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**THE IMPACT OF CLIMATE CHANGE
ON THE NATURAL RESERVATION „POIANA CU SCHIT”
FROM IASI COUNTY**

BY

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Abstract. The global climate change affects the future of our planet, due to the disastrous effects it produces. Romania is vulnerable against a series of natural and geological climate dangers, such as: floods, landslides, strong winds, droughts, extreme temperatures, as well as earthquakes which can cause numerous human and economic losses. The simulations that have been made using the global climate models indicate the fact that the main factors which determine this phenomenon are both natural (variations in the solar radiation and in the volcanic activity), and anthropogenic (changes in the composition of the atmosphere due to human activities). The cumulative effect of these two factors can explain the changes in the average global temperature we have been able to observe during the last 150 years. In order to diminish the damage produced by the climate change, we need to take prevention and safety measures. To do this, it is essential that we monitor the factors which determine these changes, that we evaluate the

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risks and that we establish measures in order to diminish the damage they might produce. Having these considerations in mind, our proposal is to monitor the natural and anthropogenic factors in the area surrounding the Poiana cu Schit natural reservation and to establish preventive and protection measures in order to keep this natural reservation unaltered.

Keywords: environmental factors, global temperature, protected areas.

1. Introduction

Poiana cu Schit is a protected area of national interest from Iasi County, which corresponds to the IVth IUCN category (flora). It is an area of habitat management from the Moldova plateau, situated on the administrative territory of the Grajduri village, on the banks of the Cocreai brook (triburary of Rebricea river), in the forest of Boroșești, on the western territory of the Poiana cu Cetate village, reservation which was inaugurated in 1994.

This natural reservation has an area of 9.5 hectares, and has been declared a protected natural area through the law No. 5/6 march 2000 (with reference to the approval of the Improvement Plan of the National territory - Section III – Protected Areas) and is an area for the protection of several silvo-steppe species of flora, among which we number: *Teucrium chamaedrys*, *Cynosurus cristatus*, *Dorycnium herbaceum*, *Agrostis stolonifera* or plants from *Festuca heterophylla*, *Festuca rupicola* and *Festuca valesiaca* species, all together with hardwood species of trees, among which predominant are the oak, ash, hornbeam, beech, linden, poplar, cherry tree, willow, hazelnut and birch.

The patrimonial attributes of a protected area, which define its purpose and functions, are a part of a summative-integrative system of the values of flora, fauna, landscape, cultural assets, geological formations etc. Their state of preservation depends on the evolution and the aggression of the factors and environmental agents, as well as on the anthropogenic elements. The climate changes are the result of the long-term effects of the deteriorating evolution of the physical state and the degradation of the chemical nature of the component elements of a biocoenosis. An important part in the evolution of the conservation state is the sum of the risk factors (which we cannot monitor), natural factors (cataclysms, bad weather or calamities) and anthropogenic (disasters or catastrophes). Their periodicity cannot be correlated to the aggressiveness or their effect, which often leads to collapse. The climate changes are the long-term results which are owed to some changes in the evolution of the environmental parameters and characteristics, among which the most important is the pollution, in all its forms: chemical, microbiological, thermic, radioactive and sonic), in addition to the above-mentioned factors.

In this sense, the article presents the impact that the climate change has had on the Poiana cu Schit protected area, by highlighting the evolutionary effects

on the conservation state of its existing morpho-structural and functional elements and components (Stingu (Palici) *et al.*, 2019a).

2. Correlations between the flora characteristics and the fauna of a biocoenosis

Among the floral species, the trees, as main edifying elements of the forest biocoenosis are radically different from the other biocoenotic producers, through their capacity to produce and stock large quantities of wood for long periods of time, giving off tree trunks of big dimensions, having the most varied uses and applications for the wooden material (Donita *et al.*, 2004).

Furthermore, the arbors have a very important role in the generator and conservatory environmental functions of the forest. These functions are only fulfilled in conjunction, when they grow together, under the form of stands.

The knowledge of the important relationship with other populations from their respective biocoenosis, is owed to the typology and age of the trees, their distribution within the area and the topography of the field. By delimitating the species, the forester can learn about their qualitative and quantitative features. In this context, the relationships with the ecological factors are very important, the way these factors interact with the area they are part of, the regenerating power of the forest, its longevity, landscaping, pests and dangerous impacts.

