Biocenosis of a natural terrestrial ecosystem – Trivale Forest

Subject: Biology
Grade level: Secondary Education
Anticipated time: four 60-minute lessons and one 120-minute lesson
Developer: G. P. Petruța

Abstract

The activity sequence engages students in the process of observation and identification of some plant and animal species found on a certain area within the Trivale forest and dioramas viewed at the Argeș County Museum in Pitesti. Also, they will observe the trophic relations which can be established among the species forming the biocenosis of this ecosystem.

We consider that is very interesting to propose for the Outlab project a study from a natural terrestrial ecosystem for aiming at the enrichment of the active vocabulary with biology and ecology notions, and as well as for increasing the wish to respect and protect the nature. The direct action of observation and investigation of the nature facilitates the correct understanding and acquisition of the biology notions, contributing at the same time to the formation and development of the ability to carry out observations about the nature, and also of the practical skills for search, investigation and correct interpretation of the obtained data. The field study gives an adequate frame for the confrontation of initiatives and for a sustained cooperation among students, for the development of some interpersonal, social-affective relations, which facilitate the learning.

Institution: University of Pitești
Country: Romania
After 1990, assuring the quality of initial training of teaching staff became a major concern of politics for the European systems of education (Student Centered Education – strategical directions concerning the formation of university didactical personnel).

Romania, as signatory of Joint Declaration on Harmonization of the Architecture of the European Higher Education, Sorbonne (May, 1998), Bologna Declaration (June, 1999), Documents adopted at the meeting of the European universities in Salamanca (April, 2001), Documents of the Reunion of education ministers from the European countries, in Prague (May, 2001), as well as the documents of the Conferences of Education Ministers from Europe, in Berlin (October, 2003), is interested in compatibilization of the Romanian higher education system with the European one, engaging in effectively contributing to accomplishment of all the objectives of the program regarding the European Higher Education Area.

Therefore, one of the specific principles emphasized into The Strategy of the Higher Education in Romania for the period 2002-2010 is: stimulation of student’s individual thinking and less of their information storage capacity.

Within the same regulating document it is mentioned that the structural improvement of the higher education, the strategical and central objective of the Ministry of Education, Research and Youth, is aiming at: improvement of the performances in students and teachers activity by reorganization of the didactical process through a new philosophy of education (pc.3b). This would presume: “Rethinking of the mode of carrying out courses, practical activities and seminars, so that to allow the student to accumulate, primarily, methods of analysis, research methodologies, models for the organization of activities, to creatively participate at the didactical activities. The universities will impose the revision of the modality of developing activities with the students, so that the focus to be switched from accumulation of information to formative activities”.

PEDAGOGICAL FRAMEWORK

Doing biology outdoors

At present, in the educational practice there is the tendency to promote the active-participative and interactive methods, to increase the importance of learning by discovery, promoter of the heuristic methods and those of learning by research, as well as the tendency to focus on the pragmatic orientation of the methodology, with emphasis on the large scale use of the practical-applicative methods.

Non-formal education, which “comprise the totality of education influences which are developed outside classroom (extra- para- and peri-scholar activities) or by the mediation of some optional
or facultative activities” (Cucoș, 2006), is completing the formal education, achieved in school or university.

Phyllis Ford consider that „outdoor education is education in, about, and or, the out of doors. This definition tells where the learning takes place, the topic to be taught, and the purpose of the activity.” He says that outdoor education refers to recreational activities, to „as a method or process for extending the curriculum, or a process involving direct learning experiences”. It includes „programs that may be curriculum-oriented, behavior-oriented, recreation-oriented, conservation-oriented, and/or camping-survival/oriented” (Ford, 1986).

Within the outdoor activities, by which is assured transmission of the knowledge in biology, the students are participating directly, by their own effort, to the rediscovery of the surrounding world. The emphasis is laid on the students’ learning activity, which is meaning both knowledge and action.

A possibility to combine the lessons carried out in school with outdoor activities of teaching and learning is the study of biocenosis, such as that of Trivale forest, described in this module.

Within the outdoor activities of this module, the direct action of observation and investigation of the nature facilitate the correct understanding and acquisition of the biology notions, contributing at the same time to the formation and development of the ability to carry out observations about the nature, and also of the practical skills for search, investigation and correct interpretation of the obtained data.

