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## NATURAL HAZARDS. CONCEPT, ESSENCE AND CLASSIFICATION ZAGROŻENIA NATURALNE. POJĘCIE, ISTOTA I KLASYFIKACJA

**Abstract:** General security is now counted among the key areas of national security. Its main objective is becoming the protection of the population from the effects of various types of threats that may arise within the territory of Poland, but also outside its borders. These threats are not only threats caused by human activity, but also threats that are caused by the forces of nature. In the article, the author has attempted to define the concept, outline the essence and present the author's classification of natural hazards from the perspective of universal security. This is the result of the author's research work, which is reflected in the monograph currently in the publishing process, entitled "Natural hazards in the ecological environment" and "Natural hazards in the ecological security space." The project received funding from the MEiN "Excellent Science" programme.

**Zarys treści:** Bezpieczeństwo powszechne zaliczane jest obecnie do kluczowych dziedzin bezpieczeństwa narodowego. Jego głównym celem staje się ochrona ludności przed skutkami różnego rodzaju zagrożeń, które mogą się pojawić na terytorium Polski, ale także poza jej granicami. Zagrożenia te mają charakter zarówno zagrożeń wywołanych działalnością człowieka, ale też i zagrożeń, których źródłem są siły natury. W artykule, jego autor podjął próbę określenia pojęcia, nakreślenia istoty i przedstawienia autorskiej klasyfikacji zagrożeń naturalnych z perspektywy bezpieczeństwa powszechnego. Jest to efekt prac badawczych Autora, które znalazły swoje odzwierciedlenie w będącej aktualnie w procesie wydawniczym monografii pt. „Zagrożenia naturalne w ekologicznej przestrzeni bezpieczeństwa”. Projekt uzyskał dofinansowanie z programu MEiN „Doskonała nauka”.

**Keywords:** public safety, ecological safety, security hazards, natural hazards

**Słowa kluczowe:** bezpieczeństwo powszechne, bezpieczeństwo ekologiczne, zagrożenia bezpieczeństwa, zagrożenia naturalne

## Introduction

Every day, people are exposed to various types of threats which, depending on the circumstances and scale of the occurrence of a particular phenomenon, can assume the size of a natural disaster or catastrophe. The universality of the consequences of such events and situations makes them the focus of an important area of national security, which is undoubtedly universal security.

The term “universal security” does not yet have a clear and universally recognized definition, so it is difficult to determine unequivocally what activities of a defensive, protective or rescue nature fall within the competence of institutions providing security to all citizens without exception.

In addition, the lack of an accepted definition makes it difficult to unambiguously classify all threats that fall into the space of universal security. However, there is no doubt among security theorists and practitioners that threats to universal security include environmental threats of natural origin, as well as anthropogenic threats, the source of which is human activity.

## The essence of modern threats

In the lexical approach to security, which is very widespread, it is often treated as being synonymous with the absence of danger. This universality and simplicity in the perception of security through the prism of threats results in most definitions, whether of security in the general sense or in specific categories, as the threat being the causal factor of the actions taken by the subject to remove it. This is a natural consequence of the fact that the world is and always has been a source of danger for humans, and distrust of it and what each new day may bring us, performs the function of a natural defence mechanism, without which no subject would be able to survive in their surrounding reality.<sup>1</sup>

Hence, threat plays an important role in knowing, understanding and properly interpreting all the circumstances and conditions of security, for it is closely related to it and, as evidenced by numerous definitions, embedded in its content.<sup>2</sup> In commonly used terms, threat is treated as the opposite of security and means the possibility of the appearance of a phenomenon negatively valued by the subject, or, alternatively, as a potential or actual phenomenon, situation or action that harms basic interests and values and poses a danger to them,<sup>3</sup> or finally, as a phenomenon or disparity

<sup>1</sup> See: Urbanek, A., *Wyzwania i zagrożenia bezpieczeństwa*, [in:] *Wybrane problemy bezpieczeństwa. Teoria. Strategia. System*, A. Urbanek (ed.), Słupsk 2012, p. 71.

<sup>2</sup> This view is expressed, among others, by Fehler W.; Cf.: Fehler, W., *O pojęciu bezpieczeństwa państwa*, [in:] *Bezpieczeństwo państw i narodów w procesie integracji europejskiej*, W. Śmiałek, J. Tymanowski (eds.), Toruń 2002, p. 166; Fehler, W., *Bezpieczeństwo wewnętrzne – próba ujęcia modelowego*, „Myśl Wojskowa” 1997, no. 6, p. 20.

