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NATURAL EMERGENCIES AND SOME CAUSES OF THEIR OCCURRENCE: A REVIEW

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In recent decades, nature has seen many anomalies with the environment, climate, and the processes taking place. This leads to a change in the temperature of the environment, the formation of meteorological processes that are not characteristic of a certain part of the planet and the triggering of emergency situations of a natural nature. The study seeks to fill the gap regarding the trends in the influence of man-made activities on the occurrence of natural disasters, their scale of distribution and consequences. The current study methodology is a combination of a literature review and bibliometric analysis to obtain the relevant impact of man-made activities to the extent of occurrence and impact of natural disasters. This report examines the main extraordinary processes that are observed around us and cause damage and departure from the normal way of life of people and the rest of the living world. It was found that many researchers indirectly confirm that anthropogenic activities can provoke negative natural events, or contribute to a significant increase in the scale of a dangerous natural phenomenon. Some of the reasons that cause them, usually independent of human activity or inaction, is also indicated. Several research works have noted that climate change over the past few decades and global warming are contributing to an increase in the frequency of natural disasters such as earthquakes, floods, tsunamis, landslides, etc. But we need to change our behaviour to minimize causing such phenomena.

Keywords: emergency; natural feature; earthquake; landslide; scree; volcano; avalanche; flood.

INTRODUCTION

In the environment around us, we become witnesses to many processes that occur without our participation, but only as a result of the natural processes of the Earth. Some of them are natural disasters, as they cause destruction and multiple losses of various types. There are several types of natural emergencies (Figure 1) (or natural disasters) (https://www.samhsa.gov/find-help/disaster-distress-helpline/disaster-types).

Such processes occur with different intensities in different parts of the world and during different periods of its development (Aizman et al., 2011). Each natural disaster is characterized by its unique nature, roots and causes, driving forces, stages of development and specific environmental impacts (Legkiy et al., 2023). Researchers have found that there is an overlap between natural disasters and environmental disasters (Spiegel et al., 2024). But in recent decades we have seen an increase in the frequency and strength of these processes (Figure 2).

Statistics show that between 1995 and 2021, 14 out of 32 major natural disasters in the Czech Republic are floods (EM-DAT, 2022). In the United States, flash flooding is the leading cause of weather-related deaths. Category 3 or greater hurricanes strike the continental United States approximately every 18 months, and flooding is often severe (Moini et al., 2023). Similarly, in the northern part of Malawi, heavy rainfall occurs, leading to flooding of large areas.

