

Individual citizens' resilience to disasters caused by floods: a case study of Belgrade

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Abstract

Due to the increasing frequency and variety of disasters caused by floods and their effect on people, environment, material, and cultural goods, there is an unavoidable need to improve the security of citizens through innovative solutions to improve Serbian citizens' resilience to such disasters. The subject of the research is a comprehensive examination of the levels and factors that affect the level of individual resilience of the citizens of the city of Belgrade to the consequences of disasters caused by floods. By applying the quantitative research tradition, citizens' attitudes about their level of resilience and the level of resilience of society were examined. The survey was conducted using a questionnaire that was requested and collected online among 377 respondents during May 2020. The research results show that there are relationships between the diversity of characteristics, experiences, and levels of education with the level of individual resilience of citizens to flood disasters. The implications of the research related to the creation of preconditions for the design and implementation of various programs, strategies, and campaigns that will improve the situation in the aforementioned area.

1. Introduction

Almost all ancient world civilizations have the myth of a great flood, that is, a flood, which does not mean that it was a real event, but indicates that even then there was an awareness among people about the flood as an event that causes enormous damage (Cvetković & Martinović, 2020; Hussaini, 2020; Thennavan, Ganapathy, Chandrasekaran, & Rajawat, 2020). For example floods have caused a huge financial losses in Turkey, amounting to US\$ 800 million between 1960 and 2014 (Koç, Natho & Thieken, 2021). This is not surprising given that the origins of all civilizations were closely linked to river valleys, which provided them with drinking water and agriculture, provided transport routes, and represented natural barriers against enemy campaigns of the surrounding tribes (Stefanović, Gavrilović & Bajčetić, 2014, p. 41). As part of the evident climate changes, which can be said that no one has not felt them on their skin, floods, immediately after the drought, represent the most common and widespread natural disaster. They cause great fear and anxiety in people due to the destructive effects it can cause, such as the destruction of entire cities, causing millions of material damages, disturbing the environment, human suffering, etc. People have certainly intensified climate change and damage to the environment through their actions (land-use change), which has contributed to their frequency in recent years. According to previous data, precipitation has not changed its extent to such an extent, but the consequences have become more destructive (Kljajić, Popović & Grujić, 2016).

Some authors (Paul, 2011) indicates that the consequences of disasters largely depend on complex social, economic, demographic, political and cultural factors, and on the other hand, the extent and scale of the consequences are influenced by the physical characteristics of the disaster itself, such as its size, scope, duration and frequency (Mirza & Hofer, 2007). Wisner and Luce (1993) agree with Bimal's view, arguing that family, as well as the social cohesion that provides social security, often weakens during disasters. Workers are left without income, traders without goods, farmers without livestock, crops, equipment. Illiterate people cannot read notices and instructions on how to act during a disaster. And those who did not have the resources and social support before the disaster, such as the homeless, are often still unnoticed by

government organizations. What we can conclude is that the consequences of disasters only accentuate existing inequalities, whether in rich or poor countries, simply, disasters make poverty even more intense (Delaney & Shrader, 2000). Contrary to the view that the consequences affect the population equally, Jonkman and Kelman (2005) say that the consequences of a catastrophe affect the poor much more than the rich. Direct material consequences occur due to damage to facilities, structures and infrastructure, while indirect ones mean lost production, earnings, absence from work. The flood protection system is resilient to the extent that public services are responsible, as well as individuals. There are four groups of activities (Stefanović, Gavrilović & Bajčetić, 2014, p. 57–58):

- Land use includes activities for the development of planning and spatial planning documentation of the community
- Flood preparedness includes activities aimed at preparing for a possible flood. This preparation includes, in addition to the community, the preparation of the people themselves, the families. This group of activities also includes private activities on additional protection of facilities made before "administrative decisions on defining materials for the construction of facilities".
- Financial readiness refers to the financial readiness of individuals to reduce the potential for harm to themselves and communities. It is closely related to the voluntary insurance of facilities and property, which represents certain financial efforts.
- Awareness raising all the above activities would be meaningless without raising awareness about floods, and for this purpose the media are most often used, such as television, radio shows, the press, but lately the Internet has taken precedence.