<sup>3</sup> Cf.: Prońko, J., *Bezpieczeństwo państwa. Zarys teorii, problemu i zadań administracji publicznej*, 2007, p. 7; Łoś-Nowak, T., *Pokój i bezpieczeństwo w teorii i praktyce stosunków międzynarodowych*, [in:] *Współczesne stosunki międzynarodowe*, T. Łoś-Nowak (ed.), Wrocław 1997, p. 135.

in resources that causes concern, fear or anxiety.<sup>4</sup> Understanding the nature of a threat requires distinguishing between its two essential elements: objective and subjective.

The objective element refers to those phenomena that cause a state of uncertainty, fear or anxiety. The subjective element generally refers to the feeling and perception of phenomena that are considered unfavourable or dangerous to the subject. Thus, the first element includes real threats and is subject to objective assessment, while the second focuses on their psychological perception.<sup>5</sup> Both elements co-shape the threat and, at the same time, allow security to be defined and better understood.<sup>6</sup>

But distinguishing the above elements is not enough to understand the essence of modern threats, because the diversity of processes and phenomena that determine the face of modernity causes them to interpenetrate each other, creating qualitatively new security threats.<sup>7</sup> Hence, modern threats can be attributed four more characteristics: complexity, ubiquity, universality and relativity.

The complexity of hazards stems from the process of mixing them and giving them a new dimension and quality, which is derived from, among other things, the effects of globalization and, in the case of natural hazards, climate change. Another feature of hazards is their ubiquity: they are massively present all around us, often taking a form that is not subject to sensory cognition. They can appear in the air, water and food as harmful and often poisonous chemical compounds (e.g. pollutants) or micro-organisms and toxins (bacteria, viruses, rickettsiae and the toxins they produce, such as botulinum toxin), causing poisoning or mass illnesses for which we have no antidote. They are also common, affecting every subject, and a sense of danger or awareness of dangers accompanies every person. This gives a new perspective on the perception of security, treated not as the traditional absence of threats, but a low, acceptable level of risk of their occurrence.<sup>8</sup>

An analysis of contemporary security paradigms shows that threat also includes the sphere of consciousness and can be treated as a mental state expressing both collective and individual perceptions and evaluations of reality or its elements, as mentioned earlier.<sup>9</sup> Relationships between the objective and subjective aspects, reality and the human psyche, allow us to distinguish four basic models of threat perception:<sup>10</sup>

<sup>4</sup> Cf.: Zięba, R., *Pozimnowojenny paradygmat bezpieczeństwa*, [in:] *Bezpieczeństwo międzynarodowe po zimnej wojnie*, R. Zięba (ed.), Warszawa 2008, p. 25.

<sup>5</sup> See: Prońko, J., *Bezpieczeństwo państwa...*, op. cit., p. 78.

<sup>6</sup> Cf.: Brzeziński, M., *Kategoria bezpieczeństwa*, [in:] *Bezpieczeństwo wewnętrzne państwa. Wybrane zagadnienia*, S. Sulowski, M. Brzeziński (eds.), Warszawa 2009, p. 24.

<sup>7</sup> Cf.: Cieślarczyk, M., *Modele i wymiary bezpieczeństwa*, „Zeszyty Naukowe AON” 1999, no. 3, p. 43; Kaczmarek, J., *Bezpieczeństwo w świetle praskiej konferencji NATO*, „Zeszyty Naukowe AON” 2003, no. 1, pp. 112–113.

<sup>8</sup> Cf.: Brzeziński, M., *Kategoria bezpieczeństwa...*, op. cit., p. 25; Beck, U., *Spoleczeństwo ryzyka. W drodze do innej nowoczesności*, Warszawa 2002, pp. 12, 31, 36, 37; Wolanin, J., *Zarys teorii bezpieczeństwa obywateli. Ochrona obywateli na czas pokoju*, Warszawa 2005, pp. 13–16.

<sup>9</sup> Cieślarczyk, M., *Niektóre psychospołeczne aspekty bezpieczeństwa, wyzwań, szans i zagrożeń*, „Zeszyty Naukowe AON” 1999, no. 2, pp. 232, 235.

