Vol. 8, No. 1/2018

Danubian Legislation and Economy

The Economic Quantification of the Ecologic Services of Forest Ecosystems

Anca Turtureanu[1], Codruța Mihaela Dobrescu[2], Leonard Magdalin Dorobăț[3]

Abstract: Forests are a component of the natural capital which has provided, ever since forgotten times, the humankind with various services, acting as a shelter, fuel provider, construction material provider, food provider. Practically, the development of humankind cannot be either imagined than strongly connected to the forest. Less than acknowledged are though the ecologic services provided by the forest ecosystems, which take various shapes. One of the causes is the "subtlety" of these services, as they are harder to identify. Paradoxical, at first sight, the value of these services is mostly emphasized when they disappear, their lack being the consequence of human intervention on these complex ecosystems. Dysfunctions regarding their functioning, not to say about their total destruction lead to long term economic consequences, most of the times being devastating or hard to correct. Their usage value (the economic value) is easy to identify, as it can be immediately transformed into money through irrational exploitation of forest ecosystems, the temptation of the immediate advantage being high. But, on long term, the ecologic value, the "future option" value, despite the fact that they can be separately considered, they have a strong connection to the long ter economic values, as not to speak about the intrinsic, moral nature value. Practically, they validate the economic value, they amplify it, as it is the reason for which a knowledge on and a quantification of these service is needed, especially of the ecologic ones. In Romania, human pressure on forest ecosystems threatens the medium and long term economic development of the country, through irrational exploitation or through the decreasing of the forest fund, actions that are mostly abusive and illegal.

Keywords: ecologic services of forest ecosystems; the quantification of the ecologic value of forests

Introduction

The significance of the natural forest ecosystems for the human wealth cannot be underestimated. Forests directly provide raw materials (food, construction wood, fire wood). All these things have been known for a long time, since the beginning of the humanity. But, at least the same significance is held by a category of other services, named ecologic services, which are provided to humanity by the forest ecosystems,

[1] Professor, PhD, Danubius University of Galati, Faculty of Economic Sciences, Romania, Address: 3 Galati Blvd, Galati 800654, Romania, Tel.: +40372 361 102, fax: +40372 361 290, Corresponding author: ancaturtureanu@univ-danubius.ro.
[2] Senior Lecturer, PhD, University of Pitesti, Faculty of Sciences, Romania, Address: Str. Targu din Vale 1, Pitesti, Arges, Romania, Tel./Fax: +4 0348453260, E-mail: codrutza_dobrescu@yahoo.com.
[3] Senior Lecturer, PhD, University of Pitesti, Faculty of Sciences, Romania, Address: Str. Targu din Vale 1, Pitesti, Arges, Romania, Tel./Fax: +4 0348453260, E-mail: coltanabe@yahoo.com.

and, in fact, to the entire biosphere. They have been intuited far more recently, several decades ago, as ecologic services have been more subtle and having needed wide ecology knowledge in order to be identified. Components of the forest ecosystems such as the soils, the herbal vegetation, the shrub and the tree ones, the microorganisms in the soil are part of the trophic networks, alongside the feature of regulating the climate, the water circuit, recycling the nutrient substances and, in many cases, even decomposing various substances which originate in anthropic activities. The stabilization of slopes, avoiding landslides or the erosion of the soil represents other services of the eco-forest systems. When one directly intervenes over the forests through various activities such as over-exploitation of wood resources, overhunting, complete deforestation, the creation of geographical barriers through the sectioning of forests by roads, railroads, highways or when the forest is affected in an indirect manner (e.g. pollution), consequences can be dramatic and they would not be immediately identified.

The Fundamental Question

This question is if the implementation of economic activities is or is not benefic? It is a very logical question from the economic perspective. In many cases, it has been noticed that, after a while, the benefits brought by a certain economic activity (for which an ecosystem had to be changed or even destroyed) are far lower than the loses.

This has frequently happened and has been possible through the insufficient knowledge of the way the respective ecosystem worked, of its connections with other ecosystems and of the economic value of the ecologic services it generated. Only an economy that is included in the "sustainable development" concept can ensure the success of the human species survival and of its economic development. Thus, the eco-economy concept has emerged (Brown, 2001) which explicitly regards this phenomenon and clearly shows that the economic evaluation of the ecologic services of ecosystems is mandatory required.

