

## The perception of risks caused by climate change in the urban environment by the city population and its usefulness in identifying measures for alleviating their impacts

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*Abstract:* – Climate change is reflected by the changing extremity and spatiotemporal distribution of hydrometeorological conditional threats. At the same time, human society is evolving and its vulnerability to these threats is changing. The result is a varying degree of risk that threats related to the climate and its change present to human society. The article presents partial results of the project "Adaptation of settlements to climate change – practical solutions and sharing experiences", mainly due to implementation of analyses of the existing impacts of climate change at the local level, and also by supporting the development of good local strategies for a gradual adaptation to climate change. The paper main objective is to introduce the methods of risk identification and establishing possible adaptation measures in the urban environment with the cooperation and participation of the public using an example of three pilot studies from cities in the Czech Republic – Hradec Králové, Žďár nad Sázavou and Dobruška.

The work is based on a combination of methods of empirical research, such as field research at the sites of case studies and sociological research – particularly public inquiry in the surveyed areas – and methods of theoretical research such as, in addition to the abstraction and generalization of gained knowledge, methods of scientific synthesis directed towards the creation of a generally applicable methodical approach to public involvement in the processes of creating adaptation strategies, respectively Road Maps.

*Key-Words:* - Climate Change, Urban Environment, Public Participation, Road Maps, Hradec Králové, Žďár nad Sázavou, Dobruška

### 1 Introduction

Over the last fifty years, the number of people living in cities around the world has increased nearly fivefold. Currently more than sixty percent of the world's population live in cities, and the number continues to rise in less developed regions.[3] In European countries, the urbanization rate is even higher, at about three-quarters of the population.[2] The city, however, serves not only for human inhabitation, but also as a center of culture, science, industry, trade, and, last but not least, decision-making and administrative processes. For the very reason that not only the vast majority of the population is concentrated in the cities, but other elements necessary for a healthy human society to function are there as well, it is essential to address the issue of threats, risks, and the impacts of climate change on cities as well as possible effective measures for adaptation. So far, however, most of the

preparatory adaptation work has focused mainly on large cities (often coastal) or on vast settled agglomerations whose organizational and financial resources, not to mention personnel capacities, are incomparably greater than the actual and realistic opportunities for small towns and villages.[8]

According to the Intergovernmental Panel on Climate Change [4,5], cities are threatened not only the gradually changing climate and rising temperatures, but primarily by more frequent weather fluctuations and by extreme weather phenomena .[8] If we focus primarily on the second of these phenomena, i.e. extreme weather phenomena, it is necessary to realize that such events affect the entire socio-economic system in all its aspects:

- Quality of the environmental: This is affected especially if the weather causes air or water pollution, or exposes living organisms to toxic

substances or living conditions that are harmful to their health.