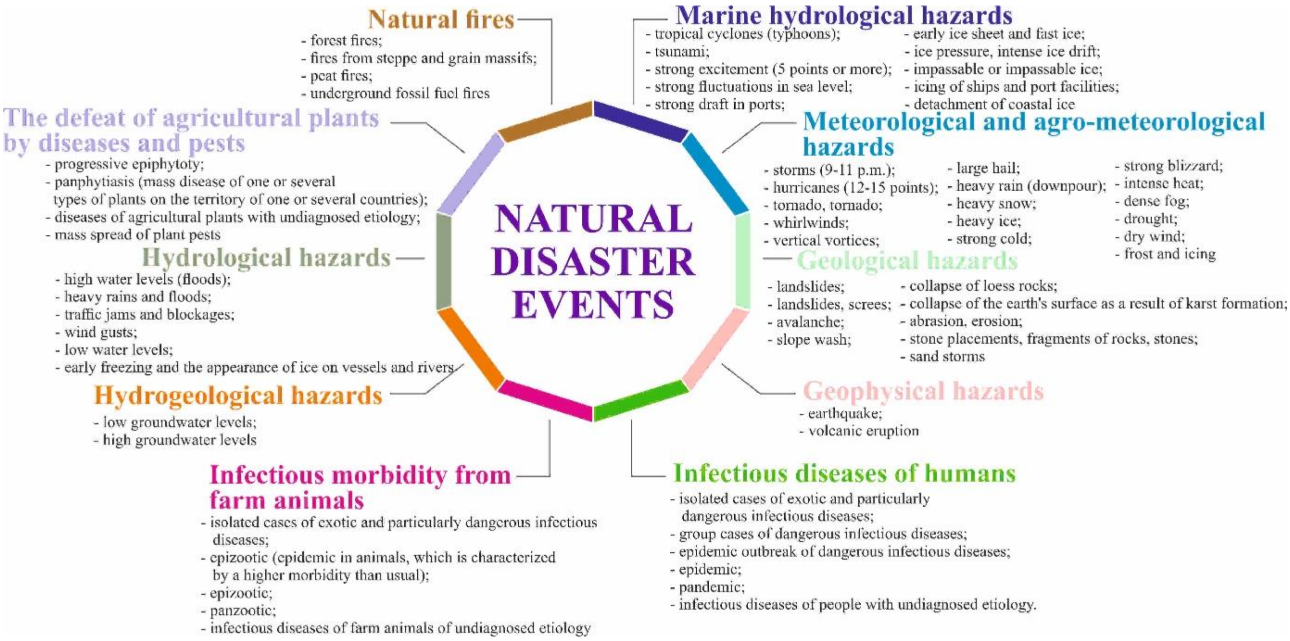

Figure 1. Natural emergencies

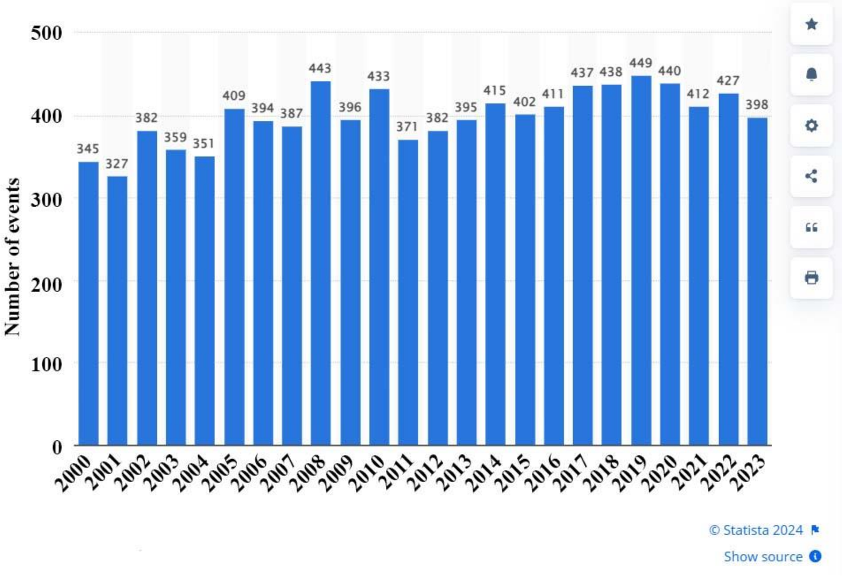

Figure 2. Number of natural disaster events worldwide from 2000 to 2023
(source: https://www.statista.com/statistics/510959/number-of-natural-disasters-events-globally/)

For example, in 2015, about 1200 ml of rainfall fell in Mzuzu City (Malawi), which affected 3748 households (Munthali et al., 2024). Between 2014 and 2019 in several European Union (EU) member states, including the Baltic countries and Poland (2014), the Czech Republic and Romania (2017), Belgium, Bulgaria and Hungary (2018) and Slovakia (2019), an epidemic of African swine fever broke out, and from 2018 to 2019, this epidemic spread in China and some other Asian countries (Niemi, 2020). In Bulgaria in 2019, as a result of infection, the number of inventory pigs (Figure 3) at the end of the year was 25% lower compared to the previous year, which caused economic damage (Ivanov, 2020).

Figure 3. African swine fever in Bulgaria, 2019

The largest number of natural disasters over the past 2023 occurred in Europe, the Middle East and Africa (https://www.statista.com/statistics/510959/number-of-natural-disasters-events-globally/). In the European region in 2023, the largest amount of land was burned by forest fires in Ukraine (214 thousand hectares) and Greece (175 thousand hectares); In Canada, more than 11.5 million hectares of land burned. Turkey and Syria are the countries most heavily affected by earthquakes in 2023. For 2023, the Philippines, Indonesia, and India topped the list of countries with the highest risk of natural disasters in the world (https://www.statista.com/statistics/510959/number-of-natural-disasters-events-globally/).

This inevitably affects the lives of people, flora and fauna. Although there are many examples of this, one of them is the situation in Ethiopia (2000) in the Gode region. In this area, several successive disasters occurred in the same place in the same time interval: first there was a drought, which provoked a food crisis; Food shortages led to civil unrest and a measles epidemic (Spiegel et al., 2024).

In order to reduce the impact of these natural emergencies on us, these processes must be well studied (DRRC, 20216; Padarev, 2018). This is justified by the fact that often human carelessness, inaction or indirect action increases their impact on the environment or their consequences.

As a rule, natural disasters develop very dynamically in space and time (Yu et al., 2018), but they have some regularities. The patterns of natural phenomena that cause emergency situations are as follows:

– each type of emergency situation contributes to a certain spatial confinement;

– the more intense the dangerous natural phenomenon, the less often it occurs;

– every emergency situation of natural origin has antecedents – specific signs;

– the occurrence of the natural emergency, with all its unexpected, can be predicted;

– it is often possible to provide both passive and active measures to protect against natural hazards (Council Directive, 2008).

The role of anthropogenic influence on the manifestation of natural disasters is great. Human activity disturbs the balance in the natural environment (Dolchinkov, 2020; Terziev, 2013). Now that the scale of use of natural resources has increased sharply, the characteristics of the global environmental crisis have become very noticeable. An important preventive factor for reducing the number of natural disasters is maintaining the natural balance.

Thus, the purpose of the current study is to study the nature of natural emergencies and identify the causes of their occurrence and dependence on anthropogenic activities. That is, the study seeks to fill the gap regarding the trends in the influence of man-made activities on the occurrence of natural disasters, their scale of distribution and consequences.

METHODOLOGY

The current study methodology is a combination of a literature review and bibliometric analysis to obtain the relevant impact of man-made activities to the extent of occurrence and impact of natural disasters. The bibliometric analysis was aimed at establishing trends in the discussion about the relationship between man-made activities and the occurrence and scale of natural disasters in the world. At the same time, a literature review was used to identify some causes of natural disasters.

