



THE MAKEOVER OF THE SCHOOL CURRICULUM IN ECOLOGY – OVERVIEW OF THE LAST 20 YEARS IN ROMANIA

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SYNOPSIS

The present environment crisis makes education in ecology an absolute priority for children in all age brackets. Building awareness and triggering concern among students about the ecosystem as a whole and about the vast array of associated problematic issues is only possible by adequate education. The curricular content shapes the students' behavior as regards the protection and conservation capacity of the environment and allows for the development of environmentally – literate citizens, competent and willing to take action. In this study, our key aim is to shed light on the ways in which the school curriculum about environment has evolved over the last 20 years. We also investigate how school children in various age groups are exposed to extracurricular activities in correlation with the topics included in the scholar curriculum. We will conduct the whole analysis while observing the competencies in ecology required and while emphasizing the obvious points of vulnerability conducive to potential ecological risks.

INTRODUCTION

In the modern world, ecology arises complex problems that have short or long term influences on the quality of human life and, moreover, on the existence of life on Earth. Industrialization has confronted Europe, as well as Romania to face ecological problems due to industrialization.

In the north western area of Romania, an area hit by ecological accidents and difficulties, the impact upon the environment is generated by: the mining industry based on the extraction and processing of the non-ferrous metals, the accumulation of industrial and domestic waste, the changes in the utilization and functionality of different pieces of land in the detriment of the natural ecosystems, the expansion of human settlements, ecological accidents induced by adverse technical solutions, all these reinforced by a deficient level of ecological education. The visible costs of the 'carelessness' can be noticed in: the high level of human intervention upon the forest,

prairie and grassy ecosystems, the decrease of natural ecosystem areas, particularly forests, the development of a scenery dominated by industrialized and man made landforms (sterile soils and pit settlings), the change of the quantitative balance between native and non-native species of plants, in favor of the latter, the diminishment of biodiversity, the extinction of some animal and plant species, the reduction of the parts destined for protected areas.

The examples presented above were collected from the Maramures area, but they are characteristic to the whole country thus sustaining the necessity of an improvement at the educational level. Until the last decade, the intense mining industry of Maramures, as well as in other areas of Romania has generated man-made landforms, as sterile soils and pit settlings for the wastes of the heavy metal flotation. These landforms take up large areas, and in most cases, still represent a major problem, both ecologically, and as far as the landscape is concerned. Such is the case of the substratum filled with wastes of heavy metals, the water deficit, the intense oxidation process and acidity, which are strong restrictive factors of the normal succession of the vegetation process. There were attempts of ecological restoration, throughout time, ending in only partial or unsatisfactory results; hence, even 20 years after the so called 'restoration' of the pit settling of Bozanta Mare, the substratum is still visible, exposed to active pluvial and aeolian erosion. The pit settling of Bozanta Mare was built in 1977, it covers an area of 1,050,000 square meters, it is 30 meters high and has an angle of elevation of 18-20°. It is made of fine particles deposited from the flotation waters transported through hydrocyclons. The total volume of this man-made landform is about 150,000,000 m³. This pit lays in the immediate proximity of the villages of Sasar, Bozanta Mare and Mocira (about 1-5km) and in the vicinity of the town of Baia Mare. Furthermore, some of the agricultural fields of these settlements are placed directly by the pit, being polluted by the particles brought by the wind and pluvial waters.

Another ecological issue of the European, Romanian and Maramures ecosystem in particular is that of the invasive plants. The adventive plants spread more and more on man-made and semi-natural landforms, some of these species being very competitive in the detriment of the native species and that of the biodiversity. Many of the adventive species were introduced in agriculture by the human factor, as a result of a deficient ecological education. Consequently, in the North Western Romania, a number of approximately 97 species of vascular invasive plants were identified, among which, 414,24% were accidentally introduced, and 58,76% were initially cultivated and then 'lost' out of control. Among these 8, 77% have developed an invasive character. Such is the case of: *Reynoutria japonica*, initially introduced for the ecological restoration of ma-made landforms, *Impatiens glandulifera*, *Amorpha fruticosa*, *Helianthus tuberosus*, *Rudbeckia laciniata* etc. The last decades' substantial deforestation of the Carpatians has resulted in hydrological disorders manifested in massive floods, freshets, earth flows, all that have a negative impact upon the environment, but also on men.

