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POSSIBILITIES OF MEASURING ENVIRONMENTAL JUSTICE IN HUNGARY

Dissertation (Ph.D.) theses

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I. Aim of the dissertation, literature review

In recent decades, sustainability and the effects of global climate change have been in the focus of research in many scientific disciplines. These studies often ask research questions that have geographical aspects, such as how different social groups, people are affected by the surrounding environment, or whether there is a difference in the vulnerability or perception of each group regarding environmental impacts. Environmental justice (EJ) research is fundamentally based on social justice theories and focuses on the unequal (geographical) distribution of environmental harm and risk and its social consequences. Papers aim to explore what economic, social, health, and legal disparities people have to fight against and deal with in their environment. Papers also highlight what decision-making processes and enforcement practices are involved to eliminate or counteract inequalities. With the increasingly significant and detrimental effects of climate change, the focus of environmental justice research has widened and expanded with many approaches and research directions. In particular, previously EJ research focused mainly on minorities and their involvement in environmentally unjust situations. However, the evolvement of new research directions, one thing is common to all research and this can be defined in its main objectives.

Environmental justice research aims to highlight the need for a liveable and healthy environment, may it be built or natural. In addition, another aim is to emphasize the importance of equal environmental rights for all and to ensure the same (high) quality and safe environment, not only for today's, but also for future generations. Failure in meeting these essential requirements will result in environmental injustices. In this case, efforts should be made to ensure that inequalities in the environment are fairly, equally eliminated or at least fairly distributed among those affected.

Environmental justice research provides a normative framework for evaluating injustice, as it is closely related to the subjective judgment and perception of injustice of individuals, and therefore the exploration of injustice requires a context-based approach. So far, relatively few studies have dealt with environmental injustices in Hungary, so limited amount of information is available on the attitudes of the population affected by environmental injustices, and on the possibilities of detecting environmental injustices, therefore there is a lack of EJ research which this dissertation aims to partly provide.

The change of the regime brought great changes both in political, economic and social terms (KOLOSI T. - KELLER T. 2010). While in some parts of the country there has been little or no transformation or restructuring, in others the process has been very dynamic (BARTKE, I. 1967; LACKÓ L. 1975; PÉNZES J. 2011; LUX G. 2016); this resulted increase in existing spatial inequalities and disparities (PÉNZES J. 2011; PAPP S. ET AL 2016; NAGY G. 2006), and led to the emergence of new ones (TÓTH I. GY. - SZELÉNYI I. 2018; ENYEDI GY. 2004, VÁRADI M. M. 2014).

There are numerous geographic studies on the socio-economic consequences of the change of regime, however, the socio-geographic research of the state of the natural environment, which was explicitly neglected during the socialist period and subordinate to the economy, is less researched (ŠPIRIĆ, J. 2017). Although, in principle, the environment and environmental processes are non-discriminatory processes, which are non-selective and do not affect individuals on the basis of their income or ethnicity, nonetheless, EJ researches conclude, that catastrophic events and changes in the environment affect the poorest, most vulnerable groups the best creating environmental injustices and this is resulting environment processes considered – wrongly – as unjust (BULLARD, R. D. 1990; BROWN, P. 1995; WILLIAMS, R. W. 1999A; FABER, D. - MCCARTHY, D. 2001; OKEREKE, C. 2006; FILČAK, R. 2007; NEWTON, D. E 2009; SOJA, E. W 2010; WALKER, G. 2010, CLOUGH, E. 2018). The reasons for this are to be found in the structure and power relations of the society, politics and economy. In Hungary the environmental inequalities and injustices that have been formed can be traced back to the earlier socialist era labelled with the de-emphasize of environmental policy, which is exacerbated by the observed processes of social polarization, marginalization and peripheralization. This can play a decisive role in production of space and the creation of social groups and that may underlie unfair environmental processes.

There is a clear link since the change of regime between the increasingly influential role of global capital, and environmental injustice, which is (trans)formed locally by political and economic power-relations through the regulation of socio-environmental conditions. The shaping of the environment is just as controlled, manipulated, excluded as the cultural, political, social or economic context in which it is embedded (SWYNGEDOUW, E – HEYEN, N.C. 2003). Therefore, the actors of society are constantly fighting for the creation and protection of their environment (HARVEY, D. 1996), the constant (trans)formation of nature affects some groups negatively and others positively (SWYNGEDOUW E – HEYEN, N. C. 2003).

Thus, directly or indirectly, these factors affect the quality of life of individuals and societies (SWYNGEDOUW, E. 2004). Processes affecting the environment are unevenly distributed in space and distributed to different social groups which is worsen by the increasing negative effects and pressure of the global climate change in the environment.

