

## REFLECTIONS ON RECOUPING ECOSYSTEM SERVICES OF THE FOREST, IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT OF ROMANIA

**Violeta Bran**

**PhD Student, Bucharest University of Economic Studies**

*Abstract: Along the development of humanity, the forest was considered to be a partner of human evolution. Economic growth and the progress of the society have generated instead, intensive exploit of forest resources, the disappearance of large areas of forest, reduced biodiversity and degradation of the natural environment. Element of renewable natural capital, the forest, is the subject of numerous policies and strategies for development, both in Romania as well as in the European Union, all aimed at the protection of the forest fund and the extension of woodland areas. In Romania, the enforcement of the law on public property, the permissive penalisation of criminal offenses, including forestry products, insufficient allocation of funds intended for planting represent a few causes which have generated degradation of forest ecosystems, accentuating the desertification of land and removal of forest vegetation by grubbing, so that woodland area in Romania is now reaching around 27%, less than the European average area (33%). This article, by using methods such as: documentation, analysis of the information, presentation, comparability and interpretation of statistical arguments, it is meant to be a radiography of the forest ecosystem of Romania, the manner in which the implementation of the measures provided for in The Strategy of Sustainable development helps to increase woodland areas and optimizing the efficiency of forest ecosystems.*

*Keywords: biotope, desertification, forest, regeneration, sustainability*

### **Introduction**

The forests have an existential importance for humanity because they provide the most important renewable resource mainly used in the economical field. For the nature's biodiversity the forest's ecosystems are a treasure, because there live two thirds of the land species on earth. Romania's forests shelter over 33 thousand species of flora and fauna. Here you can find the widest areas of virgin forests form Europe. Evaluating forests only through the economical light by the valorization of primary and secondary resources represents a restrictive evaluating way because it doesn't include the direct and indirect contribution of the forests' functions of the economical, social and ecological development of the society. The durable management of the forest's background in Romania targets the forest's ecosystem balance and the optimization of the supplied services through the forest's background by the adopted measures.

### **The correlation between the forest ecosystem and natural capital**

The development of the society depends fundamentally of sustainable exploitation of natural capital, on the protection and conservation of it, which makes both natural capital and the elements making it up to be the subject of numerous strategies, specility studies or legal regulations. In accordance with the definition of the National Institute for Sustainable Development, natural capital is composed of "water, air, living organisms and all parties of the biosphere that provides goods and services of the ecosystems for survival and prosperity". The composition of natural capital is made both from natural resources and anthropogenic resources. Natural resources are a natural environment used in human activity to meet the needs of society.

The forest, together with the land and marine ecosystems are forms of renewable natural capital, and fossil fuels and minerals are forms of unrenewable natural capital. The forest is a factor for the protection of the environment, which, by its functions, contributes to maintaining the ecological balance, fulfill the protective function of the soil, water, land and biodiversity. In recent years due to economic growth, population growth, technical progress in the past few years, intensive exploitation of natural resources has determined the degradation of natural capital and destruction of the biodiversity and natural ecosystems in many areas of the world. The concept of ecosystem was introduced in 1935 by the British botanistl A.G.Tansley, who defines it as "a complex of body and physical factors which form what we call environment of binomial", after the other authors, Odum (1960) ecosystem means the unit which includes all organisms from a territory, interacting with the physical environment in such a way that the flow of power creates a certain trofica structure, a density of species and a circuit of substances within the system. After the place in which ecosystems are found, they classify into aquatic ecosystems and terrestrial ecosystems.

Within terrestrial ecosystems, forest ecosystem represents, due to the structural and functional characteristics, the prototype of natural ecosystems. This is due to the diversity and complexity of the elements of the forest ecosystem, components which can be found in a state of maximum stability, which carries out a continuous exchange, of substances and energy, with the environment. All the elements of the vegetation and forest fauna from the woods, each constitutes, individually, an open system for energy and matter. In the framework of the forest ecosystem, the unity of living organisms with their environment is indistructible, any change, leads to considerable changes in the habitat causing changes in the structure of the entire ecosystem. The structure of the forest ecosystem is formed by the biotope and the biocenosis. *Biotope* is the nevie component (abiota) , an inorganic primary fuction unit, with its own physical and chemical conditions, and which constitute the living environment of organisms "*forming a strong filter for the structure of the species which populates it*"<sup>1</sup>. Forest biotope is formed by:

- ecotopeor or the ecological factors such as: water, solar radiation, temperature, wind and the composition of the air. These factors may have positive or disruptive character and they define the forest station
- geotopeor represents the amiental conditions like slope, relief form, the geographical placing conditions which act indirectly on biocenosis, having decisive role in the determination of the diversity of species, productivity, and resistance to interference.