The examples presented above, among other causes, owe their negative impact to a deficient ecological education of the decisional factors, and even of the experts

involved in the restoration of the industrially deteriorated areas, so that, the need of an ever improving educational program at the ecological level, starting from elementary to the university stage is required.

The prevention and restoration of most ecological problems, beyond technical solutions, have to start at the mental level of all the factors involved in the actions and decisions regarding ecological problems, but also at that of the civilian society.

The modifications at the mental level require educational interventions as : the assimilation of *cognitive* information about the species of plants and animals, the existent relations between them, the ecological dynamic, the risk factors at the level of the ecosystems, the predictability of negative consequences starting from unfavorable premises, etc.; the formation of adequate *attitudes* towards the preservation of the natural environment: sensitiveness and responsibility regarding the preservation of the environment, curiosity and interest for biodiversity, involvement and initiative in settling ecological problems; the development of an emotional *sensibility* towards all that is a natural environment for each human being. All the above mentioned cognitive, attitudinal and affective components materialize in the development of pro-ecological habits, skills, and behaviors.

The development of these components is not automatic, and it cannot be accomplished in the absence of educational catalyts. This is why, ecological education should be started from an early age, and it should be gradual and programmed to extend for the whole life, according to the theories of the new pedagogies.

The present study has as its main objective a critical analysis of the way in which the Romanian ecological education rejoins the concrete demands of the modern world, thus allowing an adjustment and a malleability of this type of education.

METHOD

The methods used to achieve the imposed objectives are mostly based on the analysis of school documents included in the national curriculum; and, on the interviews with teachers that are responsible for extra-curricular activities in schools. The synthetical presentation of the results includes an analysis of the proportion of non ecologic and ecologic classes allocated to different levels and profiles of education. Simultaneously, the time allocated to different school subjects will be reported to the proposed national objectives and to their afferent contains. In order to underline the suitability of the school programs to the ecological problems of the modern world; the time allocated to ecological subjects, the present objectives will be compared to those contained by the analytical programs stated 20 years ago. The results are the following:

For the elementary educational level (1), the proportion of the classes with ecological potential is relatively limited, compared to the classes allocated to other subjects, as it is shown in the diagrams below:

Diagram no.1.

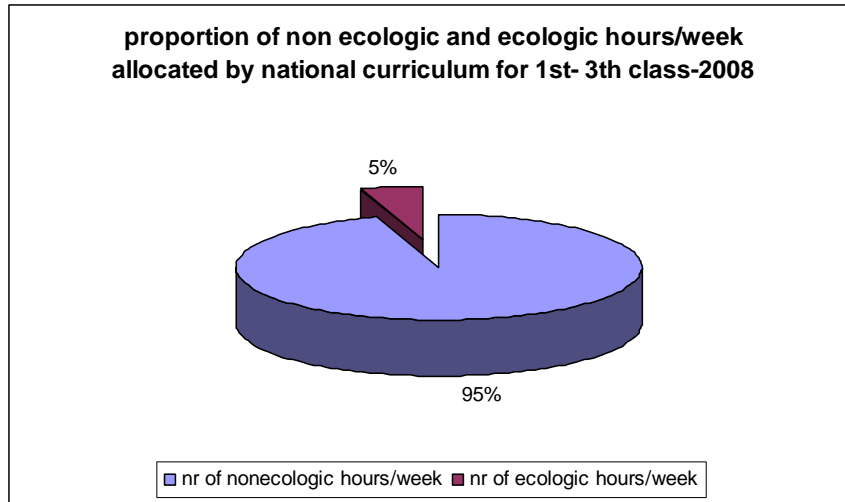
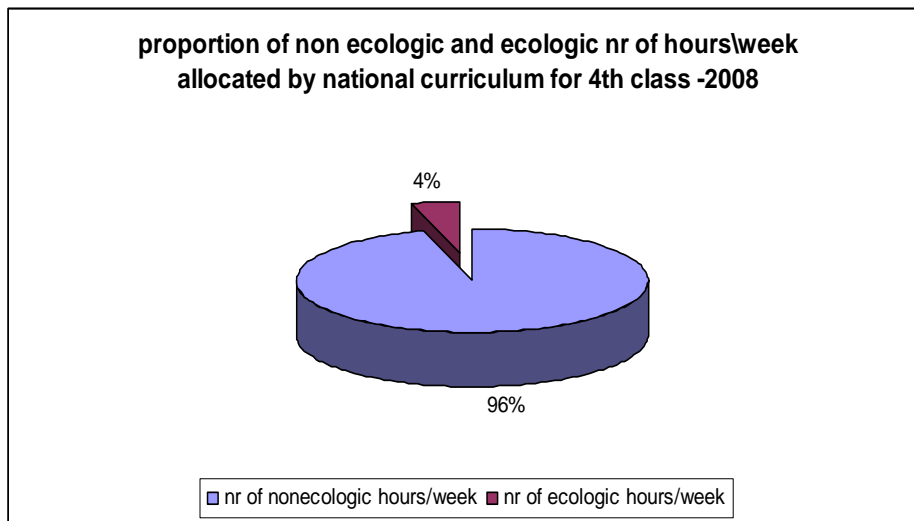


