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Analysis of the state of environmental protection in Poland

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ABSTRACT

The subject of the following study is the state of environmental protection in Poland. The theoretical part defines the concept of environmental protection and lists the most important aspects related to environmental protection in the country. The empirical part contains an analysis of the state of environmental protection in Poland.

Keywords: Environmental protection, state of the environment, environmental protection in Poland, ecological security, environmental law

1. INTRODUCTION

Environmental protection is a key issue for modern economies. It is also important that the state should take an active part in these activities, because environmental protection is considered one of the most important so-called state integration functions. The goal of such state actions is to ensure the functioning of society as a whole, by creating conditions to guarantee basic living conditions [1].

The issue of environmental protection is the greatest contemporary challenge facing man. Further development of human civilization depends on the rationalization of the use of environmental resources. However, the issue of environmental protection is an extremely complex issue. It covers a wide range of issues, such as climate change, air protection,

biodiversity issues, water and sea protection, and waste management. From the global level to the local level, we feel the negative effects of environmental pollution. They require appropriate environmental management on a global scale. However, the implementation of global management can take place thanks to the appropriate behavior of each person at the local, but above all central level [2].

The environment is a necessary, permanent and natural condition for society's real life and development. At the same time, due to its nature, the environment should be a platform for cooperation between public authorities and individuals to take protective action. Therefore, in addition to the obligations imposed on public authorities, the Constitution imposes on everyone a general duty to care for the state of the environment. This obligation applies to all those who remain under power. However, due to the subject of this article, the author will limit herself to presenting the state's obligations in the area of environmental protection and ecological safety. Environmental protection is the constitutional obligation of public authorities, which are obliged to provide the society with environmentally-friendly development conditions by means of activities aimed at maintaining the natural foundations of human existence together with care for all elements of these foundations.

The imposition of obligations on public authorities in the field of environmental protection and ecological security means that the Constitution imposes certain legal obligations on public authorities. A constitutional legal obligation is an order expressed in the constitutional legal norm or a prohibition on specific behavior in a given situation [3].

2. DEFINITION OF ENVIRONMENT PROTECTION

The state is the basic structure responsible for environmental protection, while being limited in its operation to areas of its territory. For this reason, international solutions are important in terms of environmental issues. Environmental protection, which is an integral part of sustainable development, is now considered one of the fundamental principles of international law, by which are understood mandatory norms of international law binding all entities of this right and obligations. Making environmental protection an obligation for public authorities obliges them to deter various entities from activities harmful to the environment, i.e. preventive actions. At the same time, the state administration should undertake active behaviors consisting in counteracting or preventing harmful effects on the natural environment in order to improve its condition. Therefore, the state bears the burden of responsibility for ensuring that the environment which is a common good is used in a rational manner, and for preventing potential ecological damage and removing the consequences of damage that has already occurred [4].

Initially, the concept of environmental protection was limited only to the protection of the natural environment of man, and only over time it systematically expanded. In such a broader context, the human environment, which requires protection, includes not only soil, water and air, but also housing, cultural and social conditions, i.e. all the requirements enabling an individual and society to live at an appropriate level. Environmental protection means a set of such activities and behaviors of individuals, bodies and countries that aim to provide present and future generations with favorable living conditions and to exercise their right to use the resources of the environment and preserve its values, in particular to preserve or restore natural balance [5].

Environmental protection is currently a rapidly developing interdisciplinary science, including science of environmental law. Negative effects of human activity on the environment were initially difficult to predict, especially in view of the fairly widespread thesis that environmental degradation is a natural consequence, a side effect and a specific payment that man must make in the era of progressive industrialization [6]. With time, when the deceptiveness of this reasoning was realized, man's approach to the environment changed, and the problem of his protection became a task involving both states and international organizations. It should also be emphasized that protecting and shaping the environment is one of the basic functions of the state.

Three areas can be distinguished in environmental protection [7]:

- protection and rational use of nature resources,
- protection of special environmental values, specific, valuable natural elements (national parks, reserves and nature monuments),
- protecting the environment and human life against loads (protection of soil, water, air against pollution, removal, utilization or safe storage
- waste, protection "against noise, vibration and radiation).

The basic and, at the same time, the most general normative expression of the state's goals and tasks aimed at achieving these goals are constitutional legal regulations [8] In the light of the above, it is in this legal act that the purpose of the state's action should be established, such as ensuring adequate ecological conditions for the society, and indicating basic tasks of the state in the field of environmental protection.

