

## THE IMPORTANCE OF GEOGRAPHERS IN THE STUDY OF NATURAL HAZARDS

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**Abstract:** This paper is about geographers, respectively, their role in studying natural hazards and disasters. The first part of this article is about analysis of electronic visible results (papers, conferences, projects) of the scientists. The papers, as the most often form of contribution in studying of natural hazards and disasters, have been analyzed according to their subject matter, who wrote them, respectively, how much the geographers were involved in that matter, according to the time when they were written and journals in which they were published. In the second part of this article is given attention to the geographers who are not occupied with the science. Investigation is made concerning their attitudes about their knowledge acquired during their studies – how much it was used within their job so far, or it could be used in order to have certain influence to their students, colleagues or any local inhabitants for education, prevention and protection from natural hazards and disasters. The attitudes of geographers about knowledge of certain types of natural hazards were illustrated by usage of descriptive statistics. By t-test were searched differences of attitudes between generations who matured with Internet and older ones. One-factor analysis of ANOVA variance was used for identification of differences between attitudes of geographers who had different occupations. Post-hoc Tuckey HSD test separated geographers in tourism as those who do not see the possibility to contribute in studying and preventing natural hazards and disasters within their profession. The aim of this work was to draw attention that the geographers who were not involved in science, felt ready and competent for monitoring of natural hazards at the local level and such written tracks might serve for future scientific investigations.

**Key words:** natural hazards, Serbia, geographers

### Introduction

There are various natural hazards. If we examine only those which are of the planetary origin, then it could be differed geophysical hazards (earthquake, volcano, hillslope processes), climatological hazards (extreme temperatures, drought, hail storm, wildfire), meteorological hazards (tornado, tropical cyclone), hydrological hazards (floods, avalanches). The common thing is that they are equally dangerous for man' life (Benac & Knežević, 2012),

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respectively, they often turn into natural disasters. Therefore, the informations concerning natural hazards are based on the facts about natural disasters. For example, climatological changes, caused by global warming up of the planet (Arnell, 1996; Parmesan & Yohe, 2003; Whitmarsh, 2009; Meinshausen et al, 2009; McCarthy et al, 2010) had influence to have some natural hazards more often than they used to be before (McGuire, 2005; Smith, 2013). Everyday life can be disturbed by natural disasters (Wisner, 2004). For that reason, it is very important to study them in order to improve their prediction, prevention, to allay their consequences.

Geographers have a long-standing interest in natural hazards and vulnerability research, dating back to the initial work of Gilbert F. White who submitted his ground-breaking dissertational thesis on flood hazards and flood plain management to the University of Chicago in 1942 (White, 1945). Since then, geographers have developed different interpretation about the occurrence and underlying root causes for natural hazards and disasters (e.g. Hewitt & Burton, 1971; Watts & Bohle, 1993; Cutter, 1993; Blaikie et al. 1994; Liverman, 1994; Fuchs et al, 2011).

The aim of this article is to explain the role and importance of geographers toward the society, at educational institutions and institutions which are dealing with prevention and reclaiming of natural hazards. So, in this article is analyzed the Serbian geographers contribution in studying of natural disasters and catastrophes. It will illustrate the opinion of geographers about the possibility to use their knowledge about natural hazards and disasters in the environment where they work, concerning prevention and protection and how much they believe to know about those natural hazards which happen more often in the geographic fields where they live. Beside that, this article will introduce the contribution to easy ways of studying natural hazards which can help a lot to various profiles of scientists who are dealing with it.

### **Methods**

The facts stated in this article are the result of consultations in literature and two research works. The first research refers to scientific work of geographers who studied natural hazards and disasters. The second one refers to the civic beneficial work of geographers in local environment.

By the analyses of about sixty-six electronic most visible works about natural hazards and disasters in Serbia, the answer was found concernig the question: Which hazards, respectively, disasters were brought in focus the interest of the scientists in Serbia? Which sciences do they origin from? How much do the

geographers participate in those studyings? When and in which magazines they have published their papers?

The civic beneficial work in the local environment, concerning hazards and natural disasters, is described according to the results of geographers poll. The e-mail poll was filled by 122 geographers, mostly females (63.9%). Most of examinees were younger than 35 years (55.7%) and employed in educational system (52.5%). Hypothesis were measured on a five-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The interviewing was conducted during the July 2013. Half of the questions asked for the replies on that: whether it is possible to apply the idea about prevention of protection from natural hazards within the business they are dealing with; do the geographers understand the role they could „play“ in prevention, protection from natural hazards and disasters; is it possible to allay them if a man is prepared for them or he was thinking about them and whether they have already used their position to point out some possible natural hazards. The second part of questionnaire was drafted so that examinees should state their opinion about it – how much they know about some types of natural hazards, about which are the Serbian geographers dealing with in the science. Data were analyzed by descriptive statistics and usage T – test, one-factor analysis ANOVA variance and Post-hoc Tukey HSD test.

