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ROMANIA, A BACK UP SOLUTION CONCERNING FOOD AND WATER IN 21st CENTURY EUROPE

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Abstract. *At present a major preoccupation at European level is to solve the alimentary problem on average and long term, in the context of demographic evolution, of natural resource exhaustion and climate changes. In principle, societies look for models of agro-alimentary regeneration, of adaptation of production systems, of conservation (where possible) or agro-eco-system reconversion, but also of application of circular economy principles to reuse secondary production, residues and wastes, as well as to achieve synthetic proteins. The aim of the paper is to emphasize Romania's role and place it in the situation when Europe's standard agriculture seems to have reached its limits, water as aliment becomes a problem, i.e. to show a series of solutions through which the Romanian agro-zoo technical and natural area practically becomes a reserve at continental level. The paper synthesizes the transition towards predictive agro-alimentary systems by emphasizing the main solving stages, so that Romania, through this profile, may become extremely useful in European integration, being able to decisively contribute to alimentary balance.*

Keywords: predictive agriculture, agro-zoo technical area, food, fresh water, agro-alimentary systems.

1. Introduction

It seems that standard agriculture has reached its limits in certain parts of the globe. At European level for example, and especially in the western part, the super saturation of land with chemical fertilizers paradoxically leads at present to the stagnation of agricultural production yield and quality, with effect upon animal breeding. From here worries arise as to a big alimentary crisis that might appear in EU around the year 2030. It is not surprising that the financing of agri-food scientific research is generous at present, but it seems that for the 2021-2027 period it will be too (there is information from different EU documents).

The idea we are suggesting is that Romania, having a particular specificity (geo-climatic, technical and human) can play a role in solving possible alimentary and water crises, of course by approaching certain beneficial and well financed strategies.

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It must be specified that for our country there are in fact two opposed scenarios: either nothing constructive is done and we will become food and water dependent, or we will find and apply solutions for this warning.

We mean to avoid critical points in stipulated changes for the 21st century, with effect in fighting drought and demographic and natural environment "desertification" on the salvation from exhaustion of water table from aquifer strata (the first saturated with water horizon met under earth surface, with variation of influence level by climate conditions).

The approached theme is complicated and vast. That is why we concentrate the **objectives** of the study on three directions: - to be aware of avoiding the *"Big disaster"* (in the future to look for water and food outside Romania, which aims at an *"alertness");* to achieve a synthesis on technico-organising principles for the Romanian phyto-zoo-alimentary and natural area to become a national resource with potential of reserve and element to attract "food and water" in the future decades (which aims at a "*clear* v*ision and professionalism"*);

- to find theoretic and practical production solutions concerning *"The big chances"* (to imagine basic conditions necessary to produce and sell Romanian food and drinking water, including for exportation, in order to contribute at EU level with food and water for the worrying future (which means the capitalization of a serious "*opportunity"*).

2. Methodology and Work Hypotheses

The processing of cumulated data methodologically pursued the following systemic logics, in several steps:

- ***Step I*** - Reparation of the standard system of agricultural production;
- ***Step II*** - Production orientation towards European "oasis", such as Romania, to capitalize the existing **biodiversity**;
- ***Step III*** - Imposing **bio-economic** principles and practice of circular economy (recovery and capitalization of secondary products, wastes, residues, etc.);
- ***Step IV*** - Passing towards new food resources, namely towards **synthetic proteins** (reserve of food in "casualty" conditions from the 21st century);
- ***Step V*** - Technical and psychological change of the **feeding manner**: *new alimentary directions* and a new *culinary paradigm* by applying vanguard ideas: bio complexity, personalized and predictive gastronomy and others.

3. Results and Discussions

Going through the 5 mentioned steps attempts to solve the proposed objectives, so that to sustain the idea of active player, i.e. Romania to be a "donor" in the European food security in the decades to come.

In order to achieve this desideratum, from the very beginning we consider that an intelligent strategy becomes imperiously necessary for a balanced development of Romania's agriculture in relation to *nature – food & water – human resource.*

In these conditions there are necessary elements that show **premises** from which there may start disposals of this problem, respectively concerning food and avoiding alimentary problems in the 21st century. We distinguish two basic components, namely a series of premises at European level or at the Romanian space (Bogdan, A.T., 2012; Gruia, R., 2016; Abrudan, I., 2018)**.** Food and drinking water must be a basic concern for our country, so that Romanian premises refer to *natural and social environment specificity and dynamics* (Tab.1).