Task specification should refer to [8]:

- creating special legal institutions, the use of which will allow to achieve protective goals
- enabling citizens and obliging state bodies to use these institutions,
- establishing criteria for "environmental assessment" of the activities of each entity having an impact on the environment,
- defining the rules for enforcing liability for broadly understood environmental damage.

The risks associated with inadequate management of the natural environment result not only from the limited availability of resources, but also from the consequences of environmental pollution. Sources of these phenomena can be natural or anthropogenic. It is increasingly pointed out that an important condition for securing stable development is to ensure access to natural resources. These resources are usually an indispensable element of industrial production. Analyzes draw attention to the problem of non-renewable substances, such as oil, coal, etc. It is more and more often noted that other factors, including wood, food and drinking water are also or may be difficult to access in many regions of the world.

The changeability of the natural environment is a common phenomenon. It is associated with chemical or electrochemical processes occurring in the atmosphere since its inception. Therefore, it is impossible to determine the impurities very precisely. Be aware of the fact that the presence of oxygen in the Earth's atmosphere is a kind of pollution of the original atmosphere in which there was no oxygen. But the process of oxygenating the atmosphere was an evolutionary process, i.e. very slow, not causing rapid changes that could result in the extinction of species living on earth. The key issue here is the time at which changes occur [9].

Ecological security is today included in the components of national security along with economic (including energy), economic, civic, social or military security. Security is a commonly used but ambiguous term. Dictionaries highlight its two aspects: no threat and protection against threats. The problem with the concept of security defined in this way is that both features come from two different semantic areas. The first relates to the state, the second to action, the first to subjective feelings, the second to objective factors. Safety is undoubtedly a value in itself, but it is perceived especially in the conditions of its threat, i.e. it is defined by the emerging risk. Today, ecological security is classified as an element of national security. The notion of national security can be defined as the most important value, national need and priority objective of the state, individuals and social groups, and at the same time a process involving various measures guaranteeing a lasting, distortion-free existence and national development, protection and defense of the state as a political institution and protection of individuals and the whole society, their goods and the environment against threats that significantly limit its functioning or compromise values which are subject to special protection. Although it is a normative term enshrined in the Constitution, it has not been clearly defined in any legal act in Poland [10].

Ecological security primarily serves the pursuit of creating an environment for a human being free of threats that could adversely affect his health or threaten his life. Ecological security in constitutional terms will therefore be synonymous with appropriate quality of the environment, therefore public authorities are obliged to ensure the quality of the environment in line with the needs of society. The obligation to ensure ecological safety should be understood as obtaining such a state of the environment that allows safe residence in this environment and enables the use of this environment in a way that ensures human development [11]. Ecological safety, which is to be ensured by public authorities, is a condition of the environment that allows safe staying in it and using it. The instrument of ensuring this safety is environmental protection, protecting them by the legislator should be guided by the principle of sustainable development [12].

It is worth focusing on the dynamics of phenomena and their sources when considering ecological security. Changes in ecosystems can be rapid or slow. In both cases, they may be of a natural nature or be caused by human activity. Often, however, as a result of natural disasters, technical failures occur in industrial plants. In the case of the aforementioned cumulative changes caused by human activity (e.g. accumulation of pollution, including waste and exploitation of natural resources), economic factors and changes in consumption patterns are of great importance. It is important that the price of resources include all costs, especially external costs, often overlooked so far [13].

The principles of sustainable development and environmental protection are the basis for drawing up and updating the concept of spatial development of the country, voivodship development strategy, voivodship spatial development plans, studies of conditions and directions of spatial development of communes and local spatial development plans.

In the concept, strategies, plans and studies [14]:

- specifies the solutions necessary to prevent the formation of pollution, provide protection against pollution and restore the environment to its proper condition,
- the conditions for the implementation of projects are established, enabling the achievement of optimal effects in the field of environmental protection.

Zoning and land development should as far as possible ensure the preservation of its landscape values. In the study of conditions and directions of spatial development of municipalities and local spatial development plans, conditions for maintaining the natural balance and rational management of environmental resources shall be provided, in particular by [15]:

- establishing programs for the rational use of land surface, including areas of mineral exploitation, and rational land management,
- taking into account the areas of occurrence of mineral deposits and the current and future needs of exploitation of these deposits,
- providing a comprehensive solution to the problems of urban development in towns and villages, with particular emphasis on water management, sewage disposal, waste management, transport systems and public transport as well as arranging and shaping green areas,
- taking into account the need to protect water, soil and soil against pollution in connection with farming,
- ensuring protection of landscape values of the environment and climatic conditions,
- taking into account the needs in the field of preventing mass movements and their effects,
- taking into account other needs in the scope of protection of air, water, soil, soil, protection against noise, vibration and electromagnetic fields.