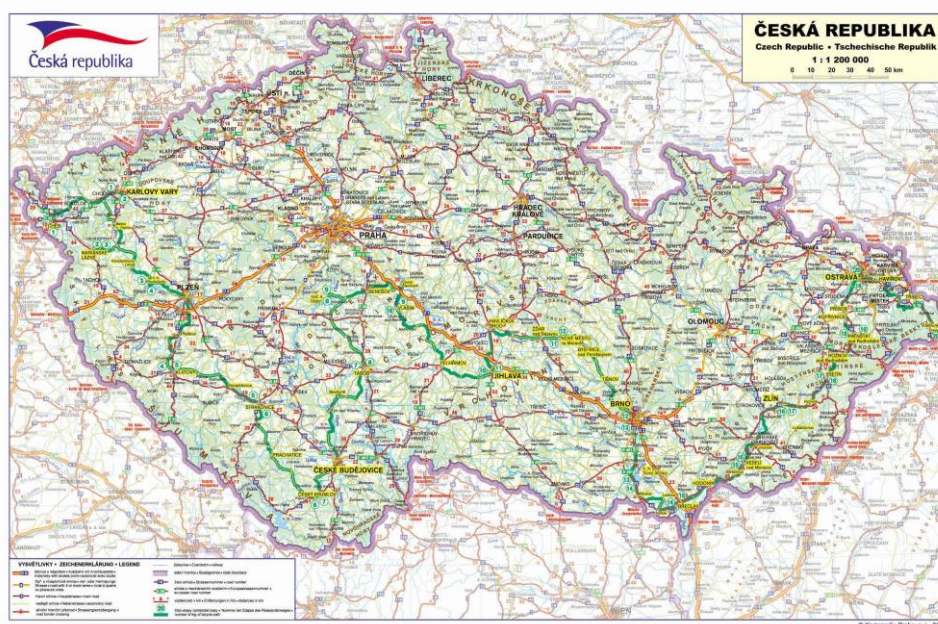
- The interconnectivity of systems: This includes modes of transmission and transport that allow for the utilization of services, including ecosystem-type that contribute to the welfare of the population. The interconnectivity of systems is particularly threatened by extreme events such as floods, landslides, fires, and storms.
- Physical infrastructure: The gradually changing climate and extreme phenomena can significantly affect or impair the physical infrastructure such as buildings or utilities.
- Social systems: The main risk is particularly extreme weather phenomena which may adversely affect social systems and the networks within them. Climate and the weather have a fundamental impact on the overall quality of life and relationships, the moods and sentiments of society, both directly and indirectly (e.g. through the disruption of other aspects of the system, such as homes and infrastructure).
- Economic and production systems: Climate and extreme weather phenomena can have positive and negative impacts on the economic situation and market positions. In the first case, these are mainly such phenomena that encourage higher productivity of the economy (e.g. manufacturing and tourism). On the other hand, it may also result in higher production costs (e.g. irrigation and air conditioning).

The issue of the impacts of climate change on cities, however, goes much further than the primary and

direct effects on a particular residential location. One event may cause a chain reaction throughout the region and beyond.

This article aims to present the partial results of the project "Adaptation of settlements to climate change – practical solutions and sharing experiences" whose main objective is to contribute to mitigating the potential negative impacts of climate change on smaller settlements (towns and villages) and to increase their adaptability in the Czech Republic. The objective of the project is to be achieved on one hand by supporting the implementation of analyses of the existing impacts of climate change at the local level, and on the other hand by supporting the development of good local strategies for a gradual adaptation to climate change. An integral part of the process leading to the adaptability of settlements is then to involve the public in an analysis of the current situation and to form consensual adaptation strategies – Road Maps. In the following text, **the authors have set out with the objective of introducing some methods of risk identification and establishing possible adaptation measures in the urban environment of cooperation**, and of sharing it with the public using the example of three pilot studies from cities within the Czech Republic – Hradec Králové (a large city with about 100 thousand inhabitants), Žďár nad Sázavou (a medium-sized town with about 25 thousand inhabitants) and Dobruška (a small town with about 7 thousand inhabitants).

Figure 1. Map of the Czech Republic showing the towns of the pilot studies



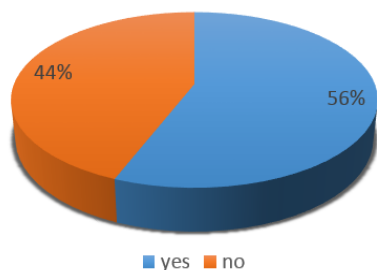
Source: Kartografie Praha, 2004

The article is divided into three main sections; a part devoted to public inquiry on the perception of the impacts of climate change on the town by its inhabitants, then the compilation of an application matrix of threats, then the last section on the possibility of adaptation, respectively the evaluation of possible adaptation measures in selected towns – pilot studies.

## 2 Survey on the perceived impacts of climate change on the town

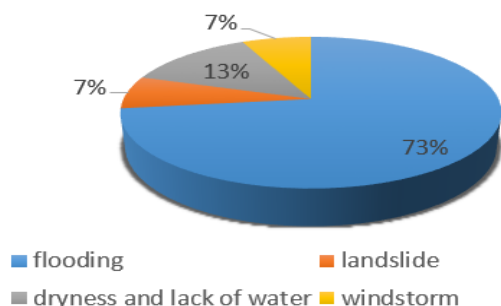
The first informational survey was carried out among approx. 150 residents of the Hradec Králové – Pardubice Regions in 2013–2014.