Answers to the Fundamental Question and Discussions

In developed countries (USA, Canada, the countries of the European Economic Area, New Zeeland, but also in the other state members of the G20 which are not included in the before mentioned categories) the following forest eco-services are well-known:

Hydrological services. Regarding the regulation of the water circuit in the nature, the maintenance of a certain level of the groundwater layer (piezometric level) in the aquifers, and thus the alimentation of springs in forested areas;

Recreational and touristic values have been long known in the USA and valued as such, in all of the states through the implementation of some series of educational,

touristic activities, paying high attention to the protection of nature. We will further mention this recreational/touristic value;

The stabilization of the terrain by avoiding the landslides, where the landscape consists of mountains or hills;

The stopping of the soil erosion, by reducing or completely eliminating the pluvial denundation and of the torrentiality development;

The quality of the air (providing oxygen, the reduction of the powders in the air) is a far known service. During one year, one hectare (2.47 acres) of coniferous forest can retain up to 40 tons of powders in the air, and the same surface of hardwood retains more than 100 tons (www.ecology.md);

The regulation of the carbon circuit in the nature probably is the function with the most implication at the level of the biosphere. Practically, the forest takes part in the maintenance of a carbon dioxide in certain limits. A single broadleaf hectare, in a sunny day, can absorb up to 280 carbon dioxide kg and release in the atmosphere up to 200 kg of oxygen (www.ecology.md). In fact, growth of the trees is 80% based on the carbon extracted from the atmosphere and only 20% from the material extracted from the soil (***, 1993);

The provision of a specific microclimate, with lower thermic amplitudes, with cooler summer days, with decreases of wind speed. This service is specially provided by the urban forests (***, 1993);

The reduction of sound pollution. Still the forests, or better, the urban forest curtains are the ones that lead to the significant reduction of the noise generated by the traffic, the railroad traffic or industrial activities. It can go up to the reduction of 20-30 decibels by the interposing of a double forest curtain (broadleaf + coniferous) between residential areas and roads (Bleahu, 2004);

Biologic diversity (biodiversity); is maximum in the forest areas and minimum in the anthropic landscapes, especially in the agricultural ecosystems. At a global level, forests host the highest number of plant and animal species. The Amazonian equatorial forest represents the ecosystem with the highest biodiversity in the world (www.science20.com; www.sciencedaily.com);

Products obtained from hunting, fishing, through the valuing of medicinal herbs and "forest fruits";

Pollination services which contributes with great benefits to agriculture (Krieger, 2001);

Cultural values of forest ecosystems are well known especially in developed countries;

High conservation values (HCV) are biologic, ecologic, social or cultural values which are seen as significant or having a critical significance at a national, regional or global level (www.fsc.org). Practically, they represent a genetic heritage of Earth, especially in the case of virgin forests;

The protection of the banks against fluvial erosion (Dorobăţ & Udroiu, 2014) **or against marine abrasion** (in case of the mangrove forests);