The term “biocoenosis” represents a superindividual level of the organisation of the living matter and describes the entirety of the living organisms, both vegetal and animal, all of which interact with each other and live together in a biosphere, forming altogether with it a whole balanced and dynamic unit, dependent on that environment (Sandu and Chirazi, 2012).

We can classify the types of interaction following morphological criteria, through the characterisation of the blossoms, fruit, seeds, bark, ritidom and wood.

The biochemical criteria are talked about more and more, but they require highly equipped laboratories and expensive investigations. To the forester, at present, it is easier to apply morphological criteria for classification, whereas for the gender determination he applies the discriminating criteria (species division). For the oak trees, for example, the shape and the size of the acorn represent 2 discriminating criteria.

After establishing with accuracy, the species, the forester can determine, out of the existing dendrologies, the qualitative and quantitative features of the trees, which are very important from a silvicultural standpoint (Donita *et al.*, 2004). They are as follows:

- the size and height of the trees;
- the rooting type;
- the shape of the trunk (stem);
- the aspect of the bark and ritidom, external layer of the old trees, the bark of the old trees, which is made up of dead tissues which crack and exfoliate with

time. For the cherry tree, the rings are horizontal, for the maple tree we have bark that comes off like scales, for the oak tree we have vertical cracks on the trunk);

- the features of the wood;
- the shape and size of the tree crown;
- the relations with the ecological factors;
- the area;
- the productivity in wood and other produce;
- pests and dangerous impacts;
- fruit yield;
- the regenerating and vegetative capacity of the seed;
- longevity;
- the reaction to sylvotechnical interventions;
- their silvicultural and landscaping value.

The *bark* and the *ritidom* are species recognising factors and are important for the protection of the arbors from heatstrokes, fires, animal damage or the sylvotechnical interventions.

The features of the wood vary according to the tree species and have great economic importance. There are species with a softer wood (willows, poplars, linden, spruce, pine) and species with a harder wood (oaks, elms, hornbeam), in various colors and patterns etc.

The area, *i.e.* the geographical spread, indicates those geographical conditions where the species thrives, especially the climate.

The relationship with the ecological factors depends on the physiological adaptations and are particularly important in the regeneration process, the application of treatments and directioning of the stands and influences the production and the optimal economic capitalization. The wood productivity of the species is the main factor by which we judge the economic value of the tree. The productivity is evaluated by the growth in height, diameter and volume and we distinguish fast-growing species, normal-growing species and slow-growing species. Other economically important features of the trees are the nectar, the pollen, the fruit, the resin, the blooms etc.

It is important to determine the longevity of the arbors, in order to streamline their durability: the trees who live the longest (spruce, beech, oak), and trees with a shorter life span (hornbeam, birch, weeping willow).

There are species which react very promptly to interventions and who grow their tree crown very quickly (beech), and species who react more slowly (oak).

The silvicultural value of the species is assessed by taking into consideration all the above-mentioned features, especially the economic value as well as the ecoprotective value, but also the cultural value of certain species which create the necessary conditions in order to develop species that are the focus of the forester's attention. We have in mind the species which improve the soil through their rapidly decomposing litter, but also the species which prevent

the earth fallow, as well as the species which protect the oak tree trunks through the formation of greedy roots (such as hornbeam, linden, acerines, sorbs etc.).

The landscape value of the species is appreciated by taking into consideration their generated decorative effect, by the shapes and colours of the different parts of the trees.

The forester is interested in the wood volume he can get from the trunk, therefore the trunk growth. When we mention the productivity of the stands we have in mind this volume and not the entire volume of the tree's wooden parts (branches, roots and trunk).

For the spring woods, the coloration is lighter, whereas for the summer woods it is darker, therefore the yearly rings are very well determined. This happens in the wooded regions where there's seasonal climate and where the growth is not constant throughout the year and is interrupted during the cold or dry seasons. In the Equator, where there are no seasons, the growth is continuous, that's why we cannot distinguish the yearly rings. In the areas with seasonal climate, the trees regularly produce one ring per year, so by counting the rings on a section of the tree trunk we can determine the age of the tree.

Judging by the thickness of the yearly ring, we can determine the influence of the heat and water on the growth, therefore the evolution of these factors during the trees' life.

