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The importance of the EMERALD sites for the conservation of biodiversity

Elena Moşanu, Anatol Tariţă, Raisa Lozan, and Maria Sandu

Abstract. Biodiversity illustrates the extraordinary variety of life on Earth, but technological progress and the intensive use of natural resources have considerably increased the anthropogenic impact on biological diversity. Therefore, to stop the decline of biodiversity through the long-term conservation of the most valuable and endangered species and habitats of European interest to identify, maintain, and restore areas of special interest for the conservation of wild fauna and flora species, the EMERALD Network was established. To integrate the objectives of conservation and protection of species and habitats of national and local interest, education, information, and public involvement in the efficient management of the heritage of the Emerald Network site and Natura 2000, it is necessary to develop management plans for EMERALD sites.
Keywords: biodiversity, EMERALD site, management plan, conservation.

Importanța siturilor EMERALD pentru conservarea biodiversității

Rezumat. Biodiversitatea ilustrează varietatea extraordinară a vieții de pe Pământ, dar progresul tehnologic și utilizarea intensivă a resurselor naturale au sporit considerabil impactul antropic asupra diversității biologice. Prin urmare, pentru a stopa declinul biodiversitatii prin conservarea pe termen lung a celor mai valoroase și pe cale de dispariție specii și habitate de interes european cu scopul de a identifica, menține și reface zonele de interes deosebit pentru conservarea speciilor de faună și floră salbatică, a fost înființată Rețeaua Emerald. Pentru integrarea obiectivelor de conservare și protecție a speciilor și habitatelor de interes național și local, educație, informare și implicare publică în gestionarea eficientă a patrimoniului sitului Rețelei Emerald și Natura 2000, este necesar de elaborat planuri de management a siturilor EMERALD.
Cuvinte cheie: biodiversitate, sit EMERALD, plan de management, conservation, conservare.

1. Introduction

One of the main concerns of humanity in Mineniul III is the conservation of biological diversity at the level of ecosystems, species, populations, and genes. But with the advancement of technological progress and the intensive use of natural resources,

the anthropogenic impact on biological diversity has considerably increased, essentially reducing the number of species and varieties of living organisms that populate the Earth.

In Europe, globally, the loss of biodiversity is accelerating. The current rate of species extinction is estimated to be 100 to 1000 times higher than the natural rate, which is much higher than the rate that allows the emergence of new species. According to the International Union for Conservation of Nature, 15% of mammals, 13% of birds, 37% of freshwater fish, and 23% of amphibians in Europe are threatened with extinction [8].

As a result, biodiversity constitutes a natural heritage that must be preserved and passed on to future generations, especially because of its essential value and the services it provides to humans (food production, climate regulation, water purification, pollination, soil fertility, etc.). Some of the major causes of biodiversity loss are the fragmentation of habitats, pollution, over-exploitation of natural areas, and artificialization of landscapes. The solution for neutralizing these causes and, consequently, for the protection of wild flora and fauna is the preservation of the natural environment.

2. Methods and materials used

The detailed analysis of the current situation of the environmental components (water, air, soil, flora, fauna) in the sites of the Emerald Network formed the basis of the research methodology used. The methods of analysis (in the field) of animal and plant species were used according to [14]. The inventory of rare species was carried out using the transect method [10]. The protection status of rare species was determined according to national and international documents [1-2, 4-7]. Water samples were collected and analyzed in accordance with SM SR ISO 5667-6:2011 [3].The soil samples were collected according to the ”satellite” method [9]. As well as the national legislative-normative framework in force [11-12, 15-16].

3. Obtained results and discussion

Nature does not take political and administrative borders into account and the best method to protect the natural environment is to coordinate the efforts of countries and jointly strengthen the means. Thus, the survival over time of the numerous endangered species was ensured by a coordinated joint effort of the European community, and consequently, each country was obliged to assume individual responsibilities.

Thus, in 1993, the Republic of Moldova, together with the member countries of the Council of Europe, undertook to actively participate in ensuring the conservation of natural habitats, spontaneous flora and fauna, including migratory bird species, on the verge of extinction by ratifying the Convention on the Conservation of Wild Life and of

Natural Habitats (Bern, 1979) [5], which is an indispensable international legal instrument for strengthening the conservation of wild flora and fauna and their natural habitats and for promoting interstate cooperation. For the same purposes, in 1995, the Republic of Moldova also ratified the Convention on Biological Diversity [5], becoming a party to ten international and regional conventions and agreements in the field of biodiversity conservation.