*Biocenosis* of the forest ecosystem comprises: fitocenosis - community of plants, zoocenosis – comunity of the animals and microbiocenosis - the community which incorporates the lower bodies. Because of the significant informational volume, the forest ecosystem plays the role of maintaining the equilibrium of the environment at regional scale.

From the perspective of the functions that the forest ecosystem has over the natural capital, these are:

- *Function of water protection* shall be carried out by the influence of the forest ecosystem on the hydrologic circuit through the interaction between biocenosis and biotope. By reducing the leakage and infiltration of surface water precipitation, the forest stops strong variation of the rivers flow, helping to stabilize the pluvial regime, thus preventing, increasing the water flows and the production of floods, but also the lack of water in the dry periods, when the water supply of the rivers comes from the infiltration of the soil with groundwater.

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<sup>1</sup> F.Bran - *Degradation of ecosystems*, Publishing House ASE, Bucharest, 2002

- *Function of water protection* and of soil through which the forest contributes to preserving the form of the relief. This function is especially important particularly in regions with embossed sandy soils and kneading by ensuring the mechanical stability of the ground that the forest has, through bioaccumulation and through the soil profile. The forest tempers leakage of surface, reducing the phenomenon of soil erosion, remove landslides, determine the consolidation of the soil characterized by excess moisture and secure the sandy soils.

- *Function of atmosphere protection* reflect the role that the forest has in maintaining the ecological equilibrium. By means of the biomass, from the surface of one forest, which is driven in the process of photosynthesis, the consumption of carbon dioxide produced by the forest ecosystem, but also of the carbon dioxide produced by ecosystems in the vicinity of the forest is realised, releasing oxygen including for neighboring ecosystems. The forest "purifies" the atmosphere of pollutants such as sulfur dioxide and suspended sedimentable powder and radioactive elements, and, because of the phytoncides the forest causes drop of microbial load. The forest ecosystem, as genetic factor of climate change by influence on the movement of the masses of air, the evaporation of the water and on the solar radiation, promotes the creation of a specific topoclimate. This topoclimate is manifested through the increase of moisture, the low-speed wind, moderation of extreme temperatures, the reduction of the intensity of solar radiation, quantitative increase and uniformization of rainfalls. The forest prevents the greenhouse effect, by absorption of carbon dioxide resulting from the combustion of fossil fuels used on a large scale, particularly in the industrialized countries, restoring the balance of the composition of the atmosphere.

- *The protective function of the genetic fund.* The concept of genetic resource means the value of the economic, scientific and social diversity of the genetic modification. The genetic diversity constitutes a "depreciation" of the fast environment consequences generated by anthropogenic activities, allowing the adaptation of plants and animals in an environment which presents new features. This function is determined by the fact that the elements making up the biocenosis and forest biotope can be found in a state of stability, determined by the self tuning mechanism of the forest ecosystem. The highest biological biodiversity from all natural ecosystems can be found in the forest ecosystem. It is estimated that in the forests of tropical area, the diversity of genetic resources, comprise 50% of all genetic resources on the Terra.

- *The function of production* looks at the forest as a supplier of renewable resources (raw materials and food). Timber supplied by the forest is a biological resource with multiple uses in the various branches of economy, and it is used as an energy source mostly in the rural areas. The renewable character of the forest is also shown by the delivery of products such as: game, products of bee-keeping, forest fruits, the resin, rubber, and other tanning agents, products that are restored every year and are delivered to society. This aspect shows the economic and social role of the forest.

Relating to the production, it may be observed that forest ecosystem is the largest resource of biomass with a production of 380 billion m<sup>3</sup>.

### **Economic and ecological imbalance caused by damage to the forest ecosystem**

The role of the forest ecosystems in maintaining the ecological balance of the planet is a well known fact. Factors that determine the degradation of forest ecosystems are natural phenomena and phenomena of anthropogenic nature. Over time, these factors had different features and intensities causing serious imbalances, sometimes with irreversible effects on the natural

environment. The main factors which have caused damage to the reduction of woodland areas are: forest clearances, drought, forest arsons, climate change, acid rains, illegal forest cuts.