Diagram no.2.



The educational *contents* (2) of the primary school are related to the natural phenomena of the surrounding world, such as: 'weather', 'time', habitats', 'natural processes', human beings in their environment', human activities', etc., all having as main purpose the acknowledgement and understanding of the natural processes in the medium, the comprehension of the impact of the natural processes upon the human activities and that of the human activities upon the environment, the examination of interdependencies in and between physical, chemical and biological systems, and the support of the students in their taking responsibilities and cooperation. The study of the dynamics of these programs shows no change over the last 20 years – the number of classes, the thematic and the objectives have been kept untouched.

Besides, the present programs can include an addition of one class/week dealing with teacher chosen thematic. As the study shows, the teachers have chosen different additional activities such as: health education, 'let's eat healthily', 'eco-school', 'the young citizen', all teaching ecological behavior; civics contests, thematic trips, planting and ecology activities in parks, etc.

The secondary level education (1) does not bring a growth in the number of classes dealing with ecology, but the contents of the subjects gain a more specific meaning, being correlated to the cognitive, affective and attitudinal development. The class distribution for the 5th – 8th graders is shown below:

Diagram no.3

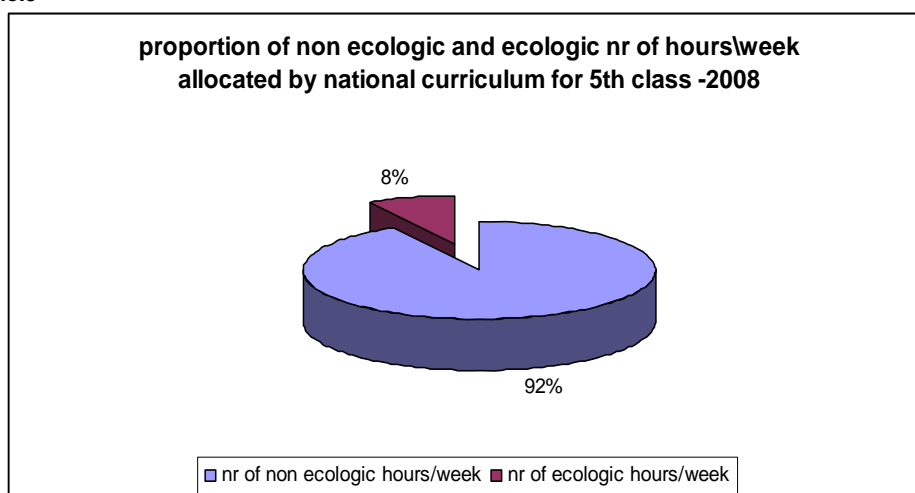
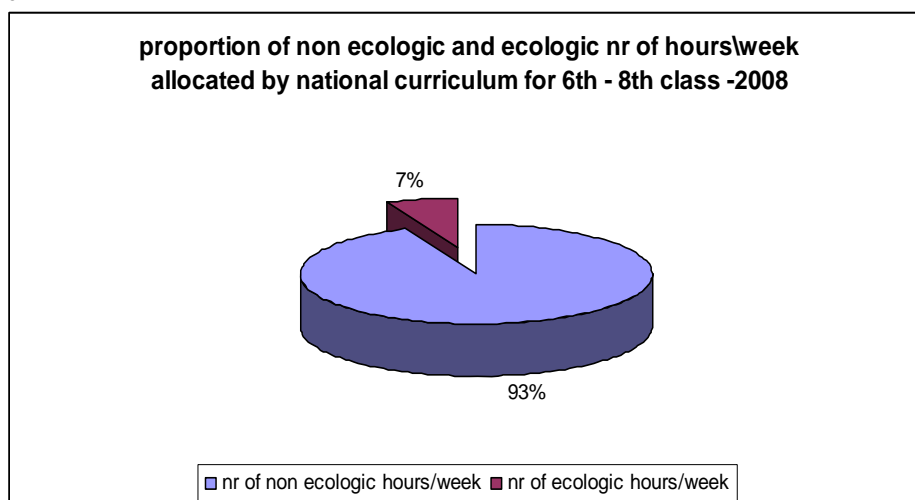