## **Results and Discussions**

### *Findings - Geographers in science and natural hazards and disasters*

The following facts were established during research concerning the thing – how much the geographers were studying natural hazards in Serbia and which of those drew mostly the scientific attention. Natural hazards were also the subject of geographers studies in the past. For example, 'Catastrophes in nature' (Marković, 1956) is surely a valuable written track. However, in this paper the attention will be paid to explorations published during 21st century and before its beginning, the reason is that they were directed to their latest and recent forms of phenomenon.

It could be seen in three forms who is searching for natural hazards: projects, conferences and scientific papers. For example, it is the international project SEERISK (Joint Disaster Management risk assessment and preparedness in the Danube macro-region). It shows how the geographers in science are engaged in practice. It is a transnational project funded by the South East Europe Transnational Cooperation Program. The project team comprises 20 project partners representing 9 countries, namely Austria, Slovakia, Hungary, Croatia,

Serbia, Romania, Bulgaria, Slovenia and Bosnia and Herzegovina (<http://www.seeriskproject.eu/seerisk/#main>). Then, IPA project, MERIEXWA (Measurement, monitoring, management and Risk assessment of inland Excess Water in South-East Hungary and North Serbia, Using remotely sensed data and spatial data infrastructure) (<http://www.geo.u-szeged.hu/meriexwa/?q=en/intro>). The most visible results of explorations were in form of papers published in domestic and foreign journals. From 66 most visible papers, more than 1/4 or 18 informs about the earthquakes (Figure 1). All papers are published in Serbia, in journals: 'Ecologica', 'Izgradnja', 'Put i saobraćaj', 'Materijali i konstrukcije', 'Geodetska služba', but at least one can also be found in 'Etnoantropološki problemi', 'Vesnik – geologija, hidrologija i inženjerska geologija', 'Journal of the Geographical Institute 'Jovan Cvijić' SASA (Zbornik radova GI Jovan Cvijić) and 'Glasnik SGD'. From all papers, the geographers of GI 'Jovan Cvijić' SASA wrote one paper and the rest papers belong to the employees in the construction institutions or schools of the same profile (The Republic Seismologic Bureau; Faculty of Mining and Geology Geophysical Institute; Republic Geodesist Bureau; Faculty for Building Management (Union); Institute for Roads; Geo-bureau Gemini). The authors from abroad come from the Institut za zemljotresno inženjerstvo i inženjersku seizmologiju – IZIIS; University 'St. Kiril and Metodij', Skopje, the Republic of Macedonia; Department of Civil Engineering, University of Southern California, Los Angeles; Deptment of Geophysics, University of Zagreb, Croatia. Some of the authors have the professions which usually do not deal with studying of natural hazards. Their master institutions are: Faculty of Phylosophy, Etnology and Antropology, Philological Faculty and Zemun High School. The earthquake in the surroundings of Kraljevo, on November 3rd, 2010 started the 'avalanche' of investigations about the earthquakes, so half of them were written after mentioned earthquake.

Wildfires are not the subject of the attention on studies of geography. But Geographers scientists studied the wildfire and then they have achieved remarkable results. Of the 14 works visible on wildfires, geographers have published 5, three of which are in prestigious international journals ('Sustainable Development in Mountain Regions', 'Archives of Biological Sciences', 'Forum Geographic'). In addition 'Journal of the Geographical Institute 'Jovan Cvijić' SASA, works on fires, in terms of natural hazards can be found in journals such as: 'Topola', 'Šumarstvo', 'Botanica Serbica', 'Nauka, Bezbednost, Policija', 'Facta Universitatis - series: Working and Living Environmental Protection' and so on. In addition to the geographers of GI 'Jovan Cvijić' and Geography Faculty, authors are with the Institute of Lowland Forestry and Environment; Faculty of Technical Science; Faculty of Forestry; Institute of Forestry; and the

institutions such as State Enterprise ‘Srbijašume’, Belgrade; Police of Republic of Serbia - Sector for Emergency Situations of Bor and Chemical Engineering Department, IST-Instituto Superior Técnico, Lisbon, Portugal.

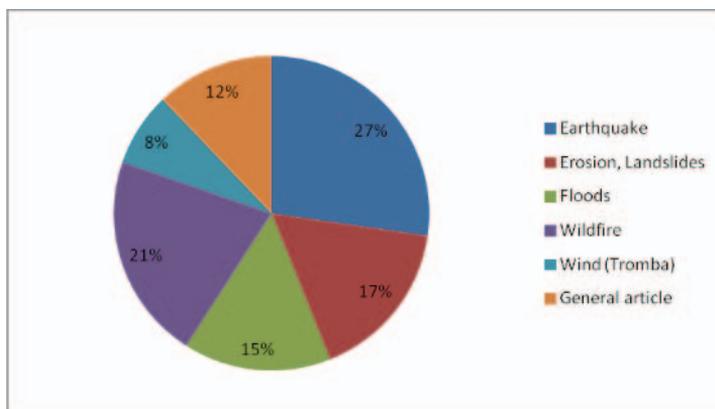


Figure 1 Articles of natural hazards and disasters, according theme

Exactly 1/6 or 11 papers talk about the erosion and hillslope. These papers were most often written by the employees at the Institute for roads; Institute for Geotechnique; Mining- geological Facult; Headquarters for Roads of the Republic Srpska; but also the Faculty of Technical Sciences and Faculty of Forestry. In the group of this papers, one was published by the explorers of GI 'Jovan Cvijić' SASA. The papers about erosion and hillslope are most often published at the journal 'Put i saobraćaj', 'Vodoprivreda', and also in 'Glasnik of SGD'. Although there is a significant number of those papers, they are the result of work from small number of explorers.