Table 1. Avoiding alimentary crises by taking into consideration basic premises

No.	Basic ideas	NATURAL AND SOCIAL DIAGNOSIS	TECHNICAL AND MANAGERIAL DYNAMICS
1	**EUROPEAN PREMISES**	- Agro-eco-systemic exhaustion - Climate changes - Demographic increase	- agro-food technologic limitations (signs of ***stagnation*** of the production level and technical saturation through modern methods)
2	**ROMANIAN PREMISES**	- Climate changes - Demographic decline - Population aging	- adaptation of the bio economic model, demographic, managerial and legislative solution in the Romanian zoo technical sector; - genetic amelioration: creation of new sorts of fodder plants and adaptation of species and animal races resistant at high temperatures and drought; - avoiding pathologic losses and water conservation when drought.

In this context, Romania may keep and consolidate its biodiversity through intelligent policies, so that the natural and food patrimony may be developed, based on the process of diversification and introduction in the agro-zoo technical circuit of new species with economic potential, required for the necessary protein

equilibrium (especially the animal one) in the future decades and to avoid potential crises of alimentary nature.

As for assuring drinking water, a series of actions become obligatory:

- regularization of water streams;
- unclogging of water streams and reservoirs;
- spring maintenance; - antipollution measures (National Report, 2004).

Concomitantly it is absolutely obligatory to totally solve the irrigation system in Romania.

Based on what has been said, we will analyze the solving steps that may represent the necessary support to elaborate a national strategy meant to ensure good enough agro-alimentary productions, including the contribution of drinking water capitalization too.

3.1. Methodological priorities to remediate and develop the Romanian agri-food system

A first step is to methodologically sustain Romania's priorities with regard to food security and safety.

The potential we have entitles us to analyze the possibility to become a real European solution concerning food and drinking water. Without pretending problem exhaustion, we mention among the necessary elements for such a strategy:

- *conservation* of natural patrimony through the demarche of an applied ecology (to avoid the destruction of agricultural potential, in many concerns there are unwanted aspects of the present!);
- application of methods and principles of *engineering and management* concept in sustainable development of the agro-alimentary system.

3.2. Diagnosis regarding natural and cultural potential to sustain the Romanian agri-food system

The second step is important in order to exactly understand the present situation, i.e. to collect data by inventorying the natural and cultural-scientific patrimony that sustains the Romanian agro-alimentary system.

Given the conditions when climate changes already affect the capacity to produce food, the new conceptual approaches undoubtedly lead to finding scientific and technical solutions. The idea to capitalize *biodiversity* and local *geo climatic and cultural diversity* seems to be essential.

Concerning **biodiversity,** it is known that in the Romanian space live numerous species of plants and animals that disappeared a long time ago in other parts of Europe, or are still existing, but in very reduced numbers (Cristea, M.D., 2007; 2012; Maruşca, T., 2017).

As arguments we remind: ***Catalogue of plant variety*** (sorts) that are cultivated on Romania's territory, identifying a number of 2118 sorts of plants and ***Catalogue of domestic mammals*** which includes 79 races (out of which 26 are still active, 19 in potential danger and 34 disappeared). However it must be mentioned that many local races (Ţurcană, Ţigaie, Capra Carpatină, etc.) have a reproduction system in local communities (reproductive isolation on a certain area, without genealogic register and production official control, the selection being made in agreement with the owner's preference).

As for **geo climate and cultural diversities,** the diagnose referring to food and drinking water may be grouped in the following typological aspects: - diversity of biodiversity geo resources (flora, fauna); - diversity of agro touristic geo resources (tourist villages / agro-alimentary products and cultural elements of the local community) and – diversity of drinking water geo resources (water as an "aliment"). Table 2 mentions synthetically (Cristea, M.D., 2012; Gruia, R., 2017), a series of information that demonstrate the existence of a real potential that may guarantee the work basis for a real food reserve in the future.

