

# FACTORS THAT CONTRIBUTE TO THE DETERMINATION OF CLIMATIC INFLUENCES IN FORESTED AREAS

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## Abstract

The paper presents some aspects related to the role and functions protected areas, of the special avifaunistic protection area (SPA), included in the list of sites of community importance (SCI), belonging to the ecological network Natura 2000 in Iasi County, with the role and function of natural habitat conservation, of wild fauna and flora, from Barnova Forest (SPA0092) and Barnova Repedea Forest (ROSCI0135). A number of investigative methods and techniques were used to enhance protected areas that also integrate historical monuments, included in the list of sites of Community importance (SCI). Among the analyzed aspects, reference was made to monitoring the evolution of their conservation status, taking into account the new findings regarding instrumental analysis techniques as well as present methodological processing / operation systems, using the Geographic Information System (GIS), which will allow geographical representation and mapping of the characteristics contained in the relational databases. As a reference, the visual representation will be used, observing in the field the distribution of nature's goods and their affectation by climatic influences largely due to environmental aggression through anthropogenic actions, but also of historical monuments in the two study areas. The results of these analyzes will underline the overwhelming importance of maintaining a clean environment and sustainable growth will be pursued, providing biodiversity benefits. Stimulating beneficial actions will be achieved by maintaining and conserving the biodiversity of ecosystems and related services, reducing unsustainable practices.

**Keywords:** protected areas, biodiversity conservation, historical monuments, sustainability, anthropogenic actions.

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## INTRODUCTION

Romania's accession to the European Union imposed from the beginning a special responsibility towards the decision-makers at national level regarding the assets of the cultural heritage and those of nature, through NATURA 2000.

NATURA 2000 is at the heart of European policy, with Europe's commitment to acting in the spirit of conserving its rich biodiversity for future generations.

The European Environment Network Natura 2000 includes Special Protection Areas (SPA) classified in the Birds Directive [1] and Sites of Community Importance (SCI) under the Habitats Directive [2], both designed for the conservation of species and habitats of Community interest. Their protection

and conservation in Romania is guaranteed by Government Emergency Ordinance no. 57/2007 [3], approved by Law 49/2011 [4], which transposes into national law Council Directive 92/43 / EEC on the conservation of natural habitats and of wild fauna and flora [5]. To meet these requirements, the Geographic Information System (GIS) is used worldwide. It allows the precise positioning of the map of species, habitats and human impact, which transposes their spatial distribution in the field. These data can be used in the future by the managers of each site to implement adaptive conservation measures for the conservation of biodiversity and strongly connected cultural heritage [6-9]. In this context, the general

purpose of this study is to contribute to the effectiveness of the Natura 2000 network in Romania in conserving biodiversity at the site ROSCI0135 Bârnova-Repedea Forest and ROSPA0092 Barnova Forest. The objectives of the

research are: (1) documentation on the spatial distribution of plant species and habitat types of these sites; (2) to record the influence of environmental factors and the potential human impact on protected areas.

