ANALYSIS OF THE IMPACT OF HOSTILITIES ON THE ENVIRONMENT

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Abstract

The article analyzes domestic and foreign literary information on the impact of military events on the environment, and assesses the impact of various factors on natural components. The aim of the work is to identify the effects of hostilities and their significance on environmental components. To assess the impact of various negative factors of military activity on the environment, the matrix method of expert evaluation was used. Using matrix analysis, the types of impacts on various components of the environment and their arithmetic mean values were identified. According to the data obtained, the total arithmetic mean value of the negative influence of the factors of military events on the state of the environment is calculated. It has been established that most of the research work in the domestic and foreign literature on this issue is devoted to the analysis of the effects of pollution of the seas during hostilities, the identification of pollutants in the atmosphere during shell explosions, and the analysis of the state of soil cover in the territories of military events. The research topics in the field of the impact of military events on the environment, which today are insufficiently studied, are determined. These include pollution of water bodies during the destruction of the water supply and sewage systems, the occurrence and spread of fires, emergencies at potentially dangerous objects, etc.

Keywords: war, military events, impact assessment, environmental components, matrix analysis, pollution, destruction, degradation, ecocide, shelling.

1 INTRODUCTION

The importance and relevance of this study is justified by the situation in the modern world. Countries are expanding existing military blocs, accumulating nuclear weapons, thus, military weapons become not only a means of achieving political goals, but also pose a threat to human civilization and all life on Earth. The conduct of hostilities, like any type of technogenic activity, negatively affects the state of the environment and is fraught with many dangers. Most military operations are accompanied by the use of heavy military equipment, weapons of mass destruction, artillery bombs, shells and other weapons. These tools of warfare contribute to the destruction of not only the enemy, but also lead to pollution and degradation of the natural territory [1].

2 METHODS

In the work, based on literary information and information from information sources, a generalization of the environmental impact of military events is carried out. To assess the impact of various negative factors of military activity on the environment, the matrix method of expert assessment is used, complicated by a point assessment. In the matrix method of expert assessment, the matrix ranks the components of the environment, comparing it with the types of impact. If a specific process caused a change in a specific component of the medium, then the corresponding cell in the matrix is marked, thereby fixing the interaction. For specification, a score is used [2].

3 RESULTS AND DISCUSSION

Environmental impact of hostilities

The first works demonstrating the negative impact of hostilities on the environment appeared in the late 1960s and early 1970s, when during the wars in Vietnam, Laos and Cambodia, facts of the destruction of the nature of the Indochina Peninsula by American troops became known. In 1972, in the book "Ecocide in Indochina" [3] it was shown that the war launched by the USA in Indochina using barbaric means of mass destruction led to irreversible, catastrophic consequences for all forms of life in the region and this can be considered as a new kind international crime - ecocide [4]. In 1974, the collection of articles "Air, Water, Earth, Fire" showed the possible consequences of using chemical and nuclear weapons and other means and methods of warfare. As part of the UN Environmental Program, work was carried out to identify desertification processes under the influence of military events.

Ecocide was used in antiquity (for example, when the Romans sprinkled salt on the ground in Carthage, etc.), but it was believed that it was still more effective to direct the blow at the enemy himself, rather than by nature. Since then, there has never been a similar case of barbaric destruction of the environment in history like in Indochina [3]. The use of chemicals to destroy vegetation began in 1961 and in 1962 and became the main weapon of war in all of Southeast Asia. According to statistics, 43% of arable land and 44% of the forest area was cultivated with herbicides. The defoliant was especially actively used, which later led to the death of the crop, capable of feeding 900 thousand people. [five].

After 1971, the US troops had a goal to destroy forests in Vietnam [6]. Almost all mangrove forests in southern Vietnam were destroyed, since they die after the first pollination with herbicides and cannot be restored for decades [7.8]. The bombing contributed to the formation of large areas of funnels (about 30 million pcs.), The depth of which reached 9 m, which resulted in soil erosion, landslides, floods, changes in the flora and fauna.

The war in Vietnam led to the fact that the problem of the negative impact of hostilities began to take on a global character. The scientific world began to actively study the specific effects of military events on the state of the environment. It was revealed that modern armed forces lead to the pollution of the territory by military vehicles, contribute to the occurrence of forest fires, the destruction of the ozone layer

during missile launches and military aircraft, radioactive pollution of the environment by nuclear submarines, etc. [5.9].