Graph 1. Do you think your town currently faces certain risks brought about by the climate change?



Source: own survey

Graph 2. What do you perceive as the biggest problem connected with the impacts of climate change on your town?



Source: own survey

In relation to these answers it is wise to realize that the people have such excellent awareness of flood risks mainly due to the fact that a part of the population has already experienced it more than twice or at least seen its consequence (television considers this risk as being very attractive for viewers, in fact the most attractive of all disasters). The topic of flooding has always ranked among the dangers regularly occurring in our territory and

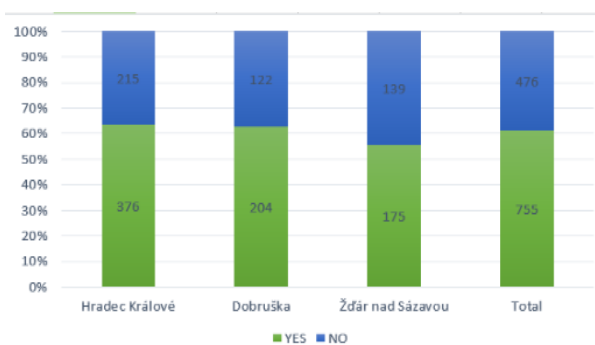
therefore it was known to our grandparents and parents, who warned us about it and passed at least some experience. Subsequently, our memory will allow us to imagine only that which we have already seen somewhere or have heard about from a “reliable source”.

Nonetheless, in questionnaires within the “Adaptation of Residential Areas in the CR” grant, the situation was different due to the longer lapse of time after the floods and whirlwinds, giving way to tendencies trivialising the danger and slightly suppressing the feeling of uncertainty, because in the given real world an ordinary resident of a smaller town (in particular) does not expect the subsequent direct impacts of climate change on him/her or his/her property. Despite the reflection that the majority of town residents have experienced an extraordinary event, today they are incapable of classifying it as something that happens and an unfounded feeling of safety is therefore increasing.

The initial step of participatory activities was the realization of an information and promotional activity for the local community. The questionnaire survey took place from April to June 2015 and included a random survey of the opinion of local residents. A supplementary and control survey was then conducted among final year students at the local grammar school, thus obtaining a sort of overview of the “voice of the people” about what they perceive as an immediate threat to the town under the influence of climate change.

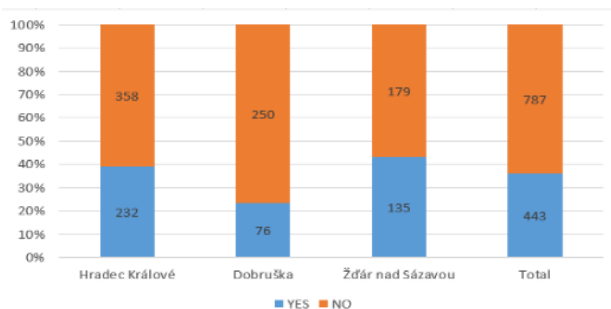
Interviewers gradually gathered 368 responses in Hradec Králové, 391 responses in Žďár nad Sázavou, and 326 responses in Dobruška. To accelerate the questions, the survey consisted of following simple questions:

Graph 3. Have you ever experienced a symptom of extreme weather such as floods, or an ice or wind storm, which was associated with climate change?



Source: own survey

Graph 4. Do you think the town of Dobruška is currently in danger due to climate change?



Source: own survey

Subsequently, the survey shows that we have come to analyse the thought process component too late and no great worries concerning the current impacts of climate change on the town and its residents are to be found in any of the monitored towns. It is indisputable that such opinions are due to longer periods free of any more serious threats and risks within the town, or even directly due to the fact that a larger part of the town is not endangered by water, or more precisely not at risk of flooding.