Based on this, it is possible to have a reconstitution of the climate over long periods of time, even before the meteorological observation was a reality. The science which studies the past climate in such a way is called dendroclimatology. The growth of the arbours offers important data which reveals the past climate. This is why the role of the protected areas is so knowable, made with the purpose of collecting data which is as accurate as possible concerning the evolution of life on Earth.

In Romania's temperate climate the growth in height of the arbors usually takes place from april-may until july-august. For some species, in the years with favourable conditions, there can be a second growth (*i.e.* for the oaks). The growth has a daily rhythm, the photosynthesis being more accelerated during the afternoon and at night, after the accumulation of sufficient organic substances to generate the creation of the wood matter.

The growth in arbors, as a result of the wood accumulation depends in internal and external factors. Among the endogenous/internal factors of the tree we enumerate: the species, through heredity and adaptations, the age, the leafy mass, the chlorophyl content in the leaves, the produced mass of flowers and seeds.

Among the exogenous factors we can mention: the CO₂ concentration in the air, the quantity of luminous and thermic energy, the water and air level in the soil, the humidity of the air, the ion-based nutriments in the soil, the density of the stand, competition, biotic factors, pests etc.

The CO₂ concentration in the air is important, because it provides the necessary elements of photosynthesis. The quantity absorbed by the trees,

however, depends on the water content in the leaves, so that the CO₂ could be absorbed through the stomata of the leaf, part which tends to shut down partially or totally in low humidity conditions.

The quantity of light and heat are determining factors. The light is the energetic factor in photosynthesis, whereas the heat generates the thermal background necessary to the development of physiological processes within the arbor. The water and the nutrients are essential in photosynthesis, water also being used for the optimal hydration of the cells and for the perspiration which carried the brute sap containing nutrients from the root to the leaves and which regulates the tree temperature.

The harmful biotic factors, such as defoliating insects, also reduce the wood production. The favorable biotic factors, such as mycorrhiza, increase the wood production etc.

The tree is an element of special significance of the ecological population, but also of the grove arbors.

3. State of conservation of the tree and flower species in Poiana cu Schit

Among the 41 indigenous tree species we find in Poiana cu Schit, we can mention: beech, hornbeam, maple, ash, linden, poplar, willow, sessile, cherry tree, sycamore, elm, birch, mountain ash and hazelnut tree.

An aggressive effect due to mushrooms, which appeared because of the climate change is a highly frequent attack on the ash trees located in our area (Fig. 1).



Fig. 1 – Biological attacks on arbors: (*Hymenoscyphus fraxineus* mushroom, parasite plants, and other types of mushrooms on dried-up wood).

Among these, the mushrooms which kill the ash forests, one which has recently been named *Hymenoscyphus fraxineus* (Kowalski, 2006, has been described in the same year by Baral *et al.*, (2014). The idea of the apparition of this highly aggressive species in Europe was harder to accept in the beginning, but today there are similar cases in almost all the forests, some of which have not been mentioned yet. Such lethal diseases, very aggressive, which debilitate or even kill the arbors (at times even in mass), are also present in our area (Chira and Chira, 2007; Simionescu *et al.*, 2012; Gross *et al.*, 2014).

The ash tree disease in the protected area we have studied appeared in 2006-2008.

The drying up of the ash tree caused by *H. fraxineus* is due to a toxin called viridiol, which can cause physiological imbalances to the host trees (Andersson *et al.*, 2010; Cleary *et al.*, 2014). It is believed that this is not the only explanation for the aggressiveness of the mushroom (Junker *et al.*, 2014), the chemistry of the host – pathogen interaction is far more complex. It is a known fact that the mushroom produces an antibiotic, which is useful for human treatment. (Halecker *et al.*, 2014)

H. fraxineus slowly produces the drying of the ash trees, in the following succession: foliage infections – necroses of the folioles and cob, followed by the withering of the leaves; necrosis and withering of the stalks; rarefaction of the leaves and the drying up of the crown; necrosis of the bark and of the wood at the base of the stem.

In addition to the micotic attack, the feet of the trees are often infested with bark insects (or bark bugs – *Leperisinus varius*, *Hylesinus sp.* or defoliators – *Stereonychus fraxini*). Initially, due to ignorance on these pathogens, the drying of the trees has been blamed on some climatic risk factors (floods, drought, freeze, etc.) or the microbiotic factors (Blaga, 2013).

