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PUBLIC AWARENESS OF THE RELATION BETWEEN NATURE-FRIENDLY WATERCOURSE MODIFICATIONS AND RECREATION IN CITIES

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Abstract

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The aim of the article is to present the results of a method of public preferences – a questionnaire survey finding an awareness of the relation between the modifications of watercourses and recreation in urban environment. The aquatic ecosystem and the water itself in a landscape are regarded by citizens as a mere source of energy, food, and water used for industry or as a means of transport. However, water elements along with the flora and fauna belonging to this living ecosystem provide a plethora of opportunities for a development of e.g. recreation, tourism, even an entire region. The questionnaire method used has been applied in selected cities in the Czech Republic, e.g. in Frýdek-Místek, Olomouc, Vlašim, Benátky nad Jizerou and others. The criterion for selecting the cities has mostly been the construction of nature-friendly modifications to watercourse while seeking to increase the recreational potential of the area. The outcome of this article is to present the original results of the public survey which have subsequently served for a further processing of drafts and measures for recreational potential in the selected locations. The most important finding of this research was the minimum level of selected site citizens' awareness of revitalization and flood modifications, projects that were realized on watercourses in the cities.

Keywords: rivers in the cities, recreational use, survey

INTRODUCTION

Water elements are an essential part of life and an important natural resource for consumption and production human activity. Due to the continuous increase in population density, the demands for utilizing water resources and their ecosystem services are also increasing.

In the past, the watercourses in our area were straightened, deepened and regulated into 'strict' shapes as a part of a flood protection and property protection. Regulating a river to a straightened bed, it got into a position advantageous in terms of urban economics (Konvička, 2002). Changes were made also regarding the runoffs and this has resulted in significant changes in the quality and quantity of water in our territory. Anthropogenic impacts were reflected also on floodplain fragmentation and disruption of retention capacity by a disruption of longitudinal and lateral connectivity of floodplains. Housing development of significant areas and creating hard surfaces in floodplains have reduced the infiltration of rainwater, decreased groundwater levels, contaminated groundwater and limited their use to supply the population and restricted suitable habitats in floodplains. This has reduced the ecological services of these alluvial, fluvial floodplains and the surrounding area (Brauman, Daily, 2008).

An anthropogenic pressure on floodplains and fluvial floodplains and their ecosystem services in the Czech Republic in the last 250 years has been very high. Research has shown that only 20 % of river area ecosystem services have not changed over the past 250 years (Demek, Mackovičin, Slavík, 2013).

As a part of the recovery of Western European cities, there is a distinct restoration of local watercourses, often artificially constructed, which have become a key element of their locations. With its importance, a watercourse is a dominant public space there. As an example of countries of Western Europe (eg. Germany, Denmark, Holland, France) we can see a successful revitalization solution of the water elements with different approaches and strategies (Ležatka, 2010).

Public surveys contribute to the theoretical understanding of the relationship between people and landscape changes, while addressing how they can better reflect these relationships in revitalizing practice (Westling, Surridge, Sharp *at al*., 2014).

For instance, a research was conducted in 2009 which addressed the factors that may affect the relationship of the population to the revitalization of the Dearne River in northern England. The survey was conducted with a long interval of 14 years after the revitalization. Its results were obtained from 16 interviews. The talks were focused on how people view the renewal of local rivers, how they relate to a revitalized river environment and what factors influence them. The survey respondents were asked questions even beyond the framework to identify any additional information. Photographs capturing the condition of riverbeds before revitalization were used during the interviews for better respondent's idea. Among the identified factors influencing the perception of a river by locals were e.g. a scenic beauty; a condition of riparian vegetation and riverbed morphology; opportunities for observing flora and fauna; a purity of a river and its surroundings; an access to the river; a connection between a river and the surrounding landscape; and the changes made after revitalizing the landscape (Westling, Surridge, Sharp et al., 2014).

The revitalizations of a waterfront in terms of US represent different approaches. They are based on the entire spectrum of diverse conditions, completely different from those which are met in post-socialistic as well as in European countries generally. Over the past 150 years of shaping the American cities, a specific and tumultuous urban and construction development can be reported. a progressive, even precipitate development hit Chicago as well. The Chicago River runs through the city which flow was previously directed into the vast Lake Michigan (Lindsay, 2005).