Table 2. Geo resources from Romania's biodiversity

Romania's flora	Romania's fauna
On Romania's territory have been identified 3700 species of plants from which up to now 23 have been declared nature monuments, 74 have disappeared and 1253 are considered rare. The three large vegetation zones in Romania are the alpine zone, the forest zone and the steppe zone. Vegetation is tiered, in concordance with soil and climate characteristics, but also depending on altitude, as follows: oak, lime, ash (in steppe and low hill zones); beech, holm-oak (between 500 and 1200 meters); spruce, fir, pine (between 1200 and 1800 meters); juniper, savin and dwarf trees (between 1800 and 2000 meters); alpine lawns formed of petty herbs (above 2000 meters). Off large valleys, due to persistent humidity, there appears meadow specific vegetation, with cane, rush, carex and often with bunches of willows, poplars and alders. In the Danube Delta swamp vegetation is predominant.	It is one of the richest and varied ones in Europe, containing rare or even unique species on the continent. In Romania there live 732 vertebrate species and subspecies and numerous (several thousands) non-vertebrate species. Vertebrates are represented in Romania's fauna by: cyclostomes (4 species), fish (184 species and subspecies), amphibians (20 species and subspecies), reptiles (31 species and subspecies), birds (382 species and subspecies) and mammals (110 species and subspecies). Among the mentioned groups, in the Romanian space almost 4000 butterfly species (from which approx. 25% on the Tâmpa Mountain/ Braşov). Among mammals, one is in imminent extinction danger (sea cow), one in danger (mink), 13 vulnerable and 4 threatened.

Table 3. Genetic resources from the traditional or recently diversified Romanian space, with economic potential in alimentation

Genetic resources with phyto-alimentary potential	**Genetic resources with zoo-alimentary & clothing potential**
FOREST FRUIT GROUP FROM ROMANIA	FARM MAMMAL GENETIC RESOURCES
Wild strawberries *(Fragaria vesca)*	Domestic pig (*Sus scrofa domesticus* or *Sus domesticus*)
Huckleberries *(Vaccinium myrtillus L)*	Ruminantia suborder cow (ruminants), Bovidae family.
Raspberry *(Rubus idaeus)*	Horse (*Equus caballus*)
Culture huckleberries *(Vaccinium corymbosum)*	Domestic sheep (*Ovis aries*)
Sea buckthorn *(Hippophaë rhamnoides L.)*	Domestic goat (*Capra aegagrus hircus*)
Blackberry *(Rubus fruticosus L.)*	FARM POULTRY GENEITC RESOURCES
Eglantine *(Rosa canina)*	Hens (Gallus gallus domesticus)
Cowberry *(Vaccinium vitis idaea - L.)*	Turkey hens *(Meleagris gallopavo)*
Elder *(Sambucus L.)*	Domestic geese (*Anser cygnoides)*
Currant *(Ribes rubrum)*	Ducks *(subfamily Anatinae)*
Gooseberry *(Ribes grossularia)*	Quails *(Coturnix coturnix)*
Strawberries *(Fragaria viridis)*	Pigeons *(Columba livia)*
Filbert *(Corylus avellana)*	Pheasants *(Phasianus colchicus)*
Nut *(Juglans regia L.)*	Peacocks *(Pavo sp.)*
GROUP OF MEDICINAL AND MELIFEROUS PLANTS FROM ROMANIA	GENETIC RESOURCES OF SMALL FARM ANIMALS
Blues *(Centaurea cyanus)*	Rabbits *(family Leporidae)*
Potato *(family Solanaceae / Solanum tuberosum)*	Chinchilla *(family Chinchillidae)*
Esculent chestnuts (*Castanea sativa*)	Nutria *(Myocastor coypus)*
Artichoke (*Cynara scolymus*)	Muskrat *(Ondatra zibethicus)*
Cucumber *(Cucumis sativus)*	Guinea Pig *(subfamily Caviinae)*
Hot pepper (*Capsicum annuum*)	Ferret *(Mustela putorius)*
Sea buckthorn (*Hippophaë rhamnoides* L.)	Mink *(Mustela vison)*
Onion (*Allium cepa*)	Polar fox *(Vulpes lagopus)*
Chicory *(Cichorium intybus*)	NON TRADITIONAL ANIMAL GENETIC RESOURCES
Fir tree *(Abies alba)*	
Thyme *(Thymus serpyllum)*	
Basil *(Ocimum basilicum)*	Molluscs *(branch Mollusca)* - invertebrates s (shells, snails, sepias, octopi and others) Crustacee (*branch Arthropoda*) - aquatic arthropods (crabs, shrimps, lobsters, krills, crayfish, crawfish and others) - terrestrial arthropodes – insects are eatable (ants, bee and wasp larvae, grasshopper, bugs, butterflies and moths and others)
Cherry *(Cesarus vulgaris)*	
Apricot *(Familia Rosaceae)*	
Primrose *(Primula veris)*	
Strawberry *(Family Rosaceae)*	
Algae – aquatic plants able to photosynthesise (sea non toxic agaes are eatable, as for ex.: spirulina, kelp, chorella and others)	
Mushrooms - *regnum Fungi / separated from regnum Plantae and Animalia* (eatable mushrooms - of *Ascomycota* type as well as *Basidiomycota* /that have top and foot)	

