



THE OPPORTUNITIES FOR INCREASING THE ECOLOGICAL POTENTIAL IN BULGARIA

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ABSTRACT

The ecological potential of the territories is determined by the specifics of the regions, related to the geographical location, climatic conditions, relief, available natural resources, but is also influenced by factors such as population size and the degree of urbanization in the region, economic development, specialization of production, etc. The aim of the paper is to analyze the state and the tendencies of natural resources in Bulgaria and on this basis to provide proposals for improving the ecological potential in the country. The introduction presents the relevance of the problem related to the importance of protecting natural resources. The analytical part analyzes the state of natural resources, presenting trends in the balance of the territory (urbanized, forest, protected, disturbed). Indicators such as water withdrawn, generated municipal waste, generated and discharged wastewater, and untreated wastewater, carbon dioxide, municipal waste sent for recycling, availability of long-term tangible assets with an environmental purpose, production of primary energy from renewable sources are analyzed. The conducted survey allows the assessment of the main activities for increasing the environmental potential in Bulgaria. Based on the analyses and assessments, proposals and recommendations for increasing the environmental potential in Bulgaria are outlined.

Keywords: ecological potential, environment, natural resources

INTRODUCTION

The problems related to environmental degradation, depletion of natural resources, and climate change underscore the urgent need to seek opportunities for increasing Bulgaria's ecological potential. Ecological potential depends on the condition of a territory's natural resources, the actions taken to preserve them, and the attitudes and perceptions of the population.

In recent years, numerous studies have emphasized the link between environmental pollution which leads to a decline in the ecological potential of territories and socio-economic development (1). Some authors (2) argue that production and consumption result in environmental pollution through a wide range of processes, while other (3) add that the pollution of water resources, air, and other

components affects both the sustainable development of territories and human health. Ecological potential deteriorates in developed regions over extended periods due to various environmental threats (4). The exploitation and pollution of natural resources reduce ecological potential at each level of extraction, production, use, and disposal (5).

Researches (6) links economic development and natural resources by distinguishing three types of potential: prospective potential – the ability of natural resources to meet human needs in the future; real economically feasible potential – natural resources that meet human needs in an economically viable and technologically feasible way; and real environmentally feasible potential – the amount of natural resources that can be used without causing negative environmental impacts. The author (6) emphasizes the development of natural potential through the protection of ecosystems and their bioregulatory capacity. The relationship between economic, social, and environmental indicators is often complex, and

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the economy, environment, and society are deeply interconnected. Other studies (7) identify an endogenously integrated relationship where economic development affects both the qualitative and quantitative characteristics of the environment, with a bidirectional dynamic.

The aim of the paper is to analyze the state and the tendencies of natural resources in Bulgaria and on this basis to provide proposals for improving the ecological potential in the country.

MATERIALS AND METHODS

The methodological framework of the study includes an introduction outlining the authors' views on the relationship between economic development and ecological potential, followed by analysis and conclusion. To assess the ecological potential in this article, trends are analyzed across indicators that reflect the state of territories, water resources, and atmospheric air, as well as indicators related to environmental protection activities. Based on a conducted survey, respondents' opinions have been analyzed regarding the relevance of proposed measures for implementing activities aimed at increasing ecological potential, and mechanisms for reducing environmental impacts and improving ecological conditions. The survey was conducted in 2023–2024 among 150 business organizations from various economic sectors across the country. Based on

the analyses and evaluations, generalized conclusions and proposals for increasing ecological potential in Bulgaria have been prepared.

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RESULTS AND DISCUSSION

For the analysis of the opportunities to increase ecological potential in Bulgaria are used data from the website of National statistical institute related to territory, water, waste etc.

The data on **Table 1** shows changes in land use structure for the period 2021–2023. Although the changes are minor, they reveal certain trends in land use. There is a steady and continuous increase in the share of urbanized territory by a total of 0.14%. This indicates expansion of settlements, infrastructure, and industrial zones, explained by ongoing urbanization processes.

For the period 2021–2023, there is a slight increase in forest areas from 33.13% to 33.25%, reflecting relatively sustainable forest management. Similar trends are observed in the area occupied by water bodies. The most notable positive change is the increase in protected areas by 0.66% over three years. The share of degraded territories remains unchanged.