The literature was used from the Scopus database and was selected in stages. In order to find out trends in the discussion about the relationship between man-made activities and the occurrence and scale of natural disasters in the world, articles were selected in accordance with the methodology in Figure 4.

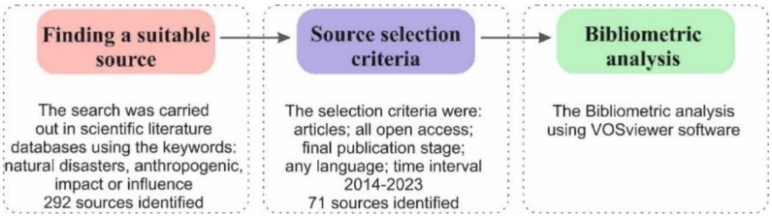

Figure 4. Literature search methodology

To identify some causes of natural disasters, the results obtained were filtered based on reading the abstract of the article. Those articles that were of interest were used as reference sources when writing the current review, in addition, they were compared with each other and complemented each other with information. Cross-referenced sources were sometimes taken into account if the information they contained was important to the current review.

RESULTS AND DISCUSSION

Bibliometric analysis

In the process of bibliometric analysis, 71 documents were identified in 4 languages: English – 65 articles; Russian – 5; Portuguese – 2; Slovak – 1. The distribution of these articles by country (territory) is presented in Figure 5. Figure 5 shows the number of articles for the first 20 countries out of 39, in which one article was published during the study period.

Bibliometric analysis of keywords that have at least 10 repetitions identified three clusters (Figure 6).

You can see connections between human activity and natural disasters, climate change, floods, drought, anthropogenic effect, land use, human impact (environment), precipitation, vegetation; between anthropogenic effects and natural disasters, climate change, floods, drought, human impact (environment). Considering the frequency of occurrence of these words in articles and the strength of the connections, it becomes clear that the topic of the relationship between anthropogenic activities and the frequency of natural disasters is under discussion. In addition, it should be noted that the number of studies in this area is increasing every year (Figure 7), which indicates an increase in the interest of scientists.