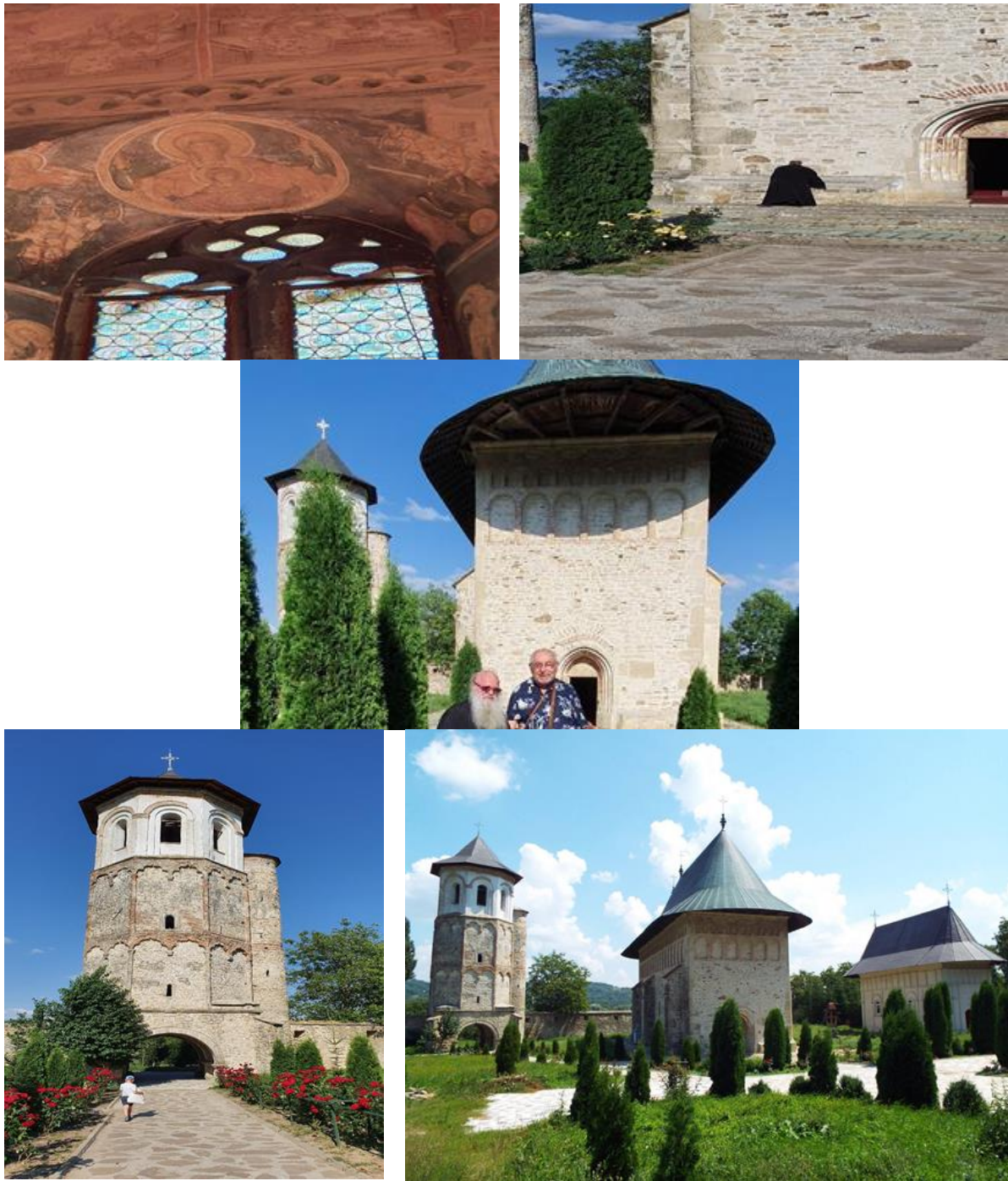
### MODERN METHODS OF VALUATION OF CULTURAL HERITAGE

In the vicinity of the site there are numerous objectives of historical, cultural and tourist interest: (places of worship, architectural monuments, archaeological sites). Using GIS, a series of important information will be identified, correlated and analyzed through modern methods of evaluation, inventory, presentation of the entire cultural heritage. The GIS technique, by monitoring and managing them, will make these places much more attractive and accessible to the general public, tourists, people of culture and art, etc. Also, in support of the collective cultural memory, the causes that can lead to the destructive damage of the ecclesiastical monuments and their restoration will be discovered and remedied. Their openness to the public is an important aspect in the management of cultural heritage, and facilitating access to its objectives is directly proportional to their conservation status, age and recognition (value). In this sense, the current policies on Conservation Science, bring to the fore the active participation of citizens, namely cultural volunteering, which must

be integrated into them, highlighting the essential role of each actor (the principle of participatory conservation). These methods present current perspectives on the electronic launch of tourism. GIS technology will monitor and manage these monuments in the field of protected areas. It will be possible to establish the precarious state of preservation of artefacts and monuments of special heritage value (due to ignorance and abandonment, unauthorized interventions, their conscious deterioration and degradation, etc.). These systems, present online, combine the advantages of the systems themselves and those of interest, which in tourism are used as decision-making systems on park routes and points of interest or as information tools. The research will refer to the management and conservation of the collections in the museum space, but also of the architectural monuments and archeological sites (recently discovered, being researched and excavated or in situ conservation). (Figure 1- 2).



**Figure 1.** Cujba's Church (Historical monument from 1609, located in Poiana cu Cetate village, Iasi, Romania)



**Figure 2.** Dobrovat Monastery is the last foundation of the voivode of Moldova, Stefan cel Mare. The restored Dobrovat monastic ensemble.