We would underline the necessity of individualization with a generally higher force of **the moral value** of ecosystems, especially of the forest ones. Many of the forests represent the house of various living communities. Their destruction does not only represent the destruction of the habitat of numerous biocoenosis' components, but also the destruction of those communities habitat, practically, their disappearance. Regarding the upper mentioned moral value, hardly quantifiable, the moral dimension in this case in a highly significant one. Who and how can monetary evaluate the disappearance of a human community, the irreversible destruction of a lifestyle? The forever disappearance of some living species that had the right to exist like the human species? In opposition to what happens in developed countries, in a series of developing (emerging) countries, as well as in low economic-social development states, things are much worse. Almost all of the states admit, in a way or other, the upper mentioned services' categories, but, in many cases, the implementation of a sustainable exploitation, of a management which would ensure the long term socio-economic development is very difficult and even impossible without external help. This last case in noticed in the case of some under-developed states which have entered the demographic trap (the growth of the population is higher than the growth of resources). Though it is curious that there are quite developed countries which, at least, on short term, which have a negligence, disregarding policy towards the economics values provided by forests. Brazil, Indonesia or China are such examples. In China, the "development by any means" slogan, applied on large scale shows its negative effects leading to decreases in the development rhythm; the ecologic costs are already felt (Brown, 2006). The case of Brazil is also significant. Pressures generated by oil or mining companies have led to massive deforestation, on large surfaces and decade long periods. Activities are still going on nowadays. But, to all these, there is also a contribution of a pervert effect of the EU policy regarding the biofuels. Thus, the EU adopted on May 8th 2003 the Biofuels Directives, which stipulates the reaching of a market share of at least 10% by 2020 (Fig. 1); then, through tax facilities, the use of biofuels was promoted (Energy Taxation Directive 2003/96/EC), and, through the regulatory document of EN14214, the quality standard of the bio-diesel was set. Romania adopted this directive in 2005, through the Government Decision 1844. But all this policy of the EU has led to the externalization of the pollution and of the deforestation phenomenon which extends in countries such as Brazil and Indonesia or African states. All of these in order to produce biofuels needful to the EU states, so that large forest areas were cut down, being replaced by oil-producing plants cultures,

generally palm-oil trees (Grevé et al., 2011). Such pressures on the forest ecosystems are more illegally exerted, in many countries. In Papua New Guiney massive deforestation is displayed (Boekhout, 2010).

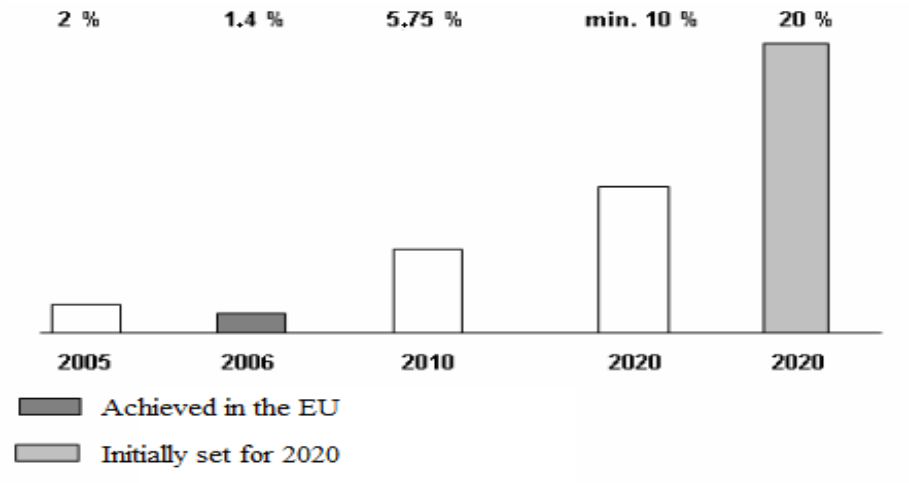

Figure 1. Level of biofuels production made or proposed by the EU (after Rus & Pop, 2007)

The result of this irresponsible policy is the destruction of the natural environment, the replacing of forests, especially of the tropical ones, with agricultural cultures (especially palm-oil trees), followed by erosion, the accumulation of pesticide-originating substances in the soil and waters, and also of herbicides used in agriculture, without mentioning the changing of the microclimate, the disappearance of many species. In an acre of tropical forest, one has averagely identified more than 300 species of trees; in many cases, a tree is host for more than 1500 animal species (London & Kelly, 2007). Deforestation phenomena are more extended and dangerous in equatorial areas (Boekhout, 2010) (Amazonia, Indonesia, Papua New Guiney, Congo River Basin). But the disappearance of forests does not only represent the extinction of many plant and animal species (many still undiscovered and of which we will never know that we had), but it also represents the extinction of many human entities, of many tribes which have always lived by being friends to the environment and which have the evident right to existence; for this some authors use the term "green criminology" (Zaitch et al., 2014). In many cases, these endangered human communities are much more aware, even if instinctively of the value of the forest and they protect their habitat (https://news.nationalgeographic.com).

The situation of the forest surfaces in Romania, on functional categories is displayed in table 1. Of the total state owned forests, 60% are ranked in functional group I (with

special protection functions) and 40% are ranked in the functional group II (with production and protection functions) (Fig. 2).

