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Вікторія Гнєзділова,
кандидат біологічних наук, доцент, доцент кафедри біології та екології,
Прикарпатський національний університет імені Василя Стефаника (м. Івано-Франківськ, Україна)

Victoria Gniezdilova,
PhD, Associate Professor, Associate Professor of the Department of Biology and Ecology,
Vasyl Stefanyk Precarpathian national university (Ivano-Frankivsk, Ukraine)
viktoria.gniezdilova@pnu.edu.ua
ORCID ID 0000-0002-3340-5747

Віра Буняк,
кандидат біологічних наук, доцент, провідний фахівець дендропарку «Дружба»,
Прикарпатський національний університет імені Василя Стефаника (м. Івано-Франківськ, Україна)

Vira Buniak,
PhD, Associate Professor
Leading specialist of the dendrological park “Druzhba”,
Vasyl Stefanyk Precarpathian national university (Ivano-Frankivsk, Ukraine)
vira.buniak@pnu.edu.ua
ORCID ID 0000-0002-3653-1968

Ірина Лисюк,
завідувач лабораторії кафедри біології та екології,
Прикарпатський національний університет імені Василя Стефаника (м. Івано-Франківськ, Україна)

Iryna Lysiuk,
Senior laboratory engeneer of the Department of Biology and Ecology
Vasyl Stefanyk Precarpathian national university (Ivano-Frankivsk, Ukraine)
iryna.lysiuk@pnu.edu.ua
ORCID ID 0000-0001-6992-4787

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ОРГАНІЗАЦІЯ НАУКОВО-ПІЗНАВАЛЬНИХ ЕКСКУРСІЙНИХ МАРШРУТІВ ЯК ЧИННИК ЕКОЛОГІЧНОГО ВИХОВАННЯ УЧНІВ У ГІРСЬКИХ ШКОЛАХ

Анотація. Екскурсії в природу з учнями різного віку сприяють активізації навчального процесу, створюють умови для організації самостійної роботи школярів. Прокладаючи екологічні стежки учні мають змогу на відносно невеликій території ознайомитись з різноманітними біоценозами, та їх видовим складом, побачити зв’язки в рослинних угрупуваннях, їх сезонні зміни, вивчити найбільш типові екологічні об’єкти пов’язані з впливом на них діяльності людини. Все що сприяє формуванню в учнів екологічної культури, розкриває світогляд щодо сучасних природоохоронних проблем. Метою нашої роботи було дослідження організації науково-пізнавальних екологічних стежок в природних ландшафтах та комплексах.

В статті подано результати дослідження що проводилися на базі гірських сільських шкіл Закарпатської та Івано-Франківської областей. З членами гуртка ботаніко-натуралістичного напряму Тереблянського НВК було спроєктовано і організовано дві науково-пізнавальні екологічні стежки: «В рідній Тереблянській стороні» та «Широколужанський заповідний масив, як еталон букових пралісів Карпат». Перша з них краєзнавчого характеру, а друга – присвячена вивченню рослинності Карпатського біосферного заповідника. У Перегінському НВК Рожнятівського району була проложена екологічна стежка: «Рослинність гірських берегів Лімниці – цінний ботанічний генофонд Карпат».

Ключові слова: екскурсія, рідкісні рослини, екологічна стежка, екологічна культура, пробні ділянки, онтогенез.

ORGANIZATION OF SCIENTIFIC-COGNITIVE EXCURSION ROUTES AS A FACTOR OF ECOLOGICAL EDUCATION OF STUDENTS IN MOUNTAIN SCHOOLS

Abstract. Excursions to nature with students of different ages contribute to the intensification of the educational process, create conditions for the organization of independent work of students. By paving ecological trails, students have the opportunity to get acquainted with various biocenoses and their species composition, to see connections in plant groups, their seasonal changes, to study the most typical ecological objects related to the impact of human activities. Everything that contributes to the formation of students' ecological culture, reveals the worldview of modern environmental issues. The aim of our work was to study the organization of scientific and cognitive ecological trails in natural landscapes and complexes.