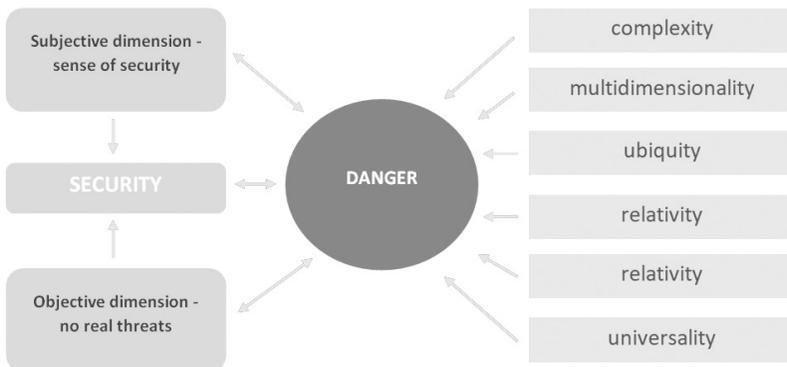
<sup>10</sup> Zięba, R., *Pojęcie i istota bezpieczeństwa państwa w stosunkach międzynarodowych*, „Sprawy Międzynarodowe” 1989, no. 10, pp. 49–50.

- a state of insecurity (when there is a large, real threat, and its perception is correct);
- a state of obsession (when an unknown and unrecognized threat is treated as a big one);
- a state of false security (when a major threat is treated as minor);
- a state of security (when the threat is slight and its perception is correct).

Hence, there is another feature of threats, relativity, which should be accepted, and when assessing the state of security, their objective dimension should be considered as important as their subjective one. A relatively uniform assessment of the state of security can be obtained only when the objective (expert, actual) assessments are adequate to the subjective (social, perceived) ones.

Here one can agree with the thesis that in making decisions it is the duty of those responsible for security to skilfully reconcile the analysis of specialists with public opinion.<sup>11</sup> It should also be noted that this approach to the essence of threats has not only a practical dimension, but also a methodological one, since it establishes how to approach the study of security. According to R. Zięba, when "(...) analysing threats, attention should be paid to their perception by politicians, researchers and the public. It must be a reflection of the real state of affairs (actual or potential threat) or it can be false (so-called misperception). (...) For proper cognition of threats, it is important to take into account the sphere of reality in which they arise and the sphere of consciousness in which the perception of these threats and the formation of a sense of certainty are carried out."<sup>12</sup> The essence and characteristics of modern threats are summarized in Fig. 1.

**Fig. 1.** Essence and characteristics of contemporary threats in relation to security



**Source:** own development.

Thus, it is possible to accept the thesis that threats are complex, ubiquitous, common and relative, multidimensional and relative phenomena, and only an equal treatment of their subjective and objective dimensions makes it possible to determine

<sup>11</sup> Cieślarczyk, M., *Niektóre psychospołeczne...*, op. cit., p. 15.

<sup>12</sup> Cf.: Zięba, R., *Pozimnowojenny paradygmat bezpieczeństwa...*, op. cit., p. 26.

the real picture of security. It is worth remembering that threats trigger the defence mechanisms of the subject and stimulate them to concrete action. Thus, they are an important stimulator of the subject's activity, allowing them to take action to ensure defence and protection against the negative consequences of threats. Their awareness by the subject and the subject's knowledge of the mechanisms, sources and consequences allows them to build a kind of security system, effectively protecting them from all known dangers.<sup>13</sup>

The concept of hazards, due to their universality and interdisciplinary nature, is used in various contexts of security considerations. When, for example, threats are discussed in the context of a crisis management system, attention is paid to the threat as a factor causing the occurrence of an emergency situation. An exemplification of this approach to threats is the definition proposed by Eugeniusz Nowak and Maciej Nowak, according to which "(...) threats are most generally understood primarily as insecurity and viewed as negative phenomena causing the likelihood of a crisis situation and dangers to the environment leading, as a consequence, to a crisis (understood as the culminating moment of a crisis situation)."<sup>14</sup> For the purposes of an emergency system, on the other hand, it is assumed that a threat is the possibility of "(...) the emergence of specific losses, determined for the situation after the occurrence of an undesirable event in the human-technical-environmental system."<sup>15</sup>

In currently emerging security publications, threats are often combined with challenges. According to R. Zięba, "(...) when studying the security issues of various entities, it is useful at the outset to distinguish threats from similarly perceived phenomena that are merely challenges."<sup>16</sup> Challenges, in dictionary terms, mean actions aimed at getting an opponent to fight back, or are a call for rivalry and competition. In other terms, it is a new and difficult situation that requires a certain response and action.<sup>17</sup> Thus, threats cannot be considered synonymous with challenges, or the two terms be treated as the same. A challenge is only a signal that, after analysis and evaluation by the subject, can be a causal factor for specific actions, and a threat is a fully real phenomenon that requires immediate specific actions, a decisive response by the subject to avoid a situation that constitutes a serious danger to them.<sup>18</sup> This was aptly summarized by R. Zięba, treating challenges as new situations, "(...) in which non-negotiable needs arise that require the formulation of a response and appropriate actions. Only unresolved challenges can turn into threats to the security of individuals, nations and states."<sup>19</sup>

<sup>13</sup> Zięba, R., *Pozimnowojenny paradygmat bezpieczeństwa...*, op. cit., p. 26.