In the study of conditions and directions of spatial development of municipalities and local spatial development plans, when allocating areas for individual purposes and when determining tasks related to their development in the structure of land use, proportions are established to allow maintaining or restoring natural balance and proper living conditions on them [16]. The study of conditions and directions of spatial development of municipalities and local spatial development plans also defines the way of developing areas degraded as a result of human activity, natural disasters and mass movements of the earth. During the construction works, the investor implementing the project is obliged to take into account environmental protection in the area of works, in particular soil protection, greenery, natural terrain and water relations.

When conducting construction works, it is allowed to use and transform natural elements only to the extent necessary in connection with the implementation of a specific investment. If the protection of natural elements is not possible, actions should be taken to repair the damage caused, in particular by environmental compensation [17]. The competent administration body specifies the scope of duties in detail in the building permit. The required scope of environmental compensation in the case of projects for which an environmental impact assessment has been carried out is specified in the decision on environmental conditions and other decisions prior to issuing which the environmental impact assessment has been carried out. Requirements for environmental protection for a newly constructed or rebuilt building object, complex of objects or installations are [18]:

- implementation of technical measures required to protect the environment required by regulations or specified in administrative decisions,
- the use of appropriate technological solutions resulting from acts or decisions, obtaining the required decisions specifying the scope and conditions for using the environment.

3. ANALYSIS OF THE CONDITION OF SELECTED ENVIRONMENT PROTECTION ELEMENTS IN POLAND

One of the main elements considered in the context of environmental protection is air pollution. Air quality has a great impact on human living conditions, the condition of ecosystems, as well as processes related to climate change. Contaminants contained in the air significantly affect human health, causing many respiratory and circulatory ailments. The greatest impact of air pollution on human and animal health is observed in industrial and urbanized areas. Small children, pregnant women and the elderly, as well as people suffering from respiratory or cardiovascular diseases are particularly vulnerable to the negative effects of polluted air.

Air pollution is understood as the introduction by man, directly or indirectly, into the air of: solid, liquid or gaseous substances in such quantities that may threaten human health, adversely affect the climate, living nature, soil or water, as well as cause other damage in environment. The main gaseous pollutants emitted into the air are: sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO), ammonia (NH₃) and non-methane volatile organic compounds (NMVOCs). By polluting the air, these substances also significantly affect human health and ecosystems.

The values of total emissions of major air pollutants in 2017 showed a further downward trend compared to 2000, with a slight increase in emissions compared to 2016. In the period 2000-2017 the emission of sulfur dioxide decreased by 59%, carbon monoxide by 25%, dusts 12%, ammonia 7%, nitrogen oxides 6% and non-methane volatile organic compounds by 2%. Total carbon dioxide emissions remained at a similar level (an increase of 6% compared to 2000).

Table 1. Total emission of main air pollutants
[Source: Environment 2019, Statistics Poland, Warsaw 2019]

Specification	2000	2005	2010	2015	2016	2017
	in thousand tonnes					
Sulphur dioxide	1 411	1 172	875	712	591	583
Nitrogen oxides ^a	852	869	888	725	742	804
Carbon dioxide	318 209	322 546	333 457	312 321	323 022	336 557
Carbon oxide	3 356	3 089	3 077	2 343	2 456	2 534
Volatile non-methane organic compounds	963	962	963	900	930	948
Anthropogenic sources	732	721	712	641	674	691

Nature	231	241	251	259	256	257
Ammonia	331	324	303	285	292	308
Particulates	386	406	390	327	335	341

The downward trend in emissions of air pollutants was caused, among others restructuring and modernizing the energy and industrial sectors as well as improving the quality of coal burned. Emission reduction was also an effect of the introduction of emission standards. However, the significant increase in the number of cars in recent years has caused stable emissions of traffic pollutants (mainly nitrogen oxides), despite the use of increasingly higher quality fuels.

Greenhouse gas emissions are another factor affecting the state of the environment. Greenhouse gases (GHG), also known as greenhouse gases, are components of the Earth's atmosphere that, due to their physicochemical properties, have the ability to retain solar energy within the Earth's atmosphere, contributing to global warming. Greenhouse gases include, among others: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and industrial gases: fluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆) and nitrogen trifluoride (NF₃). Greenhouse gases remain in the atmosphere for several thousand years. They influence the climate around the world, regardless of where they were emitted.