The activity carried out within module contributes also to the development of capacity of analysis, synthesis, generalization and abstractization, to the development of critical examination and students’ independence, to the development of responsibility for the work carried out and their own actions, to the development of capacity to exhibit a precautionary conduct toward the environment, understanding that each organism has a certain role in nature, to the development of capacity to transmit to other people the results obtained by their own work, in such way to positively influence their behavior.

**PREREQUISITE KNOWLEDGE**

In our country, according to the curriculum of biology elaborated for gymnasium, the themes of ecology are studied during the 8th class. The students from this class can study the biocenosis of the Trivale forest, according to the proposed module, within theme “The ecosystem of a deciduous tree forest” and/or within theme “The trophic relations into a deciduous tree forest”. For the successful ongoing of the module, the students should to have knowledge of botanic, zoology and informatics, acquired in the previous years of school.
SANDWICH MODEL “IN-OUT-IN-OUT-IN”

The concrete knowledge of nature, the primordial objective of the biological teaching, cannot be realized only theoretically, by talking to the students about the plant and animal world, or about biological processes and phenomena. Because, it is known, that not any kind of learning has efficiency, but rather a participative, active and creative one. Thus, under the supervision of the teacher, within the laboratory of biology or within the nature, the student must to explore, reconstruct, rediscover and recreate the scientific truth, gaining by its own efforts what the human knowledge accumulated about surrounding world.

For the knowledge of the environment, organisms, biological processes and phenomena, and for the consciously and active acquisition of the notions specific for biological disciplines, is necessary to combine the lessons carried out in school, within the biology laboratory, with outdoor activities of teaching and learning.

Within the class application in the field, in the nature, the students are enriching their knowledge of biology, having the opportunity to verify the correctness of the knowledge acquired during the lessons in school, and to elucidate some notions insufficiently understood.

For knowing some plant and animal species from other geographical regions of the Terra, or which cannot be studied concretely in the area where the school is located, and for acquiring of knowledge concerning the origin of life and evolution of the living beings on the Earth, the biology lessons can be organized within the museums of natural sciences.

Within the module Biocenosis of a natural terrestrial ecosystem – Trivale forest, the activity with students will be carried out in two contexts: a natural environment (Trivale forest) and a cultural setting (The Argeş County Museum in Pitesti).

Cyber tracker software is a program which will be used within activity carried out with students in the classroom and outdoor. For knowing how can be used this program that runs on hand-held computers, the instructor collaborated with the specialists in informatics from the University. Cyber tracker software is a program created by the South African conservation biologists and contains imagines and information concerning to plants and animals of Africa. In order to be used within this module, the program should to be modified such way to contain imagines with plants and animals which can be observed in Trivale forest near Pitești. There have been created guides for identification of plants, vertebrate and invertebrates animals, which will be used in activities with students.

Before carrying out the activity within the module, the instructor should to verify the PDA-s and computers which will be used by the students. Also, should to cover the route from the forest which is going to be studied with the students, to establish the place which will be studied detailed, to recognize the plants and animals which will be observed, to establish exactly the
aspects which will be analyzed with the students within the exhibition at The Argeș County Museum in Pitesti and to get as much as possible documentation from the scientific literature concerning the problems approached within module. The teacher will carry out a literature review on students difficulties about science concepts, including: Iordache, I. et al. (2004) - Methodology of Biology teaching and learning, and Ciobanu, M., (2008) – Didactics of Biology sciences.

BACKGROUND KNOWLEDGE

Any ecosystem, either natural or artificial, is formed from an abiotic component (lacking of life), called biotope, and an biotic component (with life), called biocenosis.

The biotope include the totality of abiotic conditions (temperature, humidity, pH, oxygen, etc) in which a biocenosis exist, and primary resources (solar irradiation, water, mineral salts), by which the existence of the biological populations depends.

The biocenosis is formed by the totality of populations, belonging to different species, living in the same biotope. Within an ecosystem, between the biotope and biocenosis there is a double relation, in the sense that, on the one hand, the biotope is determining a certain structure of the biocenosis, and on the other hand, the biocenosis is modifying the biotope due to the permanent activity of the species which it contains.