In many cases, global climate change has a negative impact on people's health (WHO 2010, 2011). On the one hand, the increase in the number of extreme weather events will increase the statistical number of related morbidity and mortality, and on the other hand, the current environmental risks and the number of those affected. In addition, the effects of climate change are also influenced by "other factors" (such as housing conditions, quality of medical care, etc.), which depend on socio-economic conditions, so that the problem is complex and multifaceted and is thus linked to the above mentioned processes. Populations may become deprived not only by their socio-economic status but also by the quality and condition of their environment. Thus, disadvantages derived from environmental events affect social groups in different ways and are manifested spatially in different ways (DAVIDSON, P. - ANDERTON, D.L. 2000; PELLETIER, N. 2010). According to the definition of EJ of the EPA *“Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.”*

The processes listed above justifies the expansion of environmental justice research in Hungary since:

- Social problems and disparities are growing, marginalization and polarization processes are creating new spatial patterns and preserving earlier ones. This has a direct and indirect impact on environmental processes, individuals and communities.
- The effects of global climate change are causing locally perceptible processes, increasing number of environmental disasters and damage. All of this affects people's everyday, quality of life and health.
- As a result of climate change and the transition, the relationship between environment and society in the former socialist countries is changing. The expectations and priorities of the population regarding their environment and thus their willingness to take risks have transformed.
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II. Objectives and questions

The dissertation was created with a dual purpose. On the one hand, it intends to give a theoretical summary published in Hungarian, which deals with the change in the approach of environmental justice research over the past three decades and interprets it in a geographical context, with its particular spatial perspective. In the dissertation I summarized the theoretical findings of the major environmental justice studies published so far and the factors that defines environmental (in)justices. This main objective of the dissertation is to examine how environmental justice fits into the post-socialist context as a research framework. On the another hand, the another aim of the dissertation is to unveil the environmental injustices perceived in Hungary. According to this aim the dissertation highlights different aspects based on empirical research explained through practical examples using the theoretical framework.

During the research I identified two main questions based on the revealed drivers of environmental injustices, which can be divided into further sub-questions. One of the main questions is theoretical and the other is practical, based on theoretical results. The structure of the dissertation follows the duality of the question:

- How can environmental justice be defined and what are the manifestations and practical implications of unjust and unfair situations derivred from the interaction of natural and socio-economic environments?
 - How does environmental justice as a framework relate to geography, and what are its links with critical geography?
 - In the last decades, what were the decisive moments that led to the development of the concept of environmental justice, and what is the currently agreed and applied logical framework?
 - What is the role of decision-making mechanism, different attitudes, individual perception, time and scale in environmental justice?
- In Hungary, what are the challenges in the field of justice and how are potential domestic environmental injustices identified, and what are their spatial characteristics from the point of view of those who are affected?
 - What areas of Hungary can be delimited where potential environmental injustices occur in the light of social and environmental changes?
 - Are there any perceived or real fears of a potential further catastrophe in the case of population affected by catastrophes directly and indirectly, and what changes are they noticing in society or in the urban tissue of the affected settlements?
 - How satisfied are the affected with the compensation process and information flow?
 - In the case of the four sample areas, what the respondents' perceptions and opinions about staying, emigrating, mobility opportunities. Can be local inequalities measured through real estate market data?

- Are there any perceived health effects on individuals affected by the various catastrophes, and is there any statistically relevant evidence that health damage can be connected to the examined catastrophes?

III. Applied research methods

In order to establish the theoretical background of the dissertation, I carried out the analysis of the literature in the framework of environmental justice. Since the definition of environmental justice consists of several elements and researches can be conducted on multiple scales, I have used quantitative and qualitative methods to observe and to measure injustices.

Measurement of environmental justice by principal component analysis

In the dissertation, primarily, I have identified potential areas that may be affected by environmental injustices. In order to do this, I constructed a complex indicator using socio-economic and environmental indicators (Table 1). The data were collected from the TeIR database for 2010, 2011, 2013, 2015 and then aggregated in SPSS using principal component analysis method. I identified the areas that were potentially subject to environmental injustices and can be selected as sample areas for my research. The decisive factor in the selection of the sample areas was to have a connection to a current natural-environmental problem that was reported by the media.