Resistance is, today, considered a desirable property of natural and human systems (Klein, Nicholls, Thomalla, 2003, p. 3). When resistance was first used in science, it meant the ability of a material or system to return to equilibrium after certain physical influences (Gunderson, 2000). Perrings (1998, p. 221) in the broadest sense, resilience is a measure of a system's ability to withstand stress and shocks and its ability to endure in an uncertain world. On the other hand, Tirnej and Brani view the concept of resilience through the prism of the capacity of physical and human systems to provide an adequate response and to effectively recover from the consequences of natural disasters (V. Cvetković & Filipović, 2018). At the global level during 2015, the issue of resilience to natural and climate hazards was discussed at global intergovernmental conferences that led to new solutions to reduce disaster risk. The World Conference on Disaster Risk Reduction, held from 18 to 22 January 2005 in Kobe, Hyogo, Japan, adopted the Framework for Action 2005–2015: Developing Resilience of Nations and Communities to Disasters (ISDR, 2005). It emphasized the need to build community resilience to disasters and identified ways to achieve this.

2. Materials And Method

2.1. Socio-economic and demographic data

The research included a sample of 377 respondents from the area of the city of Belgrade who are 18 and older than 18 years. Of the total number of respondents who participated in the study, one-third were male respondents (33.80%), and the rest were female respondents (66.20%). About two-thirds were respondents

from the group of young adults up to 30 years (66.20%), and the rest were older respondents - ages 31–50 (17.80%) and over 50 (16%). Slightly less than half of the respondents had higher education (45.10%), slightly less than a third had completed high school (27.30%), and the rest were respondents with completed high school (9.20%) or postgraduate studies (18.40%). What is noticeable is that we worked on a highly educated sample, in which over 60% of respondents have completed at least a university degree. As can be seen, about one-third of the sample consists of respondents who are not in a relationship (34.10%), almost as many who are in a relationship (33.20%), 27% of those who are married, and the rest are divorced or widowed (4.50%). Half of the respondents were employed 49.30%, 43% were unemployed, and 6.5% were retired. With this characteristic, it can even be said that the sample well reflects the situation in the population; as according to the latest data from the Bureau of Statistics 49.9% of the population is employed, while the inactivity rate (people who cannot work for various reasons (Demographic Yearbook, 2020), together with those who can and want to work, but are discouraged from looking for a job. Of the total number, 39% of respondents who participated in this survey have a total of four household members, 15% five, 13% two, and the rest some other number household members (Table 1).

Table 1
Basic socio-economic and demographic information of respondents (n = 377).

Variable	Category	<i>f</i>	%	
Gender	Male	114	33.8	
	Female	226	66.2	
Age	18–30	223	66.2	
	31–50	60	17.8	
	50+	54	16	
Marital status	Single	116	34.4	
	In relationship	112	33.2	
	Married	94	27.9	
	Divorced	12	3.6	
	Widow/er	3	0.9	
	Secondary degree	92	27.3	
	High school diploma	31	9.2	
	Undergraduate	152	45.1	
	Graduate	58	17.2	
	Master/doctorate	4	1.2	
	Employed	166	49.3	
	Employment status	Unemployed	148	43.9
		Retiree	22	6.5
TOTAL		377	100	

2.3. Questionnaire Design

The structured questionnaire was developed using close-ended and 5-point Likert scale questions (1 strongly disagree to 5 strongly agree). A survey questionnaire was used to investigate the level of individual resilience of citizens to flood disasters. The survey questionnaire consists of 30 items, which examined the knowledge, characteristics, experiences of respondents, as well as their trust in the state, and at the very end an assessment of their individual resilience. The survey questionnaire was written in simple language (Serbian), to fill out the survey clearly, quickly, and accurately.

2.4. Analyses

Descriptive statistics were calculated for the demographic characteristics of the participants in this study. After surveying citizens, the preparation of data for further processing and analysis began. Descriptive statistics were first approached, describing the respondents' answers to each question asked in the survey. This was followed by inference statistics that included the following analyzes and one-factor analysis of variance and chi-square test.