The article presents the results of a study conducted on the basis of mountain rural schools in Zakarpattia and Ivano-Frankivsk regions. Two scientific and cognitive ecological trails were designed and organized with the members of the botanical and naturalistic circle of Tereblyansky Educational Complex: "In the native Tereblyanska side" and "Shirokoluzhansky nature reserve as a standard of beech virgin Carpathian forests". The first of them is of local lore nature, and the second is devoted to the study of the vegetation of the Carpathian Biosphere Reserve. The students of Perehinskyi Educational Complex developed the ecological trail "Vegetation of the mountain banks of Limnytsia - a valuable botanical gene pool of the Carpathians".

Keywords: excursion, rare plants, ecological trail, ecological culture, test plot, ontogenesis.

INTRODUCTION

The problem formulation. From the first sources of development of pedagogical science, the big role is given to the organization of excursions to the nature with pupils of different age. After all, they contribute to the intensification of the educational process, create conditions for the organization of independent work of students and conducting phenological observations, and on this basis teach to make independent conclusions, geobotanical descriptions. Invaluable and educational role of natural excursions - they bring up students' love for nature through the prism of its study, give rich material for aesthetic education, teach students the right behavior in nature.

Ecological education is the subject of research by domestic and foreign scholars. Such as: M. Fitsula, 2002, I. Lozovska, 2011, N. Grytsai, 2019, M. Grodzinska-Jurczak, 2000.

Anthropogenic activity in the environment has become threatening to the fate of peoples, so one of the important means of protecting nature, careful and rational treatment of its resources, is a general environmental education. In this regard, the development and laying of scientific - cognitive ecological trails for excursions and observations in nature, which are a kind of laboratories in nature, are very important. By paving ecological trails, students have the opportunity to get acquainted with various biocenoses and their species composition, to see connections in plant groups, their seasonal changes, to study the most typical ecological objects related to the impact of human activities. Everything that contributes to the formation of ecological culture in students, reveals the worldview of modern environmental issues.

Educational tasks in the organization of ecological trails is the formation of the following competencies:

Cognitive: provides acquaintance with natural objects in the territory of the locality which have natural, local lore, historical value and need protection;

Practical: helps to master the skills of environmental work;

Creative: provides the formation of creative abilities of pupils in the process of performing the research work.

Social: contributes to the education of a caring attitude to nature, the history of the native land, develops a sense of patriotism, responsibility for the fate of their small homeland (I. Moroz, 2006).

Unfortunately, in the curriculum for the study of environmental topics is given quite a bit of time, therefore, more attention to the data topics can be given in extracurricular activities (N. Grytsai, 2019).

Similar problems are being studied by foreign researchers. At present, according to the subject curricula, the ecological education is taught as a multidisciplinary subject. Its knowledge is dissipated across a variety of courses, mainly biology, geography, physics and chemistry, and taught by specialist teachers (M. Grodzińska-Jurczak, 2000).

An important role in the formation of environmental awareness is played by the involvement of students in environmental activities and work in the corners of wildlife. Tourism and local lore work is connected with nature protection work, aimed at instilling skills of correct behavior in places of rest, in forests, etc. (M. Fitsula, 2002).

The works of N. Grycaj, A.Bąbelewska are devoted to the organization and methods of conducting the school excursions (N. Grycaj, A.Bąbelewska , 2017; N. Grytsaj, 2011).

THE PURPOSE OF THE RESEARCH

Of great importance for the effectiveness of the organization of excursions is a good choice of venue. In our opinion, it is very important to organize scientific and cognitive ecological trails in natural landscapes and complexes. This was the purpose of our research, which we conducted on the basis of the Educational Complex of the village of Perehinsk and Tereblyanskyi Educational Complex.

RESEARCH METHODS

To achieve this goal, theoretical research methods were used, including analysis and synthesis research results on the research problem, generalization – to formulate conclusions.

