

IMPACT OF CLIMATE CHANGES ON THE DISASTER RISK REDUCTION SYSTEM IN THE REPUBLIC OF SERBIA

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Abstract: Climate change represents those climate changes that are directly or indirectly attributed to human activities, that change the composition of the atmosphere and that are recorded over a long period of time, and are the main causes of disasters that affect an increasing number of people, the environment and material goods. A disaster is a natural calamity or a technical-technological accident, the consequences of which threaten the safety, life and health of a large number of people, material and cultural goods or the environment on a larger scale, and the occurrence or consequences of which cannot be prevented or eliminated by the regular action of competent authorities and services. The goal of this paper is the current and future danger of climate change, the natural disasters they cause, as well as the presentation of the most important prevention measures and activities aimed at strengthening the state's resistance to various forms of security threats caused by climate change. In the conclusion, an overview is given of the problems caused by climate change and the basic prevention measures against natural disasters caused by climate change.

Key words: climate change, disasters, prevention measures

1. INTRODUCTION

As in the rest of the world, climate changes have been observed in Serbia during the past decades, primarily in terms of temperatures and precipitation. We have witnessed that during the past years, Serbia has faced numerous disasters that have led to significant human casualties and enormous material damage, where emergency situations undermine the safety and survival of entire cities. Natural disasters claim many human lives every day and destroy and degrade the environment in various ways, causing great material damage and losses. Climate change in Serbia manifests itself through increasingly frequent occurrences of natural disasters that cause natural disasters and that have negative consequences for hydrology and water resources, forestry, agriculture, biodiversity, but also for people's lives and health. A

natural disaster is an elemental calamity whose consequences threaten the safety, life and health of a large number of people, material and cultural goods or the environment on a larger scale, and whose occurrence or consequences cannot be prevented or eliminated by the regular action of competent authorities and services.

The general goals that the social community strives for are ensuring the survival of man and increasing his well-being. Therefore, the priority is the ability to respond in a timely manner. The risk of disasters exists in every society, because disasters slow down the sustainable development of society as a whole, and their occurrence in one region can cause damage in another region and vice versa. Disasters are a challenge that shows when, how much and in what way society is ready to react. Disasters can be avoided. There are ways to reduce risks and limit the consequences of disasters, as well as to increase society's resilience to disasters. System vulnerability assessment and risk assessment, with the use of adequate methodology, provides insight into system vulnerability, risks and potential threats, and based on which adequate preventive measures will be taken to protect and save people, material goods and the environment. In this way, preventive action is ensured in situations caused by natural disasters or remediation of their consequences to the greatest extent possible.

2. CLIMATE CHANGES

In order to understand what climate change is and the extent of the impact of climate change on natural disasters, it is first necessary to define them, and then to explain in detail the cause of their occurrence. Climate change represents those climate changes that are directly or indirectly attributed to human activities, that change the composition of the atmosphere and that are recorded over a long period of time, and are the main causes of disasters that affect an increasing number of people, the environment and material goods. CO₂ or carbon dioxide is at the heart of the climate change story. It is a gas consisting of three atoms - one carbon atom and two oxygen atoms. Carbon dioxide is naturally released into our atmosphere. Humans and most animals breathe in oxygen and breathe out carbon dioxide. Plants use carbon dioxide to feed themselves in the process of photosynthesis. Carbon dioxide is also useful in regulating the Earth's temperature due to the retention of part of the sun's heat within the atmosphere. Without it, the planet would be too cold for life. However, human activity increases the concentration of carbon dioxide in the atmosphere, due to which an excessive amount of solar heat is retained in the atmosphere and the Earth becomes warmer. Additional carbon dioxide in the atmosphere is created by the burning of fossil fuels - coal, oil and gas, and their irrational use. This is a phenomenon known as the "greenhouse effect". In order to sustain life on Earth as we know it, we need to reduce the amount of carbon dioxide that is released. The existing measuring stations in several locations monitored the multi-decade trend (1961-2017) of temperatures in the territory of Serbia, where the trend of temperature growth of 0.36°C per decade was recorded, while only in the period 1981-2017, the trend of temperature increase was 0.6°C per decade. Based on this information, it is evident that the average annual temperature increase trend in Serbia is higher than the global average temperature trend. Furthermore, a trend was observed to increase the duration of heat waves (a heat wave is a period of at least 6 days during which the maximum daily temperature is higher than the expected maximum temperature for the time of year in which it is observed) by 4 days per decade, while at the same time there was a decrease in the number frost days (when the minimum temperature is below 0°C) and icy days (when the maximum temperature is below 0°C), by 2 and 1 day less per decade. On the other hand, although no significant changes in precipitation have been recorded, it should be emphasized that the Republic of Serbia faced serious droughts and floods during the last decades, which damaged the agricultural sector, infrastructure, housing and other buildings. With the help of climate models, climatologists have predicted the movement of the climate in the Republic of Serbia in the following three