Flood was the subject of investigations in 10 papers of which only three were published abroad. Flood is the most often investigated by explorers from the Faculty of Forestry, but it can be found that some of them (1/4) were made in cooperation with the institutions such as: Department for Ecological Engineering in Protection of Soil and Water Resources; Faculty of Mining and Geology; Faculty of Geography; Secretariat for Environmental Protection of Belgrade City; Institute of Transport and Traffic Engineering - Center for Research and Designing; Republic Agency for Spatial Planning; Ministry of Environment, Mining and Spatial Planning. The papers about floods are very often published in 'Glasnik SGD' but in the following journals, also: 'Spatium', 'Šumarstvo', 'Voda i sanitarna tehnika'. One of them was exposed at the 12th Congress INTERPRAEVENT 2012 in the French Grenoble.

From all observed electronic articles, a small part of them analyzed hazards (21.2 %) or disasters (16.7%). The greatest number of papers, 62.1% based their investigations on the characteristic of the disasters, in order to offer the solutions concerning hazards. Regarding the winds, for example, first of all - each one had happened and then it was written about it. There is not great number of papers about winds, only 8% of analysed papers, but most often they were the subject of studies by geographers from The Faculty of Geography and GI 'Jovan Cvijić' SASA. All papers were published in 'Glasnik Srpskog geografskog društva'. Beside that, one paper was noticed which was published by the exploreres of the Faculty of Civil Engineering and Architecture in the journal 'Nauka + Praksa'. Half of the papers about winds were published at the end of the last century while the others were published during the year 2009. The last article of the wind was published 2013rd in the prestigious journal 'Nuclear Technology and Radiation Protection'.

The papers, talking about natural hazards in general, in the group of 66 of electronic visible and analyzed articles, make 12%. Following facts were common for them. Most often they were the result of multidisciplinary and multiinstitutionally cooperation where the geographers has been involved. Three quarters of them were published in renowned journals abroad, such as: 'Journal of Loss Prevention in the Process Industries', 'International Journal of Environmental Research', 'Computers, Environment and Urban Systems', 'Reporting for Sustainability' and 'Forum Geographic', or they were exposed at the conference. Two home made articles were found at the journals 'Ecologica' and 'Poslovna politika'.

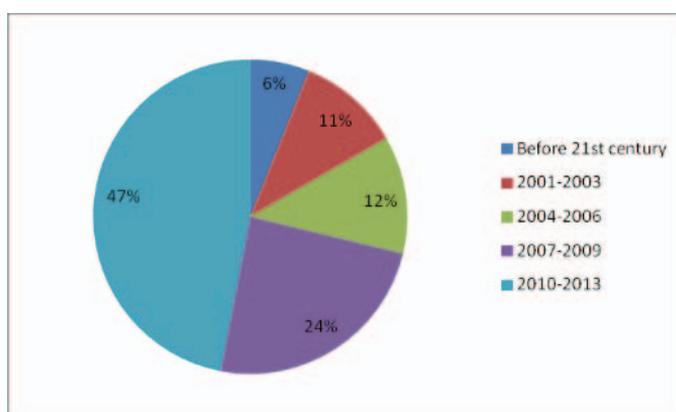


Figure 2 Share of published natural hazards or natural disasters articles, according for the year of publishing

From the beginning of the 21st century, number of papers about natural hazards in Serbia is increasing more and more (Figure 2). It speaks in favour of the fact that the scientist's attention was attracted by quick changes in nature which caused them, but more visible campaigns from abroad, also which motivate to study the natural hazards and disasters. More than 2/5 articles were published during last four years (2010-2013). From visible papers, 6% were published in the last century. It is sure that all of them are not electronically visible.

Naturally, geographic conferences in comparison with the other forms, are rarely organized, but they animate a great number of geographers. Most often they have a general character, but natural hazards and disasters are within the one section. Department for Geography, Tourism and Hotel Management organized during the year 2012 the International conference dedicated only to natural hazards under the name of: 'Natural hazards-lessons from the past, prevention and prediction'. On that occasion were exposed six foreign and about 35 scientific and professional papers, from domestic authors. Most of those papers (42.9%) referred generally to the natural hazards. Then follow the papers about hillslopes (14.3%), floods and snow (per 11.4%) and minimum papers were about volcano, earthquakes and winds (per 5.7%) or hail (only 2.9% or one paper). From all papers by domestic authors, only 17.1% were non-geographic (Weather Association of Serbia, Republic Hydrometeorological Service of Serbia, Academy for Criminology and Police Studies, School for Electrical Engineering, Faculty of Technical Sciences). On that occasion the geographers have shown their skillness and interest for hazards and natural disasters. After the conference, during the year 2013 appeared four works by the authors from Serbia in scientific journal „Acta Geografica Slovenica“, three of them had general character and one was about hail.