3. Results

One-fifth of the respondents answered that they completely disagree that they are satisfied with the way of informing the competent authorities and services about the coming of floods (19.8%), almost as many generally disagree with this statement (20.1%), the largest number of respondents is (34.1%) neutral, 18.6% of respondents generally agree, while only 7.5% of respondents fully agree that they are satisfied with the way of informing the competent authorities and services about the arrival of floods. When asked on the assessment of preparedness after learning about the onset of floods, 18.4% of respondents do not agree at all that it was well prepared, 18.3% and the same mostly disagree with this statement, then 35.5% of respondents are neutral/unsure, while 17.2% of respondents generally agree that they were well prepared, while 10.5% of respondents estimate that they were fully well prepared. Then, 20.6% of respondents do not agree at all that they are familiar with safety procedures in case of floods, while 14.9% of respondents estimate that they are fully familiar with these procedures.

About 27.1% of respondents answered that they were not satisfied at all with the level of equipment of the house/apartment, 17.6% of respondents answered that they were mostly dissatisfied, 22.3% were neutral/unsafe, while 33.1% of respondents were satisfied with the equipment of their house to respond to flood disasters. When asked about feelings of concern for the personal and safety of loved ones during floods, 21.1% of respondents answered that they did not feel worried at all, 13.6% of respondents answered that they were mostly not worried, 20.5% is neutral/unsafe, while 20.5% of respondents mostly felt anxious, while 24.4% of respondents fully felt related to this way. When asked about the feeling of fear, ie. fear during floods, 21.5% of respondents answered that they did not feel it at all, 13.9% of respondents answered that they mostly did not feel it, 27.2% are neutral/unsafe, 20.5% of respondents mostly felt fear, and 56 16.9% of respondents fully felt scared. Of the total number of respondents who answered this question, 26.7% answered that they did not agree at all that they had confidence in the state's capacity to defend against floods, 22.1% generally disagreed, while 27.9% were neutral. On the other hand, 23.3% point out that they believed in the state's ability to defend itself against floods. With the item on psychological and/or physical consequences left by floods, 79.2% of respondents did not agree, 16.8% declared neutral, while 3.9% of respondents stated in the affirmative.

Less than a fifth of the sample, 18.6%, respondents assessed that it was more or less unsustainable, 38% rated their resistance to the consequences of floods with an average grade, while 23.5% answered that they were more or less resistant to the consequences of floods. About a fifth of the causes were volunteers who helped eliminate the consequences of the flood, 21.3%, while the other respondents 78.7% were not volunteers. A significantly higher number of respondents assisted flood victims in some other way (donation

of food, medicine, clothes, etc.), 63.8%, while other respondents 36.2% did not participate in this type of activity.

Table 2
Independent sample t-test results on the individual resistance of respondents to floods

Dependent variables	Levene's Test for Equality of variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Individual flood resilience	.00	.945	1.12	332	.266	.147	.132	-.113	.407
Satisfaction with notification	.99	.319	-.32	332	.749	-.044	.137	-.314	.226
Preparedness upon learning of the impending danger	1.15	.285	.28	330	.784	.039	.142	-.240	.318
Familiarity with security procedures	.08	.781	-.10	333	.919	-.016	.155	-.320	.288
Satisfaction with the level of equipment of the apartment/house	.28	.598	2.02	334	.045*	.325	.161	.008	.642
Concerns for the personal and safety of others	1.23	.268	-2.1	330	.037*	-.353	.169	-.685	-.022
Feeling of fear	.25	.620	-5.28	329	.000**	-.806	.153	-1.106	-.506
Confidence in the state's capacity in flood defense	5.48	.020	-1.21	204	.228	-.187	.154	-.491	.118
Mental / physical consequences remained after the flood	.31	.580	-.15	325	.881	-.017	.113	-.240	.206
* $p \leq .05$; ** $p \leq .01$									