thirty-year periods: 2011-2040, 2041-2070, 2071-2100. For the period 2011-2040, the average temperature is expected to rise in the range between 0.5 and 0.9°C. In the period 2041-2070, temperatures will be higher by 1.8-2.2°C, while by the end of the century, the temperature is expected to rise by more than three degrees: 3.6-4.0°C. Warming will be most pronounced in the summer season, when temperatures will exceed the threshold of 4.0°C compared to the base period (1961-1990). On all rivers in the Republic of Serbia, the water level has decreased, which will lead to consequences in terms of water quality and water supply. The cause of this recorded decrease is the decrease in the amount of precipitation in Serbia and its surroundings. There will be a reduction in the available amounts of water, especially in the summer months when it is most needed, which will create additional pressure on the water supply. The most affected will be the individual rural water supply, which is more vulnerable to the impact of climate change than the urban/public water supply, due to the lack of expertise, infrastructure and financial resources. In addition to water supply, water quality will also come under pressure: due to reduced amounts of water in watercourses, the concentration of harmful pollutants will increase in a situation where the level is low. The other side of the impact of climate change on the water system is intense rains in short time intervals that can cause floods. As much as 18% of the territory of Serbia is located on the banks of rivers and is particularly susceptible to floods, which cause great economic losses. Namely, it is considered that the economic losses from the May floods in 2014 were 1.4 billion dollars. In the future, due to climate change, more intense precipitation is predicted in the territory of Serbia, more frequent occurrences of large waters on rivers, and thus greater chances of floods (Kalkan Danko, 2021).

Climate changes and its negative consequences simply force us to react preventively and to protect ourselves. Given that disasters cause great material damage and, in addition to destroying the environment, they pose a great risk to people's lives and health. People, instead of implementing the measures that were agreed back in 2015 at the Third World Conference on Disaster Risk Reduction in Sendai, Japan, are adopting legal frameworks, successfully legislating the area of disaster risk reduction caused by climate changes, however, what is most important, what is missing is the practical application of the enacted legal frameworks. Man does not seem to notice what is happening around him, as if he does not see the exponential deterioration of the climate and in most cases does not care about the living environment, unaware of the risk to his own health and life.

3. NATURAL DISASTERS CAUSED BY CLIMATE CHANGES

In the entire historical development, all social and state communities expressed a constant need to ensure the greatest possible safety and security of their citizens and vital social systems. In an effort to achieve this and ensure well-being, the activities they undertook, sometimes accidentally, and sometimes intentionally, led people to great pollution of the environment. In response to this behavior, climate changes occur, which further lead to natural disasters and cause natural disasters. The greenhouse effect is one of the most well-known causes of climate change, for which man himself is to blame. The greenhouse effect implies the warming of the Earth due to the retention of carbon dioxide in the atmosphere, which originates from the burning of fossil fuels. As the world crisis caused by the war between Russia and Ukraine led to a deficit and an increase in the price of oil, gas and coal on the world market, deforestation increased. Forests absorb carbon dioxide, which is necessary for plant photosynthesis, and by reducing the area under forests, the amount of absorbed carbon dioxide also decreases, which contributes to the greenhouse effect and global warming. Apparently, due to the previously mentioned war between Russia and Ukraine, the importance of preserving and protecting the environment is once again being forgotten. Due to the gas deficit on the market, most countries, in fear of the upcoming winter and due to the deficit of heating energy, reactivate coal-fired

thermal power plants and prepare them for the upcoming winter. Also, a large number of households that were heated with gas will be forced to switch to heating with solid fuels, which will greatly increase the concentration of carbon dioxide, contribute to an even greater extent to the greenhouse effect, greatly reduce air quality and thus impair human health, as well as the environment.

