integrated into the everyday work of the municipality.
- **lack of capacity** (in terms of time and human resources) at ZTA for the job. Eg. at the current level of employment, ZTA has very limited resources to participate in international projects from which the settlement could profit as well, or to ensure an even more frequent presence in the media.
- **financial resources** are showing a decreasing trend. The local government tends to misinterpret the successes in a way that the process is self-evident, therefore less effort are needed.

IMPLEMENTATION TIME AND LIFETIME OF THE SOLUTION

Implementation started 8 years ago and requires ongoing efforts for long-term results.
The city's Climate Change Strategy adopted in 2010 is subject to revision and update in 2017.

10.4. OUTCOMES AND LESSONS LEARNT FROM CASE STUDY

In 8 years, ZTA has managed to mobilise about 10% of local residents to actively participate in climate related activities. Szekszárd has become a flagship in Hungary and its approach is being taken over by other municipalities in the region (county) as well.

The above case is a good example of a partnership between the local government and a local green NGO. It clearly shows the importance of personal commitment from the participants of the process, the need for awareness raising among political decision makers leading thereto, and the importance of giving ownership to a wide local social basis, which is partly an objective of the process and partly a means to successful implementation by adding implementing capacity. Moreover, ZTA could ensure the credibility of the activities given their professional competences. It is also a lesson learnt that consistency – in the form of permanent contacts, long-term planning, regular activities and continuous media work – is key to success.

10.5. CONTACT INFORMATION

Contact person: Zsófia Gaál (ZTA): +3620/299-8960
Website of ZTA, NGO acting as Szekszárd's Climate Coordinator: http://zoldtars.hu
Szekszárd's Climate Strategy (of 2010, to be revised and updated in 2017):
http://zoldtars.hu/sites/default/files/doc/Klimastrategia.pdf

11 ▪ Trnava (SVK)

Implementing Municipality/Actor:
The City of Trnava
Location:
Trnava, Slovakia
Type of location:
city – ca. 65 000 inhabitants

11.1. SUMMARY

The nature of the urban built environment, structural aspects such as streets, buildings, and infrastructure, significantly modify and amplify climate change impacts. The structure and materials, the shape and orientation of buildings and the streetscapes can increase the need for cooling and heating of buildings. Areas of impervious surfaces can intensify flooding and are direct determinants of urban heat island (UHI) effect, particularly because the built urban environment contributes to the reduction of evaporation and increased sensible heat emission to the urban boundary layer. The presence or lack of street trees and parks, and the extent of wastewater and drainage systems, can either enhance or impede the natural processes of evapotranspiration, in addition to amplifying drought and flooding effects.

Despite being clearly vulnerable to the effects of climate change, cities are also uniquely positioned as leaders in anticipating climatic variability and change, designing resilience into their development to lead more robust systematic adaptation process and thus serve their population better. By understanding, planning and adapting to a changing climate, individuals and societies can take advantage of opportunities and reduce risks.

The City of Trnava is a pioneer city in Slovakia that decided to undergo such a process. The statute of historical city with a lot of historical buildings and paved surfaces makes Trnava extremely vulnerable to heatwaves and urban heat island effect. From vulnerability assessment to adaptation plan to implementation of pilot adaptation measures (including grant scheme within the municipal budget to financially support active citizens) is the road Trnava took in period 2013-2015 under the professional guidance of Carpathian Development Institute, Kosice. Until today (2017) it is probably the best example to be followed by other Slovak cities.

11.2. PROBLEM

As was already mentioned, climate change impacts cause major damage to health, public and private properties in Slovak cities and towns and their incidence is in coming decades practically certain. Cities and towns, their residents, entrepreneurs and local governments are in the front to experience and combat climate change consequences. The City of Trnava is not an exception.

Climatological analysis of the Trnava City territory and its surroundings revealed the following conclusions:

- Each season is getting warmer (summer most significantly, followed by winter)
- Rise of extreme temperatures is mostly occurring during the summer. The annual number of summer days (min. 25 °C) will rise from 58 (1961–1990) to 100 (2051–2100). The annual number of tropical days (min. 30 °C) will rise from 12 to 36 in the same periods.
- Trend of annual total amount of precipitations is moderately downward. The most significant drop is occurring during winter.
- Combination of temperature and precipitation trends will cause decreased soil moisture leading to more extended drought periods

Taking into consideration geographic characteristics (plain) and build-up areas the heatwaves and urban heat island effect have been selected as priority climate change impacts to be dealt with in Trnava City.