RESULTS OF THE RESEARCH

We conducted pedagogical research on the basis of several mountain rural schools in Zakarpattia and Ivano-Frankivsk regions. Namely: in Porohiv Secondary School of I-III grades of Bohorodchany district and Perehinskyi Educational Complex of Rozhnyativ district (Ivano-Frankivsk region); in Tereblyanskyi Educational Complex of Tyachiv district and general secondary education school in the Lugy village of Rakhiv district (Zakarpattia region).

Together with the members of the botanical and naturalistic circle of Tereblyanskyi Educational Complex, we designed and organized two scientific and cognitive ecological trails: "In the native Tereblyanska side" and "Shirokoluzhansky nature reserve as a standard of beech virgin Carpathian forests". The first of them is of local lore nature, and the second is devoted to the study of the vegetation of the Carpathian Biosphere Reserve. In the article we give a description of one of them.

Scientific and cognitive trail "In the native Tereblyanska side"

The ecological trail starts from the Shayan ridge of the Carpathians and ends at the waterfalls of the Tereblia River.

Excursion scientific-educational route includes the following stops:

The first stop - "Picturesque slopes of the Shayan ridge", here the group introduces students to the length of the ridge, mountain peaks, forest and meadow phytocenoses, their species composition, with rare plant species: Arnica montana, Centaurea carpatica, Platanthera bifolia, Lilium martagon, Lycopodium clavatum, Soldanella hungarica, Lunaria rediviva. By the way, in June 2021, members of the circle "To the secrets of nature" on the meadow slopes of Shayany conducted research. The students set up trial plots and counted the number of individuals of rare species growing here. Thus, laying a plot of 1m Ч 1m revealed 21 flowering, 12 faded and 6 individuals in the budding phase of Arnica montana.

The second stop - "Healing mineral springs of Shayany". This is a stop near the pump rooms with mineral water, where students talk about the chemical composition of Shayan mineral water, its therapeutic value and the history of the opening of resorts. Here the listeners should pay attention to the fact that mineral springs with balneological significance have been preserved in the villages of Drahov, Tereblia, Neresnytsia. And in Neresnytsia there are also salt lakes, about which the memories of monks from the 16th century have been preserved.

The third stop - "Tysa - the guardian of the borders of Ukraine" is located where the river Tereblia flows into one of the largest rivers in Ukraine - the Tysa. Here students say that this flooded river is formed by the waters of two smaller rivers, namely the Black and White Tysa. Black Tysa originates under the Svydovets ridge, and White - at the foot of Hoverla and Breskul, they merge both cities Rakhiv and form the Great Tysa, which flows along the borders of Ukraine with Romania and Hungary. In addition, students are introduced to a number of legends associated with these waterways. Attention is drawn to the fact that in the distant past this territory of Transcarpathia was covered with forests of rare relict Taxus baccata. Which was cut down because of the valuable hardwood that does not rot, so these rivers are called the Tysa. Taxus baccata is still called a "talisman" of the Carpathians, but tourists ruthlessly break off the branches of this Red Book species, which still grows in some places in the mountains.

The fourth stop is "Silver waterfalls of Tereblia". Here, members of the circle "To the secrets of nature" introduce students to the source, mouth and length of the river Tereblia. Reveal the historical significance of its name, describe the picturesque shores of the river basin. Since this stop is located near the waterfalls on the river Tereblia, students draw the listeners' attention to the beauty of these "silver" waterfalls, asking them to enjoy their noise. The teacher says that the big problem is the pollution of the river with solid household waste, when spontaneous dumps are created along the banks. This is especially dangerous for mountain rivers, because in the spring during the flood regime these wastes fall into the river. High school students help to clean the banks and the riverbed from debris, plant greenery along the banks, install water signs.

Passing pedagogical practice in Perehinskyi Educational Complex of Rozhnyativ district with the permission of the directorate, students organized among pupils of eighth - tenth forms a small scientific-problematic group called "Studying the kingdom of mountains, springs and flowers." Students in the problem research group were selected at will, ie those who really love the nature of their native land, want to study it more deeply, in more detail, are interested in the problems of biology and nature protection work. During the spring - summer period, the members of the group first developed a project, and then made a plan of excursions for the scientific - cognitive ecological trail and at the beginning of the school year in September already conducted excursions. The developed and laid ecological trail was named "Vegetation of the mountain banks of Limnytsia - a valuable botanical gene pool of the Carpathians". It started at the entrance to the village Perehinske and ended high in the mountains, where the river Limnytsia originates from springs 1.5 km northeast of the mountain Velyka Keputa at the altitude of about 1370 m and flows into the Dniester River.