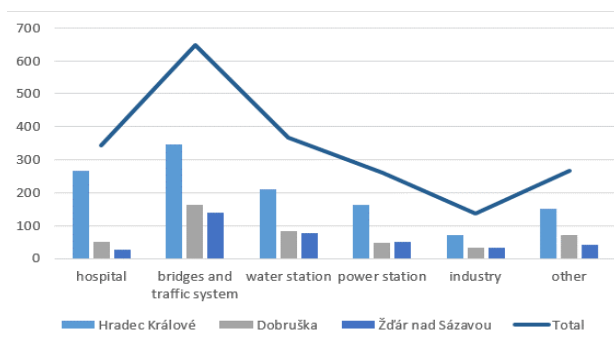
The last of the major questions to citizens testing their feelings is to identify the most crucial places in view of the adversity influenced by climate change. The answers contain general opinions about the necessity of protecting bridges, or more precisely the transport infrastructure, water and electricity supply (possibly hospitals), these topics weave in and out of the survey like the thread of Ariadne. The other places mentioned include residential buildings, schools, but also gardens and sports centres. Almost 3% of respondents could not imagine any endangered place and a total of 8% even think there are no endangered places in the towns!

After processing the results, the investigation showed that in Hradec Králové, 63% of the respondents have already experienced extreme weather. Still, 56% of the respondents believe that there is no danger facing the city, and 14 respondents even think that there aren't even any places in the city that could be endangered. In Žďár nad Sázavou, 59% of the respondents responded that they have experienced symptoms of extreme weather, but 63% of the respondents still believe that the city is not threatened by any danger. In Dobruška, as in Hradec Králové, 63% of the respondents have already experienced symptoms of extreme weather associated with climate change. But those who believed that Dobruška was in danger from any of these reasons made up only 23% of respondents. When compared with the results of the general survey by a survey in

2013–2014, these are alarming results, since 56% of respondents in this survey still perceived some threat from the impacts of climate to their town (more [6]).

Another outcome of the survey was a typology of endangered places in the town. The most vulnerable places in Hradec Králové are perceived as the infrastructure – transport (bridges), technical (waterworks/sewage treatment plants, power plant), and civil (hospitals) – 85%. In Žďár nad Sázavou these are mainly the transport and technical infrastructure (bridges, waterworks, power plant), and Dobruška people consider the most vulnerable places as bridges and the transport system, the water and wastewater treatment plants (WWTP), and slightly further also hospitals, power plants, and industry.

Graph 5. What do you believe are the most endangered places in the town in terms of the effect of possible natural disasters related to the impacts of climate change?



Source: own survey

An analysis of the results of the survey also showed that although 61% of town residents surveyed have already experienced symptoms of extreme weather, a total of 65% of the respondents believe that there is no major danger that threatens their town. The people in Dobruška feel much less threatened than those elsewhere in the Czech Republic. Generally speaking, the smaller the city, the smaller the threat perceived among its inhabitants. The fact that residents do not feel a threat makes it more difficult to prepare for one, so it is imperative to continue working with the public to understand possible austerity measures, logistic measures in case of latent dangers (e.g. a ban on entering parks or forest), and various restrictions (extension of transport times during floods, traffic restrictions during torrential rains, etc.)!



### 3 Building an application matrix of the threats

Based on previous and related works [1,6,10] a synthesis has been used to create a primary matrix for the evaluation and selection of primary hydrometeorological threats, seismic and related secondary threats for the selected town. - *Table 1 Threat matrix*

Primary hydrometeorological threats and related secondary threats		RELATED SECONDARY THREATS																				
		Geological			Hydrological				Agrogenous			Technogenic							Social			
		Wind erosion	Water erosion	Slope movements	Mudslides	Contamination of water	Reduced abundance of	Water shortages	Air pollution (smog)	Soil degradation	Crop failure	Damage to green areas	Fires	Power supply collapse	Telecommunication collapse	Water supply collapse	Sewer system collapse	Heat supply collapse	Waste collection	Transportation collapse	Impact on human health	Impact on public safety
Water	Torrential rainfall and local flooding	X	X	X	X				X	X	X				X	X		X	X		X	X
	Surface (large) floods	X	X	X					X	X					X	X		X	X		X	X
	Hail																		X		X	X
Extremely low rainfall and drought		X							X	X												
	Extreme (high) temperatures and UHI								X	X										X	X	
Heat	Extreme (low) temperature (deepfreeze)	X		X					X	X										X	X	
	Frost and ice																					
Snow and freeze	Snow calamity																					
	Extremely (strong) wind, tornado, hurricane	X							X	X										X <sup>1</sup>	X	
Wind	Inversion and windlessness								X												X	
	Thunderstorms (lightning)																			X	X	
Storms	Solar storm																			X	X	