11.3 SOLUTION

Representatives of Trnava City had indefinite idea about climate change and its consequences at local level in 2012. Therefore, they decided to participate in the international conference: *Climate Change and Local Development - Challenge for Local Governments*. The most erudite domestic and foreign speakers delivered presentations in the following topics: Climate change and its impacts on Slovakia and its regions, Addressing climate change in the process of governing local development, Local measures to address climate change by green infrastructure, water management and energy management and Tools of self- governments to mainstream the climate change into their activities. **Inspired by new information the representatives of Trnava City were actively looking for opportunities how to systematically tackle this issue.** The solution was found in a joint project led by Carpathian Development Institute called *Cities resilient to Climate Change Impacts - inspired by city of Trnava*, which was funded via Swiss Financial Mechanism. Based on CDI's tailor made methodology the systematic adaptation process could start with vulnerability assessment.

Exposure to heat waves was assessed in three ways: continuous temperature measurement using professional thermometer; driving car on the streets according to prescheduled route during a hot day and late evening; discrete measurements on selected city spots. Comparing all three types of measurements we can state that Trnava in general is equally exposed to the high temperature during the day (relatively flat results caused by mixing air). The highest temperatures were located at the southern part of the city and below the railway line. Relatively cooler parts were measured on the southern outskirt of the city and north from city center. The exposure was show in graphic form via isotherm lines. The spot measurements showed that general picture is significantly different in details (in the park, parking lot, urban forest, at the water area, blocks of flats without air circulation).

Vulnerability assessment continued with analysis of factors, which provide platform for the measurement of sensitivity and adaptive capacity to heatwaves and urban heat island effect. The following factors were identified and examined:

Sensitivity

- density of the most endangered residents – 75+; 4-;
- surface roughness preventing air-circulation and katabatic flows
- thermal insulation of buildings
- people living in underroof flats with low thermal insulation
- extent of unshielded paved/hard surfaces
- Green areas with at least 60% shielding provided by treetops

Adaptive capacity

- accessibility of green areas (larger than 2ha) covered by shield from treetop more than 60%
- level of knowledge and behavioral patterns of people
- information activities
- early warning systems
- A/C in public transport vehicles and shielding of stops
- healthcare emergency services

All factors have been weighted in terms of their seriousness for human health. They were as well narratively described and projected into maps (where possible). Each map was divided by grid network of 300 × 300 m to show the most vulnerable areas within the city. Finally, the combination of all factors produced the overall vulnerability map of the city.

The analytical phase was followed by **elaboration of adaptation plan** which aims to reduce the vulnerability of the Trnava City to heatwaves and urban heat island effect via these programs:

- Shielding of public spaces
- Cooling of public spaces
- Cooling of indoor public spaces
- Good behavior patterns during heat waves
- Enlargement and improvement of refreshing places
- Good decision-making
- Stimulation of citizens to realize adaptation measures
- Buildings at risk (to reduce their vulnerability e.g. via better insulation, green roofs etc.)

Figure 16.
Retrofitted urban square considering climate change impacts
(Source: Trnava Adaptation Strategy to heatwaves)

Each program contained specific adaptation measures and activities localized at various areas of the city. A few selected **pilot adaptation measures were implemented** in full scale from planning to actual materialization.

For example, the former abandoned area neighboring with block of flats, kindergarten and house for pensioners was completely retrofitted (removal of parking lot asphalt, planting of trees, building of fountain, new benches established). This way the **cooling area during the heatwaves and resting place was provided for local community**. It meets the requirement of minimum 60% of green area to be covered by the treetops. Retention capacity was increased as well. The place became community's spot for socializing.