<sup>14</sup> Nowak, E., Nowak, M., *Zarys teorii bezpieczeństwa narodowego*, Warszawa 2011, p. 39.

<sup>15</sup> Cf.: Zięba, R., *Pozimnowojenny paradygmat bezpieczeństwa...*, op. cit., p. 26.

<sup>16</sup> *Ibidem*, p. 27.

<sup>17</sup> Balcerowicz, B., *Pokój i „nie-pokój” na progu XXI wieku*, Warszawa 2001, p. 185.

<sup>18</sup> Cf.: Huzarski, M., *Zmienne podstawy bezpieczeństwa i obronności państwa*, Warszawa 2009, p. 22.

<sup>19</sup> Zięba, R., *Pozimnowojenny paradygmat bezpieczeństwa...*, op. cit., p. 26.

## Natural hazards and disasters as ecological hazards

Natural hazards fit into the general category of ecological hazards. In contemporary studies related to security, ecological hazards are often limited to only those phenomena negative to the environment caused by human activity.<sup>20</sup> Such an approach to ecological threats is justified when viewed through the prism of ecological problems as phenomena of a social nature. Ecological threats viewed from the perspective of a social problem means situations where significant social groups (groups, organizations or institutions) consider the consequences of certain actions to be negative for the environment. In this view, an environmental problem is determined by three elements:<sup>21</sup>

- physical facts (the physical context of the environmental problem);
- social values (values that constitute the reference point of the environmental problem);
- social behaviours (behaviours that are the cause of environmental problems).

But human activity is not the only cause of negative changes in the environment. A volcanic eruption, an earthquake or a collision of the Earth with an object of cosmic origin can have equally disastrous consequences, which, having violent characteristics, pose a direct threat to the life and health of people located in the area of the cataclysm. Therefore, it is worth looking at ecological hazards from a slightly broader perspective, and it is generally recognized that their causes can be both the activity of natural forces and human activity.<sup>22</sup>

In the sciences of international relations, ecological hazards are treated as “ (...) changes in the environment caused by its physical, chemical or biological properties and human activities, which can lead to the inhibition of socio-economic development and even threaten the survival of human civilization as a whole.”<sup>23</sup> This definition, which in a way refers to the understanding of environmental threats as social and global problems, does not fully correspond to the way they are interpreted in security sciences. Limiting the perception of environmental threats to their consequences of a socio-economic nature or the survival of human civilization is too narrow. Threats must also be viewed through the prism of their threat to human life and health, as well as other values inherent in the concepts of security, namely quality of life, integrity or development in other than socio-economic spheres of development of human civilization.

In summary, it can be assumed that ecological threats are changes in the environment of human life, including the natural environment, caused by the activities

<sup>20</sup> Cf. Książkowski, K.M., *Bezpieczeństwo ekologiczne*, [in:] *Bezpieczeństwo państwa*, K.A. Wojtaszczyk, A. Materska-Sosnowska (eds.), Warszawa 2009, p. 173; Furman, A., *Ekologiczne, naturalne i techniczne zagrożenia bezpieczeństwa publicznego*, [in:] *Niemilitarne zagrożenia bezpieczeństwa publicznego*, S. Kowalkowski (ed.), Warszawa 2011, p. 81.

<sup>21</sup> See: Matczak, P., *Problemy ekologiczne jako problemy społeczne*, Poznań 2000, p. 47.

<sup>22</sup> See: Kitler, W., *Bezpieczeństwo Narodowe RP. Podstawowe kategorie. Uwarunkowania, System*, Warszawa 2011, p. 53.

<sup>23</sup> Molo, B., *Rozwiązywanie problemów globalnych na przykładzie ochrony środowiska*, [in:] *Bezpieczeństwo międzynarodowe w XXI wieku. Wybrane problemy*, E. Cziomer (ed.), Kraków 2010, pp. 181–182.

of natural forces and human activities, posing threats to human health and life, as well as to values such as quality of life, the possibility of survival and development and freedom to pursue one's interests. In this view, environmental hazards can be divided into two categories: natural hazards and anthropogenic hazards. Thus, natural hazards are a type of ecological hazards that are part of the ecological security space and caused by natural forces. Of course, natural hazards can be the result of the cumulative action of physical, chemical or biological factors inherent in the natural environment and the side effects of human activity, but nevertheless, at the time of their occurrence, the main causal factor of the hazard is nature and the phenomena occurring in it or the space surrounding the Earth. These threats can be global, supra-regional, regional or local.