Through a comparative study of two Chicago neighbourhoods located along the Chicago River, e.g. Garett Wolf (2012) compiled a network of political, social and economic factors that create and affect the urban environment around the Chicago River. Based on these factors, he examined a perception of the river environment by locals who create a socio-environmental urban environment of this area. His study confirms that the environment arises simultaneously with connecting historical, social, physical and social and environmental processes. The survey was conducted using talks and interviews with and observations of local residents. In his survey, he examined the impact, pressure of population and their perception of changes in the development of the Chicago River environment.

Another survey asked the public opinion of citizens on the same Chicago River in the US which showed other surprising results. Almost half of the responses on the river characteristics included words such as a 'filthy' or 'dirty' place. The overall impression of the river and its surroundings was a negative one for the citizens. (Gobster, Westphal, 1998).

Another method of evaluating the effect of revitalizing treatments is dealt with by Polizzi, Simonetto, Barausse et al. (2015). These authors try to award the change resulting from the revitalization by a so called 'Ecosystem Prize'. The Ecosystem Prize attempts to quantify the environmental changes caused by human activity in monetary terms. (Ghermandi, Nunes, Portela et al., 2011). In this case, it is to evaluate the costs and benefits of revitalization in terms of recreation. The object of the research was the revitalizing treatments at the Finnish Pajakkajok River which objective was to improve the conditions for spawning and recreational possibilities of natural areas along the river. Ecosystem awarding was carried out using questionnaires submitted to both local residents and random visitors. The results showed that the completed revitalizations generate large benefits; the improved conditions for recreation were estimated at 40.0–144.7 €/person/year, with slight differences between local residents and non-residents (Polizzi, Simonetto, Barausse et al., 2015).

The aquatic ecosystem and the water itself in a landscape is regarded by many of us as a mere source of energy, food, wather used for industry or as a means of transport. However, a development of opinions on the rivers is gradually changing. Today's perception of the importance and appearance of urban watercourses are exactly the result of a comprehensive long-term development. a historical development of urban rivers is a very important part of a comprehensive understanding of the urban water environment (Hradilová, 2012).

Everyone, consciously or unconsciously, seeks a closeness to nature and water, and not only because the water in particular is needed for a survival. a man enjoys watching a river level which recalls the passage of time and the integral link between people and nature. For all these reasons, it can be stated that the rivers and water elements are an integral part of the urban composition of a city which can be straightforwardly and somewhat

in a utilitarian way defined as the needs of a city historically inextricably linked to the water element (Wittmann, 2008).

The goal and the major significance of this research is to raise awareness regarding of revitalisation watercourses and then involving society in the decision-making process in restoring rivers. Such activities can increase the sense of public ownership and the importance of the river environment with locals.

MATERIALS AND METHODS

Almost every village, town in the Czech Republic has a smaller creek or larger river flowing through, yet the views of residents and visitors to these sites vary. These views differ depending on visitors' age, sex, education as well as historical experience of citizens, an attractiveness of a very river area, its geographic location and accessibility.

In order to ascertain the views and awareness of citizens, visitors on modifications to watercourses in urban areas in relation to recreation, a research has been done in selected six cities of the Czech Republic.

The selected cities and watercourse modifications include:

- Přerov – a concept of flood protection and revitalization of the river Bečva in Přerov, Revitalizing treatments of the Bečva near Osek nad Bečvou and Revitalizing treatments of the Bečva near Familie.
- Olomouc – Flood protection Olomouc – the river Morava, Olomouc – Increasing the capacity of the stream bed (Phase II A).
- Vlašim – Revitalization of the river Jizera floodplain in Benátky nad Jizerou.
- Benátky nad Jizerou – Revitalization of the river Jizera floodplain in Benátky nad Jizerou.
- Frýdek-Místek – the river Ostravice, Frýdek-Místek – Staré Město, km 22.900 to 25.300 – Maintenance of barrages and Revitalization of the river Ostravice.
- Ostrava – Revitalizing the river Ostravice. The criterion for selecting the cities has mostly been the construction of nature-friendly modifications to watercourses in a respective city. Modifications made have been focused on flood protection, biodiversity support, while leading to an increase in the area recreational potential (Fig. 1). These have been the cities with a developed economic potential, as well as the cities not generating sufficient employment opportunities for their citizens. Finally, the cities have been distinguished by the very nature of a river.