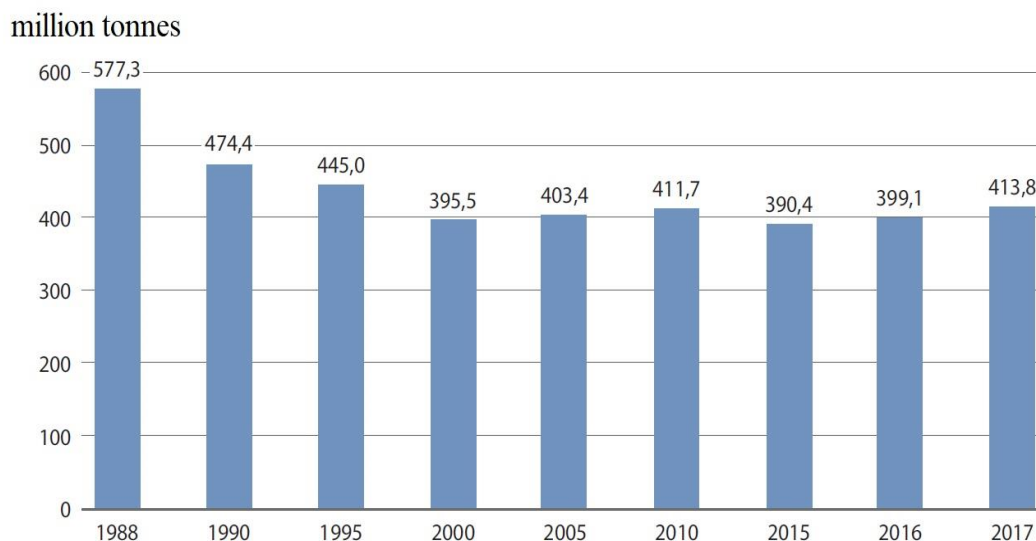


Figure 1. Aggregate emission of greenhouse gases expressed in carbon dioxide equivalent [Source: Environment 2019, Statistics Poland Warszawa Warsaw 2019]

The Kyoto Protocol, signed as part of the United Nations Framework Convention on Climate Change (UNFCCC), imposes on the parties to the convention an obligation to reduce

greenhouse gas emissions by a certain percentage compared to the base year. For most countries, 1990 was used as the base year for the three main greenhouse gases. In Poland, it was established that 1988 was adopted as the base year for carbon dioxide, methane and nitrous oxide, for industrial gases (HFCs and PFCs) and hexafluoride. Sulfur - 1995, while for nitrogen trifluoride - 2000.

Poland has committed itself to reducing greenhouse gas emissions in 2008-2012 by 6% compared to base year emissions. She fulfilled this obligation with a surplus. In 2017, total national greenhouse gas emissions amounted to 414 million tonnes of carbon dioxide equivalent, which means a 28% decrease in their emissions compared to the base year 1988. The largest decrease in emissions was recorded after 1989, when the economic model changed our country towards a market economy. Equivalent means one megagram (1 Mg) of carbon dioxide or an amount of other greenhouse gas equivalent to 1 Mg of carbon dioxide, calculated using the appropriate warming factor. The global warming coefficient is for: carbon dioxide - 1, methane - 25, nitrous oxide - 298.

Devastated and degraded land is one of the elements influencing the assessment of the state of the environment. Degraded land is understood as land whose agricultural or forestry value in use has decreased, in particular as a result of deterioration of natural conditions or as a result of changes in the environment and industrial activity, as well as defective agricultural activity. Devastated land is such land that has lost its value in use as a result of the abovementioned reasons.