So, in Serbia are mostly studied earthquakes, wildfires, floods and hillslopes while the other natural hazards, characteristic for those latitudes are in the second plan, although they do not jeopardize the inhabitants less. Although, in the scientific sense, in Serbia, the geographers study natural hazards rarely, they could give great contribution to it.

#### *Geographers in practice and natural disasters*

Graduated professors of geography can 'play the significant role' in their local environment concerning the question about following the situation of natural hazards. Making notes about natural hazards and disasters, they leave to the explorers valuable written track. They have adequate education. Scientific institutions which are dealing with geography, give them the support in the sense

of consultation and improvement. Acting institutionally, for example, working at the school, but non-institutionally, also – hipotetically they can have a great influence in the way that they could transferr acquired knowledge on the environment. This influence can be of instant effect, but long one, also – depending of the fact who should be educated.

Natural hazards, for example, according to the curriculum of the Department of Geography, Tourism and Hotel Management, Faculty of Scineces at the University of Novi Sad are studied within following subjects: geology – earthquakes, hydrology – floods, climatology – droughts and hail storms. Only wildfires were not the subject of detailed discussion. The subject 'Geography of Local Environment' has the task to teach a future graduated professor of geography about its studying. For the same purpose is to make him capable to react most professionally at the time of occurence or immediately after the end of occurence of natural hazard. It is considered that skillful and well-timed monitoring can contribute to the development of scientific thoughts, if all details are precisely and thoroughly written down.

GI 'Jovan Cvijić' SASA organizes seminars 'Natural disasters and teaching geography' which are kept beside Belgrade in eleven cities of Serbia. As a part of The Program of Professional Advancement of Employees in the Sphere of Education, seminar has been accredited by the Institution for Educational Development (<http://www.gi.sanu.ac.rs/rs/aktuelno/nepogode.html>). It is the opportunity to remind and inform the persons interested in mantioned theme.

In Serbia, presently we only have a partial hazard education, but still not a proper risk education. The coverage of hazards is systematic, while the coverage of risk is random and poorly represented. General legal capacities for the inclusion of risk education (which would be an upgrade of the present hazard education) do exist, but presently the lower range legislation (Regulations on Curricula) lags behind and fails to follow the recommendations of the international conventions and national laws. Regardless of the present flaws in the curricula, the formal (compulsory) education and geography teaching is the best framework for risk education. The possible solutions do require the changes of curricula, but before the new regulations are enacted, the teachers' interventions in the teaching process must compensate the present limitations (Kovačević-Majkić, 2014).

The quantitative analysis has shown that in Serbia, the number of geography textbook pages dedicated to the issue of natural disaster is at the similar level in the most other European countries. The qualitative analysis points to the fact that

the natural disasters are mostly presented at the level of causes, rarely at the level of consequences, while the instruction on the proper steps that should be taken before, during, and after a natural disaster occurrence are missing (Ćalić et al, 2012, 18).

In the process of prevention of natural disasters, it is important to strengthen the awareness of teachers and children they are a very important link in the transmission of information. It is necessary to include contents with instructions about adequate way of reactions during crisis situations into the formal education, but not to remain only on the level of individual positive examples (Panić et al, 2013).

Professionally presented informations about natural hazards during teaching process may have multifunctional importance. Upon ending of schooling the pupils are potential personnel who may be found in legislative and executive bodies of local, regional, governmental institutions (for example, City planning bureau, construction companies, waterpower engineering companies, city, municipal or republic assembly etc.) that bring decisions about development and transformation of certain local environment (Hyndman & Hyndman, 2010).

Examples from the world have shown that the institutions at the local level adjust to often natural hazards (Agrawal, 2010). It is not the often situation in Serbia. Geographer can be the initiator for education about natural hazards and natural disasters. He can do it institutionally, if he is in the position to have certain influence, for example to organize workshops on such theme. But, it should not be excluded out -institutional activity. There is a number of examples of selforganized groups of citizens with the aim to achieve certain goals. For example, each geographer in local community where he lives, can gather some people from the neighbourhood, friends, like-minded persons with a modest advertising or recommendation 'from moth to mouth' and for the purpose of 'high goals' share his knowledge with them. It is not a rare case that financial support was asked from some governmental or European fund. It is well-known that the absence of geographers or good experts for the environment brought very often damage in organizing and planning of space.