Table 1. Land use balance for the period 2021–2023, % of total the territory

Territory	2021	2022	2023
Urbanized territory	4,62	4,66	4,76
Forest territory	33,13	33,38	33,25
Territory occupied by waters and water bodies	1,87	1,88	1,89
Protected territory	1,39	1,66	2,05
Disturbed territory	0,42	0,43	0,42

Source: (8)

Table 2 presents data illustrating the environmental impact in Bulgaria for the period 2018–2022. The analyzed indicators include water abstraction in million cubic meters per year, generated municipal waste in thousand tons, generated and discharged wastewater in million cubic meters per year, generated and discharged untreated wastewater in million cubic meters per year, and carbon dioxide emissions in thousand tons.

For the period 2018–2020, the amount of abstracted water decreased from 5,425 to 5,076

million cubic meters per year, followed by an increase up to 5,519 million cubic meters per year. This can be explained by the COVID-19 pandemic and the reduced economic activity in some sectors, after which in 2022, water abstraction returned to levels seen at the beginning of the period. Similarly, during 2018–2020, the amount of municipal waste slightly decreased and from 2021 the quantities increase with 11% or 330 thousand tons.

The quantities of wastewater range between 415 and 424 million cubic meters per year,

indicating that this indicator does not change significantly. However, a positive trend is observed in the volume of generated and discharged untreated wastewater, which decreased by approximately 10%, from 132 to

119 million cubic meters per year. Regarding carbon dioxide emissions, a decreasing trend is seen up to 2020, followed by an increasing trend exceeding the levels from the beginning of the analyzed period.

Table 2. Environmental indicators in Bulgaria for the period 2018 – 2022

Ecological indicators	2018	2019	2020	2021	2022
Water withdrawn, million cubic meters/year	5425,2	5421,3	5076,9	5293,7	5519,4
Total municipal waste generated, thousand tons	2861,518	2838,278	2828,761	3058,061	3157,279
Generated and discharged wastewater, million cubic meters/year	424,1	417,8	415,3	423,3	418,1
Generated and discharged untreated wastewater, million cubic meters/year	132,2	129,4	126,9	129,2	119,0
Carbon dioxide, thousand tons	43576,951	42267,463	36644,242	42425,087	46994,496

Source: (9)

Alongside some indicators that measure environmental impact, activities leading to environmental improvement and enhancement of ecological potential are also analyzed such as municipal waste sent for recycling, the number of operating wastewater treatment plants, the availability of long-term tangible assets with ecological purposes, and the production of primary energy from renewable energy sources (in thousand tons of oil equivalent) (**Table 3**). Although generated municipal waste shows an increasing trend of 10.3%, the amount of municipal waste sent for recycling increased by 74%, from 215 thousand tons to 375 thousand

tons. This indicates dynamization of recycling processes and improved waste management.

The number of operating wastewater treatment plants also increased from 170 to 179, reflecting an improvement in environmental infrastructure and the potential to enhance the quality and ecological potential of water resources. The availability of long-term tangible assets with ecological purposes also follows an increasing trend, growing by 16.4%, indicating higher investments in environmental protection related assets. The trend in primary energy production from renewable energy sources is positive as well, with quantities increasing by 8.4%.

Table 3. Activities, leading to environmental protection

Activities	2018	2019	2020	2021	2022
Municipal waste sent for recycling, thousand tons	215	184	144	302	375
Operating municipal wastewater treatment plants	170	173	174	176	179
Availability of long-term tangible assets with ecological purpose, thousand BGN	9523596	9889758	10468033	10873312	11092112
Primary energy production from renewable energy sources, thousand tons of oil equivalent	2584,296	2549,061	2578,579	2973,983	2800,588

Source: (9)

The data from **Table 4** present respondents' evaluations regarding the importance of various environmentally focused activities related to enhancing ecological potential. All the activities were rated as important or rather

important for increasing ecological potential by the majority of respondents. The distribution ranges from 84% to 98% of respondents giving positive responses, identifying the development of renewable energy sources, improvement of

water infrastructure to reduce water consumption, activities to limit greenhouse gases, recycling and waste utilization, activities to reduce the carbon footprint, construction and maintenance of water supply networks, organizing waste collection and disposal, application of agroecological practices, and activities for sustainable land management as

important for enhancing ecological potential in Bulgaria.