Diagnosis will have in view, besides plants from big culture and horticulture, or from traditional zootechnics, also other genetic resources, with economic phyto-zoo-alimentary potential.

Romania is one of the few European countries where *agro systems* represent significant reservoirs from the point of view of genetic diversity both for phytoculture and for zoo culture, that have been conserved at the formation and development place (*in situ*) (Drăgănescu, C., 1984; Gruia, R., 2016).

Table 3 enumerates the species that belong to agro-biodiversity specificity, aiming to have an image of the present production and of the potential of diversification through new species with economic potential and new food sorts.

Geo resources of drinking water are a support for the optimistic idea of Romania's future alimentation, because, after a series of predictions, drinking water may become more precious than oil in the 21st century.

In Romania we consider that it becomes more than opportune to approach a **strategy** with a clear basic financing, so that present quantities of fresh water may be mentioned, regenerated, as well as capacities of drinking water capitalization may be developed.

All these are important, especially that it must not be forgotten that Romania owns 60 % from Europe's mineral water reserve (mediafax.ro/).

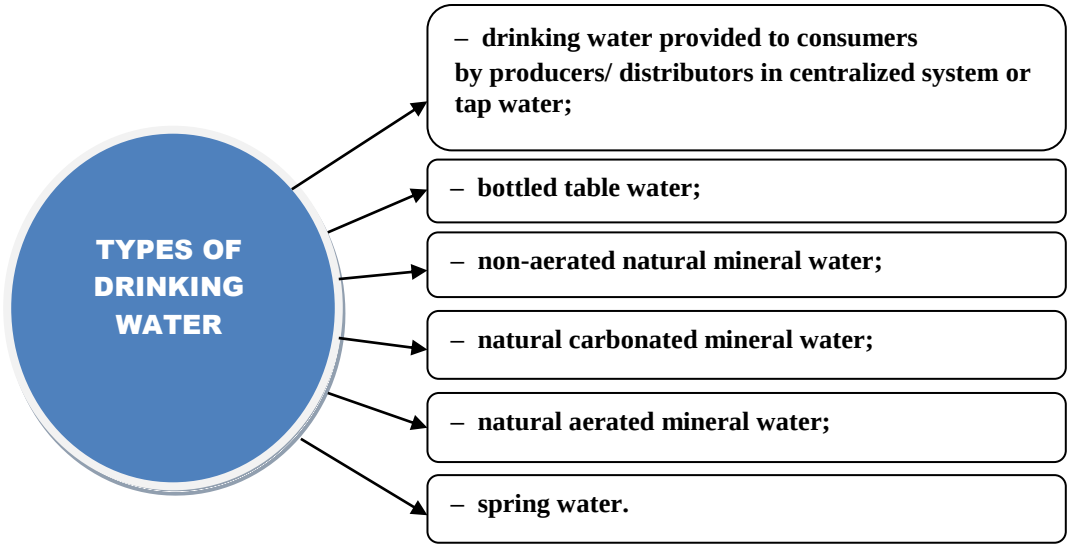

Fig. 1. Geo resources of drinking water from Romania.

Consequently, within the principles of the mentioned strategy, we should NOT sell the ownership right of this resource (as well as neither of other resources and raw materials), but to capitalize only the obtained and diversified productions (Fig. 1.).

3.3. Application of bio economy principles for the sustainable development of phyto-zoo-alimentary system

Analyzing the third step, as it is known, **bio-economy** indicates an economic theory that inevitably leads towards a sustainable development from the ecologic and social perspective.

Methodologically, it is taken into consideration matter/substance (S) and energy (E) that enter economic processes with relatively low entropy and come out with another entropy degree, which imposes to take into consideration thermodynamics principles in the context of the ever more precarious offer of natural resources (Georgescu-Roegen, N., 1979).