#### *Originality value*

Geographers' opinion about natural hazards and disasters are gathered by polls, statistically precessed are shown in the following text. The questions have been sent by e-mail to the address of 308 geographers of which only 122 geographers replied (39.6%). Some authors believe that the estimations from applied statistic methods will be good only if the sample contains minimum 51 unit (Bagozzi,

1981). Taking into consideration above stated it may be concluded that the sample used in this investigation (N=122) is representative. Most of examinees were younger than the age of 35 years (55.7%), mostly females (63.9%) and employed in education system (52.5%) (Table 1). Ten questions have been asked (hereinafter: hypothesis), of which five refers to the opinions of examinees concerning the business they are dealing with and natural hazards. Another five questions investigate the connection concerning certain natural hazard. Only natural hazards were offered to the examinees, those which most often happen on the geographic coordinates where they live.

Table 1 Sample of respondents (Number of responses: 122, in %)

Gender		Age			Work engagement				
Male	Female	<35	35-60	>60	Education	Tourism	Policy	Other	Unemployment
36.1	63.9	55.7	42.6	1.6	52.5	8.2	3.3	27.9	8.2

Source: Survey research

Average value, respectively average grades of hypothesis are in range from 3.30 (the lowest value) to 4.36 (the highest value). The highest average grades have the hypothesis 'The catastrophe may be lessened if a man is prepared for it or he had been thinking about it' and 'I understand the role which geographers may 'play' in prevention from natural hazards and disasters' (Figure 3). High average grade of the secondly mentioned hypothesis was expected, having in mind that the sample was made only by graduated professors of geography, so the academic citizens. The lowest values of hypothesis are found at 'I have already used my position to point out possible natural hazards in the environment' and 'It often occurred to me to apply the idea about prevention of protection from natural hazards within my job which I am dealing with'. Therefore, the geographers admit that it may be given bigger contribution to the prevention of protection of natural hazards.

For the most of mentioned hypothesis the standard deviation is less than 1 or it is a little bit over ( $\sigma = 1.05$ ) as it was the case of hypothesis 'It often occurred to me to apply the idea about prevention of protection from natural hazards within my job which I am dealing with' and 'it often 'struck in my mind' to do it' which shows that the examinees mostly agree with evaluation of these hypothesis. Hypothesis with the highest value of standard deviation ( $\sigma = 1.26$ ) is 'I have already used my position to point out possible natural hazards in the environment'. Separation of this hypothesis has been expected, because the answer is more precise. The examinees used their position or not.

## Prevention and Education in Natural Disasters

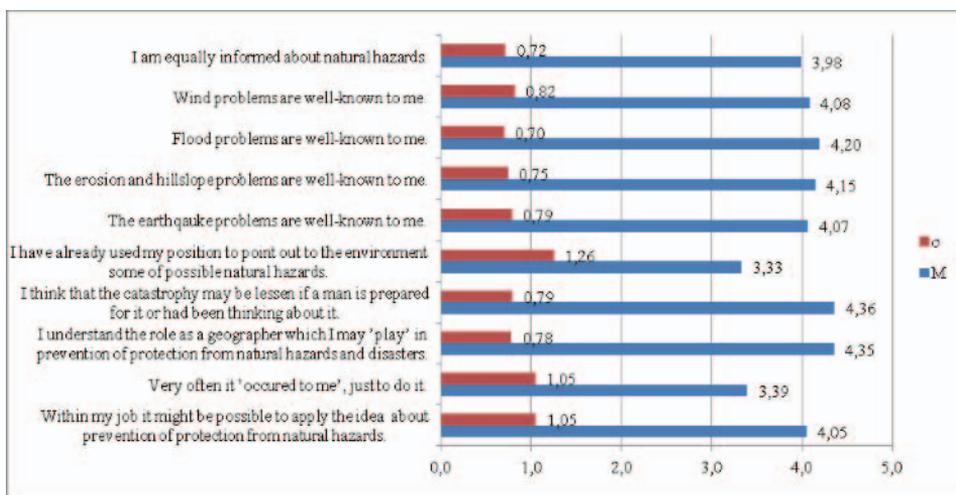


Figure 3 Descriptive statistics for individual hypothesis (M – average value,  $\sigma$  – standard deviation). Source: Survey research

One among goals of investigation was to establish if the age of geographers had influence to their thoughts about natural hazards and disasters. The examinees were divided into three age group: the oldest (above 60 years) which should be the geographers at the end of their carriere or retired geographers; middle age (35-60 years) where there were educated geographers before mass usage of internet and the youngest one (from graduation till 35) or so called 'internet generation'. Taking into consideration that only 1.6% of examinees of the age 'above 60 years' responded on polls and that more than half (55.7%) were in group 'up to the age of 35', during the work was decided that the group of the oldest examinees should join the group of '35-60' therefore it will be renamed into the group 'older than 35'.

For estimation whether the years of geographers influenced to their thinings about natural hazards and disasters, t-test was applied for independent samples by which were compared two average groups. As hypotetically, it was not possible to assume the result of comparison, 2 tailed test was used. The results of t-test do not show statistically significant differences between average determinants in relation to the age of examinees at the importance level  $p < 0.01$  ( $t \geq 2.57$ ) (Pearson & Hartley, 1966). According to that, it may be concluded that the geographers 'up to the age of 35' and 'older than 35' share the same opinion regarding knowledge about certain natural hazard (Table 2).