Source: own construction

<sup>1</sup> Promotes the spread of fire but not its primary formation  
X – possible causal relationship (primary threat => secondary threat)

This matrix has become the basis for a detailed analysis of the current state of threats and risks and was presented to the representatives of the town and local stakeholders and local experts at workshops. In addition to the mayor and vice-mayor and heads of affected offices/departments of the municipal office, the workshop was also attended by representatives of

the police, fire department, and emergency services, as well as local experts, a representative of the river authority, water and sewer system representatives, and others who evaluated the significance of the threats and the problems associated with the impact of climate change on the operation and activities of the town.

Table 2 Evaluation of the significance of the threats by stakeholders

Thematic areas of problems for the town	Threats	Dobruška		Žďár nad Sázavou		Hradec Králové	
		Significance of the problems today	Significance of the problems year 2030	Significance of the problems today	Significance of the problems year 2030	Significance of the problems today	Significance of the problems year 2030
WATER	Torrential rainfall and local flooding	1	1	1	1	2	1
	Surface (big river) floods	2,5	2,5	4	4	3,5	2,5
DROUGHT	Extremely low rainfall and drought	2	1,5	4	3	1,5	1
TEMPERATURE	Extremely high temperatures and UHI	2,5	2,5	5	4	2	1
	Extremely low temperatures (deepfreeze)	3	3	5	5	3,5	2,5
SNOW AND FREEZE	Black ice and glazed frost	3	3	4	4	3	2,5
	Snow calamity	3,5	3,5	5	5	4	4
WIND	Extremely strong wind, tornado	2	2	3	2	3	3
	Inversions, windlessness	4,5	4,5	2	2	3,5	3,5
STORM	Thunderstorms (lightning)	2,5	2,5	4	4	4	3,5
	Hail	3	3	4	4	4,5	4
OTHER	Air pollution	3	3	2	2	3,5	3,5

Rating on a scale of 1–5 (1 = very important, 2 = fairly important, 3 = neither important nor unimportant, 4 = rather not important, 5 = not important)

Source: own processing

The workshop participants in Dobruška evaluated half of these threats in a table associated with the changing climate as very important or important. The very greatest threats that they perceived were primarily flash floods and torrential rainfall. Even though this phenomenon does not occur in Dobruška very often, when flash floods hit they tend to have very severe consequences on private property and health. These floods are seen as a major threat not only presently, but for the town in the future. The second largest threat which is expected to escalate in the future is quite the opposite, i.e. drought (as well shown over the course of 2015). A very problematic and current threat is also perceived as the drying up of the local water stream – the Dědina river, which also serves as the town's water source. Other rather significant threats were identified and recorded in the matrix in particular as wind calamities that especially threaten the surrounding forests in the foothills. Other problematic phenomena are also heat waves, the formation of urban heat islands, lightning storms, and high river floods (here it must be noted, however, that in the particular case of Dobruška it is difficult to distinguish between a high river and flash flood). Five events were marked as neither important nor unimportant, namely extremely low temperatures and deepfreezes, black ice and glazed frost, snow calamities, hail, and air pollution (this last phenomenon was subsequently identified by the participants of the seminar themselves). Unimportant threats were identified as windlessness and inversions, quite logically in the foothills of the Eagle Mountains and at the same time in one of the most well-ventilated regions in the Czech Republic.

In contrast, in Žďár nad Sázavou local experts perceive only heavy rains and local flooding as very important issues, and inversions, wind, and pollution as rather important. They further assessed extremely strong winds and tornados as neither important nor unimportant, but assumed that this threat would grow over time.