Diagram no.4



The frame *objectives* formulated for the secondary level are the following:

- knowing and understanding the terminology, the concepts and the principles specific to biological sciences

- developing the ability of exploration/ investigation in order to solve specific biological problems
- developing the ability of communication, using in a proper way the specific biological language
- forming the attitudes and habits regarding the influence of biology upon the environment and community.

The educational contents are different depending on the students' age. For the 5th (3) graders the emphasis is on:

I. **The diversity of the living world** (most widespread groups of plants, adaptation of plants to diverse life conditions, soil- plant relation, plant- animal relations).

II. **The structure of a flowery- plant** (components of a plant, morpho-physiological characteristics of the components, functions of the components, breeding and life circle of the plant, the role of human intervention)

III. **The influence of the human factor upon vegetation** (plants and their importance in the humans' life, the impact of human factors upon plants, the cultivated plants: garden and decorative plants, the protection of plants)

For the 6th graders, the emphasis is on:

I. **Animal diversity** (most widespread groups of animals known to pupils, the adaptation of animals to diverse environment conditions, the existent relations between different animal species)

II. **The structure of mammals** (morpho- functional characteristics of mammals, anatomical and physiological characteristics of the systems of components, breeding, animal behavior)

III. **The influence of human factors upon the fauna** (animals and their importance in humans' life, extinction of differnt species, animal protection)

The 7th garders' educational contents (4) center upon the **functions of the human body and their anatomical basis** (reproduction, relationship, nutrition) as well as upon **notions about hygiene and health**.

The 8th graders program is much more centered upon ecological information:

I. **Plants and animals in different environments** (the study of alive organisms from terrestrial environment, the study of alive organisms from aquatic environment, the biotope and biocenosis and ecosystem.

II. **Decisive factors in the spreading of living organisms** (1. Abiotal factors: the mutual influence climate- living creatures: life during the seasons, active life and recumbence at plants, seasonal rhythms in animals' lives, hibernation and migration. 2. Biotical factors: interspecific relations: competition, cooperation, exploitation. Intraspecific relations: animals 'social life, means of communication)

III. **Trophic relations in the ecosystems** (1. trophic system, trophic levels, trophic relations in ecosystems, trophic chains. 2. The circle of substances and of the energy).

IV. **Balance in the ecosystems** (1.The balance of the ecosystems – the evolution of the ecosystems (successive stages, climate), biodiversity as a factor of the stability of the ecosystems. 2. the human factor and the natural balance – urban

and industrial arrangements, agro-ecosystems, the overexploitation of natural resources, the introduction of new species)