Table 1. Distribution of the forests on functional categories in Romania

(after www.mmediu.ro, modified)

FUNCTIONAL GROUP I		
Includes forests with special functions, such as the protection of waters, soil, climate and national interest objectives, recreational forests, protective forests of the geno and eco-fund, as well as the forests in the national interest natural protected areas. They represent 53.3% of the national forest fund.	Fields and soil protection	43%
	Water protection	31%
	Protection against damaging factors	5%
	Recreational forests	11%
	Forests considered protected and scientific interest areas	10%
FUNCTIONAL GROUP II		
Includes forests meant to accomplish both the production (priority) function and one or more of the protection functions It represents 46.7% of the surface of the national forest fund		

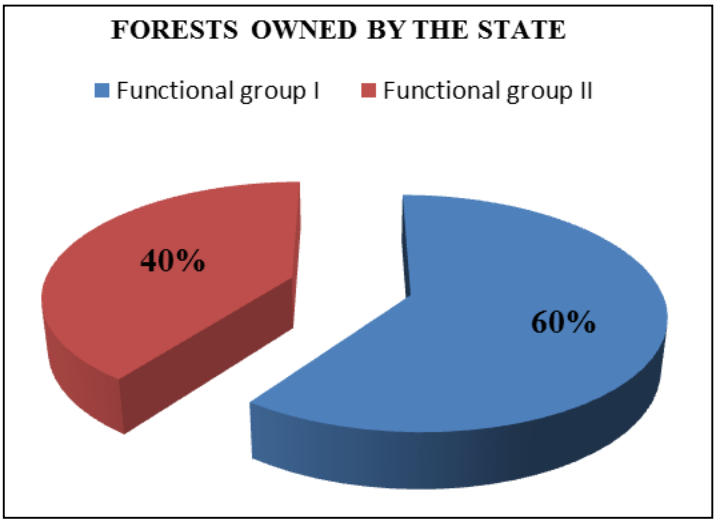

Figure 2. Distribution by functional groups of state-owned forests

(after www.mmediu.ro, modified)

In our country, the situation is not protected against threats at all; there are also pressures on the forest ecosystems too. These are manifested through illegal deforestations, over-exploitation of vegetal and animal resources of the forests in many mountainous areas (Făgăraş, Apuseni, Leaota, Iezer-Păpuşa, Retezat, Bucegi and many others). Then, there is the temptation of allowing, by law, of exploiting virgin forests; recently, the Senate has approved a regulatory act to this extent: the project regarding the modification and completion of Law no. 51/2006 of the

community public utilities services (www.senat.ro); but it can be rejected by the Deputies Chamber, decision making institution. In many countries, while trying to braking the irrational exploitation of forest ecosystems, certification systems of the forest management were implemented, which support the verification of the origin of the wood used in industry, the existence of that "label" representing the warranty that the wood comes from a corresponding management forest. The HCV (High Conservation Values) concept is found in the rules of the Forest Stewardship Council (FSC), issued through the support of the WWF. (https://ic.fsc.org/; www.hcvnetwork.org). The environmental policy provides a certificate to a forest fund which is sustainable exploited, keeping its high conservation value. According to the available data, nowadays, more than 125 million of forest acres (about 50.5 million hectars) in the entire world are FSC certified, the equivalent of approximately 5% of the production forest on the planet. Though, it is not enough, but it is a start. In Romania, nearly 2.5 million forest hectars (more than 6 million acres) are FSC certified and these standards are known by the forest specialists (http://www.wwf.ro).

Regarding the expression of the recreational or touristic value, harder to understand and quantify, the attempt of evaluating it is interesting through the method of the travel expense.

It is based on the travel expenses a tourist supports in order to visit a certain place (Freeman, 1979). This approach is applied to recreational activities and to other activities that are specific to the location or to the resources that require travel expenses in order to experience the goods or services that are associated to the location; visitors do not pay in order to use these locations, but they support the travel expenses in order to visit a wild area (***, 1993).