*The forest clearances* are determined by the enlargement of utilized agricultural area, the need for wood used as fuel and also as construction material, these needs being influenced by the rate of growth of the population. Irrespective of their cause, forest clearances represents the greatest risk factor for forest ecosystems. In many countries of the world forest clearances have exceeded the capacity to regenerate of the forest. Thailand has lost, due to the clearance of the forest,  $\frac{3}{4}$  of the forested area, and in Romania, clearances of land made by abusive cutting within a period of 40 years, have resulted in the loss of up to 143 million m<sup>3</sup> of wood. The consequences of the forest clearances influence negatively the protective functions carried out by the forest ecosystems, manifested through:

- degradation of soil and pluvial erosion of soil;
- change in the landscape determines cancelling the aesthetic and recreational effect of the forest;
- change of the forest topoclimate results in a decrease in the amount of rainfall, and diminish the regeneration capacity of the forest or even progressive dryness of deforested surfaces.
- loss of biodiversity as the effect of changing biocenotic equilibrium, as a result of the introduction of some tree species, exploitable within a short period, as is the case of the beech tree which grow in stable soils situated on steep slopes, is replaced by the track and spruce which, because of their radicular system, may cause adverse effects.

A negative influence on the biodiversity of the forest ecosystem is *the exploitation of water resources for the production hydroenergy*, as a source of renewable energy. Microhydroelectric powerplants located on the rivers across forests damage the habitats of rivers, and riverside habitats, where different species of alders can be found.

*Drought*, as a consequence of climate changes that have been affecting the planet in the last years, influences the forest ecosystem, causing the following effects:

- increase of temperatures, promote the formation and development of pathogenic agents, such as the wood borer, which destroys the living parts of coniferous breeds, causing their death.
- changes in the composition of some species of locust tree, oak and forests of conifers, which are located at a higher altitude, dry gradually. The place of these species of trees is taken by invasive plants as: aspen (populus tremula), silver birch (etula grandfather clock), bramble (rubus hirtus).
- drying of tree species and arboretum, and the massive infestation of forests affected by the severe drought with pathogenic agents.

Worldwide, most affected by drought are the forests of Brazil and Indonesia, and in Europe, Spain and Portugal are the ones that have lost the largest area of their forest because of the drought.

*Forests arsons* are caused by controlled and uncontrolled actions. In Europe, in the year 2016, according to data provided by Global Forest Wach, uncontrolled arson, have deteriorated forests on an area of 297000 km<sup>2</sup>. The type and size of the fires are influenced by the degree of fragmentation of the forest areas, structures and landscape features. The controlled forest arsons are practiced in areas where the forest has a very high density. Regardless of the cause, fire has the effect of eliminating in the air of a large quantity of carbon dioxide, which accumulates in the atmosphere and contributes to creating the greenhouse effect. *Acid rains*, whose acidity is determined by atmospheric pollution by: carbon dioxide, nitrogen oxides, sulfur dioxide, oxides of nitrogen, from industrial processes, combustion of fossil fuels, affect the spread of forest areas in

the highly industrialized regions of Europe as well as Scandinavia and Germany, and also, the sensitivity of the trees of the forest to the attack of pest insect and pathogenic agents, is enhanced by the presence of noxae into the atmosphere. Acid rains have the effect of tree foil peeling, tree leaves falling without turning yellow. As can be observed in the figure below (Figure 3), peeling of trees in comparison with other effects of atmospheric pollution, affects to the greatest extent and intensity the damage of forest.