Natural hazards are often violent, so we often refer to them as environmental disasters or natural disasters. It is therefore worth taking a slightly closer look at the above terms.

In ecology, an ecological disaster is defined most generally "... as an irreversible change in the structure and function of ecosystems without the possibility of the formation of replacement (compensatory) assemblies or links, due to an imbalance in these ecosystems."<sup>24</sup> In ecological terms, a catastrophe of this type leads to irreversible qualitative and quantitative changes in food chains, resulting in the collapse of at least one of the trophic links (producers, consumers or destructors), without which an ecosystem cannot exist. Thus, the result of an ecological disaster can be a threat to the existence and survival of various species of flora and fauna, and even the destruction of the entire ecosystem.

Environmental disasters, as mentioned earlier, can be caused by natural forces or are the result of human activity. For the purposes of civil protection systems, the concept of "natural disaster" is introduced. This concept is defined, among other things, in the Law on the State of Natural Disaster, where it is stated that a natural catastrophe or technical failure, "(...) the consequences of which threaten the life or health of a large number of people, property of great magnitude or the environment in large areas, and assistance and protection can be effectively undertaken only with extraordinary measures, with the cooperation of various bodies and institutions and specialized services and formations acting under unified leadership."<sup>25</sup> The essence of a natural disaster is its violent characteristic, the relatively wide range of impact of its negative consequences and the need for extraordinary measures and the involvement of large forces and resources to counter its effects.

According to the aforementioned law, a natural catastrophe is understood as "(...) an event associated with the action of the forces of nature, in particular lightning, seismic shocks, strong winds, intense precipitation, prolonged occurrence of extreme temperatures, landslides, fires, droughts, floods, ice phenomena on rivers and the sea, as well as on lakes and reservoirs, mass occurrence of pests,

<sup>24</sup> *Encyklopedia PWN*, keyword: *katastrofa ekologiczna*, <https://encyklopedia.pwn.pl/haslo/katastrofa-ekologiczna;3921133.html>, [accessed: 16.06.2017].

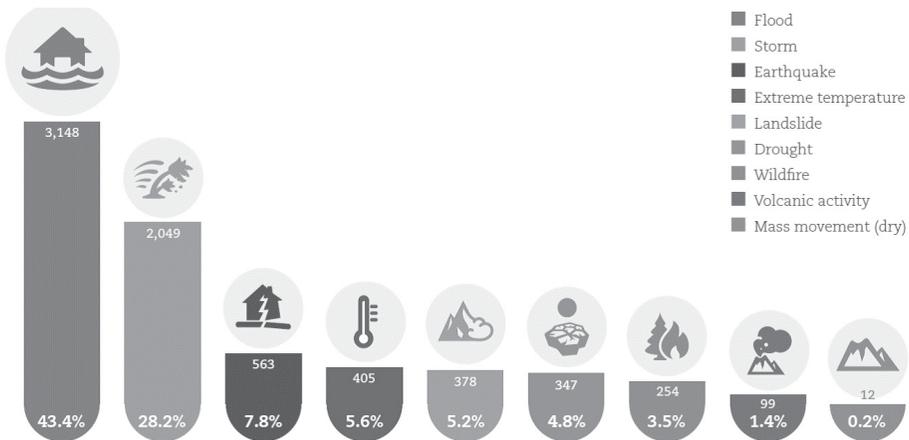
<sup>25</sup> On the state of natural disaster Act of 18 April 2002, consolidated text: Dz.U. (Journal of Laws) 2017, item 1897, Art. 3 section 1.

plant or animal diseases or infectious diseases of humans, or the action of another element.”<sup>26</sup> The law also assumes that a natural disaster can be an event caused by a terrorist act.

It is worth noting that natural hazards and the disasters they cause have a significant impact on the modern security environment and pose a major threat to human health and life, the wider economy or the environment.