Excursion scientific - cognitive and educational route includes the following stops:

The first stop - "Perehinsk Gate - the entrance to the plant treasury of Gorgany", where students-guides introduce visitors to the history of the village, its changes, gains and losses. And also with ethnic groups, their pedigree, type of economic activity. Reveal the importance of forests for people in the mountains, talk about their lives, folk and religious holidays.

The second stop - "Saffron amulet" - is located on the wet meadow slope of the reserve, where it is advisable to take a tour only in early spring, when rare species bloom – Crocus heuffelianus and Galanthus nivalis and in autumn, when Colchicum autumnale blooms. Here students acquaint visitors with the botanical features of the development and distribution of beautiful ornamental early spring plants. Crocus heuffelianus which is popularly called crocus, brandy, commander, orphan, data on it are found in the descriptions of ancient Greek writers. Here it is expedient to tell about botanical features of plants, its decorative value and belonging to endangered plants which need to be protected.

At the same time as the crocus is blooming, the first, tender, drooping snow-white snowdrop flowers appear on this damp lawn. These charming beautiful flowers are the first messengers of green-haired spring and due to their beauty are in demand among tourists and locals. So they pluck hundreds of them for sale. The number of populations of the species is catastrophically declining and the plant needs universal protection. That's why we named this ecological stop "Saffron Amulet".

In autumn, when most of the plants have finished their flowering, the flowers of Colchicum autumnale bloom on this emptied wet meadow. The whole meadow is covered with pale pink-purple flowers. Only flowers protrude above the ground, because the leaves are already dead, and the bulbs are hidden in the soil. The ovary of the flower is also sunk into the ground on a long tube. After pollination by bees, the fruit develops during the autumn-winter months in the soil and in early spring a capsule of fruit with a rosette of leaves comes to the surface. Meadow Saffron is a rare, endangered plant with a very interesting biology, medicinal and poisonous species. Students and participants of the tour listen with interest to the story.

The third stop - "Looking for the flowers of ferns." Here, at the edge of the beech and alder phytocenosis on the banks of the Limnytsia River, a large area (about 0.25 ha) is occupied by a fern association. It is dominated by several species of ferns, such as: Dryopteris filix-mas, Athyrium filix-femina, Phegopteris connectilis, Pteridium aquilinum and two rare species: Matteuccia struthiopteris, Phyllitis scolopendrium. Individuals of all populations are very well developed and have grown well. Talking about the distribution and peculiarities of reproduction of ferns, the students debunk the legends about the miraculous "flowers of ferns". They demonstrate to the listeners the spores on the leaves of ferns and clearly show the spore-bearing shoots of the Matteuccia struthiopteris, which at the beginning of its development are orange-green, are inside between the leaves and seem to "resemble a flower". But over time, these shoots turn yellow-brown, and then, when the spores ripen, darken to yellow-brown, almost black. Students also talk about the decorative value of these plants and the need for protection, because the entire development cycle of some ferns lasts from 4 to 10 years. The Matteuccia struthiopteris, which reaches a height of 1.7 - 2.0 m and its thickets resemble a forest from the coal period, attracts the attention of the listeners.

The fourth stop - "Picturesque slopes of the Gorgany ridge", here the group introduces students to the length of the ridge, mountain peaks, forest and meadow phytocenoses, their species composition. And with rare species such as: Arnica montana, Centaurea carpatica, Platanthera bifolia, Lilium martagon, Lycopodium clavatum, Soldanella hungarica, Lunaria rediviva. By the way, in June 2020, members of the group "Young Botanists" on the meadow slopes of Gorgany conducted a small research work. The students set up test plots, which counted the number of individuals of rare species growing here. Thus, laying a plot of 1m2 x 1m2, 28 flowering plants of Platanthera bifolia, 12 faded and 8 individuals in the budding phase were found.