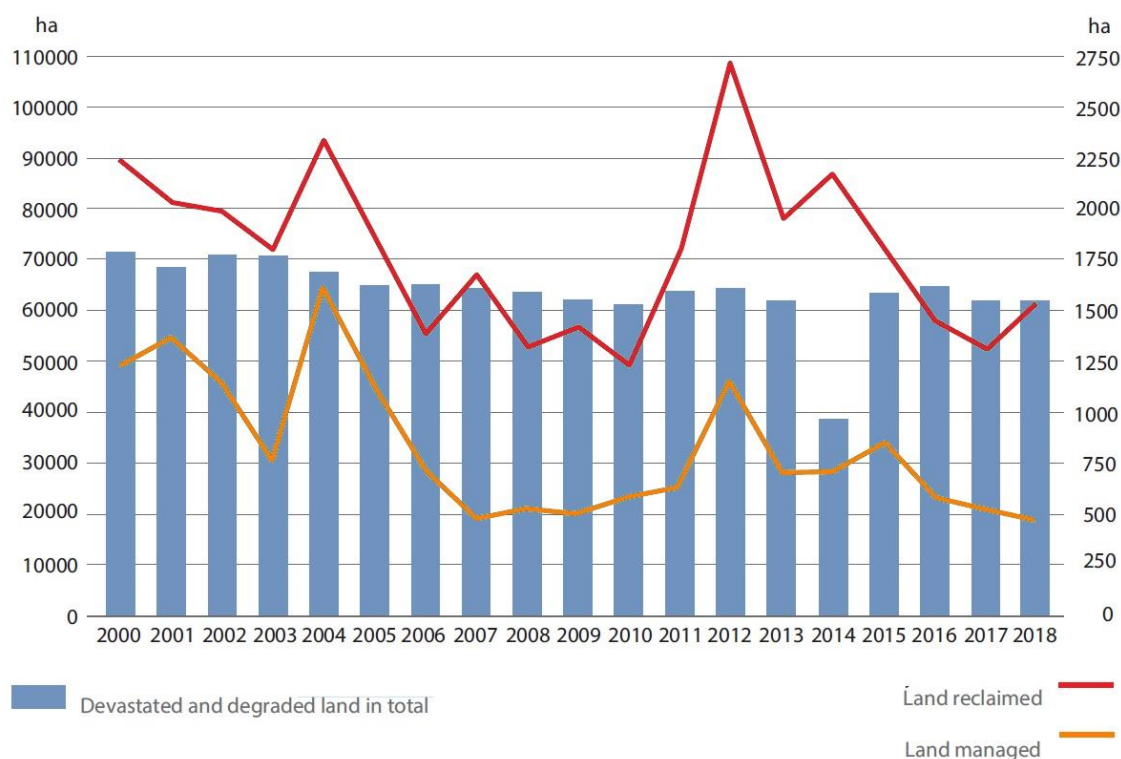


Figure 2. Devastated and degraded land and managed land
 [Source: Environment 2019, Statistics Poland, Warsaw 2019]

In 2018, 1.5 thousand were reclaimed. ha of land (17% more than in 2017), the area of developed land remained at the same level as last year and amounted to 0.5 thous. ha. The degree of reclamation and development of devastated and degraded land is still unsatisfactory and accounted in 2018 for 2.5% and 0.8% of the total area of devastated and degraded land, amounting to 62,000 ha.

The condition of the waters is another element of the environment. However, the most important task to improve water quality is to improve waste water collection and treatment. This activity is aimed at removing pollution from wastewater to the extent that allows further use of water and reduces the burden on the environment.

A sewage treatment plant is a set of technological facilities for the treatment of industrial and municipal sewage, i.e. removal of dissolved substances, colloids and suspensions from sewage, before being discharged into waters or into the ground.

Due to the type of sewage treatment methods and processes associated with them, treatment plants are divided into:

- Mechanical - removing only insoluble impurities using grates, sieves, sand traps, ie solids and fats that settle or float,
- Chemical - wastewater treatment by precipitation of some soluble compounds or neutralization of wastewater by chemical methods, such as coagulation, sorption on activated carbon, etc.,
- Biological - removing organic pollutants as well as biogenic and refractive compounds from wastewater in the process of biological decomposition through the action of microorganisms and microorganisms,
- With increased removal of nutrients - enabling increased reduction of nitrogen and phosphorus.

Over the past several years, the number of industrial wastewater treatment plants has significantly decreased from 1626 in 2000 to 882 in 2018. Some of them were liquidated with the closure of industrial plants or reorganized as a result of starting industrial wastewater pretreatment plants. In emerging industrial sewage pre-treatment plants, sewage is obtained with a pre-reduced pollution load, to a degree that allows it to be discharged to municipal sewage treatment plants or plant sewage treatment plants.

The number of municipal wastewater treatment plants in 2000-2018 increased from 2417 in 2000 to 3257 in 2018. In 2018, biological (61%) and mechanical (23%) treatment plants dominated among industrial treatment plants. On the other hand, the majority of municipal sewage treatment plants used biological methods of wastewater treatment (75%) and enabling increased nutrient removal (25%).

In order to properly monitor the state of the environment, it is also important to analyze the level of noise emissions. The most burdensome sources of noise for people include car traffic (due to its prevalence), air traffic (due to the intense nature of the phenomenon and the spread of it over large inhabited areas), as well as sources of industrial (installation) nature operating continuously or time.

Noise measurements in Poland are carried out in five-year cycles. The most recent cumulative data relate to 2012-2016, 2017 was the first year of the next five years (2017-2021). Long-term trends in environmental noise in Poland point, on the one hand, to an increase in the risk of traffic noise, and, on the other, to a reduction in growth and the occurrence of downward trends in industrial noise.