The highest score were given to activities related to infrastructure services, such as organizing waste collection and disposal, and construction and maintenance of the water supply network, which were considered definitely important by 77% and 74% of respondents, respectively.

Table 4. Distribution of respondents' opinions on carrying out activities to enhance ecological potential, %

Activities	Not important at all	Rather not important	Rather important	Definitely important
Development of renewable energy sources	1	15	42	42
Improvement of water infrastructure to reduce water consumption	0	6	35	59
Activities to limit greenhouse gases	0	13	47	40
Recycling and waste recovery	0	3	35	63
Activities to reduce the carbon footprint	0	10	43	46
Construction and maintenance of the water supply network	1	3	23	74
Organization of waste collection and disposal	0	2	21	77
Application of agroecological practices	0	9	43	48
Activities for sustainable land management	0	3	41	57

Source: own survey

The distribution of respondents' opinions regarding mechanisms suitable for reducing environmental impacts and enhancing ecological potential shows that policies motivating the adoption of ecological practices, the use of new technologies, subsidizing ecological production, increased control over applied production practices, and the implementation of eco-taxes on fuels are considered rather suitable and definitely suitable by most of the respondents (**Table 5**). Support for the different mechanisms ranges from 64% to 92%, with the use of new technologies

regarded as the most suitable, while the application of eco-taxes on fuels receives the least score.

Policies motivating the adoption of ecological practices and subsidizing ecological production receive strong support from respondents (88%), with only 12% considering them unsuitable. It can be concluded that the proposed mechanisms with an incentivizing character are considered more appropriate than those with a restrictive nature.

Table 5. Distribution of respondents' opinions on mechanisms for reducing environmental impacts and enhancing ecological potential

Mechanisms	Not suitable at all	Rather not suitable	Rather suitable	Definitely suitable
Policies that motivate the adoption of ecological practices	7	5	42	46
Use of new technologies	5	3	39	53
Subsidizing ecological production	7	5	28	59
Increased control over applied production practices	6	5	33	55
Eco-taxes on fuels	18	19	45	19

Source: own survey

CONCLUSION

Based on the conducted analyses, it can be concluded that positive trends are observed - an increase in protected areas, a reduction in the amounts of generated and discharged wastewater, an increase in municipal waste sent for recycling, increase in the number of operating municipal wastewater treatment plants, the availability of long-term tangible assets with ecological purposes, as well as an increase in primary energy production from renewable energy sources.

On the other hand, negative trends are observed regarding urbanized area, water abstraction, generated municipal waste, and carbon dioxide emissions. The evaluations of the proposed activities aimed at enhancing ecological potential are supported by the majority of the respondents. The highest rated activities (over 90%) are those related to improving water infrastructure to reduce water consumption, recycling and waste recovery, construction and maintenance of the water supply network, organizing waste collection and disposal, and activities for sustainable land management.

According to respondents, the most suitable mechanisms (over 90%) for reducing environmental impacts and enhancing ecological potential are policies that motivate the implementation of ecological practices and the use of new technologies, followed by subsidizing ecological production and strengthening control over applied production practices (both over 80%). The least supported mechanism is the imposition of eco-taxes on fuels.

Based on the analyses and evaluations, recommendations can be made to increase ecological potential by undertaking actions and measures aimed at overcoming the negative trends observed in recent years. Regarding the increase of urbanized areas, regulations could be introduced to limit uncontrolled expansion, alongside support for green infrastructure policies in urban environments, such as incentivizing the construction of green roofs, city parks, and urban agriculture.

To reduce water abstraction, water-saving technologies in households and industry can be encouraged, systems for using rainwater for domestic and urban needs can be developed, intelligent irrigation systems can be applied in agriculture and industry, and public awareness can be raised through educational campaigns on water conservation.

To reduce waste quantities, activities can be taken to expand separate waste collection systems and increase access to recycling points, implement circular economy principles by establishing innovation centers for reuse and repair, and promote eco-design and products with extended lifecycles.

The negative trend in carbon emissions can be overcome by encouraging the use of renewable energy sources, supporting energy efficiency in public and residential buildings, and developing sustainable transport.

Implementing these and numerous other measures at individual, business, and institutional levels will lead to an increase in ecological potential, improving the state of natural resources and the quality of life for people in Bulgaria.

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