Table 2 Differences concerning geographers’ perception of natural hazards and disasters based on the age (M-average value,  $\sigma$ –standard deviation, t-value, p-importance level ( $p < 0.01$ ), (‘up to the age of 35’ or ‘<35’, ‘older than 35’ or ‘>35’)).

Hypothesis	Year	M	$\Sigma$	t (122)	P
Within my job it might be possible to apply the idea about prevention of protection from natural hazards.	<35	4.057	1.1532	0.090	0.928
	>35	4.037	0.889		
Very often it ‘occured to me’, just to do it.	<35	3.382	1.037	0.165	0.869
	>35	3.407	1.073		
I understand the role as a geographer which I may ‘play’ in prevention of protection from natural hazards and disasters.	<35	4.353	0.768	0.131	0.896
	>35	4.351	0.805		
I think that the catastrophe may be lessen if a man is prepared for it or had been thinking about it.	<35	4.324	0.871	0.141	0.888
	>35	4.407	0.687		
I have already used my position to point out to the environment some of possible natural hazards.	<35	3.265	1.323	0.712	0.478
	>35	3.407	1.174		
The earthquake problems are well-known to me.	<35	4.088	0.859	0.227	0.821
	>35	4.037	0.699		
The erosion and hillslope problems are well-known to me.	<35	4.118	0.873	1.028	0.306
	>35	4.185	0.552		
Flood problems are well-known to me.	<35	4.235	0.775	0.269	0.788
	>35	4.148	0.596		
Wind problems are well-known to me.	<35	4.118	0.873	0.230	0.819
	>35	4.037	0.751		
I am equally informed about natural hazards.	<35	4.029	0.712	0.768	0.444
	>35	3.925	0.723		

Source: Survey research

For establishing the existence of statistically important connection between dependent variable (hypothesis made from the attitudes about natural hazards and knowledge about problems concerning certain natural hazard) and independent variable (one sociodemographic characteristic of examinees, in this case it is the work place of graduated professor of geography) it was applied one-factor analysis of ANOVA variance.

The results of one-factory analysis of ANOVA variance based on the work place of graduated professor of geography show that at the importance level of  $p < 0.05$  and  $p < 0.01$  there are statistically significant differences in evaluation of hypothesis concerning ‘implementation, within a job that examinees are dealing with, the idea about protection from natural hazards’ and concerning the ‘understanding of the role which the geographers may ‘play’ in prevention of protection from natural hazards and disasters’ (Table 3).

Prevention and Education in Natural Disasters

Table 3 One-factor analysis of differences between geographers based on their work place (M-average value,  $\sigma$ –standard deviation, for F (4,117), critic values according to Snedecor & Cochran table (1980),  $p < 0.01$ ;  $F \geq 3.47$ ;  $p < 0.05$ ;  $F \geq 2.44$ )

Hypothesis	Working engagements	M	$\sigma$	F	p
Within my job it might be possible to apply the idea about prevention of protection from natural hazards.	Education	4.312	0.889	4.2309	0.0031
	Tourism	3.200	0.789		
	Policy	4.000	1.155		
	Other	3.706	1.292		
	Unemployed	4.400	0.516		
Very often it 'occured to me', just to do it.	Education	3.500	1.069	0.6018	0.6621
	Tourism	3.200	1.229		
	Policy	3.500	1.732		
	Other	3.176	0.968		
	Unemployed	3.400	0.843		
I understand the role as a geographer which I may 'play' in prevention of protection from natural hazards and disasters.	Education	4.375	0.701	4.8001	0.0013
	Tourism	3.400	1.430		
	Policy	4.500	0.577		
	Other	4.353	0.691		
	Unemployed	4.800	0.422		
I think that the catastrophe may be lessen if a man is prepared for it or had been thinking about it.	Education	4.281	0.881	0.7164	0.5824
	Tourism	4.400	0.843		
	Policy	4.500	0.577		
	Other	4.471	0.615		
	Unemployed	4.000	1.333		
I have already used my position to point out to the environment some of possible natural hazards.	Education	3.469	1.208	1.1827	0.3221
	Tourism	2.800	1.549		
	Policy	4.000	1.155		
	Other	3.118	1.343		
	Unemployed	3.400	0.843		
The earthquake problems are well-known to me.	Education	3.938	0.974	1.3781	0.2458
	Tourism	4.400	0.516		
	Policy	4.000	0.000		
	Other	4.118	0.478		
	Unemployed	4.400	0.516		
The erosion and hillslope problems are well-known to me.	Education	4.062	0.906	0.6557	0.6240
	Tourism	4.200	0.789		
	Policy	4.000	0.000		
	Other	4.235	0.431		
	Unemployed	4.400	0.516		
Flood problems are well-known to me.	Education	4.109	0.819	0.6998	0.5936
	Tourism	4.200	0.789		
	Policy	4.000	0.000		
	Other	4.294	0.462		
	Unemployed	4.400	0.516		
Wind problems are well-known to me.	Education	4.125	0.864	2.4103	0.0531
	Tourism	4.200	0.789		
	Policy	3.000	1.155		