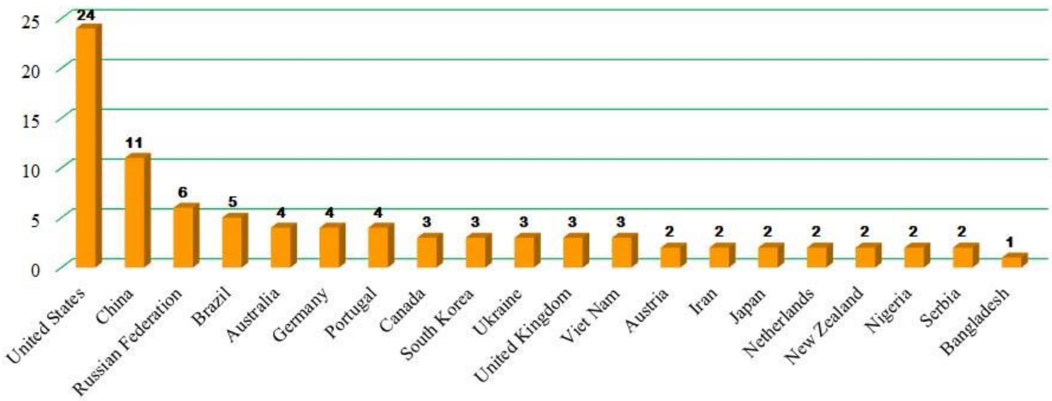

Figure 5. Number of published articles on countries/territories

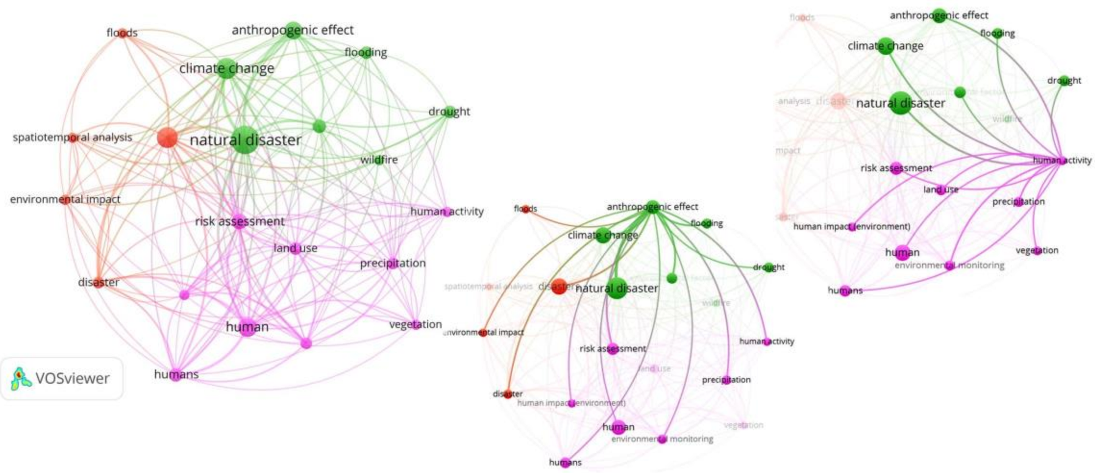

Figure 6. Keyword connections in the studied articles

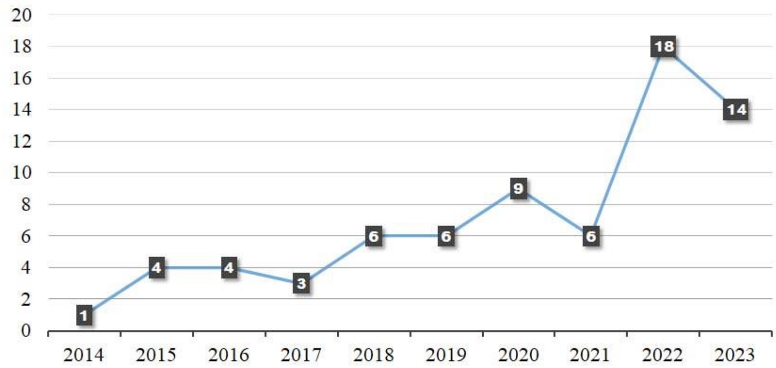

Figure 7. Distribution of studied articles by year

The analysis revealed that all emergency situations of a natural nature have cause-and-effect relationships: earthquakes and tsunamis (Fujii et al., 2019), earthquakes and landslides, debris flows, and floods (Duan et al., 2021), tropical cyclones and floods, volcanic eruptions can trigger tsunamis and fires, pollution of pasture lands will inevitably entail of livestock death. Minimizing secondary consequences and eliminating them as completely as possible is the primary protective measure in the event of emergency situations of a natural nature. Studying the causes of natural disasters and the mechanisms of their development is the most important step towards the ability to predict them, and as a result, to ensuring the successful protection of the population and material wealth (DPA, 2006; Dolchinkov & Karaivanova-Dolchinkova, 2021). An accurate and timely forecast is an important condition for effective protection against natural hazards. Some natural disasters can be anticipated, allowing disaster response teams (DRTs) to activate and establish incident command centres to provide support before the event occurs. For example, during hurricane season, the North American DRTs continually monitor potential disturbances in the Atlantic and Pacific Oceans within the National Hurricane Center and notify teams accordingly to prepare (Sawin et al., 2023). There are two types of protection for emergency situations of a natural nature: reconstruction of natural objects, construction of engineering structures, etc. that is active protection; use of shelters that is passive protection.

Dangerous geological natural phenomena are:

– earthquake;

– volcanic eruptions;

– landslides;

– a mudflow or a flow with an extremely multiple presence of mineral particles, rock fragments and stones (up to 50–60% of the flow volume), usually suddenly appearing in the basins of small mountain rivers and usually caused by heavy rainfall or thunderstorm snowfalls. A flood is a short-term phenomenon (typically lasting several hours, less than a day), typical for small reservoirs with a length of up to 25–30 km and a catchment area of up to 50–100 km² (Dolchinkov, 2020);

– a significant volume of snow sliding from steep mountain slopes what are snow landslides;

– hurricanes;

– sedimentation and failures of the earth's surface, as consequences of karst phenomena.

Natural disasters

Earthquakes

Vibrations of the earth's surface associated with tectonic processes, which manifest themselves in the form of tremors and transmit over long distances in the form of elastic vibrations, are called earthquakes. Most often, these phenomena can be provoked by volcanic activity, the fall of small celestial bodies, landslides, the dam breaks and other natural phenomena.

Scientists have not yet fully figured out the causes of earthquakes. The tension arising under the action of deep tectonic forces deforms the layers of the Earth's rocks (Vorobiev, 2002; Padarev, 2018). The deformable layers are compressed into folds, and when the stresses reach a critical level, the layers rupture and mix. At this point, changes in the earth's crust induce a series of tremors at different time intervals. Tremors include foreshocks, mainshocks, aftershocks and aftershocks. The main blow has the greatest power, which is perceived by people as the longest, while, usually, it lasts several seconds.

According to psychologists and psychiatrists, as a rule, aftershocks during an earthquake have a severe psychological impact on people. This contributes to even more stress than the main shock. People begin to feel the inevitability of trouble and, under stress, do nothing, when they should quickly make adequate decisions to protect and save their own lives and the lives of other people.

The epicentre of the earthquake is located at a certain depth in the Earth's crust, within which a large amount of energy is released. In the centre of the earthquake is a conditional point, which is called the hypocentre. The earthquake epicentre is the hypocentre projection on the surface of the earth. The greatest devastation and destruction occurs around the epicentre (Figure 8) (Dimitrov, 2018; Dolchinkov, 2016).

Figure 8. The earthquake in Svishtov, 1977

Earthquake energy is assessed by magnitude. For this purpose, a conditional value was created – the intensity of the earthquake, which represents the amount of energy released at the centre of the earthquake. The magnitude of an earthquake is usually calculated using the international seismic scale MSK-64 (Mercalli scale). The maximum conditional gradation is 12 ball.

Earthquakes are phenomena of natural origin, and no convincing dependence on anthropogenic activity has been identified.