In our country, due to the various forms of relief and the temperate climate, there are numerous types of natural ecosystems. Depending on the substrate, can be distinguished terrestrial ecosystems (forests, bushes and meadows) and aquatic ecosystems (ponds, lakes, swamps, rivers, the Danube, the Danube Delta, and the Black Sea). Among the terrestrial ecosystems, the forests are ranged in tiers after altitude and relief, climbing from the plane up to the slopes of the mountains. In Romania, depending on the altitude and dominant trees, can be found: deciduous tree and broadleaf forests (between 200-800 m), mixed forests (between 800 – 1200 m) and coniferous forests (between 1200 şi 1800 m). The forests can be formed from a single species of trees (spruce forests, beech forests, oak forests) or from many species (for example, mixed forests of deciduous broadleaf and coniferous trees), containing also bushes and herbaceous plants. The stratification of vegetation on the vertical within a forest is due to the variation of the abiotic factors, mainly of light. This stratification of vegetation determine also a stratification of the populations of animals, which can live in one or more of the strata, thus better exploiting the food resources. Therefore, within the biocenosis of a forest there are numerous species of animals adapted both to different environment conditions existing in the trees, on leaves and flowers, in the forest floor, on the soil or in the soil, as well as to the various modes of feeding. They can have a strict regime of feeding, being herbivores or carnivores, or a varying regime of
feeding, being omnivores. The most important relations established among the living beings of every biocenosis are those of feeding, called trophic relations, by which the circuit of the matter within the ecosystem is carried out.

**MATERIALS**

Hand-held computers (PDAs): PocketPC Handheld units (Dell Axim PocketPC) or All-in-One PocketPC/GPS handheld units (HP iPAQ hw 6500 Series Mobile Messenger (smart phone with gps) ) or Palm OS, smart phones; Cyber tracker software, Computer with Internet access

**CONTEXT:** The Trivale forest, The Argeș County Museum in Pitesti

**HERITAGE SITE:** Trivale forest is located in the northern part of the high plain of Pitesti, at its boundaries with the Cotmeana Piedmont and Candesti Piedmont.

It has a surface of 1808.9 ha, out of which 750 ha represents the surface with recreation role. Its altitude is varying between 325-435 m. The following tree species are found within this forest: common oak (34%), oak (28%), beech (15%), hornbeam (13%), Hungarian oak (2%), pine (2%), locust tree (1%), lime tree (1%) and other species (3%). The bushes are represented by hawthorn, hip rose, dogwoods, hazelnut tree, and the most frequent species among the herbaceous strata are the snowdrop, violets and graminaceae. The fauna is represented by numerous species of invertebrates and vertebrates. Among the species of mammals, here are found the deer, boar, badger, and forest marten. The bird species existing into this forest ecosystem are: titmouse, blue tomtit, starling, raven, nightingale, blackbird, etc.
Within the Argeș County Museum there is a permanent exhibition entitled “Environment protection on ecological bases”.

The aspects related to the theme of living matter organization and relation between living beings are presented hierarchically as follows: a) Structural organization of the living matter, levels of organization; b) Functional organization of the biosphere, whose functional unit is the ecosystem, with its two components: the biotope (non-living) and biocenosis (living); c) The circuit of matter and energy flow within the ecosystem, from the soil non-living matter into the body of plants, animals, and through decomposers again into the soil; d) The trophic pyramids and scheme of a trophic net in an forest ecosystem, which explain ecologically the relations between producers and consumers, relations which are maintained in a relatively stable equilibrium; e) The adaptative modifications in the world of living beings, as answer to the influences of the environmental factors.

Within the exhibition there are presented, dioramic, ecosystem models (swamp, steppe, mountain forest, cave), in which can be observed the differentiation of living beings depending of the biotope conditions, interdependence between the living beings from biocenosis, and between them and the components of the abiotic environment.