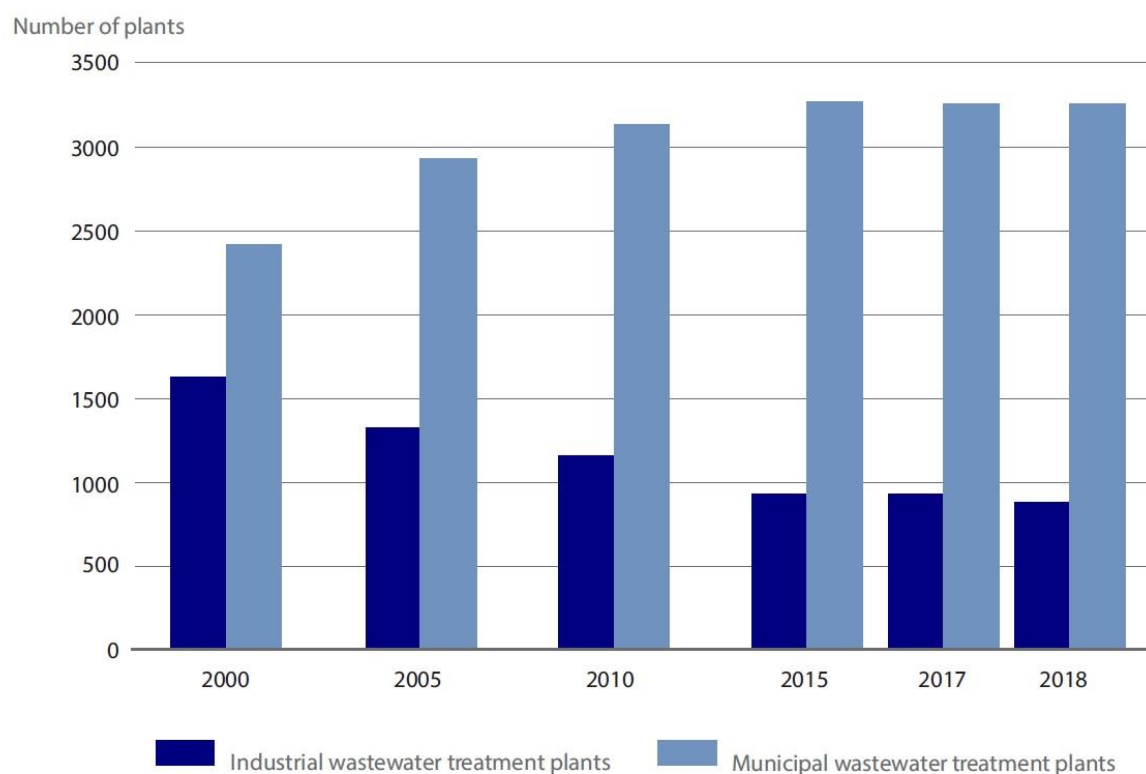


Figure 3. Treatment plants of industrial and municipal wastewater
 [Source: Environment 2019, Statistics Poland, Warsaw 2019]

The monitoring measurements of industrial noise carried out in 2018 (originating, among others, from production plants, windmills, sound system for premises or shooting ranges) controlled 2675 objects (plants) emitting noise, which are in the central records of the acoustic climate control system. Of these, only 579 plants (21.6%) exceeded the permissible noise levels, which is comparable to the previous year. At the same time, there was a significant decrease in the number of plants with exceeding the permissible levels compared to previous years (47.3% in 2007-2011 and 33.3% in 2012-2016). Monitoring of industrial noise showed the highest percentage share of plants exceeding the admissible levels among the audited plants in the following voivodships: Lubuskie (33%), Małopolskie (29%) and Dolnośląskie (26%), while the lowest - in Opolskie (11%) and Łódź (14%).

Monitoring of industrial noise showed an increase in the number of exceedances of permissible noise levels at night from 60.9% in 2017 to 63.6% of plants inspected in 2018. This value also increased compared to the results of measurements from 2007-2011 (49, 1%) and 2012-2016 (57.8%). The highest percentage of facilities exceeding night levels in 2018 was recorded in the following provinces: Świętokrzyskie (84%), Łódź (80%), Mazowieckie (71%) and Śląskie (70%), the lowest in Pomorskie (40%).

The upward trends in traffic noise relate primarily to road noise and air noise. The increase in the risk of road noise in recent years is mainly associated with emerging new roads, bridges, bypasses and highways, and a rapid increase in the number of vehicles.