Although, researchers have found that the most important type of driving forces of earthquakes in the area is located on the border of Gansu (China) over the past almost 20 years has been natural factors, and the influence of a group of natural factors was much stronger than man-made ones (Duan et al., 2021). At the same time, it was observed that climate change was the main driving force, and factors directly related to local climate had a more obvious influence on the destructive effect of the earthquake, especially on landform and geomorphic types (Duan et al., 2021; Sannigrahi et al., 2020).

Earthquakes are predicted by recording and analysing their "precursors" – previous steps such as preliminary weak tremors, the earth's surface deformation, changes in geophysical field parameters, unusual in animal behaviour. Methods for reliable prediction of earthquakes, unfortunately, have not yet been developed by scientists, although researchers from around the world are working on this. Currently, prediction of the location of an earthquake is carried out with an accuracy of tens to hundreds of kilometres, and the time interval for the onset of an earthquake can be 1–2 years. In this regard, seismic protection measures do not have the desired effect.

When designing and constructing buildings and structures in earthquake-prone regions, standards are applied that take into account the risk of earthquakes. However, in areas where seismicity can reach at magnitude 9, construction is unprofitable. Earthquakes are considered dangerous for structures and buildings, even at magnitude 7.

For the construction of buildings and structures, rocky soils are the most seismically reliable. At the same time, the safety of building structures in an earthquake-prone region is significantly influenced by the quality of building materials and workmanship. To improve the stability of buildings during earthquakes, building codes provide for strengthening of structures and size restrictions (Dolchinkov, 2018; Dolchinkov, 2020).

Among the anti-seismic actions, the following can be distinguished:

1 Prevention measures include identifying earthquake precursors and developing forecasting methods that are based on the results of a systematic study of the earthquakes' nature.

2. The effectiveness of actions in earthquake conditions depends on the professionalism of organized rescue operations during and after an earthquake, on a timely warning system and on the preparation of the population.

A very dangerous immediate consequence of the earthquake is panic, during which people cannot consciously take measures for the rescue and mutual aid due to fear (Vorobiev, 2002; Dolchinkov, 2020; Dolchinkov, 2023). If panic begins in places with the greatest concentration of people, then the situation becomes the most dangerous. This applies to public places, educational institutions, large enterprises and organizations. Falling parts of destroyed buildings are accompanied by injuries and deaths, as a result of which people may find themselves under rubble and not receive timely medical care. Destruction during earthquakes can provoke fires, explosions, the spread of toxic substances, transport accidents and other dangerous events.

Volcanoes

Volcanic activity is characterized by constant active processes in the bowels of the Earth. The movement of magma in the earth's crust and on its surface leads to volcanic eruptions. Unlike magma, during a volcanic eruption, there are no gases released in lava. Disasters caused by volcanic activity (Figure 9) can not only affect the structure of populations over tens of thousands of years, but maintain negative consequences in the long term (Bemmels et al., 2022).

Figure 9. Active volcano in Europe, 2017

Volcanoes are divided into active, fell asleep and disappeared. Three main types of eruptions are known: effusive (Hawaiian), mixed (Strombolian) and extrusive (dome). Volcanic activity and earthquakes are interconnected: seismic shocks mark the beginning of an eruption. Volcanic activity initiates landslides, avalanches, tsunamis (on seas and oceans).

Micro-earthquakes are often associated with volcanic activity, which can serve as important indicators of volcanic processes (Bernal-Oñate et al., 2024). Geologists are carefully looking for ways to predict volcanic eruptions, and in some cases have already achieved significant results. Thus, Bernal-Oñate et al. (2024) developed an approach for detecting volcanic events that cause eruptions, which significantly increased accuracy, namely, it provided the predictive results for Llaima Volcano by 94.44% and Cotopaxi Volcano by 95.45%.

Landslides and mudflows

Landslides are shifts along the slope of soil masses under the influence of gravity (Figure 10). Landslide land masses form on hillsides, mountains, river and sea terraces. A reasonable indicator of the magnitude of a landslide and its destructiveness is the area of the landslide (Li et al., 2022).

Figure 10. Landslide in the area of Veliko Tarnovo

Natural causes are erosion of the slope bases by groundwater, an increase in slope, seismic shocks, etc. At the same time, artificial reasons include ignoring the geological and geomorphological features of the area; unorganized changes in land use, such as improper agricultural practices, deforestation, and changes in vegetation cover, too much soil removal, uncontrolled urbanization processes, etc. The situation is aggravated by extreme weather events such as increased precipitation due to climate change (Lukić et al., 2016; Li et al., 2022). Modern landslides are 80% related to the anthropogenic factor.

In the mechanism of the landslide process, landslides are identified as surface, extrusive and hydrodynamic. Landslides are distinguished by the depth of sliding on the surface:

superficial (up to 1 m), shallow (up to 5 m), deep (up to 20 m), very deep (more than 20 m). In terms of displacement speed, landslides are divided into slow, medium and fast. It is the latter that causes accidents with many victims. The scale of landslides is determined by the section in the process. In terms of power, landslides are determined by the volume of displaced rocks – from several hundred cubic meters to 1 million m^3.

In cases such as hilly areas, disaster management and restoration require special planning and post-disaster measures. To prevent or reduce the frequency and severity of landslides, land use restrictions, special urban planning regulations and emergency plans should be followed, which can be effective even without slope stabilization (Li et al., 2022).