I am equally informed about natural hazards.	Other	4.000	0.696	0.9254	0.4518
	Unemployed	4.400	0.516		
	Education	4.031	0.689		
	Tourism	4.000	1.155		
	Policy	3.500	0.577		
	Other	3.882	0.591		
	Unemployed	4.200	0.789		

Source: Survey research

In order to identify the geographers’ activity which influenced on existing difference in one-factor analysis, respectively, among which work places of the examinees exist concrete differences, it was applied post-hoc Tukey HSD test. It has shown that concerning the question about ‘implementation of idea for prevention from natural hazards within the job the examinees are dealing with’ and concerning the question about ‘understanding of the role I can ‘play’ as a geographer in prevention from natural hazards and disasters’ there is significant statistic difference between those employed in tourism and other working engagements (Table 4).

Table 4 Post-hoc Tukey HSD test (MSE – mean square error, q–relevant critical value of the studentized range statistic, n–number of scores used in calculating the group means of interest, according to the table from <http://www.stat.duke.edu/courses/Spring98/sta110c/qtable.html>,  $\alpha > 0.05$ , sign not important)

Tukey HSD	$HSD = q \cdot \sqrt{\frac{MSE}{n}}$	Within my job it might be possible to apply the idea about prevention of protection from natural hazards.	I understand the role as a geographer which I may ‘play’ in prevention of protection from natural hazards and disasters.
q (from the table)		3.92, $\alpha > 0.05$	
MSE		0.998	0.579
N		24.4	
HSD		0.79278	0.60385
Differences in mean values			
Education	Tourism	1.11	0.98
Education	Policy	0.31	0.12
Education	Other	0.60	0.03
Education	Unemployed	-0.09	0.42
Tourism	Policy	-0.80	1.10
Tourism	Other	-0.51	0.95
Tourism	Unemployed	-1.20	1.40
Policy	Other	0.29	0.15
Policy	Unemployed	-0.40	0.30
Other	Unemployed	-0.69	0.45

Source: Survey research

### *Practical implication*

How the graduated professors of geography may help to the scientists geographers? Simply. At any territory of Serbia, in the network of educational institutions, surely, but hypotetically also, within the other institutions or out-of-institutions there is a geographer who can be the closest to the place where natural disasters are happening. As competent enough, he can leave the written tracks by observing and writting the facts which may be the precios for geographers who are engaged in science. Especially if it is the process that changes quickly the appearance of topographic surface from the time needed for the scientists to reach it. Beside that, by polling of the inhabitants could be achieved additional informations or checked the existing ones.

Hereinafter will be given a few examples. If the landslide appears on the terrain, local inhabitants might knew how long it lasted, if it caused them some problems, who was engaged to reclaim the landslide, have they found the connection, for example, the quantity of separated water residue and intensity of lansliding etc.

Similarly, after hilslope process, only local inhabitants may help to be identified the beginning and the end of landslide. According to these informations can be measured the size of the landslide. It is also necessary to find out if there were visible tracks on topographic surface before landsliding started, size of their dimensions, when they have appeared, how long they were existed and similar.

After the earthquake, only local inhabitants know exactly in which part of the area were left the most negative effetcs. Were there visible tracks of land movement on topographic surface.

Natural hazards, such as flood, can be described in local newspapers. However, it is not necessary to be written by a geographer. Then, only local inhabitants may say: When the flood followed? What was the limit of the water? How long it stayed there? How long it was withdrawing? What was jeopardized? If it was reclaimed, by which mode it was done? If there were similar situations recently? Etc.

### **Conclusion**

The geographers from Serbia who are engaged in science so far did not study the natural hazards and disasters very often. From about sixty the most visible papers, most of them were published during the last four years (2010 – 2013,

47.0%), one fourth (27.3%) make the papers about the earthquake. Geographers were the authors of 20 or only 30.3%.

The geographers who are not engaged in science, agreed within a job they are dealing with, that the idea about prevention from natural hazards can be applied, but they are not sure how often 'it struck their mind' to do it. They understand the role they may 'play' as a geographer, in prevention of protection from natural hazards and disasters and they agree with the fact that the catastrophe can be lessen if a man was prepared or had been thinking about it. However, they are not sure if they have ever used their position to present in the environment some of possible natural hazards. They believe that the problems of natural hazards are well-known to them, among which floods are the 'closest'. T-test has shown that there is no significant statistic difference in thoughts of those geographers who are less than 35 years old from the older ones. But the one-factor analysis of ANOVA variance proved that they exist among geographers who are engaged in different jobs. Post-hoc Tukey HSD test has helped to be discovered the fact that thoughts of geographers who are engaged in tourism differed from the others. It is clear that natural hazards and disasters are serious obstacle for tourism as economic activity.