1. Extended list of indicators taken into account based on principal component analysis along the established dimensions. Source: Own construction by WHO

Dimension	indicator
Dimensions of the built environment, housing and living environment safety	Proportion of uncomfortable and semi-comfortable apartments in 2011 (%) Number of crimes per 100 people 2011, 2013, 2015 (pcs) Number of accidents per 1000 people 2011, 2013, 2015 (pcs) Number of cancer patients per 1000 persons, 2011, 2013, 2015 (prs)
The dimension of the natural environment	Flooded area (yes-no) 2010, 2013, 2015 Inland water area (yes-no) 2010, 2013, 2015 Drinking water quality data (ammonium, arsenic, boron) in excess of limit value in drinking water (%) 2011, 2013, 2015 Value of hazardous waste per capita 2011, 2013, 2015 (kg)
Dimension of the urban environment	Population of the settlement - detection of tiny- and small villages Proportion of 0-14 year olds (%) juvenile structure Aggregated Institutional Coverage Index 2011, 2013, 2015
The dimension of the economic environment	Personal income tax base (HUF/prs) 2011, 2013, 2015 Percentage of Roma and Gypsies in 2011 Percentage of people of working age with at least eight classes in 2011 (%) Proportion of registered unemployed in the total population (%) below the national average 2011, 2013, 2015 Difference between taxpayers in the lowest and highest taxlines, 2011, 2013, 2015

In my dissertation I investigated three different types of environmental injustices, flood, inland water and red mud disaster in case studies, in a total of four sample areas (Bereg, Borsod, urban and rural inland water areas Szeged-Baktó and Domaszék, red mud area) (Figure 1).

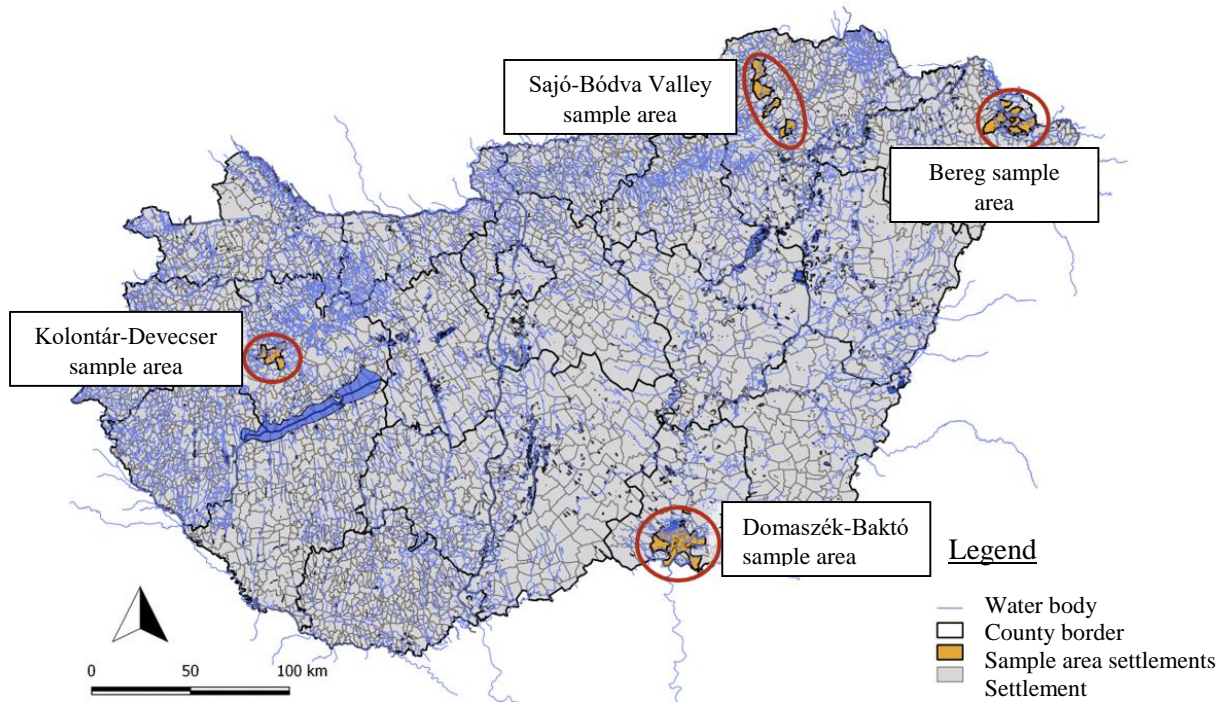


Fig.1.: sample areas of the dissertation

Methodology of empirical research of selected sample areas

To identify environmental injustices, empirical data were also collected in 2010, 2011, 2013 and 2015 through a questionnaire and interview survey. The results can be compared by the matching content of the questionnaires. The questionnaire consisted of three main sections, environment, political decision-making influence, and personal information.