In Hradec Králové, the biggest current problem which according to local experts will continue to grow in the future is extremely low rainfall and drought. Heavy rains and flooding local as well as extremely high temperatures and UHI (heat islands) were further assessed as rather important, again with the expectation that these problems will increase in the future. Local experts in Hradec Králové further assessed large (river) floods, extreme low

temperatures, frost and freeze, extremely strong winds, tornados, inversions, windlessness, and air pollution as neither important nor unimportant. A worsening of conditions was assumed only for large floods, extreme cold temperatures, and frost and freeze.

The main problems that the towns face, according to local experts and stakeholders, are mainly associated with excess rainfall or conversely with water shortages. It was noted that even according to historical sources, threats from low temperatures are not likely to be of importance, neither now nor in the longer term.

When comparing the results of the perception of residents and local experts and stakeholders, it is interesting that the inhabitants of Dobruška feel very safe, but local experts identified the most threats of all monitored towns (perceiving 6 out of 12 threats as rather important), compared to Žďár nad Sázavou and Hradec Králové, where only 3 threats were seen as in the same categories (very or rather important). On the other hand, experts in Dobruška basically expect no deterioration in the future, in contrast to Hradec Králové, where six categories of threats are expected to worsen. The situation in Žďár nad Sázavou can be assessed as medium; worsening is expected in two types, specifically in addition to extremely strong winds and tornadoes also in extremely low rainfall and drought, but here from the category of rather unimportant to the category of neither important nor unimportant.

#### **4 Possibilities for adaptation**

Based on the analysed threats and risks, work on the project continued with discussions about possible or appropriate adaptation measures. Like with the evaluation of the importance of the threats, the local stakeholder groups then evaluated their importance, specifically the priority of adaptation measures for the town and the possibilities of integrating adaptation measures into local municipal policies. The results of the discussion on available measures are summarized in the following table as created by the participants. The town of Dobruška is given as an example.

Table 3 Evaluation of potential adaptation measures by stakeholders in Dobruška

Adaptation measures	Adaptation measures Importance/priority adaptation measures 1 = very important, 2 = fairly important, 3 = neither important nor unimportant, 4 = rather not important 5 = not important	The inclusion of adaptation measures in the policies of the town  1 = included, 2 = planned 3 = not included, 4 = rejected, 5 = not considered	Notes
<b>WATER</b>			
Consideration of risks in the construction of buildings and infrastructure (design, materials)	3	1/ 3/ 5	Given by regulations. The citizen takes the risk on himself
Maintenance or improvement of sewer system	1.5	1/ 2	
Drainage network for rainwater independent sewer system	1.5	1/ 2	Ideal situation, it is not implemented everywhere
Construction of temporary water reservoirs	3.5	2/3	Not possible
Flood barriers and dams	1	1	Need to complete the Mělčiny.
Green infrastructure (parks, gardens, water areas, green roofs)	2	1/2	Not much room for further expansion of GI.
Support for soil retention	2.5	1	
Revitalization of rivers and wetlands, including riverbanks	2	1/ 3	Together with the Labe River Management.
Maintenance of green areas outside the community (support of retention)	2.5	1/3	
System of forecasting and early warning	2	1	Newly introduced.
Risk mapping, strategic planning and crisis management	1.5	1	Digital flood plan.
Raising awareness and knowledge, encouragement for changes in behavior leading to a minimization of damage	2	1	Prevention, public hearings, public education.
<b>HEAT</b>			
Thermal insulation of buildings	1	1	Surface insulation in municipal and cooperative houses.
Blinds	2	1/5	Yes, in municipal buildings.
Passive cooling of buildings	3	2/ 3	
Reducing emissions and air pollution	2.5	1/ 3/ 5	Not within the competence of the town.
Creating shaded areas and space for natural ventilation	2.5	1/ 4	
Increasing the proportion of green areas	1.5	1	
Ventilation corridors	4.5	5	Not applicable
Increasing the proportion of water areas	2.5	3/ 5	
Raising awareness and information on appropriate measures in households	3	2/ 3	Not included, but often talked about.
Early warning system	2	1	



Mapping threatened areas and population groups	3	1/3	
<b>DROUGHT</b>			
System for recycling gray water	3	3/5	
System for collecting rain water	3	3/5	
Collection of water in wetlands and reservoirs	3	3/5	
Support for the establishment and maintenance of green areas in cities and outside it	1.5	1	
Quality forecasts and early warning system	2	1	
Raising awareness and opportunities for sustainable water management	2	1/2	
Adequate water prices	1.5	1/2	One of the most expensive in the region.
<b>WIND</b>			
Windbreaks	2.5	3/5	

Source: own processing

Conclusions from the evaluation of proposals for adaptation measures indicate that the main activities of the adaptation strategies in the town of Dobruška will focus mainly on the issue of floods and flash floods.