The disease generated by *Hymenoscyphus fraxineus* is registered on the quarantine lists of the disease-free countries, with the purpose of limiting the spread of the fungus, and understanding its means of spreading (seeds, leaves, bark and wood are susceptible to all sorts of infections, fact which leads to their commercial interdiction). The control of the tree nurseries in order to prevent the disease is a way to make sure man does not spread it. As a means of prevention, the common ash and the narrow-leaved ash are no longer recommended for plantation in the countries which are very affected by the disease. We are also looking for ways to induce a resistance to the disease through hybridization with durable species or through preservation in natural or synthetic fungicide and insecticide, which can protect them (Heuertz *et al.*, 2006; Fernandez-Manjarres *et al.*, 2006).

Poiana cu Schit is a three-in-one reservation: for flora, history and art.

It is known that 4 objectives from the Grajduri village are included on the list of historical monuments from Iasi County, of local interest. One of them is an archaeological site, situated at “Cetate”, on the northwestern limits of Poiana

cu Cetate village, where we found traces of human settlements from the eneolithic age (Cucuteni culture, stage A) and from the Latène age. The other 3 are classified as architectural monument: the ruins of the „Poiana cu schit” hermitage (around the XVII century), situated in the Boroșești forest near the Grajduri village; a house which dates from 1910 in Pădureni village; and Cujba’s church (XVII Cent.) from Poiana cu Cetate.

Of the 4 historical monuments, the one in Poiana cu Schit has got a series of special patrimonial attributes, as an area of integrated natural reserve.

Connected to the history of the hermitage, it is known to have been built by Prince Duma Negru, Alexander the Good’s father-in-law, in the XIV cent. (1395 - 1397). At the request of the hermits, he brought in greek monks who could investigate a mummy they had found here. It is thus known, from ancient documents (1392), that after the removal of the slab guarding the cave door, there has been found on a stone table a sarcophagus, beautifully ornated with precious stones and strange paintings. Inside, there was a mummy of a very tall man. Immediately after the arrival of the Greeks, there has been built a hermitage, whose special religious anniversary is the Birth of St. John the Baptist, on June, 24, the Sanziene Holiday.

Immediately after the building of the hermitage, the cave becomes a secret pilgrimage site and the Prince built here a citadel, also. The fortified castle has been attacked and robbed in turns by Tatars, Turks and Polish and has been left in ruins. Later, it was rebuilt on its old foundations in 1747 and in 1864 the Greek monks leave the hermitage, which degrades a lot with the passing of time, and during the Second World War it is almost completely destroyed by a bomb.

Coming back to this short history, the age of the hermitage is considerable, and the stories surrounding it are more than enigmatic.

Author Mihail Sadoveanu wrote about these places with great art, overwhelmed with the nostalgia of times long gone, which urges you today as well to at the “country beyond the mists, at the times when the ancient horn rang the assembly of the hunters near the campfire and the hunter’s midday” (Sadoveanu, 1926).

Today, Poiana cu Schit only keeps a few relics which have been continuously subjected to vandalism, and construction material extraction, made by the inhabitants of the surrounding areas. Due to abandonment, the site has long suffered at the hands of the bad weather.

4. Particularities as a flora reservation

Poiana cu Schit is pretty widely spread, situated in the centre of a hardwood forest, which has an exit towards the Poiana cu Cetate village, an unpaved forest road (Fig. 2) and the entrance towards the meadow is on a narrow path, shut with a barricade (Fig. 3).



Fig. 2 – The forest access road between the Poiana cu Cetate village and Poiana cu Schit.



Fig. 3 – The access path to Poiana cu Schit.

In Fig. 4 there is a pannel which marks the entrance to the protected area, alongside the rules which must be respected and the penalties in case the rules are not obeyed.



Fig. 4 – The Poiana cu Schit Flora Reservation entrance pannel.

In this area, we can find trees of different ages (Fig. 5), which were highly exploited in the past, as well as a series of spring flowers, mostly indigenous (Fig. 6). Among the latter, the most frequent are the ones we meet in the forest thicket, on the banks of the brook, or in the meadows, and they are: *Scilla bifolia*, *Ranunculus ficaria*, *Viola odorata*, *Lathyrus vernus*, *Corydalis solida*, *Crocus heuffelianus*, *Pulmonaria officinalis*, *Anemone nemorosa*, *Anemone ranunculoides* and *Galanthus*.