In the first phase of the research a questionnaire survey was conducted with the help of interviewers in the segregated Gypsy settlement of Boldva in Borsod-Abaúj-Zemplén county in 2010 (N = 68), in 2011 in nine Szabolcs-Szatmár-Bereg county settlements affected by the 2001 Tisza flood (N = 411) and finally in Sajó-Bódva valley in the settlements affected by the floods of Hernád and Bodva (N = 443). In order to prepare the dissertation, in the second phase of the research 150 people were interviewed in the three settlements most affected by red mud spill, Kolontár, Devecser and Somlóvásárhely, in 2014 about the disaster and the related compensation and reconstruction process through a questionnaire survey. In the third phase, in the case of inland excess water areas, the study area was selected based on the data of the TeIR database, the inland water related press articles published in the period 2000-2015 and the principal component analysis made earlier. In this sample area a survey was made with a total of 250 people in 2015 with the help of interviewers.

The unique nature of the case studies required varied sampling strategy. While all households were contacted at the Boldva Gypsy Settlement, systematic sampling of the red mud sample areas was performed using a random number table. In the case of Bereg and Borsod sampling, an expert quota was applied for according to the degree of involvement.

Statistical methods used to process case studies

For the analysis, I applied statistical methods, the Chi-square test for the nominal and ordinal variables, and the t-test for the metric variables according to the conditions defined in the literature (SAJTOS L. - MITEV A. 2007, BARNA I. – SZÉKELY M. 2004, FREEDMAN, D. ET AL. 2005). For grouping K-mean cluster analysis was made, and decision-making analysis was conducted through drawing decision trees using the CHAID method, based on the Chi-test and the F-test (TAN, P. 2012). In the case of decision trees I used mostly binary and ordinal attributes, but I also included continuous variables for different principal component values. I drew relatively shallow decision trees and defined the "parent" and "child" nodes (JÁNOSA A. 2011) at 25 and 15 persons. The mapping was done with QGIS and ArcGIS software, and the figures were created in the dissertation with Corel Draw.

IV. Summary of results

In the first part of the dissertation I answered my theoretical questions, while in the second part, the questions connected to the appearance of environmental injustices in the sample areas were answered.

1. How environmental justice as a framework is related to geography and critical geography, I have found three main factors. First of all, the spatial approach that most links environmental justice research to geography. Secondly, the theory and framework of sustainable development and, thirdly, pluralism and criticism-based research, which links this framework to critical geography.

2. In the development of the environmental justice conceptual framework, I have identified two major moments in EJ history. One is the civil rights movement that emerged in the 1960s, which gives the activist nature of the EJ researches, and the other is the incorporation of environmental justice into the law in the 1990s. Since the middle of the twentieth century geographical and social research became more and more diverse, the former quantitative approach, has been extended with the qualitative approach, but the quantitative methods did not disappear. Based on scientific publications, the former single focus on distribution of injustices, which collects evidences for injustice, the emphasis shifted on exploring the processes (procedural justice) leading to injustice and the individual's perception