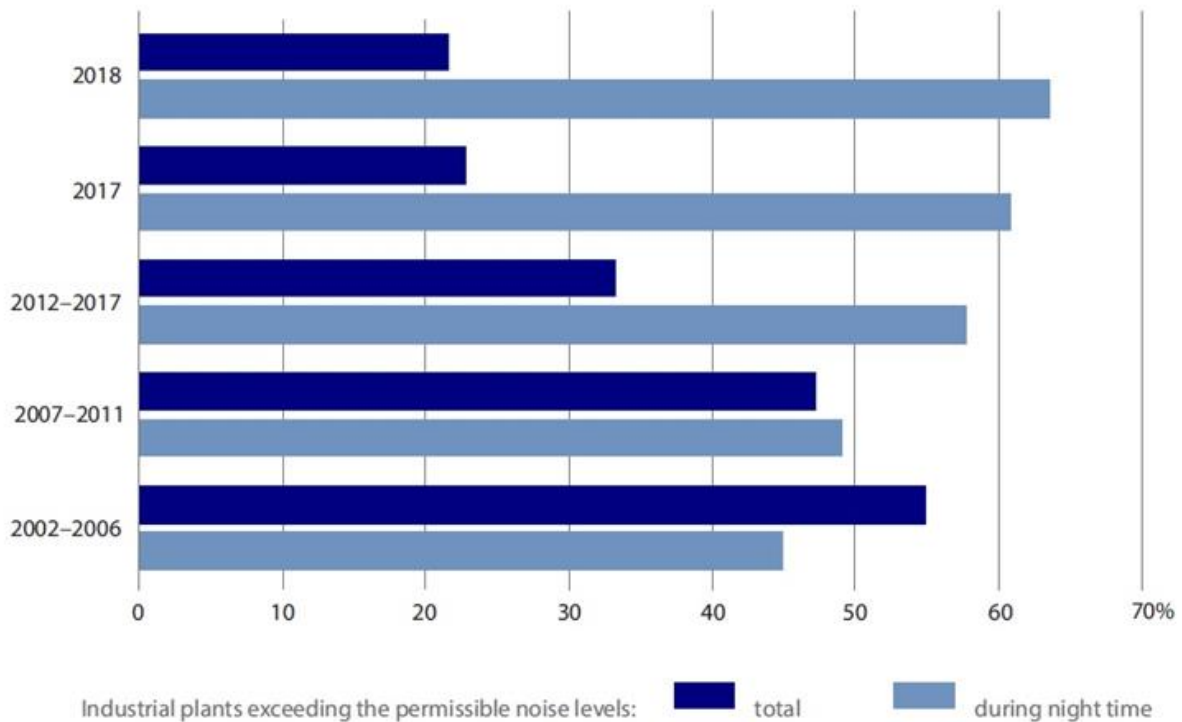


Figure 4. Exceeding the permissible noise levels from industrial plants
 [Source: Environment 2019, Statistics Poland Warsaw 2019]

In Measurements made in 2018 in the field of noise monitoring from acoustic maps showed that road noise was a threat primarily in urban areas and was felt by an increasing number of residents. Of the 265 km of roads inspected in 2018, only for 22 km of roads the emission of road noise was in the range up to 60 dB (decibels), i.e. emissions not exceeding the permissible sound levels in the daytime in residential areas adjacent to the roads. On 92% of roads inspected, the noise level was exceeded. For many years, road noise levels in cities have remained high, around 70-80 dB. The largest percentage of streets where noise emission exceeded the maximum permissible level of 60 dB for the length of streets inspected was recorded in 2018 in the cities of Lubelskie, Lubuskie, Podlaskie and Zachodniopomorskie (100%); the smallest in cities of the Warmian-Masurian Voivodeship (52%). An increase in the level of air noise was observed as a result of the development of air traffic. This noise is characterized by the impact on large areas of the area and high levels of emissions, as well as the lack of effective environmental protection.

4. CONCLUSIONS

Environmental problems are the subject of increasingly complex analyzes. Initially, this issue was raised only in the aspect of endangered species and the need to protect them. Then, these issues began to be analyzed in economic aspects, i.e. as a matter of the most optimal and cheapest access to natural resources. Over time, the negative effects of pollution caused by

industry, incorrect farming and incorrect spatial policy began to be noticed. It wasn't until the late 1960s that it was noticed that environmental threats are widespread worldwide and that the fight against many problems must be global [19-21].