The results of the independent samples t-test analysis showed that with only the variable confidence in the state's capacity to defend against floods did not have equal variance within the group of men and women, and an analysis was performed that does not assume equality of variance (Table 2). Of the total number of

dependent variables, statistically significant differences between the results of men and women occurred with the following dependent variables: satisfaction with home equipment (men: $\bar{x} = 2.97$, $SD = 1.417$; women: $\bar{x} = 2.65$, $SD = 1.389$; $t(334) = 2.017$, $p = 0.045$, eta square = 0.012 - small impact); concern for the personal and safety of others (men: $\bar{x} = 2.90$, $SD = 1.523$; women: $\bar{x} = 3.26$, $SD = 1.524$; $t(330) = -2.097$, $p = 0.037$, eta square = 0.013 - low impact); feeling of fear (men: $\bar{x} = 2.45$, $SD = 1.324$; women: $\bar{x} = 3.25$, $SD = 1.318$; $t(329) = -5.279$, $p = 0.00$, eta square = 0.078 - small impact).

The results of the chi-square test of independence (χ^2 Ta) showed that there was a statistically significant relationship between gender and the experienced consequences of floods ($p = 0.015$, $\phi = -0.113$ - mean impact) and gender and volunteering ($p = 0.020$, $\phi = 0.127$ - medium impact). On the other hand, no statistically significant association with donation was found ($p = 0.928$).

Table 3

Chi-square test of independence between the education level of respondents and subsidiaries of variation experienced tangible and intangible result of floods, volunteering in assisting victims, donating medicines, food, money, etc.

	Value	df	Asymp. Sig. (2-sided)	Cramer's V
Experienced non / material consequences	7.969	1	.093	0.154
Volunteering in assisting victims	4.813	1	.307	0.120
Donation of medicines, food, money, etc.	11.354	1	.023*	0.184
* $p \leq .05$				

The results of the Chi-square independence test (χ^2) showed that there was a statistically significant relationship (Table 3) between education and donation ($p = 0.023$, Cramer's V = 0.184 - mean impact). On the other hand, no statistically significant association was found with the experienced consequences ($p = 0.093$) and volunteering ($p = 0.307$). Based on the results, it is noticed that the more educated the respondents, the higher the percentage of those who donated money, groceries, food to the flood victims. 49.5% of respondents who completed high school answered in the affirmative to the question of donation, so answered 71.02% who completed high school, 68% college, 70% of those who completed master studies, and 75% of those who completed doctoral studies. There is no statistically significant association in terms of education with the consequences experienced, nor with volunteering.

According to the results of one-factor analysis of variance, no statistically significant difference was found between the mean values of these groups of any of the continuous dependent variables - individual flood resistance ($p = 0.513$), familiarity with safety procedures ($p = 0.932$), satisfaction with equipment apartments / houses ($p = 0.445$), concern for personal and safety of others ($p = 0.745$), feeling of fear ($p = 0.769$), trust in the state's capacity to defend itself from the consequences of floods ($p = 0.180$), other non / material consequences ($p = 0.874$). It was shown that the samples of respondents from different educational levels differ in terms of variance in the variables preparedness upon learning of the onset of floods and satisfaction with the method of notification. The results showed that (Table 4) there was no difference between educational groups in terms of satisfaction with the way of informing ($F = 1.190$, $p = 0.343$, eta square =

0.016 - small impact) and preparedness ($F = 1.459, p = 0.235, \eta^2 = 0.018$ - small influence). In other words, all educational groups were estimated that they were equally prepared for the coming of the flood, after hearing the announcement.