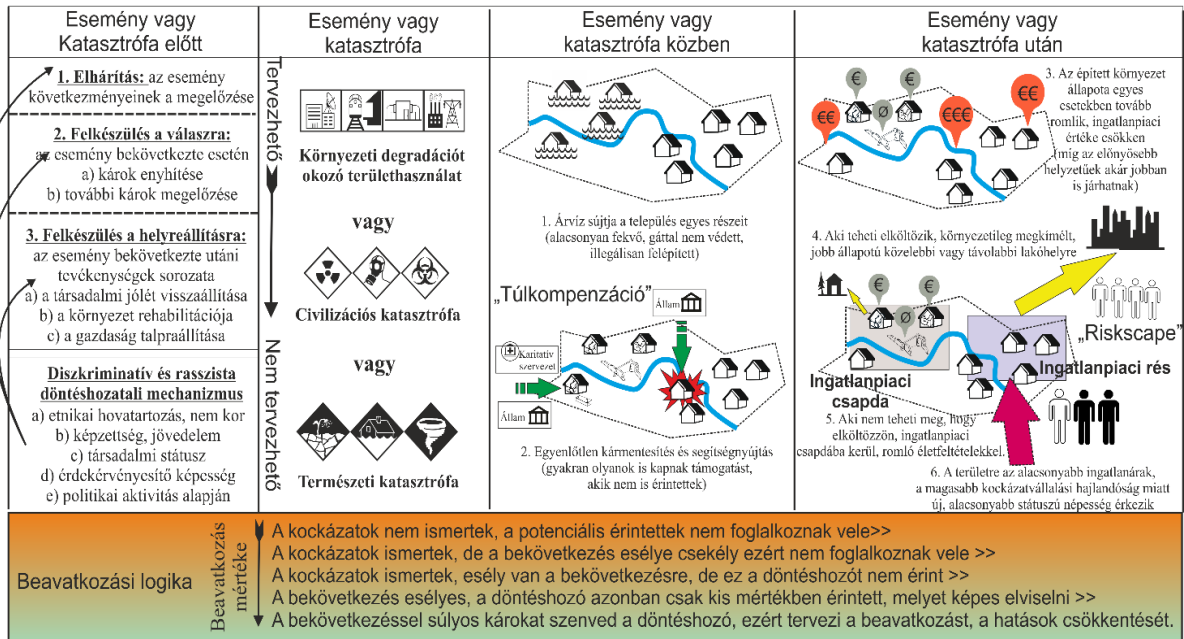


Fig.3.: Ex ante, ex post and top-down and bottom-up environmental injustices. Source: edited by the author

4. Individuals and groups may have different attitudes towards environmental injustice, from PIMBY to BANANA. But not only terms for individuals but for regional aspects (LULU and LWLU) are appearing. All of these attitudes may change in the meantime of environmental unjust situation due to external factors (such as an information campaign). Changes in attitudes may also be associated with a change in the subjective evaluation of particular processes, and with the recognition of injustice.

5. Environmental injustices occur in a multidimensional and multiscale geographical space, in which the scales and the various spatial units are constantly interrelated and interrelated.

6. The manifestation of injustice has spatial consequences that can be measured both quantitatively and qualitatively and can be felt at different scales. According to the literature, the most important of these are:

- o Fear of an individual's perceived or actual risks;
- o Public attitudes and satisfaction;
- o Assessment of empowerment;
- o Satisfaction with assistance and compensation;
- o Change in the settlement milieu;
- o Assessing the subjective health of an individual;
- o Changes in the social composition of the settlement;
- o Transformation of residential mobility patterns;
- o Impact on the real estate market, real estate market trap.

Based on these factors, I constructed a model for the interpretation of environmental justice, which I used for practical investigations (Figure 4).

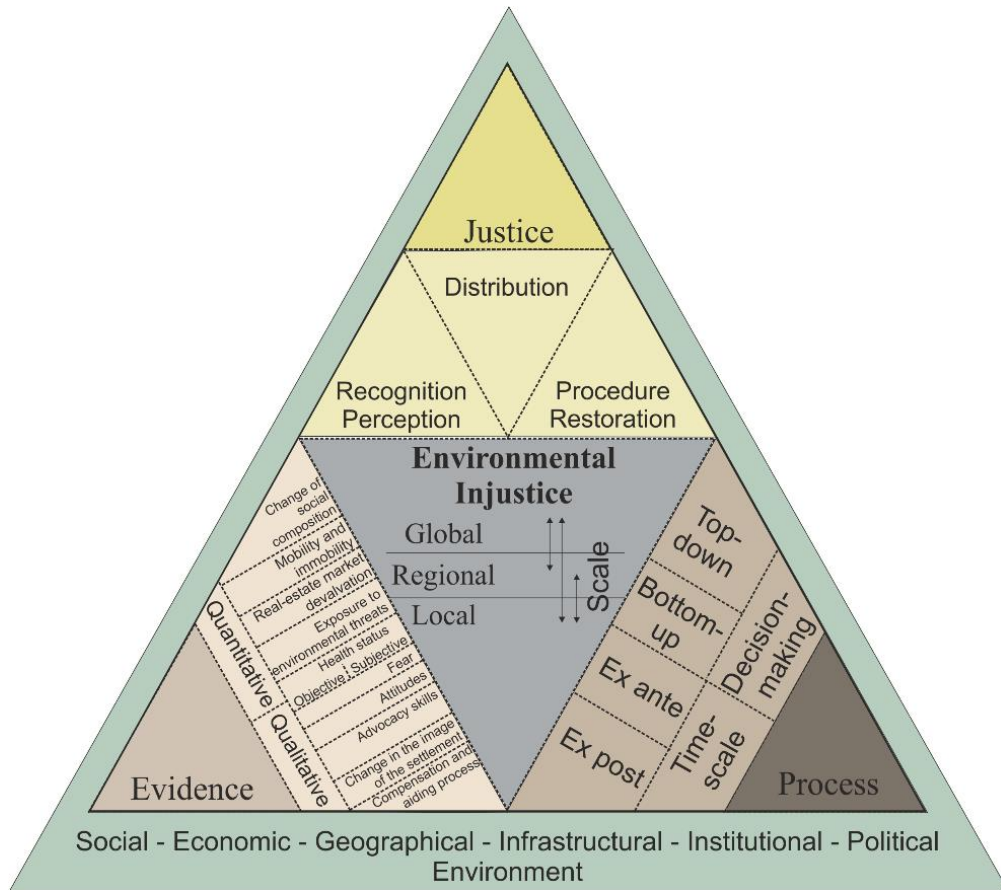


Fig.4: The components of environmental injustice and their relationship with each other. Source: own edition

In the dissertation the manifestations of spatial injustices in selected sample areas were researched. Namely, two flooded areas, one inland excess water affected area, these represent the areas with natural disaster, and a red mud sludge disaster site, which represents the civilization disaster type were under survey.