Various disciplines deal with environmental protection. Environmental protection is interdisciplinary. Its implementation requires linking physical, chemical, social, technological, political, economic and legal aspects. Everyone who expresses interest in environmental protection should pay due attention to legal regulations. The law is central to the organization of the environmental protection system. Law is an essential tool in the hands of the state. Through legal regulations, the state creates rules and instruments aimed at economic transformation. A change in the behavior of consumers and business entities is handled by an appropriate legal regime. Law educates society and dynamizes relations to protect the environment. The state uses the law to encourage appropriate behavior, e.g. through subsidies, subsidies, tax breaks. By law, the state also introduces sanctions to eliminate behavior harmful to the environment [22].

References

- [1] Michel-Guillou, E., Moser, G. (2006). Commitment of farmers to environmental protection: From social pressure to environmental conscience. *Journal of Environmental Psychology* 26(3), 227-235
- [2] Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of Social Issues* 56(3), 407-424
- [3] Gunningham, Neil, Robert A. Kagan, and Dorothy Thornton. Social license and environmental protection: why businesses go beyond compliance. *Law & Social Inquiry* 29.2 (2004) 307-341
- [4] Daley, D. M., Layton, D. F. (2004). Policy implementation and the environmental protection agency: What factors influence remediation at superfund sites? *Policy Studies Journal* 32(3), 375-392
- [5] Guo, X., Marinova, D., & Hong, J. (2013). China's shifting policies towards sustainability: a low-carbon economy and environmental protection. *Journal of Contemporary* 22(81), 428-445
- [6] McCuin, R. M., Clancy, J. L. (2003). Modifications to United States Environmental Protection Agency methods 1622 and 1623 for detection of *Cryptosporidium* oocysts and *Giardia* cysts in water. *Appl. Environ* 69(1), 267-274
- [7] Hanson, M. L., Wolff, B. A., Green, J. W., Kivi, M., Panter, G. H., Warne, M. S. J., Sumpter, J. P. (2017). How we can make ecotoxicology more valuable to environmental protection. *Science of The Total Environment* 578, 228-235
- [8] Jacobs, F. (2006). The Role of the European Court of Justice in the Protection of the Environment. *Journal of Environmental Law* 18(2), 185-205
- [9] Panwar, N. L., Kaushik, S. C., & Kothari, S. (2011). Role of renewable energy sources in environmental protection. *Renewable and Sustainable Energy Reviews* 15(3), 1513-1524

- [10] Jenkins, H., Yakovleva, N. (2006). Corporate social responsibility in the mining industry: Exploring trends in social and environmental disclosure. *Journal of Cleaner Production* 14(3-4), 271-284
- [11] Alshuwaikhat, H. M., Abubakar, I. (2008). An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices. *Journal of Cleaner Production* 16(16), 1777-1785
- [12] Maskus, K. E. (2002). Regulatory standards in the WTO: Comparing intellectual property rights with competition policy, environmental protection, and core labor standards. *World Trade Review* 1(2), 135-152
- [13] Taylor, D. E. (2000). The rise of the environmental justice paradigm: Injustice framing and the social construction of environmental discourses. *American Behavioral Scientist* 43(4), 508-580
- [14] Guojun, S., Shuqin, J. (2008). Evaluation on the policies for water environmental protection in Huai River Basin [J]. *Environmental Pollution and Control* 4, 123.
- [15] Feiock, R. C., Stream, C. (2001). Environmental Protection Versus Economic Development: A False Trade-Off? *Public Administration Review* 61(3), 313-321
- [16] Cash, D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., Guston, D. H., Mitchell, R. B. (2003). Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences* 100(14), 8086-8091
- [17] Petrescu, F. I., Apicella, A., Petrescu, R. V., Kozaitis, S., Bucinell, R., Aversa, R., Abu-Lebdeh, T. (2016). Environmental protection through nuclear energy. *American Journal of Applied Sciences* 13(9), 941-946
- [18] Owen, A. L., Videras, J. (2008). Trust, cooperation, and implementation of sustainability programs: The case of Local Agenda 21. *Ecological Economics* 68(1-2), 259-272.
- [19] Petrescu, F. I., Apicella, A., Petrescu, R. V., Kozaitis, S., Bucinell, R., Aversa, R., & Abu-Lebdeh, T. (2016). Environmental protection through nuclear energy. *American Journal of Applied Sciences* 13(9), 941-946
- [20] Beata Draszawka-Bolzan. Effect of pH and soil environment. *World News of Natural Sciences* 8 (2017) 50-60
- [21] Tomas U. Ganiron Jr. Performance of Community Water Supply Management towards Designing Water Safety Plan. *World News of Natural Sciences* 10 (2017) 10-25
- [22] Hironaka, A. (2002). The globalization of environmental protection: The case of environmental impact assessment. *International Journal of Comparative Sociology* 43(1), 65-78