From all of the above, it can be seen that we are yet to face a time of uncertainty and great challenges in confronting natural disasters caused by natural disasters due to significant climate changes. We are reminded of this by the unprecedented floods that occurred in May 2014, and then by the intense rainfall in September of the same year, which led to the occurrence of landslides in the Bor district. Every year in the summer period, we have more and more frequent occurrences of hail and torrential rivers that cause great material damage of a local nature. Natural disasters take a heavy toll and affect the well-being and security of the people, communities and countries affected by them. Disasters, most of which are exacerbated by climate change and are increasing in frequency and intensity, greatly hinder progress towards sustainable development. Recurring small-scale and gradual disasters especially affect communities, households and small and medium-sized enterprises, and account for a high percentage of total losses. All countries – especially developing countries, where mortality and losses from disasters are disproportionately higher – face increasing potential hidden costs and challenges in meeting their financial and other obligations. While some progress has been made in building resilience and reducing loss and damage, more substantial disaster risk reduction requires perseverance and persistence, with a clearer focus on people and their health and livelihoods.

4. LEGAL FRAMEWORK FOR DISASTER RISK REDUCTION

The problem of major climate changes, the disasters that these changes cause and the challenges, risks and threats they bring has been present in human consciousness for many years. It is no longer necessary to look at statistical data from years ago and understand from them that the climate is changing. Climate changes are clear, evident, noticeable and happen almost every day. It is not difficult to notice that the maximum daily temperatures have increased, that it has become normal for the temperature to be 40°C in summer, that summers last longer, that winters are milder and almost without snow, that precipitation is less, and that natural disasters that affect humans and animals the middle more and more. Every year, the city causes a lot of material damage, which is a big blow to agriculture, which makes up a large part of the gross domestic product. Therefore, there is a need to adopt a strong regulatory legal framework for disaster risk reduction. In the last few years, the Republic of Serbia has made progress in strengthening the legal and regulatory framework for emergency response and risk reduction. The key indicators of the development so far are the adoption of the following regulations: the Law on Emergency Situations from 2009, the Law on Amendments to the Law on Emergency Situations for the Integration of the Concept of Risk Reduction from 2011 and the National Strategy for Protection and Rescue in Emergency Situations from 2011, with an emphasis on disaster risk reduction (Babic and Komazec, 2017).

The Constitution of the Republic of Serbia, as the highest legal act in the Republic of Serbia, in Article 24. guarantees every citizen the right to life, in Article 74. the right to a healthy environment, the right to its protection, the right to be informed about its condition, while in Article 97. it regulates the defense and security of the Republic of Serbia and its citizens and measures in the event of a state of emergency (Official Gazette of the Republic of Serbia, No. 98/2006 and 115/2021).

The national security strategy is the highest strategic document that determines the national interests and the bases of the security policy in the protection of the national interests of the

Republic of Croatia. of Serbia, identify challenges, risks and security threats; determine the goals, basic principles and elements of the national security policy and define the structure, principles of functioning and responsibilities within the security system, as well as the basic goals in preserving the environment and resources of the Republic of Serbia (Official Gazette of the Republic of Serbia, No. 94/2019).

The Act on Emergency Situations regulates the action, declaration and management of emergency situations, the system of protection and rescue of people, material and cultural assets and the environment from natural disasters, technical-technological accidents-accidents and disasters, the competences of state bodies, autonomous provinces, local self-government units and the participation of the police and the Serbian Army in protection and rescue, the rights and duties of citizens, companies, other legal entities and entrepreneurs in connection with emergency situations, the organization and activity of civil protection in the protection, rescue and elimination of the consequences of natural disasters and other accidents (Official Gazette R. of Serbia, number 111/2009, 92/2011 and 93/2012).

The national strategy for protection and rescue in emergency situations aims to protect the life, health and property of citizens, the environment and the cultural heritage of the Republic of Serbia. The basis for the adoption of the National Protection and Rescue Strategy is the Law on Emergency Situations. The national strategy defines national coordination mechanisms and program guidelines for reducing disasters caused by natural phenomena and the risk of accidents, protection, response and remediation of the consequences (Official Gazette of RS, No. 86/2011 of 18.11.2011).