7. Areas of potential environmental injustices were demarcated in the light of social and environmental changes. The delimitation process was based on previous Hungarian researches on social inequality, development and welfare (PÉNZES, J. 2018, NAGY G. 2006, NAGY E ET AL. 2014). The most important findings of the dissertation are that all three sample areas are potentially affected areas of environmental injustice based on WHO recommendations (Figure 5). The created index integrates natural factors stronger than other indices measuring socio-economic development earlier, and helps to understand better a longitudinal, dynamic, change-oriented explanation.

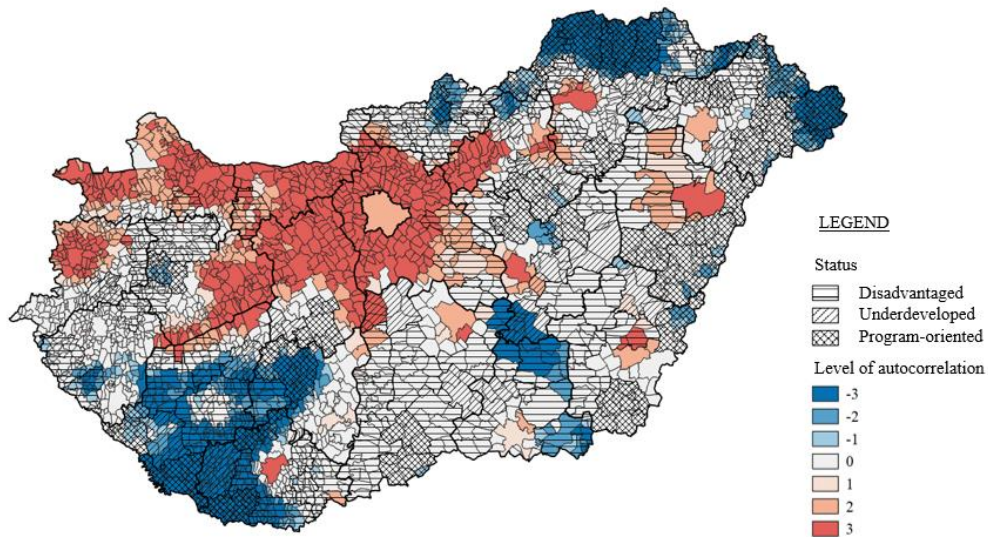


Fig. 5.: The components of environmental injustice and their relationship with each other. Source: own edition

8. One of the dissertations sub-question was, whether there is a perceived or real fear of a further catastrophe in the population, and what changes are observed in the society or the urban tissue. The surveyed population can be primarily divided into directly and indirectly affected groups. We may find that those affected by any disaster are more likely to approve the main component of fear and change, but this is not as simple and straightforward. As ethnicities influence the response, the research shows that Roma are more prone to agree with the principle component of fear because they feel much less likely to be involved in the decision-making process. It is important to note that the Roma-Hungarian difference is not generally applicable, as the sample areas and their unique characteristics influence individuals' decision-making mechanisms in judging fear and change (Figure 6). Generally speaking, it is the disaster response strategy that significantly determines how each group views the future and the changes of a given sample area.