The Center for Research on the Epidemiology of Disasters (CRED) has analysed natural disasters on a global scale from 1998 to 2017, and the results are truly alarming. According to the report presented by the Center,<sup>27</sup> between 1998 and 2017, natural disasters caused the deaths of some 1.3 million people and another 4.4 billion were injured, made homeless, displaced or in need of other forms of assistance. While most of the fatalities were caused by geophysical events, mainly earthquakes and tsunamis, 91% of all disasters were caused by floods, storms, droughts, heat waves and other extreme weather events. As shown in Figure 2, floods (43.4%) accounted for the largest number of disasters during the period under review, followed by strong winds (28.2%), earthquakes (7.8%) and extreme temperatures (5.6%). The United States of America suffered the greatest losses of about \$945 billion, followed by China (\$492.2 billion) and Japan (\$376.3 billion). The greatest single cause of damage, with losses of \$228 billion, was the Great East Japan Earthquake and Tsunami in 2011, which consequently led to the closure of the Fukushima nuclear power plant. In contrast, the 2008 earthquake in Sichuan, China, cost \$96 billion and affected 46 million people.<sup>28</sup>

**Fig. 2.** Natural disasters 1998–2017



**Source:** CRED, *Economic, Losses, Poverty & Disasters 1998–2017*, Report, p. 7.

<sup>26</sup> *Ibidem.*

<sup>27</sup> CRED, *Economic, Losses, Poverty & Disasters 1998–2017*, Report. Raport powstał w wyniku współpracy pomiędzy: United Nations Office for Disaster Risk Reduction (UNISDR), Centre for Research on the Epidemiology of Disasters (CRED), Institute of Health and Society (Université Catholique de Louvain).

<sup>28</sup> *Ibidem.*

The above data on the risks to human health and life and their economic impact shows how dangerous natural disasters are and why we should analyse this problem from a security perspective.

### Classification of natural hazards

In order to understand the nature of natural hazards and how they are treated in modern security concepts, consideration should begin with how hazards are classified. In the literature, we encounter numerous classifications, with some being created for the purposes of security theory, others for the purposes of crisis management systems, and others for the purposes of emergency systems. The latter two are of interest to us because they deal with universal security.

Analysing the essence of threats, W. Kitler stated that "(...) threats to man and his goods and environment can arise from two sources. The first – is the activity of man against man or the laws of nature, the second – is the activity of natural forces, such as water, fire, air, space, the biological (microbial) world."<sup>29</sup> This simple distinction between the two basic categories of threats, taking into account their source, is now widely used in crisis management theory and practice.

Thus, according to W. Lidwa, we can distinguish four groups of threats that can quickly lead to crisis situations, which can have impacts on the territory of an entire state or its individual regions. These include:<sup>30</sup>

- 1) natural hazards, caused by the forces of nature, including floods, strong winds, droughts, weather anomalies, tectonic movements, epidemics and animal plagues;
- 2) technical risks, resulting from the civilizational and economic development of society (fires, chemical accidents, radiation accidents and incidents, transportation, construction and mining disasters, and technical equipment failures);
- 3) terrorism (terrorist attacks in the air, at sea and on land);
- 4) other threats, which include: proliferation of weapons of mass destruction, mass migrations, civil unrest, collective acts of public disorder and organized crime.

A clearer and more orderly classification of threats that can trigger emergencies was proposed by E. Nowak, W. Kitler, A. Skrabacz and K. Gąsiorek. According to them, one can speak of two categories of threats. The first is threats caused by the forces of nature (natural disasters), and the second is threats caused by human activity, including: technical failures, social events (unrest) and terrorist events. Still other considerations are taken into account when classifying hazards for emergency systems. This takes into account the criterion of: the extent of the threats (local, regional, continental, global, space), the source of the threats (industry, transport, agriculture, military action, terrorism, forces of nature, etc.) and the type of

<sup>29</sup> Kitler, W., *Obrona cywilna – szerokie podejście do problematyki cywilnej w obronie narodowej*, [in:] *Obrona cywilna (niemilitarna) w obronie narodowej III RP*, Warszawa 2001, p. 35.

<sup>30</sup> See: Lidwa, W., Krzeszowski, W., Więcek, W., *Zarządzanie w sytuacjach kryzysowych*, Warszawa 2010, pp. 7, 23.

impact (hydrosphere, atmosphere, biosphere, geosphere).<sup>31</sup> From the point of view of the practice of emergency operations, the basis for the distinction is the size of the area affected, hence the following are distinguished: widespread hazards (caused by chemical disasters, nuclear disasters, energy disasters, weather anomalies, epidemics, etc.) and local hazards (caused by road accidents, domestic accidents, construction disasters, explosions, local poisoning, etc.).

The above classifications show how, from the perspective of universal security practice, it is important to specify which threats we are dealing with. In all classifications, in which the basic criterion becomes their source, the division into natural and anthropogenic hazards is already widely used, although there is no unified position on what phenomena, processes or other events can be included in this category.