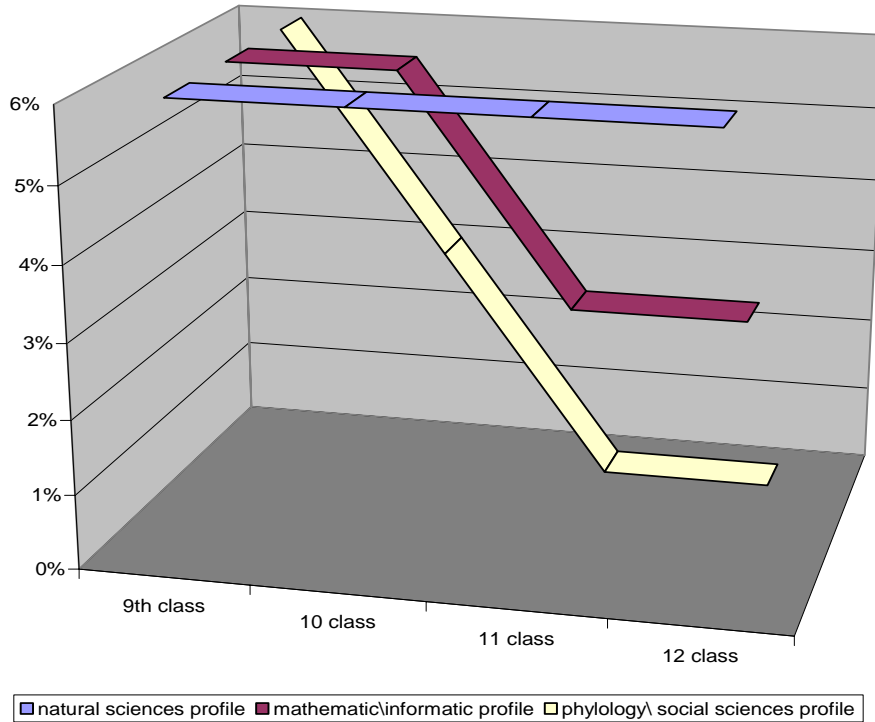
As was the case of the above mentioned curricular level, the proportion of ecological subjects contained in the current programs and that of the 20 years before, is almost unchanged in regarding classes/week. The qualitative progress can be noticed in the inclusion of ecological themes(1/3 of all classes, for each level), themes which serve as a completing element to the classes destined to the analytic study of the components of the vegetal, animal and human organisms. The ecological studies of the 8th grade, the end of the secondary level are dedicated exclusively to ecology as a synthetic biological science, centered upon the principles, laws and practicability that are characteristic to supra-individual living systems. 20 years ago, this synthetic biological science was completely cancelled. Given the importance of the classes and the ecological contents, it is appropriate to notice that the secondary level has got the most important habit-forming valences regarding the ecological education of the individual. As in the primary level of education, the school activities are completed by optional subjects and extra-curricular activities that have ecological thematic: eco-school, arranging grass plots, separate waste collecting, recognition of protected species of plants and animals, activities of marking the protected areas, etc.).

When talking about the high school level of education, the importance given to ecology differs depending on the profile of the high school (5). The Romanian educational system offers the following options: theoretical high schools (with profiles as: natural sciences, mathematics, computing, philology and social sciences), technical high schools (having profiles as: technical sections, natural resources and environment protection, services and vocational) and professional schools, and professional vocational schools. Due to the huge diversity of educational programs, it is difficult to realize a comparison of all types of high school. That's why, we have focused on the profiles that involve the biggest number of students and that suppose a better ecological preparation. It is the case of the theoretical high schools, and that of the areas of Natural resources and environment protection (having profiles as environment protection, forest and agriculture).

The number of biology classes and specialty subjects varies beyond rather large limits, as illustrated in the following diagrams. At the level of theoretical high schools, there is a tendency of diminishing and even retrenchment of biology as a school subject, except the natural resources profile, where the 6% ratio of biology classes is maintained during all the 4 years.

Diagram no.5

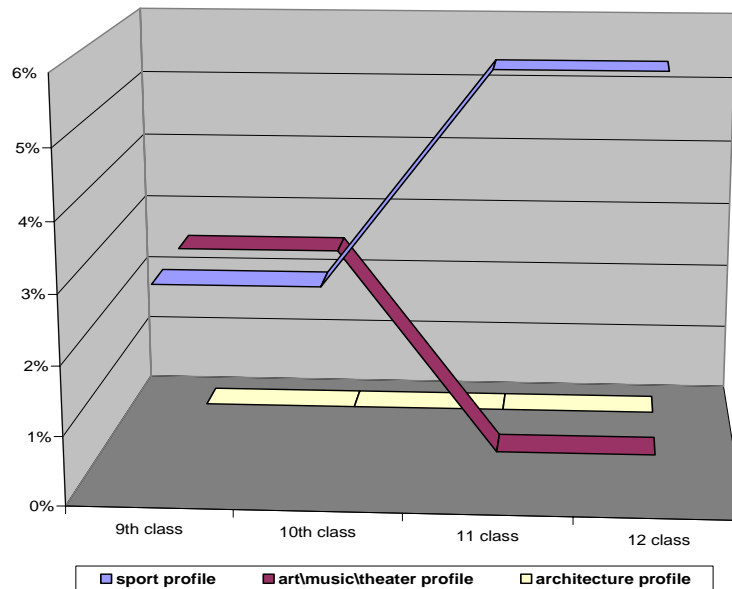
proportion of ecologic nr of hours \week allocated by national curriculum for different profiles of theoretic high schools -2008