Table 4

Results of Robust Tests the difference between educational groups in terms of respondents' resistance to floods

Robust Tests of Equality of Means					
		Statistic ^a	df1	df2	Sig.
Individual flood resilience satisfaction with notification	Welch	.794	4	21.628	.542
	Brown-Forsythe	.911	4	65.282	.463
Preparedness upon learning of the impending danger	Welch	1.190	4	21.425	.343
	Brown-Forsythe	1.303	4	35.687	.287
Familiarity with security procedures satisfaction with the level of equipment of the apartment/house	Welch	1.407	4	14.814	.280
	Brown-Forsythe	1.459	4	36.502	.235
Concerns for the personal and safety of others	Welch	.204	4	21.458	.933
	Brown-Forsythe	.211	4	53.235	.931
Feeling of fear	Welch	.836	4	21.263	.517
	Brown-Forsythe	.807	4	27.826	.531
Confidence in the state's capacity in flood defense	Welch	.390	4	21.188	.813
	Brown-Forsythe	.440	4	28.910	.779
Mental / physical consequences remained after the flood Individual flood resilience	Welch	.382	4	21.208	.819
	Brown-Forsythe	.420	4	36.403	.793
Satisfaction with notification	Welch	1.628	4	21.317	.204
	Brown-Forsythe	1.512	4	32.972	.221
Preparedness upon learning of the impending danger	Welch	.311	4	21.373	.868
	Brown-Forsythe	.316	4	43.315	.866
* $p \leq .05$					

One-factor analysis of variance tested variables in which there were no deviations from the conditions of equality of variances. None of the results were statistically significant satisfaction with the way of notification ($p = 0.103$), readiness to learn about the coming of floods ($p = 0.256$), familiarity with safety procedures ($p = 0.334$), satisfaction with the level of equipment of the apartment / house ($p = 0.705$), concern for personal and safety of others ($p = 0.605 > 0.05$), feeling of fear ($p = 0.303 > 0.05$), trust in the state's capacity to defend itself against the consequences of floods ($p = 0.429 > 0.05$). The results showed that there was a difference between groups of different marital status in terms of individual resilience (Table 5) ($F = 3.018$, $p = 0.031$, eta square = 0.016), but not the variables of residual non / material consequences ($p = 0.235$). Additional analyzes show that the difference exists only between the group of people who are in a relationship ($M = 3.63$, $SD = 1.004$) and who are married ($M = 3.12$, $SD = 1.088$) $p = 0.011$).

Table 5
 Analysis of the existence of differences between respondents of different marital status in terms of continuous dependent variables.

Robust Tests of Equality of Means^b					
		Statistic ^a	df1	df2	Sig.
Individual flood resilience	Welch	3.061	4	13.569	.054
Satisfaction with notification	Brown-Forsythe	3.018	4	34.789	.031*
Preparedness upon learning of the impending danger	Welch	No widower answered this question, so the statistics were not calculated			
	Brown-Forsythe				
Familiarity with security procedures	Welch	4.778	4	14.258	.012
Satisfaction with the level of equipment of the apartment / house	Brown-Forsythe	2.042	4	83.862	.096
Concerns for the personal and safety of others	Welch	.839	4	13.496	.524
	Brown-Forsythe	.989	4	21.297	.435
Feeling of fear	Welch	2.378	4	14.560	.100
	Brown-Forsythe	.667	4	88.087	.616
Confidence in the state's capacity in flood defense	Welch	.609	4	13.452	.663
	Brown-Forsythe	.524	4	12.711	.720
Mental/physical consequences remained after the flood	Welch	1.044	4	13.487	.421
	Brown-Forsythe	.973	4	10.891	.461
Individual flood resilience					
Satisfaction with notification	Welch	.753	4	13.516	.573
	Brown-Forsythe	.866	4	18.093	.503
Preparedness upon learning of the impending danger	Welch	1.462	4	13.542	.268
	Brown-Forsythe	1.715	4	16.999	.193
* $p \leq .05$					

What is interesting is that the same trend was obtained in the results in terms of established statistical significance of relationships - there was a significant correlation between marital status and the experienced

consequences of floods ($p = 0.036$, Cramer's $V = 0.144$ - medium impact). On the other hand, no statistically significant association was found with volunteering ($p = 0.226$) and donation ($p = 0.491$) (Table 6).

Table 6

Only Chi-square test of independence between the marital status (category 3) subjects and the following dependent of variation experienced the tangible and intangible result of flooding, at the voluntary provision of assistance to, the donation of medicines, foods, and cash.