For the more effective protection of biodiversity, in 1989, the contracting parties of the Berne Convention initiated the creation of a special instrument for the protection of Europe's natural environment: the EMERALD Network [8]. As a continuation of the European biodiversity conservation process, in the Republic of Moldova by Law no. 94/2007 regarding the ecological network, the National Ecological Network was established as a component of the Pan-European Ecological Network (Fig. 1).

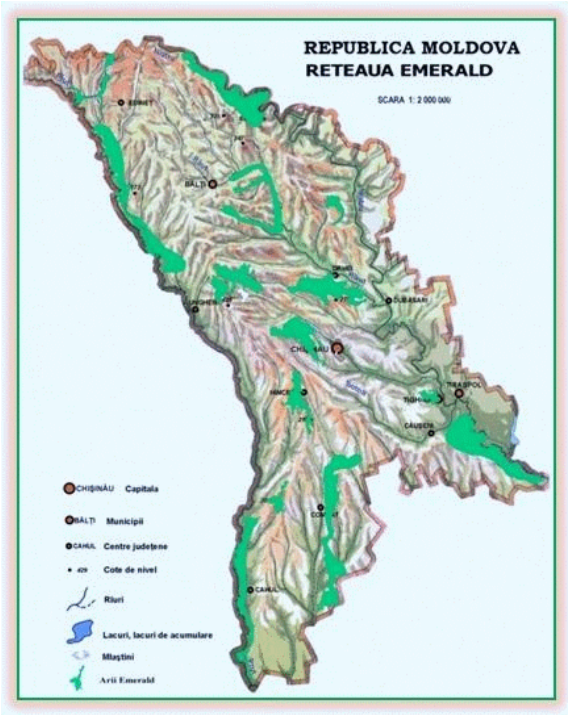

Figure 1. The Emerald network in the Republic of Moldova [9].

And to stop the decline of biodiversity through long-term conservation, with the aim of identification, of the most valuable and endangered species of flora and fauna and habitats of European interest, maintaining and restoring areas of special interest, the Emerald Network was established. The given network is composed of areas of special interest for conservation (ASIC) [15]. These are areas of essential value, with the potential to

contribute to the maintenance or restoration of species and habitats in a favorable state of conservation, especially in terms of:

- endangered, endemic, migratory, and rigorously protected species under the Berne Convention;
- endangered and exemplar habitat types, as well as mosaics of various habitat types;
- migratory species that constitute a general heritage for European countries.

ASIC are areas assessed from a scientific point of view as suitable to achieve the objective of the conservation of species and habitats. Especially when the sites represent fairly well, the species and habitats in their distribution area, their diversity, and their specific conservation needs as well as the area of habitat and the percentage of populations of the species included in the sites are considerable concerning the overall national resource.

The Emerald network includes around 3,500 candidates or certified EMERALD Sites in 16 countries, approximately 600,000 km^2, and an average of 11%-12% of the national surface of the countries involved [8].

To integrate the objectives of conservation and protection of species and habitats of national and local interest, education, information, and public involvement in the management of the heritage of the Emerald Network site and Natura 2000, it is necessary to develop management plans for EMERALD sites.

The Management Plan is to promote a management model that allows the sustainable development of human communities and the conservation of species and habitats, biological diversity, and other values of the natural environment in the protected area.

In the Republic of Moldova, EMERALD NETWORK Sites are devoid of Management Plans. Their lack forced us to elaborate up the first management plan for the ”Cărbuna” Landscape Reserve - Emerald site in 2020, after which, within the framework of the institutional project (with institutional funding), ”Completion of the data bank of the register of the automated information system of the fund of natural areas protected by the state” natural areas protected by the state”, for the stage of 2022, the Management Plan of the EMERALD Site ”Pădurea Hâncești” was developed [19]. Thus, the developed plans serve as a model of sustainable management of human communities and the conservation of species and habitats, biological diversity, and other values of the natural environment in protected areas.

In the Lower Dniester area, the ”Cărbuna” Landscape Reserve is the second most important protected area. Founded back in 1933 on an area of 35 ha, by 1975 it had expanded its area to 356 ha, today exceeding 600 ha.