By the help of illuminated panels, it is presented the division into zones of vegetation depending of altitude, from the plane to the mountains, from the Danube until the Moldoveanu peak, each zone being characterized by a certain type of woody and herbaceous vegetation. The last part of the exhibition presents the relation human-nature, the transforming action, either conscious or unconscious, of humans over their life environment, which lead to the deterioration of some balances between different components of the biosphere, disappearance of some plant and animal species, as well as the evolution of actions towards the preservation of environment in Romania.
CENTRAL IDEA: Study biocenosis of the Trivale forest

DRIVING QUESTION: which are the species of plants and animals characteristic to biocenosis of Trivale forest and what relations do exist among these species within the biocenosis.

INSTRUCTIONAL ACTIVITIES

Lesson 1: Preparatory Activities at the computer lab
Duration: 60 minutes

Objectives
Collecting some information about the natural terrestrial ecosystem of the Trivale forest and customizing the students with the use of PDA and CyberTracker software

Description of activities
a) What type of forest is Trivale forest
The students will study independently a PowerPoint presentation carried out by the teacher, entitled “Forests of Romania”. In this documentary there are presented plant and animal species characteristic to the deciduous tree forests, mixed forests, and coniferous tree forests. Then, in a discussion with the whole class, the students will explain the differentiation of forest depending on altitude, as well as the adaptation of plant and animal species to various environment conditions. It will be emphasized the importance of forests for the life of entire planet, given by its role in producing oxygen by photosynthesis.
Further on, the students will search on Google both information and images about the Trivale forest. They will collect data concerning the geographical position, altitude, climatic conditions, soil, plant and animal species characteristic to this forest. The students will gather also information about the importance of the forest for the citizens of the city of Pitesti, as well as about the pollution effects on the forest.

b) How to use a PDA and the CyberTracker software
The teacher will explain the mode of use of the PDA and CyberTracker program for collecting the images with plants and animals, in order to identify the species with the help of various guides: Plant Identification Guide, Invertebrate Identification Guide and Vertebrate Identification Guide, for completing the various tables, and finally how to download into a PC the information gathered with the Cyber Tracker software.
The students will do exercises to use PDA, independently or working in pairs.

Assessment
Analysis of the material produced by the students. Each student will storage the gathered information within a portfolio, in which will present the Trivale forest.
Lesson 2: Out of classroom: Plant and animal species within the Trivale forest – *Field study*

Duration: 120 minutes

**Objectives**

The observation and identification of some plant and animal species found on a certain area (7th zone of the Trivale forest) within a natural terrestrial ecosystem, explaining its stratification on the vertical.

**Description of activities**

The teacher, together with the students, is going to the place which should be taken under investigation. During the introductory discussion, the teacher is reminding to the students the notions of ecosystem, biotope and biocenosis, asking them to study the biocenosis of the Trivale forest.

The teacher, together with the students, will delimitate with a string the territory in the forest which is going to be analyzed. The territory should be a square, following to be divided in squares with smaller surface. For instance, for an activity which is going to be carried out with 16 school-children will be delimitated a square with the side of 8 m, which will be subsequently divided in 4 squares with the side of 4 m, as following:

<table>
<thead>
<tr>
<th>Zone 4</th>
<th>Zone 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 3</td>
<td>Zone 1</td>
</tr>
</tbody>
</table>

The activity will be carried out within groups. Eight students will form the first group that will observe, recognize or identify the plant species of the forest by using a cyber tracker. In each zone, 2 students from this group will be distributed (1, 2, 3, 4). They will have to take into consideration both the plant species from the edge of the forest, and those from inside the forest. Depending on the dominant trees, they will establish the forest type – deciduous tree forest. They will observe the unequal growth of plants in height, due to the plant’s struggle for capturing the sunlight, necessary for the photosynthesis process.

The plant sightings, which the students from the first group collected on the PDAs, will be downloaded into a Cyber Tracker Summary Table. In this table, they will complete the following data: the strata of the forest (trees, bushes, herbaceous plants and forest floor), the woody and herbaceous plant species identified and the location (zone) where the plants have been seen.

Four students will form the second group. Two students will study the invertebrate animals from zone 1, then from zone 3. Other two students will study the invertebrate animals from zone 2,
then from zone 4. The students from the second group will identify, by using the cyber tracker, the invertebrate animal species existing on soil and into the soil, within the forest floor and the herbaceous vegetation, as well as in the living or dead wood of the trees, on their leaves, flowers and bark.