	Value	df	Asymp. Sig. (2-sided)	Cramer's V
Experienced non / material consequences	6.653	2	0.036*	0.144
Volunteering on provision of assistance to	2.974	2	0.226	0.097
Donation of medicines, foods, and cash	1.423	2	0.491	0.067
* $p \leq .05$				

According to the results of one-factor analysis of variance, a statistically significant difference was found between the mean values of these groups in the following continuous dependent variables - satisfaction with the way of notification ($F = 3.754$, $p = 0.025$, eta square = 0.022 - small influence). The results obtained on the dependent variable feeling of fear are at the very limit of statistical significance of ($p = 0.05$) and on a slightly larger sample would certainly be significant, and they will be recognized as relevant data to be discussed ($F = 5.506$, $p = 0.054$, eta square = 0.018 - small impact). The results of other dependent variables were not statistically significant - individual flood resistance ($p = 0.856$), preparedness upon learning of the impending danger ($p = 0.548$), familiarity with safety procedures ($p = 0.421$), satisfaction with the level of equipment apartments / houses ($p = 0.248$), concern for personal and safety of others ($p = 0.288$), trust in the state's capacity to defend against the consequences of floods ($p = 0.712$), other non / material consequences ($p = 0.127$).

4. Discussion

Starting with the gender variable, ie the difference between the sexes before, during, and after the flood, the results of the research indicate statistical significance in terms of fear and concern for the personal and safety of others. Men are less worried and less afraid during floods, as well as volunteering more to eliminate the consequences of floods, which is confirmed by research on the role of gender in flood risk preparedness (Cvetković, Roder, Öcal, Tarolli, & Dragičević, 2018). Also, the obtained results are consistent with the results of research in which it was found that the level of fear differs concerning demographics, sociological psychological characteristics of respondents (Cvetković, Öcal, & Ivanov, 2019). On the other hand, the higher participation of men in eliminating the consequences of the flood can be seen through the result that men experienced a higher percentage of the consequences of the flood. The obtained results may be related to the fact that men, to a greater extent than women, traditionally have responsibility for family safety (Pećnik & Sindik, 2013), they are more engaged in some jobs that require physical strength (filling bags, rescuing from water, etc.). Regarding the donation of food, medicine, and money, as well as volunteering, there are no statistically significant connections, which confirms the research on the attitudes of residents about

assisting during and after disasters, where the vast majority answered in the affirmative (Cvetković & Marina, 2021).

This research does not coincide with research (Hegney et al., 2007) which indicates that older people are to have more experience, knowledge, and traits that are listed as resistant traits individual. The obtained results are expected, bearing in mind that the younger ones overestimate their resistance concerning their physiological predispositions (stronger muscles, false self-confidence, and insufficient knowledge for proper reaction in the armed forces). Research has confirmed that adults are more emotionally resilient to the effects of natural disasters (Heller et al. 2005) and that their better preparation and familiarity with safety procedures is related to the fact that older people mostly built their households and are more familiar with the characteristics of the area reside (Norris et al. 2002).

According to the results of our research, the variable of education in case of floods, respondents who have a higher level of an education donate more compared to those with a lower level of education, which can be explained by greater empathy for victims of these disasters, which reinforces the need for assistance.

Conclusions

Disaster risk reduction and disaster mitigation is a long-term education approach. The geography in which people live and the type of disasters they are exposed to affect people's disaster perceptions and preparations. For example Gölcük / Turkey in a study based on children aged 11–14 years flooding as the second-most threatening hazard after earthquake events and almost half of the children rated the flood hazard as unlikely to affect the future (Yıldız et al., 2021). Undoubtedly, the effects of the Gölcük earthquake on 17 August 1999 (although they did not experience it) had an effect on these children's thinking this way. There is no doubt that the high level of students' perception and fear of earthquake risk is related to the fact that they live in an area with high risk (Kara & Özdemir, 2020). Participants in this study are expected to be concerned about floods, as it is the most common natural disaster flood in Serbia. It is also in line with the relevant literature that female participants are more concerned than men.

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