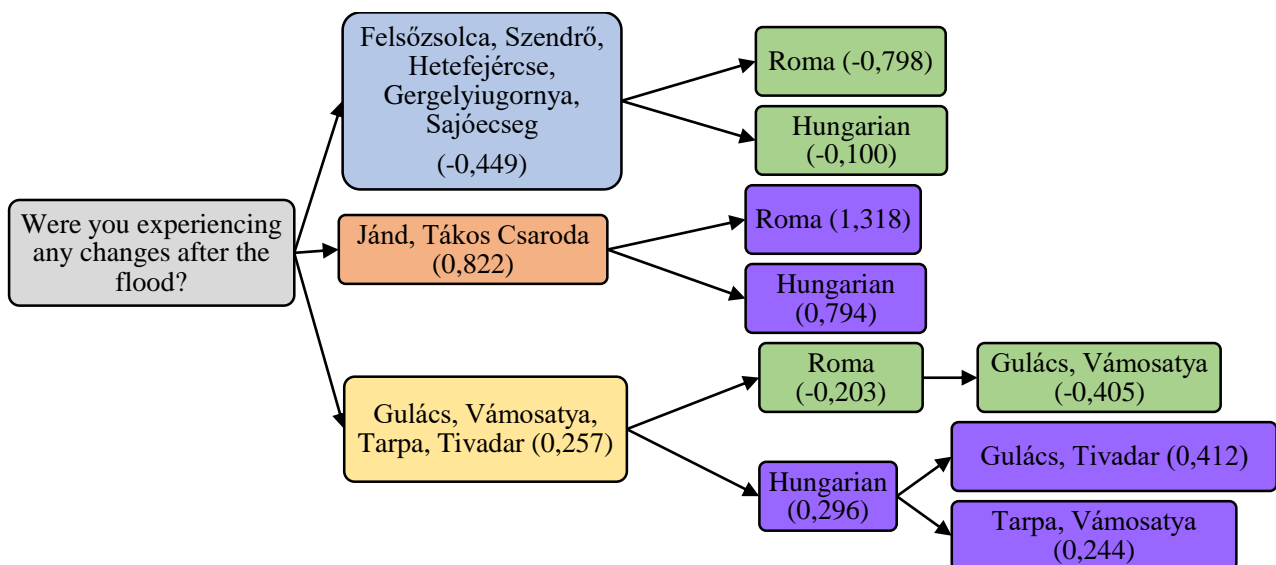
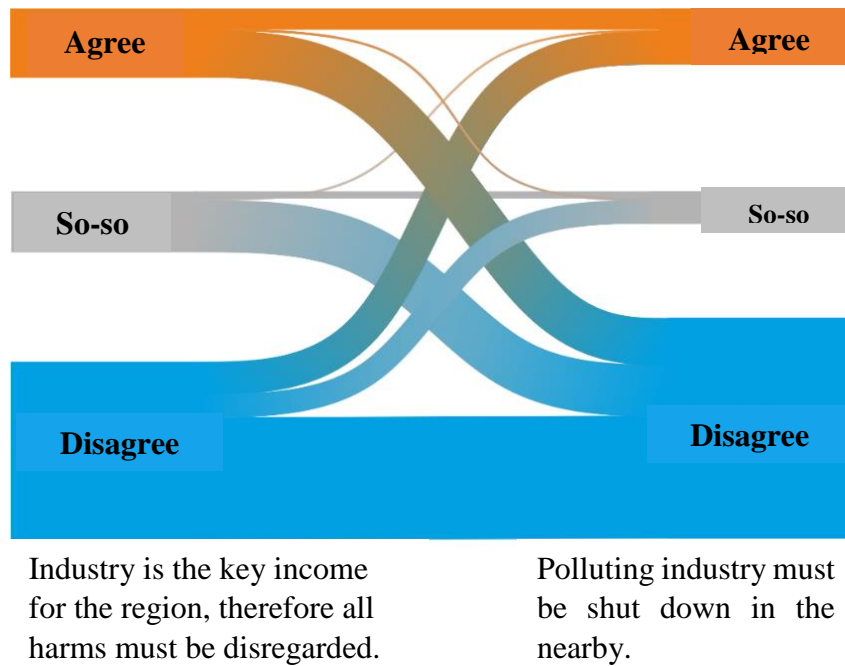


Fig. 6.: Fault lines in opinion within Roma and Hungarian population. Source: own calculation

9. The information flow and compensation process is somewhat contradictory. generally, the top-down way of compensation interventions are perceived by residents and stakeholders as more successful than bottom-up "liberalized" compensation is, despite the main principle of regional development is subsidiarity. In Hungary, in the observed cases the bottom-up compensation process had many inequalities and misuse. Respondents in both red mud and flood affected areas referred floods and the red mud as "golden flood" and "golden mud", indicating injustice of compensation. Despite this, the information-flow during and after the disasters are not considered appropriate in either case. The respondents were not satisfied with the speed of the dissemination of information, the transparency or the truthfulness of the information.

10. On the basis of the results a very fast, robust differentiation and transformation started in the sample areas, which was reflected not only in the change of the real estate market, ownership, but also in the mobility of the population. Primarily, the emigration of wealthy people from the Borsod, Bereg and Kolontár-Devecser areas after the disaster began, which can be seen as a "riskcpae", meaning escaping the wealthier from risk. In addition, the real estate market trap has begun. In some municipalities, residents believe that real estate cannot be sold or, if so, at very "depressed and low prices". The state-led compensation and intervention worsen this situation, because in many cases it legitimately forced affected people to stay in the settlement in return of renovation or a new real-estate. This prevented outmigration from the sample areas. Staying is often reasoned by habit and the presence of family or workplace. Respondents in many cases justified their immobility by reference to their age with statements and sentences with similar meanings, for example: *"At this age I am no longer going anywhere"*, *"what to expect at the age of seventy"*, *"I have lived my whole life here"*. The major destinations were the nearby large cities and regional centres for all the study areas examined.