The fifth stop is "Crystal springs of the source of the river Limnytsia". Here, students-guides acquaint visitors with the sources and length of the river Limnytsia. They reveal the historical significance of its name, describe the picturesque shores of the river basin. Since this stop is located near the falling waterfall, students draw the listeners' attention to the beauty of these "silver" waterfalls, teach them to listen to their noise. The teacher should tell the children that the big problem of the river is the pollution with solid household waste. High school students can clean the banks and riverbeds of their rivers from landfills, plant greenery along the banks, install water protection signs. After all, protection of rivers is an important matter and each of us can contribute to the preservation of rivers.

The sixth stop - "Healing mineral springs of Gorgany", it is located at the foot of the mountain range, in the vicinity of Perehinsk, near a natural spring and a consecrated chapel. Here, members of the tour group stop when returning from a mountain route. Guides tell about the chemical composition of Perehinsk mineral water, which has a high content of glycerin and hydrogen sulfide, is very soft and useful when consumed, can be stored for a long time and has healing properties. Here is the monastery of Andrii Sheptytskyi, listeners are told about the history of its creation and the moments experienced and the current significance, both for pilgrims and for the local population.

In addition to conducting excursions along the scientific and cognitive routes, on each of the trails the pupils also carry out some research work. As we mentioned above, the students of Tereblyanskyi Educational Complex at the stop "Picturesque slopes of the Shayan ridge" laid a test plot to study the ontogenesis of Arnica montana, and students of Perehinska school - on the slopes of Gorgany - a test plot to study a rare Red Book species of Platanthera bifolia. They successfully use the results of their own research when conducting excursions. On the ecological trail "Rare species of plants - the golden gene pool of Montenegro", the pupils of the Lugy school are conducting research on the development of the "autumn flower" - the rare species - Colchicum autumnale. This plant is decorative, valuable medicinal, but poisonous because it contains the alkaloid colchicine, which has medicinal value. The ontogenesis of the Meadow Saffron is very interesting, original and we can say something mysterious, the plant blooms in autumn and bears fruit in spring. This interests and encourages students to observe the plant. Throughout the summer Colchicum autumnale is not visible on the wet meadow mountain slopes, as if it is not there at all, because its bulbs are hidden deep in the soil. And in early autumn (August - September), these slopes are covered with leafless very beautiful flowers of pink-purple color, which seem to stick out above the ground on tall flowerstalks. Meadow slopes turn pink from the delicate petals of these miracle flowers, which seem to want to prove that autumn is no worse than spring adorns the earth. The flowers have six petals, with six stamens and a long tube (style), the ovary together with the bulbs are hidden deep in the ground. The fertilization take place in the soil after pollination by bees and during the winter months there develops a fruit - a capsule with seeds. Only in the spring a rosette of large entire leaves with a capsule, inside which the seeds are formed, appear on the surface of the soil. This biological property of the Meadow Saffron was studied by the members of the circle. In autumn, they counted

the number of flowering individuals, and in spring counted how many plants bore fruits, that is, brought to the soil surface capsules with seeds. They compared the percentage of pollination with fertilization in plants and with fruit development, whether it is affected by snowfall and winter frosts. The results of research are used by the group members in stories during excursions. The mysterious development of the plant is associated with many legends and stories about the late flowering, which students also do not ignore. This plant is also one of the oldest medicinal plants, as evidenced by records in the Hindu books of the Vedas. It was also used in ancient Egypt, so it is shrouded in a number of legends associated with the brave Argonauts, the heroes of Greece and the goddesses Aphrodite and Athena.

It should be noted that the students of all the educational institutions we study are very interested in the history of their region, its nature, customs and quite interestingly weave it into their stories at scientific and educational stops of ecological trails.