Analysing the above issues in the literature, one gets the impression that they are treated marginally. Speaking of natural hazards, one points more to disasters that can be the result of various factors, and not to the hazards themselves, which do not necessarily always have to lead to catastrophic consequences.

Marek Graniczny and Vladimir Mizerski<sup>32</sup> divide natural disasters<sup>33</sup> into six main groups:

- geological – earthquakes, volcanic eruptions, mass movements, tsunamis, erosion;
- hydrological – floods, desertification, snow avalanches;
- oceanographic – coastal flooding, sea level changes, pollution of bodies of water;
- meteorological – storms, cyclones, tornadoes, hurricanes, snowslides;
- related to vegetation cover – fires, droughts, locusts;
- cosmic – collision with the Earth of a meteor, comet or asteroid.

At the same time, as they note, there are natural disasters that are the result of the interaction of several factors, and one natural disaster generally stimulates another.

According to CRED, natural disasters are divided into hydrological events (floods, landslides and wave action), meteorological (storms, extreme temperatures, fog) and climatological (droughts, fires), which are collectively referred to as weather or climate-related, and geophysical disasters (earthquakes, volcanic eruptions, massive earth movements). As can be seen, this is a fuzzy, very general classification and does not include all hazards that qualify as natural hazards.

Taking into account a kind of eclecticism in the approach to classifying natural hazards, the author of the articles proposes his own classification, useful for both cognitive and practical reasons. Similarly, as in the classification presented by M. Graniczny and W. Mizerski, natural hazards can, according to his thoughts, include six basic categories: threats to ecosystems (global and regional/local);

<sup>31</sup> Konieczny, J., Wawrzynowicz, H., Mydlarska, J. (eds.), *Psychologia bezpieczeństwa. Kompendium*, Agencja Wydawniczo-Reklamowa Esus, Poznań 2011, p. 128.

<sup>32</sup> Graniczny, M., Mizerski, W., *Katastrofy przyrodnicze*, Wydawnictwo Naukowe PAN, Warszawa 2009, p. 3.

<sup>33</sup> *Ibidem*.

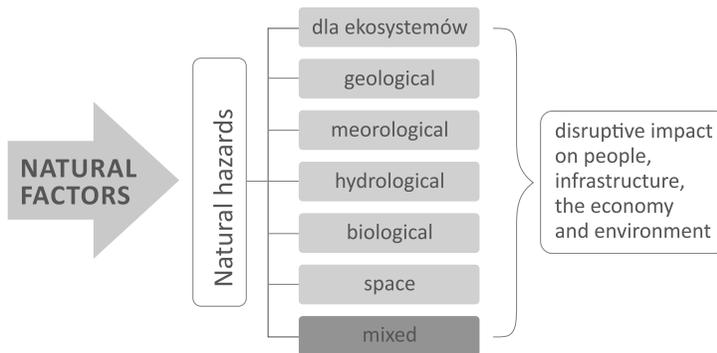
geological hazards; meteorological hazards; biological hazards; and space hazards, and additionally include mixed hazards. (See Figure 3).

Threats to ecosystems can be divided into two basic categories: global threats (climate change, ozone hole) and regional/local threats (loss of biological diversity, soil degradation, forest destruction, water pollution and scarcity, marine and ocean degradation, air pollution and large-scale fires).

Another category of hazards is geological hazards. These can be divided into five basic categories: seismic hazards (earthquakes); tsunamis (of varying extent: local, regional and supra-regional); volcanic hazards (volcanic eruptions); mass earth movements (landslides) and erosion (e.g., of seashores).

The most numerous category is meteorological hazards, which include: hazards associated with strong winds (winds associated with atmospheric circulation – hurricanes, cyclones, orkans and local winds: scowls, tornadoes, foehn winds, including hail winds); those related to precipitation (intense rain and snow, hail, acid rain, fog and haze, snow blizzards and blizzards, freezing rain and glaze); those related to air temperature (frost, ice hazards: icing, icebergs and sea ice, heat); mixed (storms, thunderstorms, once in a century winters); and weather anomalies (El Niño and La Niña).

**Fig. 3.** Classification of natural hazards



**Source:** own development.

The next threats, hydrological, are related to excess water (floods and flooding) and water scarcity (droughts: meteorological, soil, hydrological and hydrogeological).

Biological hazards, in turn, can be divided into three categories: the mass occurrence of diseases among humans (epidemics/pandemics), animals (epizootics) and plants (epiphytoses); the occurrence of pests on a massive scale; and biological contamination of water and food.

The sixth category, cosmic threats, includes: space weather anomalies (solar storms); cosmic radiation (gamma rays) and collisions of the Earth with space objects.