Most military operations are accompanied by shelling and bombing. During shelling, such damaging factors as shock wave, light and ionizing radiation arise. The shock wave due to the rapid pressure drop and air pressure leads to the destruction of buildings, equipment, injures people. Light radiation acts only on unshielded objects and can contribute to the ignition of combustible materials, provoke fires, and damage people and animals. Penetrating radiation resulting from the explosion of ammunition and bombs, has an ionizing and destructive effect on the molecules of human tissues, causing radiation sickness.

Explosions of bombs and shells, the construction of trenches, trenches and dugouts lead to a change in terrain, huge masses of soil are moving [10]. Due to the movement of huge masses of rocks, a change in the biogeochemical balance of the territory occurs, which in turn leads to the destruction of ecosystems. For example, during the First World War in Europe, when creating trenches, more than 240 million m3 of soil was excavated, and during the Vietnam War, 2 billion m3 of soil was moved [8].

The movement of troops, equipment across the territory, the burial of military industry waste, the formation of funnels are the main causes of soil degradation, the death of the plant world, loss of land fertility, withdrawal from agricultural use, and more. Mined areas, remnants of military corrosion equipment, chemicals, combustion products and highly toxic fuels reduce agricultural use, and open burning of organo-arsenic compounds present in chemical munitions can cause locally high concentrations of arsenic in the upper soil layers of the region [11].

Military action is a source of waste generation, including metal, which includes fragments of bombs, artillery shells, bullets and other military equipment, which also become sources of soil pollution. The impact of ammunition dumps during the war on soil conditions is negatively affected. For example, an excess of the concentration of heavy metals was observed in 24 of the 32 visited land sites, including for copper and lead [12]. The impact of hostilities on the geological environment is expressed in violation of the solidity of rocks (crushing, loosening, mixing, dispersion) during explosions, engineering preparation of the area, etc. Bombing and underground nuclear tests initiate earthquakes. There are many cases when such a connection has been proved [13].

Explosions of shells, artillery bombs lead to significant emissions of dust, carbon dioxide, oxides of sulfur and nitrogen, heavy metals and polycyclic aromatic hydrocarbons. After exposure to atmospheric air, these substances lead to contamination of adjacent territories and infection of living organisms [14]. Air emissions from the activities of the armed forces make up 6-10% of total air pollution due to unavoidable fires, as well as emissions of dust, gases, toxic chemicals in warehouses and industrial enterprises. So, for example, due to the fire after the explosion of the Kuwaiti oil well in 1991, carbon emissions amounted to about 200 thousand tons and spread from the fire to more than 1000 km from Kuwait [6.15].

Based on the analysis of atmospheric air during the war, it was revealed that carbon monoxide occupies the largest share among harmful emissions - 29% of all emissions, sulfur dioxide (sulfur dioxide) - 21%, dust - 15%, other organic compounds (nitrogen oxides, hydrocarbons) - 13%, as well as ammonia, phenol, heavy metals [16]. During detonation of shells and ammunition, oxide and carbon dioxide, nitrogen,

hydrocyanic acid, formaldehyde and a large number of toxic organic compounds are formed [17].

The introduction of hostilities contributes to the release of a significant amount of greenhouse gases, mainly carbon dioxide, which is involved in the formation of the greenhouse effect [18]. These effects may be more noticeable in the face of climate change. Military activity leads to the death and worsening of the living conditions of animals.

For example, in the explosion of a sea mine weighing 100 kg, all representatives of the fauna within a radius of 44 m die [19]. So, according to statistics, during the Second World War, a large number of whales died, since many of them were mistaken for submarines [6].

An important cause of environmental pollution is the significant burial sites remaining at the sites of major battles. When corpses are decomposed, poisons are formed which, together with rains or groundwater, can enter water bodies.

Such poisons are dangerous in that their influence can begin as soon as possible, and appear only after a few years. In many military events, secondary emergencies also arise, such as fires, the destruction of potentially dangerous facilities, breaks in the networks of pipelines and sewers, an outbreak of infectious diseases, and more [1].