In the case of vocational high schools, the dynamic of the allocated biology classes varies from one profile to other. We face a paradoxical situation in the case of the architecture profile, where biology is totally excluded from the curriculum. We consider this situation as being a negative influence upon formation, depriving students from an important source of inspiration regarding the designing and framing of architectural spots in natural areas. Given the modern orientation in ecology which comprises the human habitats in the thematic areas, as well as the development of branches as surrounding ecology and human ecology, this curricular decision is unjustified and imprudent.

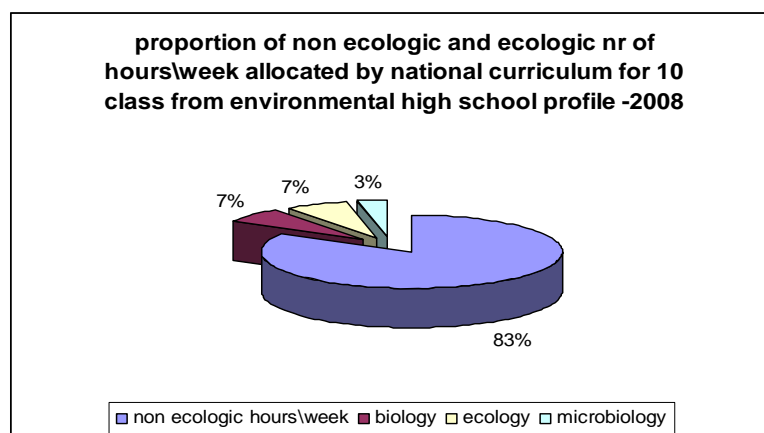
Diagram no.6

Proportion of ecologic nr of hours\week allocated by national curriculum for different profiles of vocational high schools



Even in the case of the profiles destined to form towards environmental protection, the proportion of ecological subjects and the variety of themes is very low. In the 9th, 11th and 12th grades the proportion of ecological subjects does not exceed the threshold of 6%, and even a 3% in the 12th grade. The only exception occurs in the 10th grade, where the distribution, the proportion of classes and the type of subjects related to ecology reach a 17%, as it is illustrated in the following diagram:

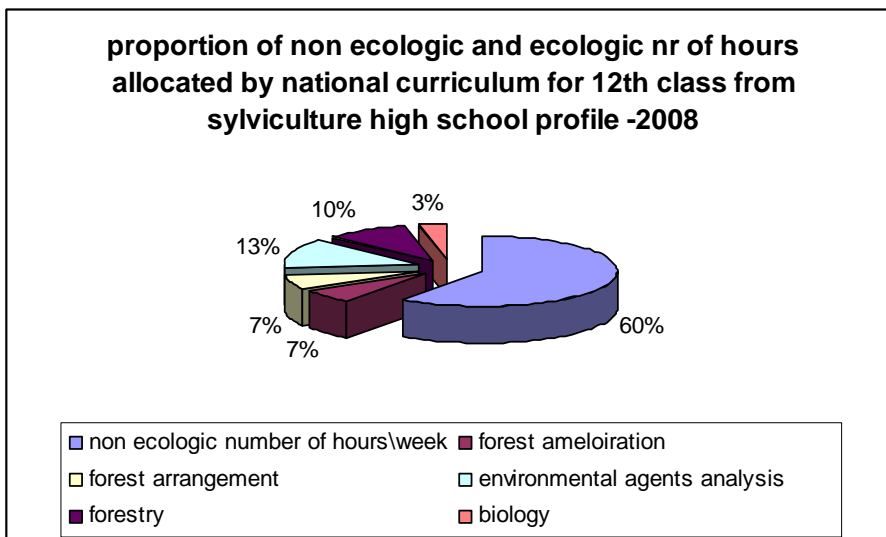
Diagram no.7



In the case of forest profile high schools, the distribution of the biology/ecology/environment profile is more appropriate to the profile, and constantly ascending, starting from the 10th grade. If in the 9th grade we meet a proportion of 6%