We can also find here certain types of grass which are characteristic for hay or for small meadows (Fig. 7).

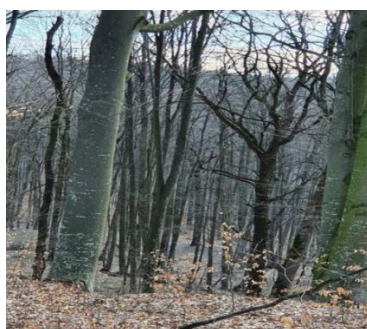


Fig. 5 – Hardwood arbors which are over 50 years old.



Fig. 6 – Indigenous forest flowers from the floral reservation area.



Fig. 7 – Straw-like plants specific to the meadows and steppe hays.

5. Patrimonial attributes as an artistic and architectural site

In Poiana cu Schit we should be able to find a total of 30 massive stone sculptures spread randomly on the entire surface of the meadow, representing a homage that the present generation has brought to the magnificent past (Fig. 8). The rock has been extracted from the Focseasca stone quarry, Vaslui county, situated cca. 10 km from the protected area.

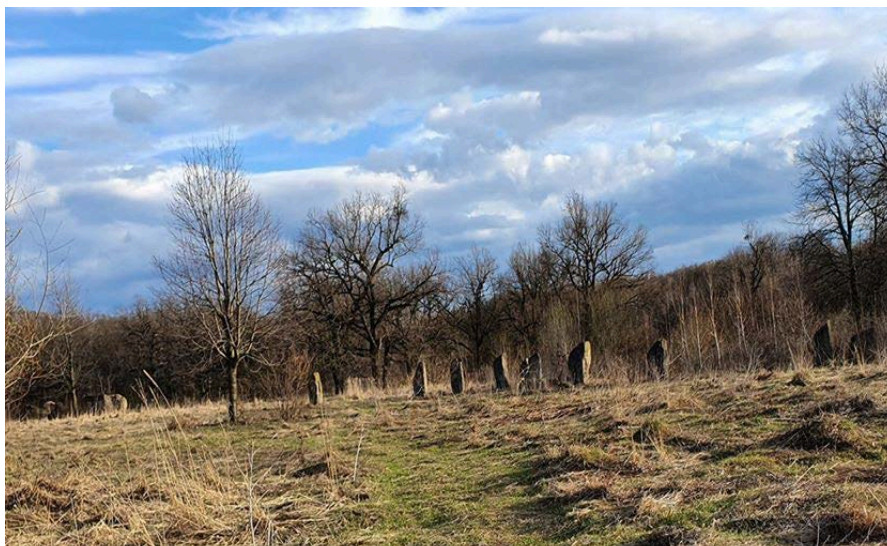


Fig. 8 – Display of some sculptures in Poiana, one of the few which remained after the vandalism of the last years.

The Monuments sculpted in the archaic/primitive style were created between 1986 – 1988, during the summer, by the greatest Romanian sculptors, whose names have been enrolled on a presentation panel of the former sculpture camp (Fig. 9): Dumitru Căileanu, Dan Covătaru, Alexandru Galai, Mihai Istudor, Vasile Ivan, Dumitru Juravle, Dorin Lupra, Traian Moldovan, Romelo Pervolovici, Aurel Vlad, Napoleon Tiron, Corneliu Camaroschi, Mihai Ecobici, Nicolae Ghița, Grigore Patrichi, Constantin Platon, Cornel Stănescu, Corneliu Tache, Ion Buzdugan, Alexandru Ciutoreanu, Constantin Costache, Iorgos Iliopolos, Dumitru George, Alexandru Marchiș, Alexandru Nancu and Marian Petre. The sculptures weigh from 10 to 54 tonnes each and are a genuine open-air museum, this area being the only stone sculpting camp in Moldova, which was meant to continue the tradition from the one in Măgura, Buzău county.



Fig. 9 – The panel with the positioning of the sculptures within the area of the site and their authors from the 3 editions (the panel fell from its original stone support).

In Figs. 10 – 14 there are some of the most representative sculptures, still existing.