In general, the majority of studies in the areas of military operations are devoted to the consideration of pollution of the seas [20–25], the identification of pollutants in the atmosphere when shells break [26,16], and the analysis of the state of the soil cover [11, 12, 27]. Impact assessment in a matrix-ball way.

Based on the analysis of domestic and foreign literature sources, we performed a matrix analysis of the assessment of the impact of military operations on the environment [2, 28]. In the expert evaluation on the matrix methods, points from 1 to 5 points were used (Table 1).

Table 1. Matrix analysis of the environmental impact of hostilities

Environmental componentes / B Types of exposure	Climate	Landscape	Relief	Soil	Surface water	Groundwater	Flora	Fauna	Average value
Air pollution	-5	-1	-2	-5	-5	-5	-5	-5	-4,13
Water pollution	-4	-2	-2	-5	-5	-5	-5	--5	-4,13
Soil pollution	-3	-4	-2	-5	-5	-5	-5	-5	-4,25
Death of animals	-3	-1	-2	-4	-5	-5	-5	-5	-3,75
Death of plants	-3	-5	-2	-4	-4	-3	-5	-5	-3,88
Destruction and damage to the system	-3	-4	-3	-5	-5	-5	-5	-5	-4,50
Sewerage, treatment facilities, utilities	-3	-5	-5	-5	-3	-3	-5	-5	-4,25
Formation of funnels from bomb	-5	-2	-3	-5	-5	-5	-5	-5	-

explosions									4,38
Radioactive contamination	-5	-5	-4	-5	-4	-4	-5	-5	-4,13
Fire	-5	-5	-5	-5	-5	-5	-5	-5	-5,00
The occurrence of secondary emergencies (accidents at industrial facilities, landslides, earthquakes, floods)	-3	-2	-2	-3	-4	-4	-5	-5	-3,50
The occurrence of ionizing radiation	-4	-4	-5	-5	-4	-4	-5	-5	-4,38
Land movement	-3	-5	-4	-5	-3	-4	-4	-4	-4,00
The emergence of wasteland, cluttered territories, withdrawal from circulation for long periods of land	-4	-5	-4	-5	-3	-3	-3	-4	-3,38
Minefield formation	-3	-5	-3	-5	-3	-3	-4	-4	-3,75
The destruction of the agricultural system and agrophytocenoses	-4	-4	-3	-4	-4	-5	-5	-5	-4,25
Destruction and disposal of weapons and equipment, military waste	-3.75	-3,38	-3,19	-4,69	-4,19	-4,25	-4,75	-4,81	-4,25
Note: - negative impact; + - positive impact; - lack of exposure; 1 - very low impact; 2– low impact; 3 - significant impact; 4 - strong impact; 5 - very strong impact.									

According to table 1, in most cases, military events lead to the formation of explosive funnels, destruction / accidents at industrial facilities and utility networks, provoke dangerous natural phenomena (landslides, earthquakes, floods). According to the matrix analysis, the total environmental impact of military operations is -4.25, which corresponds to a “strong negative” impact. to the greatest extent it is expressed in the destruction and degradation of the soil cover (4.69 points), the death of animals and plants (4.75-4.81), the pollution of surface and groundwater (4.19-4.25 points), and gas contamination of the territory, the occurrence and spread of fires, an increased risk of infectious diseases and the infection of the territory with toxic substances.

4 SUMMARY

1. An analysis of domestic and foreign literature showed that most of the research work on the analysis of the effects of hostilities is devoted to the consideration of pollution of the seas, the identification of pollutants in the atmosphere during shell explosions, and the analysis of the state of soil cover in the territories of military events.

2. Using matrix analysis, it is shown that military events have a strong negative impact on the environment; to the greatest extent it is expressed in the destruction and degradation of the soil cover, the death of animals and plants, the pollution of surface and groundwater, etc.

5 CONCLUSIONS

Despite the considerable amount of research being carried out in the field of the impact of military events on the environment, some aspects remain not fully understood. For example, topics such as the impact of the destruction of the water supply and sewage systems on the state of water bodies in the areas of warfare, the

occurrence and spread of fires, emergencies at potentially dangerous sites, the destruction of the agricultural system and agrophytocenoses, and the death of the animal and plant world are hardly covered.

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