The second example is focused on encouragement of people to perform their own adaptation measures. Therefore, City of Trnava created grant scheme within the municipal budget to financially support active citizens either through individuals or organizations. Each year a minimum of 10 000 EUR is allocated for this activity from the city budget. Proposed measures must be in line with the city adaptation plan. Detailed criteria for awarding will ensure that. Moreover, ongoing monitoring and annual evaluation is being carried out. Mainly awareness raising activities at local schools are being supported at the moment.

ROLE OF ACTORS IN THE SOLUTION

- City leadership (two different mayors) provided political backing
- Carpathian Development Institute provided methodology and expert leadership
- Local expert group was established and consisted of:
  - Local experts for demography data
  - Spatial planners who can project gained data into territory and provide broader perspective to adaptation
  - Landscape architects who are specialized in green and blue infrastructure
  - Physicians who can assess climate change impacts on human health
  - Development planners who can link adaptation into broader development context
- Specific assembly of institutions called *Partnership for Adaptation* was established as well. Its goal was to secure the implementation of adaptation strategy after the conclusion of the project. The following institutions created the partnership: city administration, city businesses, local state administration, key private businesses and nongovernmental organizations. Each member has a role to communicate and promote the goals of adaptation plan within its own environment.
- Public was involved via survey mapping their awareness and behavioral patterns and through realization of grant scheme. The public was also a target group of various awareness raising activities – video spot, brochure etc.

FINANCING

The funding was provided through the project *Cities resilient to Climate Change Impacts – inspired by city of Trnava*, which was funded via Swiss Financial Mechanism. The grant scheme was funded by the city.

SUCCESS FACTORS

- Strong commitment from the city leadership from beginning to end despite the fact that change of mayor occurred in the middle of the project
- All relevant players were given opportunity to participate in a proper manner
- Thematic programs and measures how to tackle heatwaves and UHI were prepared
- Adaptation principles have been projected into the city regulation acts
- Pilot measures have been implemented and implementation process of adaptation plan is ongoing
- The grant scheme funded from the city budget

LIMIT FACTORS

- Successful implementation of adaptation strategy is dependent on availability of external financial resources
- City governments and central government agencies acting in or around the cities may struggle to coordinate among each other
- City leaders and city administration are overwhelmed by the “day job” of immediate service delivery.
- Adaptation to climate change impacts is a new and multi-sectoral topic. Some sectoral experts are not fully familiarized with all links, correlations and causalities yet.

IMPLEMENTATION TIME AND LIFETIME OF THE SOLUTION

The elaboration of adaptation strategy lasted 24 months, from early 2014 to 2015. It is an open and live document, which should be regularly monitored, evaluated and updated. It should serve up to 10 years as a midterm document.

11.4. OUTCOMES AND LESSONS LEARNT

The City of Trnava is one of the first cities in Slovakia with systematic approach to climate change impacts. The adaptation plan will serve not only as a tool to tackle heatwaves and urban heat island effect. It is also a prerequisite for drawing external resources from new EU program period (2014–2020) and others, where adaptation to climate change is amongst highest priorities.

The experience from the process showed that even change in the city leadership doesn't necessarily mean the slowdown, if it is explained in proper and understandable manner for elected representatives. The complexity of the whole process proved that adaptation to climate change impacts, especially in urban areas, is a broad topic beyond environmental boundaries. It has enormous societal and economic links to be considered at the same time.