Finally, the last category consists of mixed hazards, which may be caused by other natural hazards or may be the result of human activity. Details of the above classifications are shown in Table 1.

**Table 1.** Types of natural hazards

| <b>Hazard category</b>        | <b>Subcategory</b>  | <b>Type</b>   |
|-------------------------------|---|---|
| <b>Threats to ecosystems</b>  | global  | climate change, ozone hole  |
|                               | regional/local  | loss of biodiversity, soil degradation, forest destruction, water pollution and shortages, degradation of seas and oceans, air pollution, large-scale fires |
| <b>Hazards geological</b>     | seismic   | earthquakes   |
|                               | tsunamis  | local, regional, trans-regional (Pacific)   |
|                               | volcanic  | volcanic eruptions (effusive, explosive, mixed eruptions)   |
|                               | massive earth movements                                       | landslides, avalanches  |
|                               | erosion   | coastal erosion   |
| <b>Hazards meteorological</b> | related to strong winds                                       | winds associated with atmospheric circulation: hurricanes, cyclones, squalls and local winds: gusts, tornadoes, foehn winds, including mountain winds       |
|                               | related to precipitation                                      | heavy rain and snow, hail, acid rain, fog and mist, blizzards, freezing rain and glaze  |
|                               | related to air temperature                                    | frost, frost heaves, ice hazards: icing, icebergs and sea ice, heat waves   |
|                               | mixed hazards   | storms, once in a century winters   |
|                               | weather anomalies   | El Niño and La Niña   |
| <b>Threats hydrological</b>   | related to excess water                                       | inundations, floods (fluvial, precipitation, snowmelt, groundwater, seawater, water and waste water facilities)   |
|                               | related to water scarcity                                     | droughts: meteorological, soil, hydrological, hydrogeological   |
| <b>Hazards Biological</b>     | massive outbreaks of disease among humans, animals and plants | epidemics/pandemics, epizootics and epiphytoses   |
|                               | occurrence of pests on a massive scale                        | pests of agricultural crops, foodstuffs, forests, spreading diseases  |
|                               | biological contamination of water and food                    | water contamination, food contamination   |
| <b>Hazards cosmic</b>         | space weather anomalies                                       | solar storms  |
|                               | cosmic radiation  | penetrating radiation   |
|                               | collisions of the Earth with cosmic objects                   | collisions with meteorites, asteroids, comets   |

| Hazard category    | Subcategory                     | Type  |
|--------------------|---------------------------------|---|
| <b>Risks mixed</b> | caused by natural hazards       | e.g. an eruption of an underwater volcano can trigger tsunamis or earthquakes, storms, and especially the accompanying lightning, which can cause large-scale fires, El Niño and La Niña, both of which can cause drought or flooding, etc. |
|                    | caused by anthropogenic threats | e.g. disasters of hydraulic structures can cause floods, the use of geological weapons can cause earthquakes, etc.  |

Source: own development.

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## Legal Acts

On the state of natural disaster Act of 18 April 2002, consolidated text: Dz.U. (Journal of Laws) 2017, item 1897.

## Summary

Natural hazards, especially those related to climate change, are becoming an important factor that affects the operation of civil protection systems. Learning about these phenomena, systematizing knowledge about them, and finally creating effective systems to protect the population from their destructive effects is a part of the problems that should be analysed from the perspective of universal security. This problem must not be underestimated or marginalized by the relevant services in Poland, hence, it is worth attempting to draw some conclusions that emerge from the analysis of the above problem presented by the Author:

1. The risk of the occurrence of natural hazards as a result of increasing industrialization and climate change is increasing, and their effects will affect most of the inhabitants of our globe, so systematizing knowledge about them is a relatively urgent endeavour that will determine how well we are able to prepare ourselves to face their destructive impact on people, infrastructure and the environment.
2. Natural hazards are a type of environmental hazard, which are part of the ecological security space, the causes of which are natural forces. Of course, natural hazards can be the result of the cumulative action of physical, chemical or biological factors inherent in the natural environment and the side effects of human activity, but however they occur, the main causal factor of the threat is nature and the phenomena occurring in it or the space surrounding the Earth.
3. It is reasonable to divide natural hazards into six basic categories: ecosystem hazards (global and regional/local); geological hazards; meteorological hazards; biological hazards and space hazards, and additionally include mixed hazards.
4. The classification proposed by the Author is not enumerative. It is an open classification, on the basis of which further work can be carried out to systematize and generalize knowledge on the subject. It is also worth researching the impact of climate change on natural hazards, because in the near future they will determine the activities of crisis management systems and civil protection systems.