After the year 2012, the European economy is focused towards a more important and sustainable utilization of renewable resources. In other words, taking into consideration that the paradox between demographic increase and finite natural resources dramatically accentuates, Europe needs secure and healthy renewable biologic resources for food and fodder for animals, as well as materials, energy and other corresponding products. That is why we should have in mind to pass from standard agriculture to modular and precision agriculture (Gruia, R., 2010).

Green economy, based on bio-economy green power (implicitly sustainable), is part of the integration in green revolution, with ecologic management, green energy and corresponding "green" affairs: solar energy, wind energy, bio fuel, hydro energy, thermal energy and last but not least, agro alimentary system green power (Bogdan A.T. and Comșa, Dana, 2011). The natural consequence is the decisive step in professional formation. We mean "eco-bio-economic engineering", but also "eco-bio-economic management" (Gruia, R., 2013).

Practically, nowadays and at the present technical level, nobody may allow a vast extending of green economy, so that there appeared development models based on the principles of this type of economy, but with new dimensions. The question is about considerable enlarging the systemic coverage towards *social aspects* (taking into consideration that there is higher unemployment, situations of loss of national capital, lack of chances for youth and others), enlarging towards innovation and technology rethought, especially on *circular model*, these ones finally leading to *"blue economy" model* (Pauli, 2010).

Blue economy is firstly based on scientific analyses that identify the best innovations. These lead to the creation of a social capital that, in its turn, will allow to have *cheaper* and the best products, the healthiest products and will stimulate *entrepreneurship*. Solutions are stipulated to re-project manufacture processes in environmental friendly and cheap systems.

This economic model offers private entrepreneurs instruments capable to sustain the creation of jobs, men's well-being, but also environment health (being aimed in fact the *eco-health generation*, especially the getting food direction).

Passing from green economy to blue economy may lead to **Romanian economy security** in the decades to come, and in the agriculture field the change of managerial paradigm supposes, among others, the following elements too: - agro-eco-system reconversion (application of technologies friendly with natural environment);

- circular economy (with reuse of secondary agri-food production, wastes and residues);

- reorientation of human resource formation in the field (new educational approaches on bioeconomic and sustainable development direction) (Pillet, G., 1993, Gruia, R.,1998, Pauli, G., 2010).

3.4. Finding new food resources in order to counteract potential alimentary crisis

In a fourth step of analyses there may be observed the historic evolution of the feeding manner and food production. Thus, mankind needed almost 10.000 years of agriculture to develop the cultures and animal livestock we are now consuming. There were necessary only some centuries to develop agricultural tools that culminated with large scale and efficient mechanized agriculture and with nowadays biotechnology equipment.

There were necessary only decades to harmonize science with food, to connect food with health, allowing us to directly manipulate the genetic constructions of the food we eat. In the future, as almost 75% of the world population is affected by the lack of different types of aliments, the next frontier is our ability to produce aliments from molecular components and to replace thus the need of practices that develop the food which consumes resources, almost non ethical ones, with personalized, health generating systems, etc.

A possibility agro-alimentary research develops in the present refers to **synthetic foods,** that are created by combination of alimentary substances (in fact they are natural raw materials) and submitting these substances to different modern processes in order to get the desired food product.

Although these are artificial food products, they contain complete proteins that have been derived from natural foods. It must be mentioned that there is a very little quantity of food that contains complete proteins (all the amino acids that are not produced by the organism).

3.5. Alimentary education as resource for the understanding of another feeding pragmatic level

We cannot solve any alimentary crisis unless we put, in the fifth step, the problem of men's permanent education in the more and more accelerated conditions of science and technique development, including from the perspective of population information and formation for the understanding of new paradigms linked to the feeding manner.

The feeding manner is aimed when food is accumulated both by energo-nutritive contribution and by the health generating and psycho-sensorial ones. These are well underlined aspects in obtaining food supplements (based on certain ingredients), functional food (with innovative fortifying components), nutraceuticals and others.

As for culinary production, among the new paradigms we may remind ***predictive alimentation*** (it refers to the passing from empiric or mystical predictions to algorithms and predictive modelling) and ***personalized gastronomy*** (it is based on the idea that men differently respond concerning alimentary habits and behaviours, because of certain environment factors and due to the influence of genetic variants concerning absorption, metabolism and utilization of nutritive components from food).