The natural reserve ”Cărbuna” - EMERALD Site with the code MD0000022 with an area of 678 ha, includes 2 habitats regarding the conservation of wildlife and natural habitats in Europe (Berna, 1979): 1. Oak-hornbeam forests - G1A1; 2. Ponto-Sarmatic deciduous thickets - Ponto-Sarmatic deciduous - F3.247; 3 bird species, and 4 other species according to the updated list of officially adopted EMERALD Sites in December 2019 [8] (Tab. 1). Some species of birds, reptiles, and insects from the given list are given below:

Table 1. Updated list of Emerald Officially Adopted Sites (2019)

Republic of Moldova							
Site Code	Site Name	Site Area (ha)	Birds species number	Other species number	Habitat number	Total features	Biogeo region(s)
MD0000022	”Carbuna” Natural Reserve	678	3	4	2	9	CON
MD00000019	Pădura Hâncești	11290	18	8	4	30	CON, STE

Updated list of officially adopted Emerald sites (December 2019), pag. 9.

A 1188 Bombina bombina, B A429 Dendrocopos syriacus, I 1083 Lucanus cervus, B A073 Milvus migrans, M 1323 Myotis bechsteinii, A 1166 Triturus cristatus (A = Amphibians, B = Birds, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles) [8].

The EMERALD Site ”Cărbuna” has a varied biodiversity, due to the divergent climatic and topographical conditions found in this area. Natural forces, combined with human interaction over time, have created a complex and confusing patchwork of natural and semi-natural habitats, each with a different content of plants and animals.

Biodiversity in the EMERALD Site ”Cărbuna” is, however, damaged. The main pressures and factors behind this decline are habitat destruction, degradation, and fragmentation due to land use change. Key pressures include over-exploitation of natural resources and environmental pollution. The effects of climate change on biodiversity are also visible, with changes in species distribution, migration, and reproduction patterns. Through the lens of the management plan of the EMERALD Site ”Cărbuna” , there are

proposed the following general actions to improve the situation: Stopping the decline of biological diversity represented by genetic resources, species, ecosystems, and landscape and restoring the degraded systems, to stop the reduction of the areas with fundamental natural stands proposes that the fundamental natural oak stands (*Quercus pubescens, Quercus petraea* and *Quercus robur*) be managed only by the method of installation and development of the seed, the regeneration of the oak will be carried out only from the account of natural regeneration. Areas with *Carpinus orientalis* require particular attention. It is also necessary to regulate the rest and recreation of the population in the territory of the protected area according to the regulations in force, it is recommended to integrate the policies regarding the conservation of biodiversity in the researched area and the promotion of knowledge, practices and traditional innovative methods and clean technologies as support measures for the conservation of biodiversity as support of sustainable development [18].

Recommended: activities to maintain or improve the conservation status of rare species: species of flora and fauna: A 1188 *Bombina bombina*, B A429 *Dendrocopos syriacus*, I 1083 *Lucanus cervus*, B A073 *Milvus migrans*, M 1323 *Myotis bechsteinii*, A 1166 *Triturus cristatus* as well as the two habitats: - G1A1 Oak and hornbeam forests - Oak-hornbeam forests, F3.247 Ponto-Sarmatic deciduous thickets - Ponto-Sarmatic deciduous; monitoring the quality of water bodies, to identify those that are at the limit of achieving the objectives of the Water Framework Directive, and using the appropriate measures to restore their condition, as well as evaluating the extent of the eutrophication process by determining the trophic index, monitoring avifauna from the EMERALD Site ”Cărbuna” [18].

It is necessary to monitor the avifauna from the EMERALD Sites ”Cărbuna”, and the results obtained will be recorded regarding the sex of the birds, the rearing behavior of the chicks, and the age class. Habitat data will be recorded for each segment. Floating nests (platforms) will be installed to improve the breeding conditions of water-nesting bird species, creating favorable nesting conditions for birds and prohibiting the presence of humans in the nesting areas during April-June; Realization of a continuous regime of protection of bird colonies during the breeding period; Improving the trophic base of birds through actions to maintain the water level in aquatic ecosystems (performing some dyke activities, cleaning and preventing the phenomenon of clogging, planting new protective strips, etc.), monitoring reptiles, etc.