## DISCUSSION

These protected areas are located in the east of Moldova, on the territory of Iasi and Vaslui counties and were designed to preserve the forests of the two types of habitats of community interest, namely, Asperulo-Fagetum beech forests and Dacian oak and hornbeam forests, which provides food and shelter for many species of mammals, birds and insects. It also protects rare floristic elements by sheltering an endangered species of wild orchid, which is protected by law, called the lady's slipper orchid (*Cypripedium calceolus* L) and which lives in shady deciduous and mixed forests,

on the slopes of high hills, preferring calcareous soils. For the monitoring of *Cypripedium calceolus* L, the ecological requirements of this rare and endangered species will be taken into account [10]. According to Nicolè et al. [11], many orchids, including *Cypripedium*, rest in unfavorable conditions for several years, further reducing their chances of survival. As flowering takes place in cycles that sometimes last several years, the monitoring process for this orchid requires long-term studies. (Figure 3).



Figure 3. Cypripedium calceolus

The Dacian beech forests show a fragmentation that is influenced by both natural and human factors and which has led to the reduction of their distribution area within the site. Beech lives on steeper slopes, forming a mosaic with the rest of the forest and allows many species of small plants to survive in areas where it predominates, forming within the so-called beeches, rich and beautiful biotopes. Oak-hornbeam forests are represented inside the site by two types of habitats: Moldovan forests with sessile

oak, beech and linden which are widespread and have a continuous distribution in the site, while Dacian oak forests have a fragmented distribution, being the more affected habitat within the site. The history of forests in the region, through paleobotanical, palynological, anthracological and carpological analyzes performed in both palynological and archaeological sites, demonstrates the millennial age of forests in the area, but also at the regional level [12].

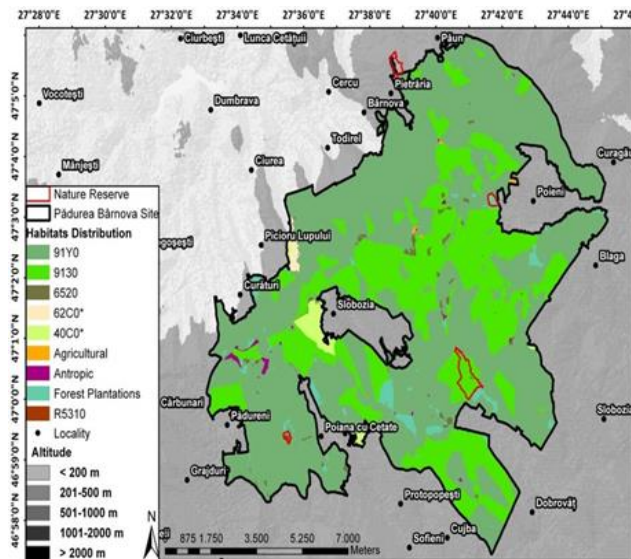


Figure 4. Distribution of habitats in the protected area Barnova-Repede Forest



Figure 5. Barnova-Repede Forest protected area

In the ROSCI protected area Barnova-Repedea Forest, which was declared in 2007 a site of community importance within Natura 2000, other habitats of community interest were identified: ponto-sarmatic steppes (very small habitat in the

geological type Dealul Repedea Fossil Place Reservation and paleontological, specific for sunny areas with low humidity), deciduous ponto-Sarmatian forests, of millennial ages, fine mountain meadows. (Figure: 6- 7- 8).