After the Third World Conference on Disaster Risk Reduction in Sendai, Japan, held in March 2015, the Republic of Serbia is passing more legal acts that regulate the field of disaster risk reduction. The fact that disaster risk reduction and emergency management is a national and local priority is also evidenced by the fact that in 2018 the Law on Disaster Risk Reduction and Emergency Management came into force (Official Gazette of the RS, No. 87/2018-3). According to Article 15 of the aforementioned law, the preparation of a disaster risk assessment and a protection and rescue plan became a legal obligation for the Republic of Serbia, Autonomous Provinces, local self-government units, facilities of special importance, all economic companies, health institutions except for pharmacies, as well as preschool and school institutions, faculties, for all facilities where children stay, that is, where classes take place. The consequences of disasters can be significantly reduced if there is a preventive response, which is achieved by creating disaster risk assessments and protection and rescue plans. Risk assessment, as an integral part of vulnerability assessment, is the basis for further development of preparedness, response and recovery plans. In this sense, it is very important to do the risk assessment in the best possible way with respect for realistic assumptions, respect for existing data, but also with the use of innovation. The risk assessment is prepared and adopted by legal entities that manage business, trade, sports, catering and accommodation facilities and leisure facilities with a capacity of more than 100 people, and if the facilities are intended for the stay of children up to 14 years of age, regardless of capacity. The disaster risk assessment and the protection and rescue plan are extremely important, because they train us how to defend ourselves in the event of an emergency situation at all levels, from individuals to legal entities to local self-governments (Official Gazette of RS, no. 80/2019).

Although the legal and regulatory framework for disaster risk reduction is good, it is still necessary to review existing practices, introduce new approaches and thereby improve the current way of working on disaster risk reduction (Ivanis, Babic & Komazec, 2016).

5. PREVENTION IN THE MANAGEMENT OF NATURAL DISASTERS IN THE REPUBLIC OF SERBIA

In order for society to prepare for the response to certain dangers that inevitably threaten from day to day, it is necessary to understand those dangers and assess the risk of them. In order to assess the risk, it is necessary to consider a large number of factors related to the dangers that threaten. Reducing the risk of natural disasters is a worthwhile investment in preventing future losses, which is achieved by taking preventive measures to reduce the possibility of natural disasters or, if they have already occurred, by taking measures and activities to rehabilitate their consequences. Prevention includes a set of measures and activities for mitigating existing risks as well as reducing the risk of new consequences of disasters. It is of crucial importance and very necessary to predict, plan and reduce the risk of disasters, in order to protect people, the environment and material assets in a more effective way and thus strengthen their resistance to disasters. Prevention in the management of natural disasters in the Republic of Serbia is achieved by creating disaster risk assessments and protection and rescue plans. The primary goal of disaster risk assessment and protection and rescue plans is to strive to build, support and improve the ability to act preventively on risks and hazards, as well as to mitigate the consequences of various disasters that any society and country can be affected by. The assessment consolidates existing resources on protection and rescue and response to natural disasters. By creating a disaster risk assessment and protection and rescue plans, the organization is improved, human capacities and equipment supply are strengthened, thereby increasing the level of safety and reducing the number of victims, as well as material damage.

In order to reduce disaster risk, according to the Sendai Framework, there is a need to tackle existing challenges and prepare for future challenges by focusing on: monitoring, assessing and understanding risks, sharing information about and how risks occur; strengthening the management system for disaster risk management and coordination among relevant institutions and sectors, and the full and meaningful participation of relevant stakeholders at appropriate levels; investing in the economic, social, health, cultural and educational resilience of people, communities and countries, and in environmental protection, also through technology and research, improving the system for early warning of multiple hazards, preparedness, response, restoration, rehabilitation and reconstruction. In order to complement national activities and capacities, there is a need to improve international cooperation between developed and developing countries, and between signatory states and international organizations. It is of crucial importance in the post-disaster reconstruction, rehabilitation and reconstruction phase to prevent the creation of disaster risks and to reduce them through "establishing a better system than the one before the disaster" and through increased education and increasing public awareness of disaster risks, which also is the essence of the natural disaster management process (United Nations Office for Disaster Risk Reduction (UNDRR), 2015).

The preventive policy in the Republic of Serbia is very poorly developed. Instead of taking measures to eliminate the cause of the problem and adhering to the popular proverb "prevention is better than cure", people, most often out of negligence, leave the situation to chance and only after the disaster occurs do they wonder why something was not done before the disaster happened. In order to realize the prevention and management of natural disasters, we must go back to the beginning. The most important thing is reducing the concentration of carbon dioxide from the atmosphere. Let's take the example of the French city of Grenoble.