In the same way, the permanent assessment of air quality and atmospheric precipitation at the EMERALD Sites ”Cărbuna” (local and transfrontier pollution) is required, because

the accumulation of large amounts of atmospheric pollutants have an impact on the environment, such as the greenhouse effect, global warming, air pollution, ozone depletion, and acid rain. And the inclusion of landscape elements and biodiversity conservation principles are indicated to be included as major conditions for the development of tourism infrastructure.

The Emerald site - MD code 00000019 "Pădura Hâncești" is located between the villages of Lăpușna and Merești in the Hâncești district, Republic of Moldova. The specific objective of the Site is the protection of the fundamental natural groves pedunculate oak, rare plant species, and landscape landscapes. This site includes the Natural Reserve of Medicinal Plants "Logănești" with an area of 710 ha and the Landscape Reserve "Pădurea Hâncești" with an area of 4499.0 ha [7].

The protected area includes three habitats of European importance, they are 9170 (A): Oak forests of *Quercus robur* and *Quercus petraea* on rocky slopes and gravel alluvium; 9170 (B), rocky oak forests with the predominance of *Quercus pubescens* on developed carbonate soils; 91 HO and Balkan forests with *Quercus pubescens*.

The ecological state of the mentioned habitats is satisfactory, the dominant stand, according to the state of health, is assigned to the category of healthy trees and trees with the crown partially affected by the accompanying species. Biological diversity includes 29 rare plant species and 19 animals with national and international protection status, including 8 species of plants and 12 animals found in the Red Book of the Republic of Moldova. Here you can find 2 plant species (*Fritillaria Montana* and *Pulsatilla grandis*) and 6 animal species (*Bombina bombina, Triturus cristatus, Lucanus cervus, Morimus asper funereus, Zerynthia polyxena*, and *Euplagia quadripunctaria*), species from the Reference List of species of Union interest.

There have been identified 27 species of birds, of national and international importance that require priority protection, of which 6 species of woodpeckers (including 2 species from the RBM – the oak woodpecker and the black woodpecker). Birds Directive 2000 – 10 species; - Bern Convention- 8; GEO Romania – 17. It was established that the average density of the oak woodpecker in the forest ecosystem of the Emerald site "Pădurea Hâncești" is approximately 0.9 individuals per km^2, and the black woodpecker - 0.3 individuals per km^2. Common bird species identified are 50 species, most of them being from the Passeriformes Order [19].

The elaborated management plan of the site has actions that would allow the improvement of the quality of the environmental components in the area, such as: management, protection and conservation of forest sectors of European importance, where the ecological management prevails over the economic one; restricting any intervention in the

state-protected areas (LR Pădurea Hânceşti and NRMP Logănesti) in the territory of the Site; sustainable collection of natural resources without affecting the trophic base of habitats; performing sustainable Biomonitoring; the installation of artificial nests in poorly productive sectors, with low densities of trees older than or equal to 70 years; in the execution, modification or expansion of the activities in the field (use of water resources for different purposes, constructions, installations on water or related to water, use of minor riverbeds) the Regulation on the procedure for establishing the protected natural area regime [12]; continuous assessment of air quality and atmospheric precipitation at the EMERALD Site "Pădurea Hânceşti" (local and transfrontier pollution), etc.[19].

Prohibition of hunting activities in protected areas, they represent the only place of refuge for fauna. It is also recommended to carry out afforestation in deforested areas, for faster regeneration of affected forest habitats.

The systematic assessment of the ecological state of the surface and underground waters as well as the continuous assessment of air quality and atmospheric precipitation at the level of the Emerald site "Pădurea Hânceşti" (local and transfrontier pollution), etc.[19]

The Management Plans include actions to improve the administrative and scientific staff of the EMERALD Sites "Cărbuna" and "Pădurea Hânceşti" of the ecological education of the young generation from the localities in the area through the prism of the development of some thematic stands on the conservation of biodiversity, of the scientific evaluation courses of different groups of animals in nature and of acquiring contemporary methods of fauna assessment in field conditions, etc. as well as consultation, awareness, and information activities through the organization of lessons in educational institutions, conferences, round tables, seminars, distribution of leaflets, participation in profile television shows, etc.

4. Conclusion

These studies address and integrate the recommended actions, respecting national and European legislation on environmental components and especially biodiversity, and the results obtained contribute to the scientific substantiation of the development of recommendations to improve the sustainable management of the EMERALD Sites.

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(Elena Moşanu, Anatol Tariţă, Raisa Lozan, Maria Sandu) Institute of Ecology and Geography of the Moldova State University