Figure 6. Fossil Place Reservation Dealul Repedea

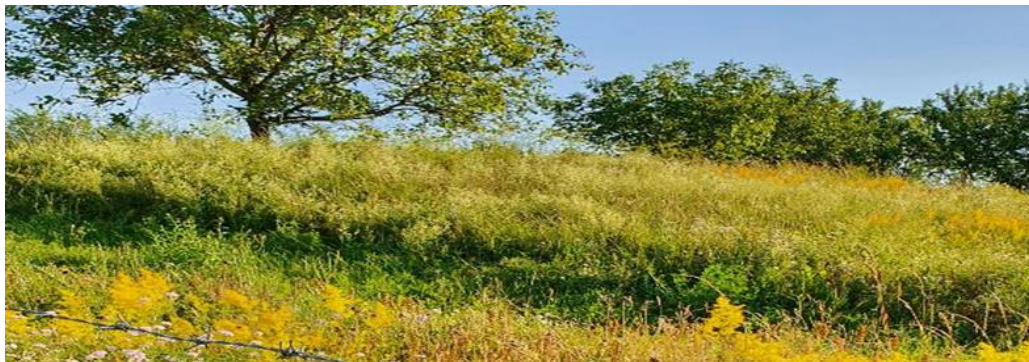


Figure 7. Spontaneous flora Dobrovat

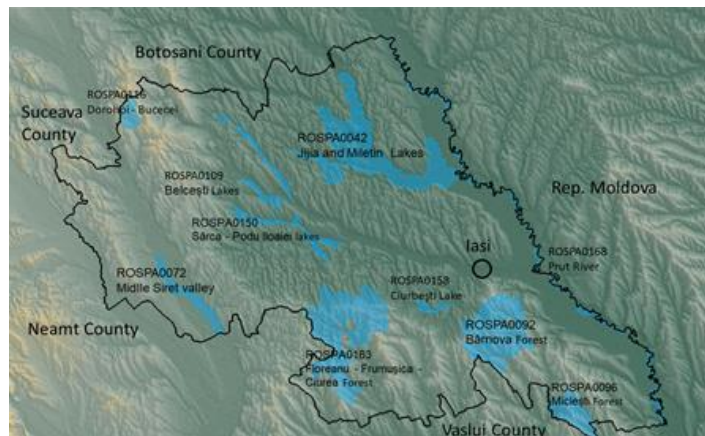


Figure 8. (In Iasi County there are 10 SPA sites distributed all over the territory)

The flora of the natural area is diversified and consists of trees, shrubs, herbs and flowers, among which are species protected by European Council Directive 92/43 / EC of 21 May 1992, as follows:

Trees and shrubs with species of: beech (*Fagus sylvatica*), oak (*Quercus robur*), hornbeam (*Carpinus betulus*), oak (*Quercus petraea*), ash (*Fraxinus excelsior*), silver lime (*Tilia tomentosa*), hazelnut (*Corylus avellana*), sânger (*Cornus sanguinea*), rosehip (*Rosa canina*) etc. Rare flowers and herbs: wild orchid Lady's slipper (*Cypripedium calceolus* L) grow in shady forests, rooster's foot (*Ranunculus repens*), goat's foot (*Aegopodium*

podagraria), yellow grass (*Anemone ranunculoides*), violets (*Scilla b*), snowdrop (*Galanthus nivalis*); wild garlic (*Allium ursinum*), straw grass (*Festuca stricta*, *Festuca ruoicola*); Insects (beetles, butterflies); Birds (migratory, transient, sedentary); Reptiles and amphibians: viper, field lizard, lizard, green tree frogs; Mammals: *Spermophilus citellus*, different species of bats. The vegetation develops within the site on brown forest soils, gray forest soils, calcareous rendzines, degraded chernozems and on a geological substrate that consists of sandy clays and limestone horizons.

### **IMPACT FACTORS FOR THE FORESTED AREA BARNOVA-REPEDEA FOREST**

The natural area of the site has been affected to some extent by current pressures, which refer to anthropogenic actions (human activities that change nature in terms of quality of life for other species): deforestation that has not fully complied with management protected area, other human intrusions and imbalances, pollution, which is mainly due to transport on DN24, telephone and communications networks, urbanization, residential and commercial development, factors that cause changes in the ecosystem of the site, which triggers adaptive anatomical changes and morphological features of other organisms. Environmental factors: abiotic factors (climate, which influence temperature, light, precipitation, pressure, etc.) and biotic factors (parasites, pests, intraspecific and interspecific competition) influence the evolution of risk and safety parameters, intervening in changing the dynamics of the species, to change fertility, the way organisms behave. These imbalances lead to genetic changes in the species or extinction, to dry summers, which accelerates the deficit between photosynthetic efficiency, saturation deficit, water potential and nutrient intake, and the drying phenomenon of old trees in forests is increasing, intervening drought stress (water stress). Forests store significant amounts of water in the soil. They are an important part of the forest ecosystem, and the canopy leaves make the forest floor a shady and humid place, but the massive cuts in recent years have caused changes in the atmosphere, affecting habitats. Decomposition processes take place on the forest floor, fungi and microorganisms disintegrate dead plants and animals and recycle raw materials