Other four students will form the third group. Two students will study the invertebrate animals from zone 2, then from zone 4. Other two students will study the invertebrate animals from zone 1, then from zone 3. The students in the third group will be asked to observe and identify with the cyber tracker the vertebrate animal species, especially birds. In the case when the students recognize certain plant and animal species, the cyber tracker will be used for checking their knowledge and verifying the truthfulness of their findings.

The animal sightings, which the students from the last two groups collected on the PDAs, will be downloaded into a Cyber Tracker Habitat Summary Table. In this table, they will complete the following data: the habitat where the animal lives, the animal group, the name of the animal, the number of animals seen and the location (zone) where the animals have been seen.

For enrichment of the collection with images of plants and animals from the Trivale forest, the teacher together with students will shortly analyze other 6 zones, in their way to the Zoological Park. The observation will be focused on the other plant and animal species, not found in the studied territory.

The student’s activity is one of their real participation to the process of learning, formation of some skills for macroscopically observation of the organisms, of setting off independently the morphological characters, of experimenting with methods and techniques which are specific for biological sciences, of formation of practical skills.

At all stages of inquiry, teacher decide when and how to guide the activity of the students. Also, he encourage student learning.

**Assessment**

Analysis of the material produced by the students:

- The collection of photographs with the woody and herbaceous plant species identified within the different strata of the forest, and the table realized by the first group of students.
- The collection of photographs with invertebrate and vertebrate animal species, and the table realized by the last two groups of students.

**Lesson 3: In classroom - Follow up activities at the computer lab**

*Duration: 60 minutes*

**Objectives**
Carrying out PowerPoint presentations, containing photographs and information concerning the plant and animal species observed within the biocenosis of the Trivale forest

**Description of activities**

The lesson begins with the presentation of students’ findings concerning the research carried out by each group. A representative of each group will present the information gathered about the plant species, and respectively the animal species observed, identified or recognized within the Trivale forest.

Comparing the results obtained by the students from the first group following the study of plants from the four zones of the analyzed territory (1, 2, 3, 4), zone with the greatest diversity of species will be established. Comparing the results obtained by the students from the second group following the study of invertebrate animals from the two zones of the analyzed territory (1+3 and 2+4), zone with the greatest diversity of such species will be established. Comparing the results obtained by the students from the third group following the study of vertebrate animals from the two zones of the analyzed territory (1+3 and 2+4), zone with the greatest diversity of such species will be established. Following the discussion it will be concluded that diversity is one of the characteristics of any biocenosis.

Further on, the students will download into a PC the information gathered with the cyber tracker. Each group shall realize a PowerPoint presentation, which must include photographs and information concerning the identified species of plants and animals, respectively. For all the organisms observed, either in nature, the students will mention the scientific name, common name, specific characters of the species, and feeding regime for all the observed species of animals.

**Assessment**

Analysis of the PowerPoint presentation realize by the groups of students.

Lesson 4: Out of classroom: Trophic relations within a deciduous tree forest – The study of photographs and dioramas representing this ecosystem, at the Argeş County Museum

**Duration**: 60 minutes

**Objectives**

The observation of some conserved plant and animal species, specific to a deciduous tree forest, and identification of the trophic relations which can be established among the species forming the biocenosis of this ecosystem.

**Description of activities**

The teacher, together with the students is going to the Argeş County Museum from the city of Pitesti, where they will visit the section of natural sciences. Here, within the dioramas, they will
observe different plant and animal species, existing within the Trivale forest, but who could not be observed live (plants which ended their period of vegetation or which are flowering later, and big size vertebrates – deer, wolf, fox, boar, etc).

Analyzing the figure which present the scheme of a trophic relation within an deciduous tree forest, the students will observe the trophic categories existing within the structure of biocenosis (producers, consumers of different ranks and decomposers), as well as the trophic relations which are established among the species forming the biocenosis, represented under the form of trophic chains. They will observe that numerous trophic chains of biocenosis are crossing in certain crossing points and that due to these points of contact the trophic chains are forming a trophic net. At the level of these crossing points or nodes, the students will identify or recognize animal species who are consuming different food and who can act in two or more trophic chains.