The observed variation of visit ratios (quantitative, the number of visitors) and of the travel expenses (a proxy for the price) describes the demand for the location and thus the demand function allows the estimation of the consumption surplus of the economic value of the site (***, 1993).

Conclusions

Subsequently to this brief research, we can note several conclusions:

Generally, the idea that forest ecosystems provide ecologic services is approximately unanimously accepted.

Also, these services we mentioned in the paper are already known in most of the countries.

In many countries, especially in the developed ones, there are attempts of finding some measuring methods of the ecologic services and for the calculus of the cost/benefit ratio in the case of the actions on forest ecosystems.

In the case of other states, with fast development during last decades, the general problem of the environment and especially of the forests is neglected (China, Indonesia, Brazil etc).

Some policies of the developed states (EU states) can transfer pressures on the forest ecosystems in less developed extra-community states, stimulating them, such as for a fast and short term income, to destroy their forests, replacing them with biofuel providing plants. We consider this as a very dangerous phenomenon.

In very weak developed states, one can hardly implement environmental policies that would induce a sustainable exploitation of the natural capital, and thus of forests.

In Romania, many environmental and rational exploitation policies were implemented, partly recognizing the ecologic forest services. On other hand, illegal deforestations, attempts of attacking virgin forests through exploitation, show that many individuals have not still been aware of these services, not even at the level of political decision making indivduals.

Acknowledgments

This paper of Magdalin Leonard Dorobăţ was supported by the strategic grant POSDRU/159/1.5/S/138963 - PERFORM, co-financed by the European Social Fund – Investing in People, within the Sectorial Operational Programme Human Resources Development 2007-2013.

References

Bleahu, M. (2004). *Arca lui Noe în secolul XXI – Ariile protejate şi protecţia naturii/Noah's Ark in the XXIth century - Protected areas and nature protection*. Bucharest: National Publishing House.

Boekhout van Solinge, T. (2010). *Equatorial deforestation as a harmful practice and criminological issue*. In R. White (Ed.), *Global environmental harm. Criminological perspectives,* pp. 20–36. Devon: Willan.

Brown, L. (2001). *Eco-Economy: Building an Economy for the Earth*. NY: W.W. Norton & Co.

Brown, L. (2006). *Plan 2.0 – Rescuing a Planet Under Stress and a Civilization in Trouble.* Washington: Earth Policy Institute.

Dorobăţ, M.L. & Udroiu, B.M. (2015). Study regarding the side erosion processes on the middle reach of Doamnei River and methods of preventing them. *Current Trends in Natural Science*, Vol. 4, Issue 7, pp. 82-87.

Freeman, A.M. (1979). Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues. *The Scandinavian Journal of Economics*, vol. 81, no. 2, pp. 154–173.

Grevé, A.; Barbanti, L. & Fazio, S. (2011). *Handbook on Biofuels and Family Agriculture in Developing Countries*. Bologna: Pàtron Editore.

Krieger J.D. (2001). *Economic value of forest ecosystem services: a review*. Wilderness Society, Washington.

London, M. & Kelly, B. (2007). *The last frontier. The Amazon in the age of globalisation*. New York: Random House.

Rus, V. & Pop, B. (2007). *Biocombustibilii, între obligativitate, necesitate şi risc/ Biofuels between compulsoriness, necessity and risk*. Symposium The Impact of the Community Acquis on Environmental Equipment and Technologies. In www.inginerie-electrica.ro/acqu/pdf/2007_2.pdf.

Zaitch, D.; Boekhout, Tv.S. & Müller, G. (2014*). Harms, crimes and natural resource exploitation: A green criminological and human rights perspective on land-use change*. In Conflicts over Natural Resources in the Global South – Conceptual Approaches. *CRC Press/Balkema*, Leiden. (6), pp. 91-108.

*** (1993). The forest story. Division of Forestry. Minnesota department of natural Resources.St. Paul.

https://news.nationalgeographic.com/news/2013/12/131222-amazon-kayapo-indigenous-tribes-deforestation-environment-climate-rain-forest/.

www.ecology.md.

www.fsc.org.

www.hcvnetwork.org.

www.science20.com.

www.sciencedaily.com.

www.senat.ro.

www.wwf.ro.