A questionnaire of own design divided into two parts has been used as a research tool. The first one contained demographic information (e.g. age, sex, education of the respondents, etc.). The second part contained questions on the views and satisfaction of respondents with modifications made to the rivers and their recreational use.

The questionnaire has been compiled from a total of 17 questions, some of which have been closed-type questions (dichotomous, polytomous, scale). A rating scale from 1 (unsuitable) to 7 (suitable) has been set for the scale questions. The scale questions are considered metric-interval characters and can be evaluated by parametric methods (Budíková, Lerch, Mikoláš, 2005). These questions have had higher predictive value. The last question has been open. The respondents have had the space to express their opinions and suggestions for improving a revitalized area.

Own survey was conducted directly by the rivers in selected cities in the period from June to November 2015.

1: *Recreational use of berm of the Bečva River in Přerov (Lampartová, 2015)*

The questions mentioned include for instance:

- Do you know the term 'revitalization' in relation to water elements and landscape?
- Do you know any revitalized (restored, recovered in a natural-friendly way) watercourses or surfaces in Vlašim and its surroundings?
- In the Vlašim city centre, changes were made to the river Blanice under the project *'Flow increase of the river Blanice in a nature-friendly way in the urban area of Vlašim'*. Do you know this project? Please write where have you learnt about it?
- Please review these conditions for recreation near the river after its modification?
- What would you suggest as further modifications for an increased recreational use of the river surroundings?

The target group was the residents of a city who know a location near a river. Research was attended by 480 people. The number of respondents in each city was almost uniform so that no town was over-proportionally represented in the research. Respondents' opinions were collected directly by a watercourse in a given city. The per cent of unfilled items in the questionnaire exceeded 10 % with 26 respondents, thus some of the subsequent evaluation questionnaires were excluded for this reason. The questionnaire was administered by a paper form.

Primary data obtained from the questionnaires were evaluated using standard statistical methods. The data were analysed using frequency distribution tables, some selected issues tried to find out the depending existence through contingency tables and characteristics depending on verbal signs, mainly using Cramer's contingency coefficient. The scale questions were processed by multi-criterial statistical method - factor analysis, which aims to analyse the correlation of higher amount of variables (questions) and based on this analysis, to determine the groups of questions that statistically "have something in common." To process the received data, which were mostly qualitative, the Unistat ver. 5.6 statistical software was used.

RESULTS

Primary data obtained from the questionnaires were evaluated using standard statistical methods. The data were analysed using frequency distribution tables, a depending existence was determined within the selected questions through contingency tables and characteristics of depending verbal signs, using mainly Cramer's contingency coefficient. The scale questions were processed by a multicriterial statistical method – a factor analysis which aims to analyse the correlation of more variables (questions) and based on this analysis, to determine the groups of questions that statistically 'have something in common' (form a common factor), while the number of total factor should be minimized and the observed dependences should be explained as simply as possible. To process the obtained, mostly qualitative data, a statistical software Unistat ver. 5.6 was used.