11.5. CONTACT INFORMATION

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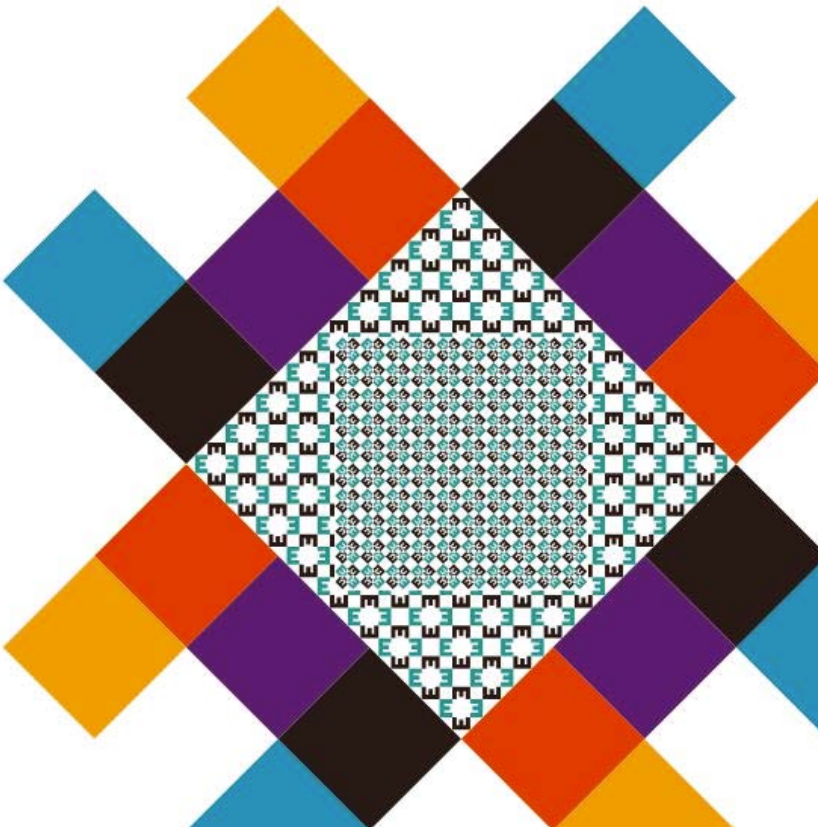

12 ▪ Wrocław (PL)

Implementing Municipality/Actor:
City of Wrocław
Location:
Wrocław, Poland
Type of location:
Town with more than 100 000 inhabitants

12.1. SUMMARY

Wroclaw is among the 14 cities competing for the title of Green Capital of Europe in 2019.

Together with Manchester (United Kingdom), Valencia (Spain), Brest (France), Zadar (Croatia) and Modena (Italy) Wrocław applied for co-financing a joint pilot project under the Horizon 2020 program. In the application for the title of Green Capital of Europe – Wroclaw presented the project "Green Zone" within the EU program Horizon 2020.

The purpose of the project is to adapt to climate change by creating a catalog of demonstration solutions, based on the so-called environmental services, enabling the local management and use of rainwater, creating oases of greenery, providing shelter from the heat, providing shading and local temperature reduction. Demonstration solutions will be accomplished in Ołbina, which is in a district with intensive downtown development, where many people have the need to contact with green areas in the immediate vicinity of their home.

The project addresses the mitigation of extreme weather events by introducing green areas such as pocket parks. In 2016 Wrocław was among the laureates of this project and will receive EUR 3 million for its implementation.

The new green zone covers an area of about 0.8 km^2 and consists of seven pocket parks with green walls and one green street.

The so-called pocket parks offer a great opportunity to use wastelands, space between buildings and quarters. At the same time, it is a very good way to offer greenery for buildings, often with the possibility of growing vegetables, and creating a place where people can relax and spend their leisure time.

One of the implemented examples is Bird Grove (Ptasi zagajnik), with an outdoor gym, bushes, chessboard and new benches. Bird's Grove at ul. Skwierzyńska has already been opened thanks to the initiative of the inhabitants, whose project won 330 thousand PLN in 2014 within the framework of Wrocław Participatory Budget.

The participatory budget is a process in which all permanent inhabitants of the city take part in deciding about the way of spending public money. It aims at increasing of local awareness and promoting the idea of self-government. Thanks to the participatory budget, inhabitants can easily submit their ideas of relevant tasks, that they think the local authorities should carry out (i.e. projects) and later choose the best of them in a vote.

12.2. PROBLEM

'Pocket parks' is a research project; one of its aims is the integration of green areas into the urban fabric and testing how it improves the city's resilience to changes. As in most cities urban space is very limited for green and blue infrastructure, urban landscape architects have to plan on a smaller scale. Pocket parks are not planned throughout the whole courtyard, so residents are not forced to give up parking in the courtyards. The courtyard interiors fulfill the various functions needed by the residents. That is why it is necessary to talk to the inhabitants to bring the essence of the project together and to reconcile the different visions of the use of these areas.