and essential nutrients. In areas with limited water availability, plants need to regulate their water use capacity, increase biomass production or adapt to drought by acclimatization. Water efficiency is the relationship between yield, biomass or assimilation and the amount of water used. In the protected area Barnova Forest (ROSPA0092) there are activities inside the site that show a negative impact on ecosystems: high-capacity logging, unorganized tourism, grazing in the forest and poaching. To keep these areas intact, better management of the site is needed, by stopping vehicle access to the forest, by placing more barriers on forest roads. Warning signs and information panels are not enough and are not found in key places, such as entry points. The few paths / roads to visit, the tourist routes do not have appropriate signs. Also, a waste collection network is insufficiently set up. Panels with orientation maps, themed trails, campsites and fireplaces are needed, and in the communities within the site information points (leaflets, companions) are needed for safe movement in the depths of the forest. In the future, it is envisaged to improve and comply with the site management plans for the 4 reservations. The Barnova-Repedea Forest site partially overlaps with the protected area ROSPA0092 Bârnova Forest. Within the SCI, several nature reserves of national interest can be found: Pietrosu Dobrovăț, forest type; Poieni Cărbunăriei, forest type; and Poiana cu Schit, of botanical type; The fossiliferous place Dealul Repedea, of geological paleontological type. All these are included in Law no. 5/2000 Section III Protected areas. [13]

### **Conservation status and human impact within the Natura 2000 site Bârnova-Repedea Forest**

The structure and functions of habitats, including typical species, which are in good condition without significant damage, can be easily observed. Some

actions of extraction of beech and hornbeam wood have been observed in the field in some habitats.



Figure 9. Floristic Reservation Poiana cu schit



Figure 10. The anthropic factor from Barnova-Repedea Forest (ROSCI0135)

The appearance of this type of fragmented habitat, only in certain areas of the site is due almost entirely to environmental conditions and, in very few cases, to chaotic forestry interventions. No actions were observed that would significantly affect the conservation status, except for those that were carried out in accordance with forest management. An exception is oak and hornbeam forests which have suffered considerable losses due to logging practices which have led to the fragmentation of these communities. However, evidence of natural regeneration and reforestation activities was observed. In summer the meadows are mowed once or twice to produce hay. This habitat is especially important for its ecosystem services.

However, one factor that should be considered is sustainable forest management. Given the current pressures at the Natura 2000 site Bârnova Repedea Forest, we can see the presence of large categories, such as: communications networks, urbanization, residential and commercial development, use of biological resources, agriculture, forestry, human

#### **DELIMITATION METHODS**

The entire natural and cultural heritage of the two protected areas in the study will be analyzed by selecting a modern system of methods, which aims to highlight and capitalize on cultural heritage assets by assisting and corroborating instrumental and digital techniques. Both GPS field measurements and the capitalization of the physical-geographical, geomorphological elements of the landscape and ecosystems will be used, followed by GIS analysis and processing, in relation to the National Coordinate System of Romania. The correct results will be obtained after analyzing palynological and archaeobotanical studies, which will allow the assessment of the current state of ancient forests in these two protected areas, revealing the presence of more or less extensive forests in the region of protected areas, since the oldest times.

The information obtained will provide new data on the habitats and distribution of plant species. Field data will be correlated with existing topographic

#### **PROJECTIONS. WHILE PROVIDING GUARANTEES OPTIONS AND INNOVATIVE DEVELOPMENT**

Population growth and economic development in the coming decades will set as basic objectives, adapting agriculture to the growing threats of climate change, reducing the impact of emissions from agriculture, obtaining new basic food resources for life. Also, intensive agricultural practices and the abandonment of biodiversity-rich agriculture will in the future contribute to the

intrusions and imbalances, pollution, invasive species, other species problems, changes in the natural system, natural biotic and abiotic processes (without catastrophes), global change. Given the categories of human impact identified, non-intervention management is recommended for habitats with self-restoration capacity. If replanting is required, non-native trees should be avoided to maintain the characteristic structure of these forest habitats. Non-intervention, management of protected areas and large Natura 2000 sites are known to significantly improve habitat conservation status and living conditions for different species, depending on the dynamic natural processes. The code list of threats and pressures in the Habitats Directive / 2006 will be studied, the degree of damage to habitats and species will be monitored and assessed. Current impacts and potential threats will be analyzed for each habitat type of Community interest and for *Cypripedium calceolus* in the Natura 2000 site, in order to establish conservation measures. (Figure: 10).

maps and aerial photography. [14-15] The use of the geographic information system will allow the observation of the field distribution of species and habitat types in precise maps, which can be used in the future by the managers of this site for the implementation of adaptive conservation measures. Also, human activities will be mentioned that can lead to considerable changes on these protected areas and that will configure the map of current pressures, generated based on these impact categories, which in turn influence climatic factors, which disrupt the entire activity and structure of ecosystems existing.