The most important measures in terms of adaptation to climate change were included in the following proposals:

- building flood control dams and barriers,
- improving the condition of the sewer system,
- building a drainage network for rainwater independent of sanitation, and
- mapping the risks together with quality risk management.

Concerning the issue of floods, green and ecosystem-based measures were particularly identified as more important, specifically the support of retention capacities of the floodplain flows, wetland restoration, and the expansion of green areas in the town and outside it. Raising awareness and educating residents of the town in the future was also seen as equally important. In fact, all of the above mentioned measures are either already covered by the communal politics of the town, or are being planned provided that they are within the jurisdiction of the municipality.

In the area of adaptation to the threats associated with temperature, the stakeholders labeled the thermal insulation of buildings and the expansion of existing green areas in the town as the most important measures. Both of these measures are also incorporated in the policies of the town. Less significant but essential measures included the installation of roller shutters in buildings, reducing

the concentration of emissions in the town center, creating shaded areas, expansion of water bodies, and ensuring an adequate early warning system. The expansion of green areas and ensuring adequate water prices were selected as priority measures against drought and water scarcity. These measures are also included in the policies of the town. Also identified as important were "soft measures", namely an early warning system and increasing awareness among town residents.

In terms of issues related to wind, existing and new windbreaks were identified as more important measures, but these are currently not included in the municipal policies and their construction is presently not under consideration.

A similar procedure was also used in Žďár nad Sázavou and in Hradec Králové. The conclusions from Žďár nad Sázavou suggest that adaptation activities here are focused mainly on the issue of flooding. The most important measures in terms of adaptation to climate change were identified as mainly green (ecosystem-based) and so-called soft measures, specifically the building and maintenance of a green infrastructure in and outside the town, supporting the retention capacity of the soil, and early warning systems and risk mapping together with quality risk management. Most of the measures are already implemented, or they are being counted on in the near future. An exception is the maintenance of green, particularly agricultural, land outside the city, where appropriate environmental measures should be applied, according to workshop participants. In the issue of floods, the building of temporary reservoirs and independent drainage network for rainwater was

marked as rather important above all. In the area of adaptation to threats related to temperature, participants saw the thermal insulation of buildings as the most important measure. Most of the measures, even though some of them have already been implemented, are seen as somewhat or totally unimportant. Priority measures in the area of water scarcity and droughts were selected as adequate water prices, but these are not taken into account in municipal policy and nothing will change here in the future. Soft measures were also identified as important, specifically raising awareness among municipal inhabitants, while measures are included in the town's policies. Systems of collecting rainwater, water storage in reservoirs, and expanding green areas in and outside the town were also categorized as equally important. In issues related to the wind windbreaks were identified as a more important measure and it is currently partially included in municipal policies.

In Hradec Králové, adaptation activities are focused mainly on the issue of flooding. All the proposed measures were identified as very important or rather important. At the same time, according to the workshop participants, the overwhelming majority is included in the city's policies or their implementation is planned. In the area of adaptation to threats related to temperature, participants marked the thermal insulation of buildings, reducing pollution and emissions, creating shady areas, and expanding green areas in the city as the most important measures. Both of these measures are already incorporated in the policies of the city. Slightly less but still important measures included the installation of roller shutters in buildings, passive cooling of buildings, expanding water surfaces, and a group of soft measures (i.e. an early warning system, mapping populations at risk, and raising people's awareness of the risks). Most of them are more or less included in local policies, if they lie within the city's authority. As a priority measure in the area of water scarcity and droughts, the expansion of green areas, a system for recycling gray water, and educating people about the potential risks associated with drought and methods of sustainable water management were selected. These measures are partially incorporated in the policies of the city or possibly considered (depending on the finances and authority). Collecting water in wetlands and a quality forecast system were also marked as important, while these measures are included in the policies of the city. In issues related to the wind, windbreaks were identified as a rather unimportant measure, especially because Hradec Králové is very well ventilated. In addition to the proposed measures,

two more were identified, specifically the treatment of waste water and garbage, while both issues are already implemented in the policies of the city.