Villages are natural floods on mountain rivers, mudflows caused by heavy rainfall, river leaching, intense snowmelt and earthquakes. Anthropogenic factors also contribute to mudflows. The main danger is the high speed of mudflows (15 km/h). Streams are divided into strong, medium and weak in terms of power.

To prevent mudflows, water-resistant and self-guiding hydraulic structures are built, the vegetation layer is fixed on the slopes of the mountain and other measures against mudflows are carried out.

Avalanches

A variety of landslides are avalanches (Figure 11), which are a mixture of snow, water and air crystals. These huge masses of snow creeping off the mountain slopes claim about 100 lives a year in Europe.

Figure 11. Avalanche formation in the Carpathians, 2019

The cause of the formation of avalanches can be an earthquake. The large kinetic energy contained in an avalanche has enormous destructive power. Based on the nature of their movement, avalanches are classified as: moving along a natural slope, gutters, jumping.

The most optimal conditions for the formation of avalanches are created on the mountain slopes without forests. The speed of snow movement can reach from 20 to 100 m/s. It is impossible to predict the exact time of avalanche formation.

Passive and active preventive measures can be taken. Passive methods are the construction of dams, snow plows, snow holders and planting forests (Padarev, 2018; Dolchinkov et al., 2021). Active methods include artificially provoking an avalanche in a certain place and at the right time. This is the shelling of snow-covered slopes with shells and explosions with a directed action, as well as the use of loud sound sources.

Emergency situations of a meteorological nature

Natural disasters of a meteorological nature are very diverse both in manifestation and in the scale of consequences. Such phenomena include wind, storms, hurricanes, tornados; heavy rain; large hail; heavy snowfall; snow storms with speeds over 15 m/s; icicles; frostbite and fever.

Wind is the movement of air relative to the Earth. Air moves from high to low atmospheric pressure. Uneven heating of the earth's surface leads to atmospheric circulation, which affects the weather and climate of the planet. The wind direction is divided by the azimuth of the side of the horizon from which it blows, measured in m/s, km/h, in knots. It was adopted in 1963. World Meteorological Organization.

The cyclic activity of the atmosphere is the main cause of hurricanes, storms, and the occurrence of tornadoes. A region of low pressure in the atmosphere with a minimum in the centre is called a cyclone (Figure 12). In diameter, it can reach several thousand kilometres, and its speed – from 30 to 200 km/h. Cyclones are divided according to their origin into tropical and extratropical. The cyclone has the following structure:

– its central part, where there is the lowest pressure, weak winds and cloudiness, is called the "eye of the storm or hurricane";

– the outer part of the cyclone, where there is a maximum atmospheric pressure, the hurricane speed of the air flow is a "cyclone wall", alternating with the peripheral part, where the atmospheric pressure drops sharply and the winds weaken.

Figure 12. Southern Hemisphere Cyclone, 2019

In the Northern Hemisphere, the air masses in the cyclone move counter-clockwise, in the Southern Hemisphere - clockwise. When the cyclone is dominated by cloudy weather, it is characterized by strong winds.

A hurricane or typhoon is a wind with enormous destructive power and acting for a long time. Its speed is 32 m/s and more (according to the Buford scale – 12 points). Hurricanes are divided according to the place of origin of cyclones into extratropical and tropical. Tropical hurricanes move mainly in the direction of the meridians, and extratropical hurricanes – from west to east. Hurricanes appear at any time of the year, and depending on the area under consideration, they are characterized by a pronounced period of action. A certain cyclical nature of their origin contributes to their more accurate prediction. Forecasters give usually feminine names to hurricanes or use four-digit numbering. Hurricanes are accompanied by heavy rains, snowfalls, hail, lightning. They can cause sand and snow storms. The storm is a very strong and continuous wind with a speed of more than 20 m/s. Storms cause far less damage and loss than hurricanes. Eddy storms are generated by cyclonic activity and are typically spread over large areas. Among the whirlwinds is distinguished powder, snowy and gusty (stormy).

In deserts, sand, or dust storms occur, during which huge masses of soil and sand move at high speed. Similarly, when snowstorms occur, huge masses of snow are transported through the air over long distances. On the plains of the European part of the Russian Federation, in the steppe part of Siberia, as well as in Canada and Alaska, there may be the most powerful snowstorms.

A sudden start and an equally sudden end, enormous destructive power and short duration of action are characteristic of gusty storms. During such storms, short-term wind increases can reach up to 20–30 m/s. Various regions, both onshore and offshore, may be susceptible to gusty storms. As a rule, the United States, the European part of Russia and Canada suffer from such a disaster. Between mountain ranges connecting valleys, torrential storms usually occur, which are characterized by horizontal movement of air or its movement up a slope.

During a thunderstorm, an atmospheric vortex called a tornado can develop. Visually, the top of the tornado looks like a funnel-shaped expansion merging with the clouds. The bottom of a tornado can sometimes expand as it approaches the Earth's surface, resembling an inverted funnel. Physically, a tornado is a mixture of air, water and dust, spiralling counterclockwise at a speed of up to 100 m/s and having a height of 800 to 1500 m. Due to a decrease in pressure inside the tornado, water vapour condenses, and the presence of water and dust in this vortex contribute to the visibility of a tornado. Its diameter above the sea is measured in tens of meters, and above land – in hundreds of meters (Aizman et al., 2011). Based on their structure, tornadoes are classified into solid (sharply limited) and vague (vaguely limited); in terms of temporal and spatial impact – on small tornadoes with a flat action (up to 1 km), small (up to 10 km) and hurricane vortices (more than 10 km).