11. Environmental injustice research has repeatedly states that stakeholders generally condemn activities that are harmful to their health, but when the elimination of the questionable or harmful activity would affect their own existence, they become accepting or supportive, changing their attitude, from BANANA (Build Absolutely Nothing Anywhere Near Anyone) to PIMBY (Put In My Backyard). This was confirmed in the case of red mud spill affected study areas (Figure 7).



12. Environmental injustices in many cases lead to damage to health, mainly affecting the minority, poor, deprived populations. Based on statistical data and a questionnaire survey, the dissertation proved that there are significant differences between the affected and non-affected respondents in terms of illness. The prevalence of mental illnesses, including depression, is extremely high in all the regions studied, and their symptoms are also present. A higher proportion of respiratory diseases could be expected in the examined regions, but this does not differ from the national average. Although many respondents feel that environmental injustices are the cause of their illness, this is not medically proven, the relationship is only subjective.

V. Utilization of the results

The results of the dissertation can be utilized in several ways:

- The dissertation expands the focus of environmental justice in the East Central European region. The dissertation provides a theoretical framework to social geography especially to its critical trends for presenting injustices in the environment. It may result active scientific debate and discourse, which may lead to the further development of the framework.
- The dissertation is a methodological experiment, offering an opportunity to answer the questions raised. The conducted principal component analysis is based on the current legislation, but the results are providing more complex, reflexive, not only human but also environmentally oriented perspective on which also can be used in legislation. The indicator created react dynamically to changes. All this would be applicable to the delimitation of disadvantaged areas. Due to the global climate change, legislative

integration of environmental factors will be a fundamental need and will be appreciated not only at the municipal but also at the regional level.

- The dissertation emphasizes the interdependence of local and national power relations, peripherization, marginalization and social inequalities with injustices in the environment. The conclusions can be useful for decision-makers to plan different interventions.
- The dissertation examines the environmental and industrial catastrophes that have occurred in several ways. The satisfaction of the local population in many cases does not develop in the way and according to the “textbook”. This also indicates the importance of a practice-oriented approach for decision makers. Each event is unique, so detailed exploration and understanding of the drivers is necessary for successful state or municipal intervention.
- One of the basic statements of the dissertation is that the subjective perception of fear, change and information flow does not necessarily coincide with the statements of the state claiming the intervention was successfully. Therefore, the involvement of the population in these processes is indispensable, despite the scarce financial resources. Nonetheless, it seems that without public involvement intervention will change the internal dynamics of local society for decades, generating fractures and reinforcing existing ones. On the other hand, investing and rebuilding in affected settlements does not necessarily contribute to improvement of the image of the area, but it greatly improves the quality of life.
- The results of the dissertation can be utilized for the synthesis of the IPCC study on climate change in Hungary.
- The results of the dissertation can be utilized in research coordinated by the Ministry of the Interior because of its spatial specificity.
- The results of the dissertation can also be used in the creation of Smart City concepts, especially in the case of urban (Szeged) pilot areas.

VI. Further possible directions of research

Several future directions of research can be outlined, which concern the expansion of the theoretical framework, the better geographical embedding, and its methodological improvement:

- Within the theoretical framework, global climate change and its impact on the environment and society could be more explicitly explained. The main goal here is to synthesize the results of research in social and physical geography and to create synergistic cooperation.
- The theoretical framework of municipal conflicts related to local power relations and dependency systems could be expanded to provide a better

understanding of decision-making mechanisms. In this case, further interview surveys would be needed, since the dissertation is currently exploratory, but can only be considered as fundamental research.

- Higher-level processing of spatial analysis could also be adapted to the methodology, but this requires additional data, preferably at sub-settlement level. This may be a shift in direction and connection to the Smart City mindset, but it is strongly related to social and smart equality, security and not the main focus of Smart researches, the technological solutions.
- A further possible direction would be to re-survey the survey areas to measure and analyze the extent of the change in medium to long term.
- The rural-urban conflict, the theoretical background and the practical processing of the urban-rural and its periphery could also be expanded in the case of the inland water issue.
- A further direction of research may be environmental-health-social status research, which may be linked and complementary to departmental health geography and deprivation research.

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