Fig. 10 – Eminescu’s statue, sculpted by Dan Covataru from Iași and the House of Being – a meditation spot for Alexandru Marchiș.



Fig. 11 – Shepherd’s Space by George Dumitru and the remains of Uroboros by Romeo Pervolovici.



Fig. 12 – Remains of an unknown sculpture invaded by greenery within the meadow (Statue “Shadow” by Alexandru Galai).



Fig. 13 – Icarus by Petre Marian, one of the better preserved sculptures, but the display space has been invaded by shrubs.



Fig. 14 – Other statues in state of precollapse.



Fig. 15 – Relics of the former hermitage.



Fig. 16 – Ornamental slab from the wall of the old "St. John the Baptist" Church.

6. Observations regarding the state of preserve of the hermitage relics and of the sculptural ensemble

The lack of preoccupation on behalf of the local community and of the County Cultural Committee led to the dramatic situation, which seems unacceptable, that the 3 reservations find themselves into (flora, historical and

art). All of them are in a precarious state of preserve; some of them are even in the state of precollapse, whereas others are even destroyed. Part of the sculptures are either missing or vandalised in order to extract construction material, the remaining bricks from the hermitage wall are in the same situation.

This article is meant to be an alarm so that urgent measures may be taken in order to salvage what can be kept for the future generations.

We are all well aware of the role and the functions that the Cultural and Nature Patrimony Assets of a Nation have, as they represent a calling card for us, the living connection between our past, present and future, within the current geopolitical European and global context.

Furthermore, at present we can access European funds, in order to save the inestimable values, which complete our most valuable assets, our heritage as a nation (Stingu (Palici) *et al.*, 2019b).

7. Conclusions

In addition to the fact that Romania is vulnerable to a series of natural and anthropogenic dangers, we are witnessing at present a lack of respect for the common values. The socio-economic life, the cultural life has both been affected negatively by the political factor. The majority of the post-communist Governments wished to exploit our country's resources to their fullest without concentrating on a sustainable financial development, on the quality of the education and population health, as well as on the protection of the inland values. The cumulated effect of the two factors can explain the changes we can observe in the current European geopolitical context. In order to diminish and/or stop all the negative consequences, the only solution is to take measures to salvage the socio-economic stability and preserve our country's biodiversity through coherent policies of long-term development for the State. For the Cultural and Nature Patrimony Assets, we must take urgent measures of protection and valorisation. Starting from these premises, it is clearly necessary to monitor the evolution of the natural and anthropogenic factors in the natural reservation areas, archaeological sites, architectonic monuments and other monuments and artefacts of mobile patrimony, all of which are representative for our nation and country. Poiana cu Schit, from Iași County, through its current preservation status, demands the establishment of urgent preventive and protective measures, with the purpose of keeping it unaltered.

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IMPACTUL SCHIMBĂRILOR CLIMATICE ASUPRA REZERVAȚIEI NATURALE POIANA CU SCHIT DIN JUDEȚUL IAȘI

(Rezumat)

Schimbările climatice globale afectează viitorul planetei, datorită efectelor dezastruoase produse de acestea. România este vulnerabilă la o serie de pericole naturale climatice și geologice, cum sunt: inundații, alunecări de teren, vijelii, secete, temperaturi extreme, precum și cutremure, care pot provoca numeroase pierderi de vieți omenești și pierderi economice. Simulările realizate cu ajutorul modelelor climatice globale au indicat faptul că principalii factori care determină acest fenomen sunt atât naturali (variații în radiația solară și în activitatea vulcanică), cât și antropogeni (schimbări în compoziția atmosferei datorită activităților umane). Efectul cumulativ al celor doi factori, poate explica schimbările observate în temperatura medie globală din ultimii 150 de ani. Pentru a diminua daunele produse de schimbările climatice sunt necesare măsuri de prevenire și protecție. Pentru aceasta este esențială monitorizarea factorilor care determină aceste schimbări, evaluarea riscurilor și stabilirea măsurilor în vederea diminuării daunelor care s-ar produce. Plecând de la aceste considerente ne propunem monitorizarea factorilor naturali și antropogeni în zona rezervației naturale Poiana cu Schit din Județul Iași și stabilirea măsurilor de prevenire și protecție în vederea păstrării nealterate a acesteia.