A particular danger of hurricanes, storms, and tornadoes is their destructive power and the inability to forecast and predict the place and time of occurrence. Consequently, the consequences of such natural phenomena can only be compared with earthquakes.

Hydrological disasters

As a result of hydrodynamic disasters, the following occurs:

– too high water levels or floods, during which part of the settlements and crops are flooded, damage to transport and industrial facilities;

– too low water levels, which disrupt navigation on navigable water snow avalanches;

– snow avalanches;

– the early freezing, the appearance of ice on navigable waterways and on vessels.

This group of emergency situations includes marine hydrological phenomena - tsunamis, storms, ice pressure, their intense deviation.

The raging and destructive power of the water element is capable of causing irreparable damage to the ecological and economic sectors of any country. One of the frequent emergency situations that operational services have to deal with is the rising water level of local bodies of water and going beyond the shoreline.

In such cases, they speak of a flood, a sharp rise in the level and a flood. However, these concepts are often confused or even completely identified with each other.

High water or a sudden rise in the level of the water column is a short-term but sharp rise in water in rivers and lakes. It is characterized by its suddenness and is completely independent of the time of year. It can appear several times a year. The causes are usually associated with the external circumstances in the environment: prolonged and heavy rainfall, sudden warming with rapid snowmelt. The maximum duration is numerous days. Sudden changes in water levels, one after the other or with a short time interval between them, can lead to flooding and an emergency situation (Figure 13).

Figure 13. Amazon – the most flooded river in the world, 2018

Flooding is a common natural phenomenon that always occurs at the same time of the year, in the spring. It repeats annually and is characterized by a long and high rise in water levels in water bodies. In most cases, the water comes out of the river bed, but floods can also happen without flooding the coastal area. The river level during this phenomenon can rise by 20–30 m. The decline can last up to 1 month. It is caused by the heavy inflow of water into the catchment area due to rain, melting glaciers and snow. A peculiarity of winter floods in Siberia is the fact that they, as a rule, cover the same rivers or permanent sections of rivers and repeat at approximately the same times. Therefore, winter floods are more effectively predicted (Kichigina, 2021). However, the anthropogenic influence on the scale and severity of the flood cannot be detected due to the complexity of the process of run-off formation associated with the condition of the soil, the presence of snow, etc. (Teufel et al., 2017). Flash floods associated with excessive snowmelt in high mountain areas are typical for the Caucasus region and rivers located in the Alps and Central Asia.

Flooding is always a major natural disaster with significant land covered by the waters of water bodies. Globally, floods are the most destructive natural disasters, causing the most deaths and damage (Tien Bui et al., 2019). Economic losses due to inland flooding are ranked as the third most important climate risk, after coastal flooding and food insecurity (Elalem & Pal, 2015).

High water is a phenomenon associated with climate and annual seasons, and the water regime of the river. This happens every year due to the spring melting of snow. A distinctive feature of a flood is the snow recharge of the rivers. The rise in water levels in reservoirs is much more significant and slower. It is necessary to prepare for it annually, and managers of large reservoirs must monitor weather forecasts and statistics on the average annual inflow into the reservoir. High water is always replaced by another phenomenon – low water. This is a period when water levels drop below minimum values. As a rule, it is winter, lasting until the spring flood and the dry period of summer. Depending on the damage caused and the territorial coverage of the flood, the following types are distinguished:

1) Low water level or small flooded area. The most harmless floods. They are found in rivers located on flat terrain. According to observations repeated every 5–10 years. They do not pose any threat to the lives of the population.

2) High water level or large flooded area. They are characterized by a fairly strong flood that affects large areas of land. With this form, evacuation of people from nearby houses may be necessary. Material damage is not above average, but very noticeable. There is often destruction of fields, pastures. They rarely meet – once every 20–25 years.

3) Extra-large. They are fixed once a century. They cause a lot of damage as all farming activities are completely stopped. Residents of the entire settlement have been evacuated to a safe place.

4) Catastrophic. Such floods rarely occur without human casualties. The disaster zone covers the territory of several river systems. Human activity in the area subject to catastrophic flooding is completely blocked. They are observed once every 200 years.

The severity of the consequences depends on many factors: how long the water has been spilled on the land, its elevation, the speed of the falling flow, the area of the flooded territory and the population density.

A variety of reasons can lead to flooding. For areas with a warm, mild climate, prolonged and heavy rains that occur frequently can become a threat. In areas where the dry and cool climate prevails, rainfall is less frequent and the risk of flooding is minimal. While historical climate variability may not be directly correlated with a given region's current vulnerability to flooding, it also may not be directly related to the future vulnerability. The rationale for this is that many factors work together to determine vulnerability, determining the region that has experienced past and present floods and the associated climate (Elalem & Pal, 2015). A study of the Alberta flood (Canada), which occurred in 2013 and was the costliest natural disaster in Canadian history, found that anthropogenic increases in greenhouse gas emissions may also have contributed by causing evapotranspiration rates to be higher than they would have been under pre-industrial conditions (Teufel et al., 2017).