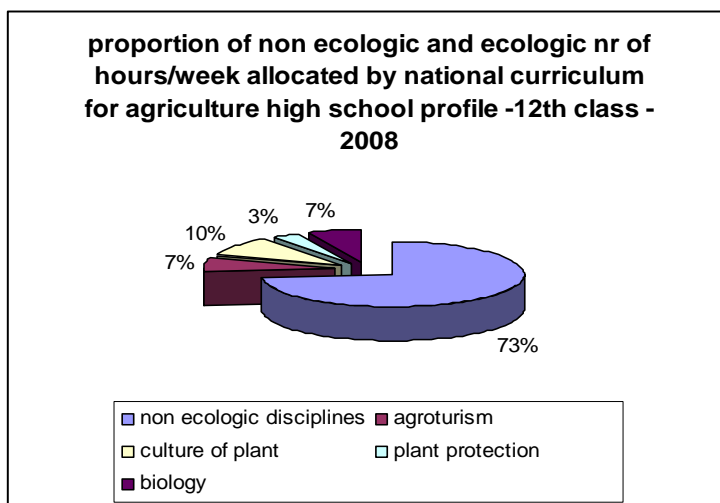
for biology, in the 10th grade, the biology, forest legislation, forest and environment management registers a proportion of 13%, in the 11th grade, the proportion of these classes rises to a 17%, including subjects as: silviculture, wood exploitation, and in the 12th grade it reaches 40% of the program and it deals with much more specialized subjects as demonstrated in diagram no. 8.

Diagram no. 8



In the case of high school profiles of Natural resources and environment protection, the agricultural and agro-mountaining classes are also included. The ecologic formation in these profiles is achieved following a similar dynamic as that of forest profiles. We illustrate only the situation of the 12th grade, where the ration of the ecology/biology classes reaches a 27%.

Diagram no.9



As regards the educational *contents* of the biology program, it is rather homogeneous to all specializations and profiles (6), including notions of systematic in the living world, the kingdoms of the living world, notions of cytology and cellular biology and genetics. These are studied thoroughly depending on the number of classes allocated/profile.

The 10th grade program (7) deals with contents related to the structural and functional aspects of the living organisms, such as: histology notions, the functions of: nutrition, breath, circulation, excretion, relations at animals/plants, followed by a chapter reserved to ecologic disturbances. We consider that this chapter would require a preamble of ecology notions of supra-individual biology subjects such as the ecology of populations and phyto-sociology.

In the 11th grade (8), the students learn about the biology, anatomy and physiology of the human body, including notions of hygiene in each chapter. The program of the 12th grade (9) comes to complete the biology notions with notions of molecular genetics and it allocates 40%: 15% to the study of history of life, and 25% to the organisms and their habitats, areas of ecological synthesis, their placement at the end of the curricular circle being well-justified.

In our opinion, the program has a judicious distribution of contents throughout high school years, but the profiles that stop the biological formation in the 10th grade lack the ecologic integration perspective upon the living world, a fact that could have influences upon the attitudes and behaviors of the future citizens.

The thoroughgoing study and the advanced specialization of the students that attend profiles as: environment protection, silviculture, agriculture, and agro-tourism, offer the premises of responsible future decisional factors. In addition, the teaching methods and the stated objectives aim at cognitive, affective and attitudinal aspects at the theoretical non-ecological profiles, and in addition, new methodologies and actionable objectives proceed during practical activities on the field and in laboratories.(at the environment protection sections).

CONCLUSIONS

We can draw some general *conclusions*:

- There is still a relatively low proportion of biology at all curricular levels, the ecology thematic taking up only 1/3.

- The absence of the biology classes from the curriculum of many high schools, and in the actual conditions of a world dealing with serious ecologic problems, such an absence deprives an important sector of students from a solid ecological education meant to offer solutions, preventive measures, attitudes and pro-ecologic competences. This deficit is illustrated in the existing crisis in society, and due to the absence of recovery solutions, the crisis will perpetuate and deepen.

- The positive counter-balance could be found at the level of environment protection specialization,(including silviculture and agriculture) where the gradual

formation can achieve the development of competitive decisional factors, at the levels directly related to environmental problems.

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