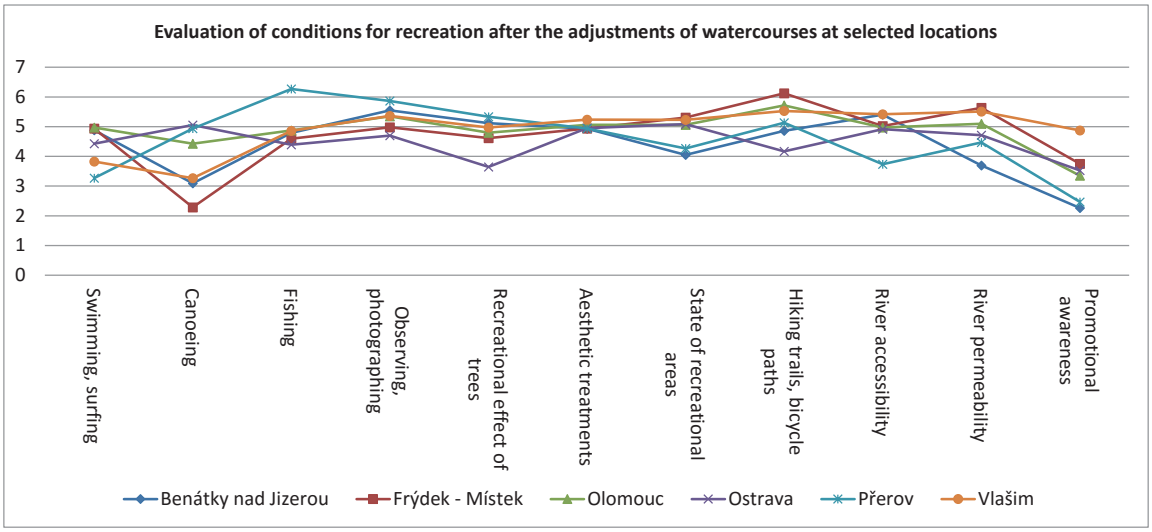
The interviewed respondents were represented by a larger proportion of women (55.9 %) than men (44.1 %), the age category of 20–29 was the most represented (36.1 %), followed by 30–39 (19.2 %), 60 and more years (14.3 %). Most respondents had secondary education with a maturita exam (38.3 %) and higher education (25.1 %). Nearly half of the respondents (49.1 %) were employed, students and pupils (24.9 %).

55.5 % of respondents visit the river in their town regularly, 33.5 % of them have already visited the site several times. 68.5 % of respondents know the term 'revitalization of water elements', 77.6 % think that the revitalization have generally a positive impact on the landscape and selected localities surveyed, 70.4 % like the landscape near watercourses after revitalization better. An interesting finding is that 20 % of respondents do not see any difference between the original state and modified watercourses with their surroundings. More women than men had a positive opinion.

More than half of respondents (61.9 %) know the implemented projects of watercourse revitalization in selected locations. For example, a high dependence (Cramer's coefficient = 0.4863) of a location impact on the project knowledge can be mentioned. The interviewed respondents from Frýdek-Místek never knew the implemented revitalization project; on the contrary, there was a great knowledge of the project in Vlašim and in Ostrava. Most respondents happened to notice the implemented project by chance, others learned about it mostly from the Internet and print.

The respondents within the selected locations evaluate as the best the conditions for recreation in the area of hiking, cycling, fishing, resting, an opportunity for observation and photographing aquatic fauna and flora. Less positively evaluated conditions were for swimming, wading and especially promotional awareness (informational, educational and safety boards).

Respondents in Benátky nad Jizerou rated as the best the conditions for observing and photographing flora and fauna, accessibility to a stream and recreational effect of trees. In Frýdek-Místek, hiking trails and bicycle paths, accessibility (stairs, exits) and stream permeability (bridges, footbridges) and a state of recreational areas were evaluated positively. In Olomouc, hiking trails and bicycle paths along the river, the possibility of observing and photographing flora and fauna were evaluated the best by the citizens. The citizens of Ostrava value the most the suitable conditions for boating, fishing, the number of recreational areas, the river accessibility and aesthetic treatments nearby the river. The conditions for fishing, observing/photographing water birds and other animals, hiking trails and bicycle paths were rated the best in Přerov. In Vlašim, the respondents



2: *Evaluation of conditions for recreation after the adjustments of watercourses at selected locations (Lampartová, 2015)*

positively assessed the conditions of hiking trails and bicycle paths along the river Blanice, the river permeability and accessibility, aesthetic treatment and the possibility of observing and photographing flora and fauna (Fig. 2).

In the course of evaluating the data, the frequencies of responds and the influences of e.g. identification data (gender, location, age, education, current situation) on the knowledge of the term revitalization, on the knowledge of realized revitalization projects in the territory, on the view of the overall impact of restoration measures on the surrounding countryside, on an 'attractiveness' of a revitalized area, etc. were examined.