Protected areas will be monitored to be assessed in accordance with historical objectives in the geopolitical context, their role and functions. These objectives will be achieved through participatory conservation actions and the elimination of all forms of vandalism, the effects of anthropogenic deterioration and degradation. [16, 20]

decline of ecosystems in the area of protected areas. The long-term sustainability of agriculture is compromised by actions of unnatural soil degradation, regression in the case of pollinators, loss of natural biological control of pests, diseases and exacerbation of processes related to the loss of genetic diversity of plants and animals. Therefore, conclusive changes to agricultural systems are



needed to suddenly reduce greenhouse gas emissions, especially in the agricultural sector, as well as to effectively adapt to climate change and improve the conservation of biodiversity in protected areas. A sustainable increase in agricultural productivity will be pursued, by providing benefits for biodiversity, by supporting and promoting options and innovative development in a number of agricultural systems: certain residues and waste will be used for energy purposes, while providing guarantees environmental impact of new technologies, which could have undesirable negative effects on biodiversity.[17, 19] Stimulating beneficial actions will be achieved by maintaining and improving ecosystems and related services, reducing unsustainable practices. The devastating effects of abiotic climatic factors (drought, wind, industrial pollution) also contribute to the extension of the phenomenon of abnormal fragility of drying forest ecosystems. Forests face various challenges, including the disappearance of habitats and the growing risks of attack by new biotic factors, genetic mutations in fungi, flora and angiosperm. The forest area refers to the trees that are part of this ensemble, along with many species

## CONCLUSIONS

Biodiversity conservation in protected areas Barnova Forest (ROSPA0092) and Barnova-Repedea Forest (ROSCI0135), but also of assets that are part of the cultural heritage, can be achieved by identifying new interdisciplinary, participatory and collaborative works in current practice, both by professionals in heritage conservation and by political and economic actors and social (including the general public).

For this, it will be considered the observance of the forest management plan to ensure the sustainability of economic activities in protected areas, the deepening of international normative and legislative acts in the field and their impact in current practice during investigation, intervention, display, storage, creating a synergy between existing instruments and policies and to improve them. It will analyze how participatory conservation can be stimulated by new technological discoveries. The GIS system provides up-to-date information that helps identify critical or risky situations within the protected area.

Thus, the historical monuments within the protected areas, which were not rehabilitated and were not of interest, could be restored and through the new presentation can become a point of attraction, being connected with the other natural tourist attractions in the area. They will be included in a tourist circuit,

of plants, mosses, fungi, herbs, shrubs and animals that coexist here. [18, 20]

As the forest ages, the trees regress physiologically, no longer grow in diameter and height, produce less biomass, thus consuming less carbon dioxide and releasing less oxygen. A young forest produces a much larger amount of oxygen. Therefore, the exploitation of forests as forest management must be seen as an operation that ensures the future and permanence of the forest, the felling must be scheduled, approved, in accordance with the forestry legislation in force for protected areas. [21-23]. The percentages of cuts approved for the secular forests around Iași will be respected, forests that are considered a real green lung for the city of Iași, which is on the list of cities heavily affected by pollution. Maps of nesting, mating or feeding areas of protected bird species will be followed, and the precautionary principle will not be violated by late adoption of conservation measures. The precautionary principle is required, proposing the conservation, protection and improvement of the quality of the environment, including the conservation of natural habitats and protected species.

increasing their real value, and their functions will be optimally exploited. Members of developed communities, from regions with tangible cultural heritage (monuments, buildings, archeological sites, historical sites and natural elements), can be stimulated to become active actors and collaborators (in the process of conservation / restoration). They can be promoters of cultural, ethnographic, religious values that involve, as an expression of the cultural identity of the area, goods that must be protected and preserved, promoting, identifying and managing heritage, but also disseminating innovative approaches.

Improving the quality of the environment actually means improving the quality of life, building societies aware of their diversity and the wealth they represent. Along with the recognized heritage, there are other sites, objects, customs, activities, traditions that local people keep alive.

Efforts must be made to ensure that these often-unrecognized forms of heritage are not neglected. Oral transmission of cultural heritage and preservation of its memory is an unwritten law, because the local population is the basic ambassador of the territory in which they live, in their own interest and in that of newcomers or tourists.

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