A geographer is very important factor in studying of natural hazards. In each local environment, hypothetically, exists at least one (for example professor of geography in the elementary school) or even more persons who are geographers. Professor at school has the possibility to introduce a number of generations within the educational plan and program with the characteristics of various natural hazards. Well educated generation, who hypothetically, may become the important social factor in future, may adequately react in case of natural hazards. Geographers' knowledge is very useful in various institutions which are the public service. When the natural hazard happens, a geographer in certain environment is in the position to visit the jeopardized territory and estimate different types according to his observation and to leave written track according to questionnaire made among the local inhabitants who survived the natural disaster. All of it may help the explorer a lot. It is not enough to point out the importance of a geographer's presence whether in developing the strategy for defence from natural hazards or after the performance of certain natural disaster. The most important thing is to raise the self-consciousness about this significance, in order to start with applying the action of the geographers in certain local environment with the first following difficulty.

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### References

- Agrawal, A. (2010). Local institutions and adaptation to climate change. *Social Dimensions of Climate Change: Equity and Vulnerability in a Warming World*. World Bank: 173-198. Washington DC
- Arnell, W. N. (1996). *Global warming, river flows and water resources*. John Wiley & Sons Ltd.
- Bagozzi, R. P. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error: A Comment. *Journal of Marketing Research*, 18: 380
- Benac, Č. & Knežević, R. (2012). Utjecaj geološkoga hazarda na razvoj turizma na području Kvarnera (sjeveroistočni Jadran). *Hrvatski geografski glasnik*, 73, 2: 35-47
- Blaikie, P., Cannon, T., Davis, I. & Wisner, B. (1994). *At risk. Natural hazards, people's vulnerability and disasters*. Routledge, London
- Kovačević-Majkić, J., Milošević, M., Panić, M., Miljanović, D. & Čalić, J. (2014). Risk education in Serbia, *Acta geographica Slovenica*, 54-3, DOI: 10.3986/AGS54305
- Liverman, D. (1994). Modeling social systems and their interaction with the environment: a view from geography. In: Groffman P, Likens G (eds) *Integrated regional models*. Chapman & Hall: 67-78, New York
- Marković, J. (1956). *Katastrofe u prirodi, Nauka i život*, Beograd: Narodna knjiga.
- Meinshausen, M., Meinshausen, N., Hare, W., Raper, C.B. S., Frieler, K., Knutti, R., Frame, J. D. & Allen, R. M. (2009). Greenhouse-gas emission targets for limiting global warming to 2 C. *Nature* 458, no. 7242: 1158-1162.
- McGuire, B. (2005). *Global Catastrophes: A Very Short Introduction*. Oxford University Press. Oxford-New York: 132.
- McCarthy, M. P., Best, J. M., Richard A. & Betts, A. R. (2010). Climate change in cities due to global warming and urban effects. *Geophysical Research Letters* 37, no. 9.
- Panić, M., Kovačević-Majkić, J., Miljanović, D. & Miletić, R. (2013). Importance of natural disaster education-case study of the earthquake near the city of Kraljevo: First results. *Journal of the Geographical Institute Jovan Cvijic, SASA*: 75-88.
- Parnes, C. & Yohe, G. (2003). A globally coherent fingerprint of climate change impacts across natural systems. *Nature* 421, no. 6918: 37-42.
- Pearson, E. S. & Hartley, H. O. (ed.) (1966). *Biometrika Tables for Statisticians*, Vol 1: 146, third edition.

International Conference “Natural Hazards – Links between Science and Practice”

- Smith, K. (2013). *Environmental hazards: assessing risk and reducing disaster*. Routledge, 2013.
- Snedecor, G. W. & Cochran, W. G. (1980). *Statistical Methods*. Iowa State University Press, Ames, Iowa
- Fuchs, S., Kuhlicke, C. & Meyer, V. (2011). Editorial for the special issue: vulnerability to natural hazards—the challenge of integration. *Natural Hazards* 58, no. 2: 609-619.
- Hewitt, K. & Burton, I. (1971). *The hazardousness of a place: a regional ecology of damaging events*. University of Toronto Press, Toronto
- Hyndman, W. D. & Hyndman, W. D. (2010). *Natural hazards and disasters*. CengageBrain. com.
- Cutter, S. (1993). *Living with risk*. Edward Arnold, London
- Ćalić, J., Milivojević, M. & Milošević, M. (2012). *Natural Disasters in the Serbian Education System, Natural Hazards, Lessons from the past, prevention and prediction, International conference, Abstract book, UNS, FS, DGTH, Novi Sad, 18.*
- Watts, M. & Bohle, H. G. (1993). The space of vulnerability: the causal structure of hunger and famine. *Progress in Human Geography* 17:43–67
- Whitmarsh, L. (2009). What's in a name? Commonalities and differences in public understanding of “climate change” and “global warming”. *Public understanding of science* 18, no. 4: 401-420.
- Wisner, B. (Ed.). (2004). *At risk: natural hazards, people's vulnerability and disasters*. Psychology Press
- <http://www.gi.sanu.ac.rs/rs/aktuelno/nepogode.html>
- <http://www.stat.duke.edu/courses/Spring98/sta110c/qtable.html>
- <http://www.seeriskproject.eu/seerisk/#main>
- <http://www.geo.u-szeged.hu/meriexwa/?q=en/intro>