Important internal and external actors:

- City of Wrocław,
- Wrocław Aglomeration Development Agency,
- Wrocław University of Environmental and Life Sciences

12.3. SOLUTION

- Creation of an innovative model of micro-green areas in the city, built on the following components: pocket parks, green streets and other green infrastructure solutions.
- Development of methods for local management of rainwater and prevention of heat island.
- Local improvement of the quality of life of the inhabitants – Increased availability of public green areas, improvement of air quality.
- Preparing recommendations for other European cities on how to use micro-green systems to improve their resilience to climate change.
- Coordination of activities on green infrastructure at multiple levels, promoting green infrastructure and modern approaches to greening public spaces, promoting new solutions, enhancing and improving the quality of green spaces in the city, extending ecosystem, natural and social functions.

Figure 17.
Ptasi Zagajnik
– park revitalized
(source: wroclaw.wyborcza.pl)

FINANCING

Green Zone project is financed within the EU Horizon 2020 program. Project budget is 3 million Eur.

SUCCESS FACTORS

In the plebiscite the inhabitants submitted 129 documented proposals. 7 of them have been selected for pocket parks and one route will be converted into a green street. As part of the award-winning project, experimental solutions will be developed in the part of Ołbina. Daszyńskiego and Prusa streets will create a “green street”, and in the neighborhood (in the area of Nowowiejska and Jedności Narodowa streets) pocket parks with green walls will be built. The social role of pocket parks is very important, because these parks are major meeting and integration places in Poland.

12.4. OUTCOMES AND LESSONS LEARNT FROM CASE STUDY

It worth to use smaller spaces of the city and greening them in case of urban-climate purposes and awareness raising of the inhabitants. Cooperativeness of the inhabitants can be raised by the participatory budget, which allows them to show and implement their own initiatives.

12.5. CONTACT INFORMATION

Town Hall in Wroclaw. Department of Real Estate and Operation of the City Hall.
www.wroclaw.pl/rozmawia/ptasi-zagajnik-na-nowo-zdjecia-wideo
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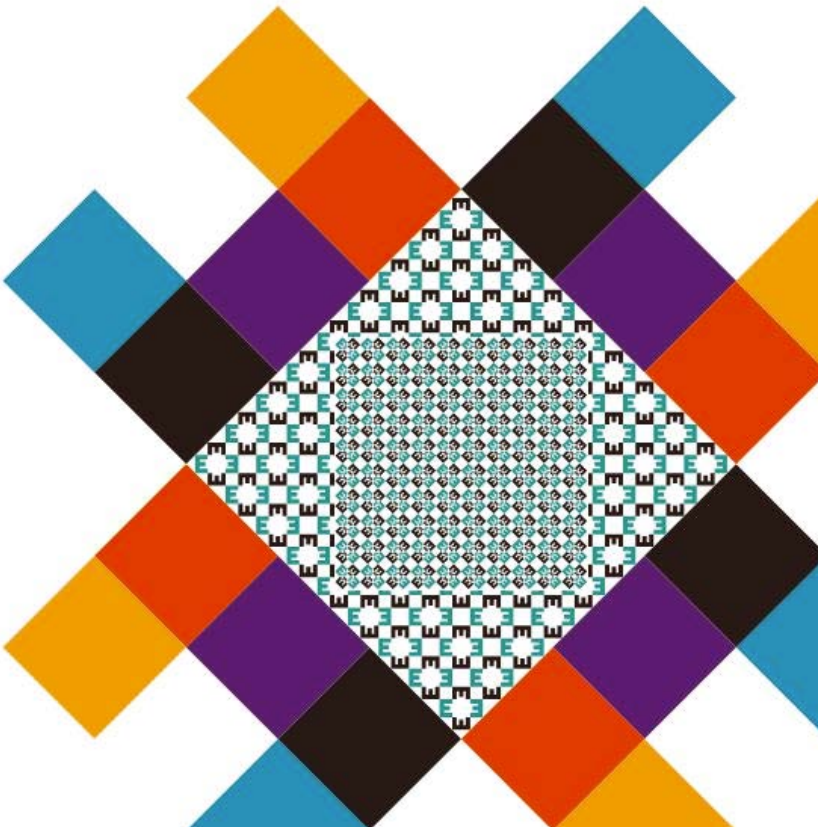

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