For example, a high dependence (Cramer's coefficient = 0.2263) of a location impact on the project knowledge can be mentioned. The interviewed respondents from Benátky nad Jizerou, Frýdek-Místek and Ostrava almost never met with the revitalization concept, while in Přerov, Olomouc and Vlašim, there was a great knowledge of the term.

A high impact (Cramer's coefficient = 0.3268) of education on the knowledge of the term was also demonstrated. The most familiar with this term are the citizens with secondary education ended with a maturita exam and university students.

Another high dependence (Cramer's coefficient = 0.2226) was observed in the impact of age on the knowledge of the term revitalization. The concept of revitalization was unknown for the respondents in the 10–19 age group, while those aged 30–39, 40–49 had a big knowledge of the term.

Another indicator investigated and confirmed was the high influence of age (Cramer's coefficient = .1641) and educational attainment (Cramer's coefficient = 0.1467) on a river 'attractiveness' and its surrounding area after modification. Citizens older than 60 years evaluated the state before modifications better or did not see any difference. Conversely, the 30–39 age group assesses the rivers and their surroundings better after being modified. The state of the sites after modifications was rated the best by the citizens with secondary education ended with a maturita exam and university students.

As further adjustments to increase the recreational use of watercourses and their surroundings, the respondents from Přerov, Vlašim and Benátky nad Jizerou would welcome the completion of furniture (benches, bins, lighting). They would also like to have more rest areas directly near the river and the installation of information, educational or safety boards built along the rivers in Vlašim and Benátky nad Jizerou. The Olomouc respondents suggested the construction and interconnection of existing hiking, biking and in-line skating trails and paths, e.g. to the centre and its surroundings. They would also welcome organising social and cultural events by the river and its surroundings. In Přerov, Frýdek-Místek and Ostrava, the citizens prefer to have social facilities on a hiking or bicycle trail along the river (toilets, refreshments) provided, adding furniture and maintenance of greenery on the banks of streams and in the adjacent areas (mowing the lawn, etc.).

A factor analysis was used on the range of 11 questions; this is a multivariate statistical method, the essence of which is to reveal the structure of the interdependencies of questions based on the assumption that these addictions are the result of a smaller number in the background standing immeasurable factors. Using the method of the main axis and the consequent rotation of factor matrix via Varimax, four factors were obtained. The first factor 'appearance along the river' included questions

of the existence of trees with a recreational and aesthetic effect of a bed, waterfront modifications. The second factor 'leisure and recreation' included the issues of access to the river, swimming, wading and relaxing by the river and the existence of recreational spaces. The third factor 'sports' is formed by questions possibility to use the river for fishing and the possibility of using the river for canoeing; within the final, fourth factor 'availability and promotion', the questions the condition of hiking paths and bicycle trails, the permeability of a river (bridges, footbridges) and promotional awareness (information, training, safety boards).

Proposals for changing watercourses and the adjacent areas to increase the recreational potential of Frýdek-Místek and the river Ostravice

The following describes draft measures to maintain and increase the recreational potential of a chosen model locality of the Ostravice River in Frýdek-Místek (Fig. 3). The draft measures are based on the results of field and questionnaire survey. As a part of the revitalization project, good conditions for recreation and relaxation were created there, but some of them failed to fulfil their intended purpose.

The examples of draft measures include:

- Increasing the management, patrols and maintenance of the newly constructed and existing objects (fireplaces, sheds, furniture).
- Increasing the number of rest areas directly by the river (relaxing and sunbathing piers).
- Complementing wooden furniture (benches, bins, lighting).
- Supporting education (complete the information, learning and safety boards) on the area, river revitalization project, transverse objects on the river, and others.
- Supporting the possibility of organizing cultural and social events by the river (barbecue, watching films in summer, opening the river for boaters, fishing competitions, etc.).
- Complementing safety features of high transverse structures.
- Complementing social and refreshment facilities on the banks of the stream and the adjacent park.
- Removal-extraction of a large strip of gravel benches extending beyond the actual watercourse due to their width in some places.
- Creating smaller pools of stone in the river bed to encourage biodiversity, and as a possibility of a shelter for animals in an extremely dry summer months.
- Renewal of and complementing low wooden sills in the riverbed for a possibility of a slight backwater and e.g. for subsequent bathing or wading by visitors.
- Creating quiet zones and hiding places for water birds and other wildlife on the banks of the riverbed.
- Fortifying the banks of the riverbed in places of abrasion damage and steep slopes.
- Pruning and disposing of some riparian and accompanying vegetation which generic, health and age composition is inappropriate in some places.
- Creating rest places and vistas to the riverbed in the strip of riparian vegetation.
- Planting new vegetation fulfilling a hygienic, microclimate, as well as a recreational function.
- Regular maintenance of grasslands on the banks and in the surrounding park.

The specified measures take account of the flood protection, preservation and enhancement of biodiversity and increase in the area recreational potential.

3: *Use of the Ostravice River and surrounding areas in Frýdek-Místek for the performance of recreation in the form of cycling, swimming, wading and resting (Lampartová, 2015)*

DISCUSSION

With the growing interest in the watercourse revitalization programmes, a need for monitoring and evaluating these actions from a societal perspective increases. Therefore, it is important to try to capture the opinions and attitudes of local residents towards the revitalization actions (Aberg, Tapsel, 2013).

The questionnaire method used has been applied in selected cities in the Czech Republic, in Frýdek-Místek, Olomouc, Vlašim, Benátky nad Jizerou, Ostrava and Přerov. The criterion for selecting the cities has mostly been the construction of nature-friendly modifications to watercourse while seeking to increase the recreational potential of the area. An important finding of this research was the minimum level of selected sites citizens' awareness of revitalization and flood modifications, projects that were realized on watercourses in the cities. The research demonstrated a high dependence (Cramer's coefficient = 0.4863) of a location impact on the project knowledge. Visitors to all selected areas lack information about ongoing treatments. The limits of that research are certainly in the number of responses obtained from respondents. However, current trends and similar research point to the same problems. Promoting awareness is considered a main recommendation to raise public awareness of the relation between nature-friendly modifications of watercourses and recreation in cities.

A research by Gobster and Westphal (1998) points out the somewhat surprising finding that more than a third of participants in a public survey had no idea about the characteristics of rivers or connected them with neutral terms such as 'water', 'green' or 'boats', yet most of the opinions on rivers were negative.

The opinions of the residents are very important when designing and implementing the rehabilitation programs of the watercourses. Alam (2011) states that current knowledge about public opinions on the revitalisation of rivers is inadequate and biased due to lack of awareness expertise of respondents.

Raising awareness of watercourses and revitalization can be done by involving society in the decision-making process of restoring rivers. Such activities can increase the sense of public ownership and the importance of a river environment with locals (Eden, Tunstal, 2006).

Additionally, it can thus improve the probability of realizing and maintaining a revitalization project (Junker, Buchecker, Müller-Böker, 2006).

CONCLUSION

This article contains the results of research into the impacts of modifications and the use of waterways for recreation in a countryside. The aim of the research was to identify and assess public awareness of the impact of watercourses on recreation in an urban environment. Research methodology was based on the method of public preferences – a survey. Field interviews were performed with 480 respondents. The term 'revitalization of watercourses' is known by more than a half of the respondents (68.5 %). Most respondents from selected sites (77.6 %) think that the revitalization generally has a positive impact on the landscape. a landscape character of watercourses after revitalization modifications is liked more by 70.4 % interviewees. The most important finding of this research was the minimum level of selected site citizens' awareness of revitalization and flood modifications, projects that were realized on watercourses in the cities. The survey results provided valuable information for a further processing of other drafts and measures to promote the public awareness of water elements and to increase a recreational potential in selected locations. The main draft and recommendation for raising public awareness of the relation between near-natural modifications of watercourses and recreation in cities is considered primarily a promotion of education (completing information, learning and safety boards) for the area, watercourse, revitalization/flood control adjustments, structures on the river and in its surrounding area, etc.

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