Following observations carried out in the Trivale forest and Arges county Museum, the students will ascertain that there is a reduction in the diversity of plant and animal species, due to the human intervention.

Finally, the students will complete the data basis realized in the previous lesson by using the cyber tracker soft, with the information acquired during the visit at the museum, about the living beings of a natural terrestrial ecosystem, such as a deciduous tree forest.

**Assessment**

Analysis of the material produced by the students.

**Lesson 5: In classroom – Follow up activities at the computer lab**

*Duration: 60 minutes*

**Objectives**

The completion of the PowerPoint presentations with the data gathered from the dioramas within the Argeș County Museum in Pitesti and construction of some trophic chains including one of the observed plant or animal species.
Description of activities

The lesson begins with the presentation of students’ findings concerning the research carried out by each group. A representative of each group will present the information gathered about the plant species, and respectively the animal species observed, identified or recognized within the Trivale forest and dioramas viewed at the Argeş County Museum in Pitesti. These data will be written in a file by one of the students and distributed subsequently to the whole class, in order to realize the trophic chains.

Each group of students will complete the PowerPoint presentation carried out previously by the teacher, with information and images about the plant and animal species observed within the Museum.

Further on, the students will mention the trophic category, for all the organisms observed, either in nature, or at the museum. Each group will draw several trophic chains, which must contain one of the observed species of plants or animals. Each group will mention what is going to happen with the rest of the components in a certain trophic chain, if the number of individuals belonging to a species is increasing, decreasing, or even the species is extincted, due to the human intervention.

Assessment

Analysis of the PowerPoint presentation realize by the groups of students.

Possible extensions

- Realizing of a trophic pyramid containing all the plant and animal species observed, identified or recognized within the Trivale forest and into the dioramas viewed at the Districtual Museum in Pitesti.

- Studying the biocenosis of an artificial terrestrial ecosystem – a park

Assessment

- The students will be evaluated for the realization of the content of their portfolios, for the Power Point presentation containing photographs and information concerning the biocenosis of the studied ecosystem. The portfolios must contain photographs and information about at least 10 plant species and 10 animal species observed, as well as about 2 trophic chains.

- The students will be evaluated for their involvement in the activity of researching the biocenosis of the Trivale forest

- The students will be evaluated by a final test at the completion of the module. The test will be focused on recognition of some representative plant and animal species forming the biocenosis of the Trivale forest, designing of trophic chains starting from a given
component and emphasizing the mode in which the humans can contribute to the protection of the forest.

- The teachers progress toward acquisition of each learning outcome, as part of teaching will be evaluated by the instructor, who must observe: if the teachers (students who are wishing to become teachers) are using correctly the scientific terms, how the teacher is organizing the students of the class taking into consideration their individual particularities, what relation are established among them, how the questions addressed to the students are formulated (if these are directed towards the development of thinking, rather than to the development of their ability to memorize), how they explain various scientific concepts, taking into consideration the students individual particularities and age, how they are guiding or helping the students in solving the different working tasks, if they are encouraging the students to express their own opinion, if they appreciate permanently the correct answers given by students and their progress during the activity.

In the future, if we have good results in students’ learning, we will use this module in schools, within outdoor activities of teaching and learning. Also, if the students will show difficulty in learning, we will change the structure of module.

Iterative evaluation

In the module Biocenosis of a natural terrestrial ecosystem is described a possibility to combine the lessons carried out in school with outdoor activities of teaching and learning. Within the outdoor activities, the students are gaining abilities and practical skills for research and investigation, as well as the ability for the correct interpretation of the data obtained from experimental activities.

Each student is participating to the interpretation of the investigation results and the graphical representation of these is done jointly by the group as a whole. The activity of the students can be guided step by step by the teacher, or only partially guided, when the intervention of the teacher is only rarely needed.

The outdoor activities give an adequate frame for the confrontation of initiatives and for a sustained cooperation among students, for the development of some interpersonal, social-affective relations, which facilitate the learning.

The use of methods for collaborative learning, such as “discussion and debate within groups, the solving of problem situations within groups, and learning by discovery within a team” (Cerghit, 2002), are creating to the students the ability to cooperate for realizing some learning tasks.
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