#### 4 Conclusion

The experience from the towns of Dobruška, Žďár nad Sázavou and Hradec Králové were a good start for the Adaptation of Settlements project which addresses the cities and towns in the Czech Republic, because the results of the survey conducted among random citizens were very helpful on one hand, while on the other the solutions and threats identified by participatory methods in cooperation with the stakeholders yielded quite interesting outcomes.

The response of the stakeholders to the table of risks was largely positive, as was the willingness to work together. On the other hand, it should be noted that in the Czech Republic, and especially in smaller towns, awkward situations occur in which the locals can not imagine real threats or the real consequences of climate change impacts. The culprit in this case is probably the method by which this information is presented to the public, mainly focused on presenting the global nature of disasters through television broadcasts, as well as their solely visual mediation results in essentially the belief that on television, nothing can happen to us. This, combined with the remoteness of the towns, leads them to an unawareness of their own vulnerability in terms of the latent impacts of climate change. In fact, the main problem is the discontinuity between the images presented on television and the simultaneously perceived living pictures in the towns. Public involvement in identifying threats related to climate change in Dobruška, Žďár nad Sázavou and Hradec Králové showed that with awareness and cooperation, and not only with the professional community, we can find a way to create a functional model of adaptation strategies and a Road Map to mitigate the effects of climate change in which various restrictions on developments in the municipality will be necessary and which will be understandable and acceptable to the local population.

#### References:

- [1] CROUHY, Michel, MARK, Robert, GALAI, Dan. *Risk Management*. McGraw-Hill Education 2000. ISBN 13: 9780071357319
- [2] EEA, 2012. Urban adaptation to climate change in Europe - challenges and opportunities for cities together with supportive national and European policies. Copenhagen, Denmark: European Environment Agency.

- [3] EEA, 2013. Living in an urban world: Analysis for update and improved assessment of this megatrend.
- [4] IPCC, 2013a. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Working Group II Report
- [5] IPCC, 2013b. Climate Change 2014: Mitigation of Climate Change. Working Group III Report
- [6] ŠILHÁNKOVÁ, Vladimíra, PONDĚLÍČEK, Michael. (2014a) Evaluation of Threats Connected with the Impacts of Climate Change on Towns and Regions In MASTORAKIS, Nikos E., BATZIAS, Fragiskos a GUARNACCIA, Claudio (eds.). *Recent Advances in Urban Planning, Sustainable Development and Green Energy*. Proceedings of the 5th International Conference on Urban Sustainability, Cultural Sustainability, Green Development, Green Structures and Clean Cars (USCUDAR '14). Florencie 22.-24.11.2014. WSEAS Press 2014, ISSN: 2227-4359, ISBN: 978-960-474-404-6, pp. 156 – 163
- [7] ŠILHÁNKOVÁ, Vladimíra, PONDĚLÍČEK, Michael, ČERNÁ, Eva, EMMER, Adam. Possibilities of Identifying Risks Posed by Climate Change in the Urban Environment with the Support of Public Participation using the Town of Dobruška as an Example in BULUCEA, Aida. *Mechanics, Energy, Environment*. 260 p. WSEAS Press 2015, ISSN 2227-4359, ISBN 978-1-61804-346-7, pp. 76-83
- [8] WILBANKS, T.J., ROMERO LANKAO, P., BAO, M., BERKHOUT, F., CAIRNCROSS, S., CERON, J.-P., KAPSHE, M., MUIR-WOOD, R., ZAPATA-MARTI, R. (2007). *Industry, settlement and society*. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 357-390.
- [9] The World Bank. *Guide to Climate Change Adaptation in Cities*, 2011

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