Conclusions

(1) In the situation when Europe agriculture seems to stagnate and water (as an aliment) becomes a problem in the context of climate changes, the solution is to consolidate new concepts (having as a basis the capitalization of local *biodiversity* and of *geo-climatic and cultural diversity*, bio-economy and bio-technology principles etc.), that lead to a **change of paradigm** concerning the regeneration of the alimentary act by which it is possible to pass from standard agriculture towards modular and precision agriculture, to predictive/preventive and personalized alimentation, but also to synthetic food.

(2) Having a significant geo resource potential, in conformity with the presented diagnose, the production of food in the future decades has to ensure good and secure agri-food productions for Romania, also including the contribution of drinking water capitalization, through a **national strategy** on the axes of harmonizing the relation *Nature –Food & water –Human resource*, equation in which, in order to understand and apply the strategy and the new paradigm linked to the feeding manner, the priority if human resource information and formation and corresponding financing of the research in the field.

(3) The next frontier is our ability to produce foods from molecular components and replace the need of practices to develop aliments that consume resources, often non ethical ones, through personalized and health generating systems, including (although we are not yet prepared) the development of practices to obtain synthetic foods.

(4) Romania is one of the few European countries where *agro systems* represent significant reservoirs from the point of view of genetic diversity both for phyto culture and for zoo culture, that have been conserved at the place of formation and development (*in situ*) and that have in their structure geo resources of drinking water of six types, so that, based on a *smart strategy*, to be able to benefit from the **opportunity** that Romania may represent a reserve and a contributor of food and water in Europe, in the future decades.

R E F E R E N C E S

[1] Abrudan, I., (**2018**): In Search of Performance, Review of Management and Economic Engineering, AMIER, Vol.17, nr.1(67), 5-12.

[2] Bogdan, A.T. (**2012**): *Despre ecoeconomie şi economie verde în România,* Referat ştiinţific, Școala Postdoctorală de Biodiversitate Zootehnică şi Biotehnologii Alimentare, INCE/CSCBA - Academia Română, Proiect 89/1.5/S/63258, **2007-2013**.

[3] Bogdan, A.T., Comșa, Dana (**2011**): Eco-Bio-Economia o nouă paradigmă, în Soluții eco-bioeconomice bazate pe biodiversitate agrosilvică, Ed. Libris Danubiu, București, pp. 34-38.

[4] Cristea, M.D., **2007**: Biodiversitatea, Ed.Ceres București, ISBN: 973-40-0748-3.

[5] Cristea, M.D., **2012**: Biotehnologia și biodiversitatea, Ed. Academiei Române Buc., ISBN: 978-973-272-095-0.

[6] Drăgănescu, C, **1984**: Zootehnia, ecologie aplicată, Ed. Ceres, București.

[7] Georgescu-Roegen, N. (**1979**): Legea entropiei, Ed. Politică, Bucureşti.

[8] Gruia, R. (**1998**): Managementul eco-fermelor, Ed. Ceres, Bucureşti, pp. 41-50.

[9] Gruia, R. (**2010**): Modular Agriculture – Paradigm of Globalization Dynamics within the Context of Climatic and Scientific Changes, in Environmental Engineering and Manag. Journal, Iasi, vol. 9, nr. 12, pp. 1601-1606.

[10] Gruia, R. (**2013**): Bazele managementului şi direcţiile viitoare de evoluţie, Editura Lux Libris, Braşov, ISBN: 978-973-131-230-9, pp. 140-143.

[11] Gruia, R., (**2016**): Zootehnia bioeconomică, Ed. Lux Libris Brașov, ISBN 978-973-131-357-3, 27-42.

[12] Gruia, R., (**2017**): Resurse genetice în fermele agroturistice, Editura Clarion Brașov, ISBN 978-606-94470-0-0, 189-242.

[13] Marușca, T., **2017**: Elemente de gradientică și ecologie montană, Ed. Universității Transilvania Brasov, ISBN 978-606-19-0892-9.

[14] Pauli, G., (**2010**): Economia albastra: 10 ani, 100 de inovaţii, 100 de milioane de locuri de munca /Ed. Paideia București, ISBN 978-973-596638-6.

[15] Pillet, G. (**1993**): Economie écologique – introduction à l'économie de l'environnement et des ressources naturelles, Georg Editeur SA, Geneva, 153-211.