Grenoble is the second most densely populated city in France and in 2022 it was declared the Green Capital of Europe. This city, which has more than one hundred thousand inhabitants, has shown how to protect the environment in the best way in an urban environment with the

help of innovative and long-term projects. Grenoble has established an urban policy to mitigate pollution and biodiversity loss by limiting vehicle speeds throughout the city to thirty kilometers per hour, making it the largest low-emission traffic zone in France. The city also reduced greenhouse gas emissions by 25% from 2005 to 2016 and is working on a 50% reduction by 2030. Among other things, Grenoble promoted cycling and encouraged the opening of private gardens, the vertical greening of buildings and the planting of trees. By the way, public transport uses biogas for power, which is obtained by purifying water, that is, sewage sludge, and besides buses, trams are the most common form of public transport, but bicycles are the favorite vehicle of Grenoble residents. In addition, the number of electric cars is growing, but still on average one citizen drives in a car, so the goal is actually to reduce the total number of vehicles in the city, that is, to have as many people as possible use public transport and bicycles. By the end of 2022, electricity in public buildings will be obtained 100% from renewable sources, i.e. without fossil fuel. About 80% of thermal energy for central heating, for about 40,000 households, is obtained from renewable sources. Solar panels allow buildings to be independent objects, since they have batteries that collect electricity. Rainwater is industrial water and is mixed with city water to guarantee constant water quality regardless of the weather, while waste water is collected and treated to be used in toilets. Grenoble systematically nurtures and designs green areas. In the past 15 years, many old parks have been renovated, and new ones have been built. Since 2014, more than 5,500 trees have been planted in the city, and the plan is to plant 10,000 trees before 2030 (Beta, 2022).

When we look at the measures taken by the city of Grenoble, the policy of preserving the environment, and therefore reducing the impact of climate change on natural disasters and increasing the efficiency of natural disaster management, does not seem so difficult. The most important thing is to influence people's consciousness, the mentality of the people in a certain area, additional education in the field of environmental protection, additional subsidies in projects related to environmental protection, and every city in the Republic of Serbia can be a new Grenoble.

6. CONCLUSION

It is inevitable that climate change is an actual problem of modern world. Man uses and consumes natural resources uncontrollably, making minimal effort to use renewable energy sources, thereby endangering the environment more and more. Environmental pollution has already reached serious proportions. This primarily refers to the reduction of areas under forests, uncontrolled exploitation of energy resources, irresponsible and careless use of arable land and sources of drinking water, pollution of air, waterways and soil, and uncontrolled disposal of waste. In addition to irreparable material damage, such behavior causes unfavorable climate changes, pollutes the environment and seriously endangers people's lives. Monitoring the current state of climate change allows us to predict what may await us in the future. If we continue with unacceptable behavior, with uncontrolled deforestation, the use of non-renewable energy sources and the emission of carbon dioxide into the atmosphere, by the end of the 21st century in Serbia we can expect an increase in the average annual temperature by about 4°C compared to the period from 1961 to in 1990. This increase in temperature levels and disturbed precipitation regime may not seem particularly terrible to anyone, but it will certainly bring with it consequences that can be very serious: greater frequency and duration of heat waves and dry periods, increased risk of floods, more frequent forest fires, deterioration of quality water, deteriorating air quality, greater possibility of occurrence of natural disasters that can cause natural disasters and therefore threaten the life and health of people and lead to large material and economic losses. All this can be gradually prevented. It may seem complicated and impossible now and it is thought to require expensive, modern technology, but often the simplest way is the best best way. The concentration of carbon dioxide in the air

can be greatly reduced by simply afforesting areas. Simple, right? It may not be possible to completely eliminate the consequences of global warming, but it is certainly possible to rehabilitate them to a large extent. The Republic of Serbia has adopted a number of important regulatory and legal frameworks, as well as measures and activities for the prevention and reduction of the impact of climate change on the natural disasters that they cause, however, until every person changes their consciousness and realizes what damage they have caused to nature and the environment. and as it all comes back to us, it will be difficult to deal with one of the biggest threats to the security of all citizens of the Republic of Serbia, as well as citizens of the entire world.

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