In the northern regions, however, there is another danger – glaciers, snowy mountain peaks and abundant snow cover. In the case of a sudden warming or early spring, rapid snowmelt will occur, which will lead to a strong rise in the water in the rivers. A large, sudden rise in the water level can cause flooding.

The accumulation of mineral deposits at the bottom of the river contributes to raising its level. If the water body is not cleaned in time, disasters in the form of floods cannot be avoided (Dolchinkov, 2020).

The cause of the most catastrophic floods can be a tsunami, which occurs suddenly and causes terrible destruction and numerous victims. They are giant waves, breaking and spilling onto land one after the other, sweeping away everything in their path. Powerful waves in the sea can be formed due to hurricanes or strong winds. They are capable of hitting the shoreline with force.

The breaking of the earth's crust and the appearance of underground water on the surface is also one of the possible causes of floods. The tributaries and landslides lead to overflowing mountain rivers. They, emerging from the channel, descend to the plain with force and a flow of mud. This natural disaster has serious consequences.

The human factor in the formation of floods is expressed in the incorrect operation or accident of hydraulic structures, which leads to their destruction and breakthrough of a large flow of water to populated areas. Different technological disasters can cause flooding of different sizes. Along the coasts, floods can be caused by earthquakes, volcanic eruptions and tsunamis. Floods caused by the action of winds, pushing water from the sea and raising the water level due to its retardation at the mouth of the river, are called surge.

If the groundwater flow speed exceeds 1 m/s and reaches 1 m, then experts regard this as a danger of flooding. Destruction of houses is observed if the water rises to a level of 3 m. At the same time, due to the influence of a cyclone in the sea, long waves can arise and provoke a flood even in conditions of complete calm. In St. Petersburg, for example, the islands in the Neva delta have been flooded more than 260 times since 1703.

River floods differ in the water rise height, the flooded area scale and the damage caused: small, medium, exceptional, catastrophic. This classification is based on the frequency of recurrence: after 10–15 years, after 20–25 years, after 50–100 years, after 100–200 years for small, average, exceptional and catastrophic floods, respectively. The duration can range from several days to 3–3.5 months. The flood of the Tigris and Euphrates rivers in Mesopotamia, which occurred 5600 years ago, had very serious consequences. In the Bible, the flood is called the Flood.

During underwater earthquakes, volcanic eruptions or other tectonic processes, large areas of the seabed can be displaced. Such phenomena create conditions for the occurrence of tsunamis – marine gravity waves propagating over long distances. Near the coast, tsunami waves can reach up to 10 m, while in the area of their occurrence their height is 1–5 m, and in bays and river valleys more than 50 m. The main regions of tsunami occurrence are considered to be the coast of the Pacific and Atlantic oceans. The tsunami spread inland to a distance of up to 3 km. They suffer significant economic and human losses.

To protect against tsunamis, structures such as breakwaters, embankments, and harbours have been created. However, this will only provide partial protection. Tsunamis are not dangerous for ships on the open sea.

The protection of the population from tsunamis is carried out by warnings of the special services about the approach of the waves, based on preliminary registration of earthquakes by coastal seismographs.

Natural disasters are usually unexpected. In a short time they destroy territories, dwellings, communications, and cause famine and disease. Natural emergencies have been on an increasing trend in recent years. In all cases of earthquakes, floods, landslides, their destructive power increases.

The negative impact of natural emergencies is distinguished by its depth and severity of consequences. The worst thing about this is that the cause of such emergencies is usually man-made activities. Due to disrespect for the laws of nature and underestimation of the importance of solving environmental problems, the world experiences serious consequences in the form of economic, biological, resource losses and, often, human casualties.

CONCLUSION

Since natural disasters develop very dynamically in space and time, have certain patterns and have large-scale negative consequences, the current study was aimed at studying the nature of natural emergencies and the dependence on anthropogenic activities. The analysis of literary sources did not reveal studies entirely devoted to establishing the influence of anthropogenic activities on the occurrence of natural disasters. At the same time, in some literature sources studied, this issue was raised and discussed along with other main research goals.

It was found that many researchers indirectly confirm that anthropogenic activities can provoke negative natural events, or contribute to a significant increase in the scale of a dangerous natural phenomenon. However, concrete results and 100% evidence are lacking, due to the fact that these studies had other goals at the forefront.

At the same time, several research works have noted that climate change over the past few decades and global warming are contributing to an increase in the frequency of natural disasters such as earthquakes, floods, tsunamis, landslides, etc. It is obvious that humanity is making a significant contribution to the development of global warming processes through the development of uncontrolled urbanization, unorganized changes in land use. At the same time, deforestation, changes in vegetation cover, excessive removal of soil, etc. contribute to an increase in the scale of development of these natural disasters and consequences.

Thus, for a better understanding of the relationship between anthropogenic processes and certain natural disasters, additional research is required, initially at the regional level, taking into account the climate characteristics of the region, and after that on the global level by systematizing and comparing trends. The main obstacles to this may be the insufficient amount of data (or gaps) over a wide time interval, which can lead to errors in the results during their mathematical processing and further interpretation.

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