To test the knowledge of students of Perehinskyi Educational Complex they were asked to take a quiz using the mobile application Kahoot!. The children had the opportunity to answer the teacher's questions using their mobile phones. Later, everyone could see the correct answer and the rating of students who passed the test. Upon completion of testing, each received a score, depending on their outcome. Students who visited the excursion route "Vegetation of the mountain banks of Limnytsia - a valuable botanical gene pool of the Carpathians" the day before, coped better with the test tasks. 89% of 8th grade students and 94% of 10th grade students received excellent and good grades. We conducted the same testing among students who did not want to visit the tour. The scores were lower. 67% of students answered excellently and well in the 8th grade, and 75% in the 10th grade. Thus, we can conclude that the tour of the ecological trail has significantly deepened the knowledge of children about the nature of their native land.

In our article we want to offer several experiments that can be conducted in the study of the nature of the native land, they can be a kind of factor in environmental education in mountain rural schools.

Experiment 1. The role of herbaceous plants in protecting the soil from erosion.

The purpose of the experiment: to find out which herbaceous plants protect the soil from erosion.

Methods of the experiment:

1. To set the age of the erosion process. Under what culture the site was used earlier? When is plowing stopped? What measures were taken to consolidate the soil?

2. What plants have survived? Compare the species composition of plants with neighboring areas that are not subject to erosion.

3. What new plant species have appeared? To do this, make a herbarium of stems with flowers, without digging up the plants. Get acquainted with the characteristics of plants.

The most promising plants that can grow on eroded soil, after repeated observations can be recommended for protective sowing (it is necessary to collect seeds from them).

Experiment 2. Study of road ecology.

The total length of highways in the world is 18.3 million km, of which 10.9 million km are paved roads. The average road density in Europe is 24.0 km / 100 km2. Cars emit sulfur dioxide and lead with exhaust gases, which get into the soil, oxidize it, reduce fertility, cause plant poisoning. Different species of plants have different properties in terms of sulfur dioxide capture. For example, False Acacia during the growing season can absorb 69 g of this gas per 1 kg of dry leaves, elm - 39 g, black poplar - 157 g. In tree leaves, sulfur dioxide is oxidized to sulfates, the toxicity of which is much lower. Woody plants (Horse Chestnut, Small-leaved Lime, Black Poplar) planted along the roads clean the polluted air from lead.

The purpose of the experiment: To study the impact of roads on the environment.

Methods of the experiment:

1. To investigate the types of local forest roads: highways, dirt, trails.

2. To make a map of roads.

3. To identify the types of plant communities along the roads. Compare the species composition of plants near the road and at a distance of 10, 20, 30, 50, 100m from it.

4. To determine the congestion of the road within an hour, making a plan of the area where the road passes, the length and width of the road on which the study is conducted. Record the data in the table: "Road congestion for an hour" (Table 1).

Table 1. Road congestion for an hour

Types of roads	Means of transport					Pedestrians
	Trucks	Cars	Buses	Motorcycles	Agricultural cars	
Highways						
Dirt roads						
Paths						

CONCLUSIONS AND PROSPECTS OF FURTHER RESEARCH

After several excursions on organized scientific and educational ecological trails, we saw that they not only acquaint students with the nature of the native land, its flora and fauna, but also help them understand the relationship between man and the environment, become fighters for ecological cleanliness. A part of such excursions is visiting national

parks, reserves, forestry, mountain complexes. Regardless of the age characteristics of students, excursions broaden their horizons, teach to see nature in all its beauty, develop cognitive interest and observation. Biological excursions acquaint students with the nature of the native land, increase the quality of knowledge, help them understand the relationship between man and the environment, the sexes of fighters for ecological purity of the environment, contribute to the formation of ecological culture.

During our research we developed scientific - cognitive ecological trail as an excursion route: "Vegetation of the mountain shores of Limnytsia - a valuable botanical gene pool of the Carpathians" conducting comprehensive thematic excursions on this ecological trail, for students of all levels of secondary education and age expands students' knowledge and improves their quality.

Carrying out of test control tasks in 8th and 10th classes of Perehinskyi Educational Complex, showed that quality of knowledge of pupils who participated in excursions on studying the nature of native land to put 89-94%, and the quality of knowledge of pupils who did not take part in was 67-75%.

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