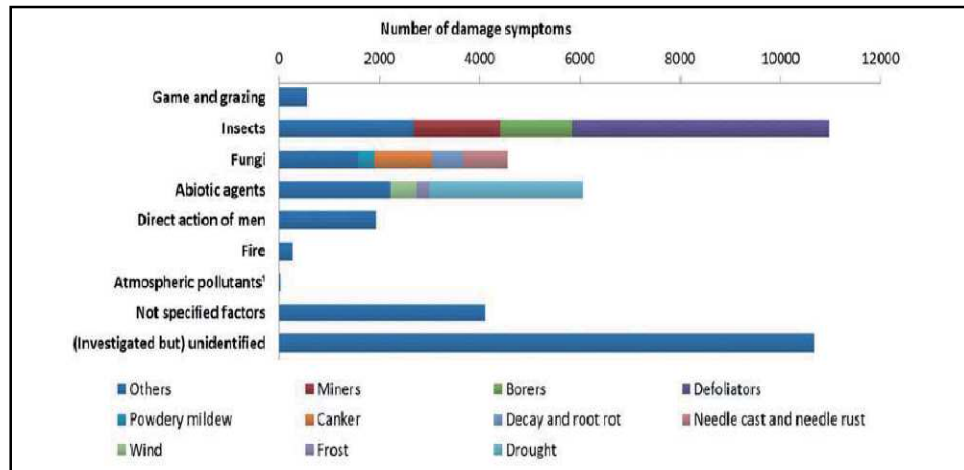


Fig. 3 Visible symptoms of direct atmospheric pollution impact only

Source: ICP Forest

All the above mentioned factors result in the loss of biodiversity of forest ecosystems, the need to protect the forest, it is an unanimously recognized imperative, but the identification of viable solutions to prevent damage to forest ecosystems, in order to be applied, you must have an economic foundation.

### **The fight against the forests' resources decline from Romania by the sustainable management of the forest's background**

According to the Forest's Code, „the forest's background includes all the forests, all the areas destined to the afforestation of those which serve the needs of culture, production or of the forest's administration, of ponds, of the rivers beds, of other areas with forestry destination including the non-productive ones regardless the property form.”

The management of the forest's background in Romania is done by the Romsilva Forests' National Direction through 331 state's forestry and through 145 forestry regimes.

Nowadays Romania has a total area of 3145793 thousands ha of forests which represents 27,5 % of the country's territory and which has progressively decreased over the years due to some factors such as the growth of population, the need for resources imposed by the economical and social evolution of the country and not least because of the exportation of some big quantities of forestry products. The continuous reduction of the forestry area from 80-85 % up to 28,9% at the beginning of the new millenium has made Romania to have the lowest average woodland in Europe (32,4%).

The forest formations which cover Romania's territory are made of spruce, fir, beech, sessile, oak trees, the greatest number being kept by the beech trees while the lowest number being represented by the fir and other softwood trees as seen in the following label.



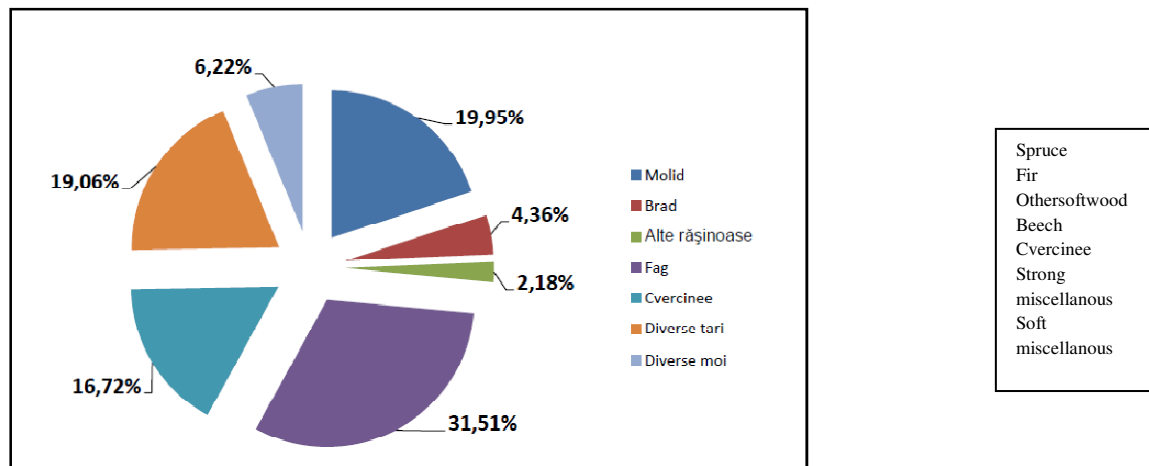


Fig. 3 Forests' Structure in Romania  
 Source: Forestry strategy 2017

Regarding the protection forests from Romania, they cover an area of 1112786 ha, their structure being the following:

- 31% forests protecting the waters;
- 42% forests protecting the soil;
- 6% forests protecting against the climatic and pests factors;
- 11% recreation forests;
- 10% forests protecting the forestry eco-background and the scientific interest out of which an area of 13800 ha is included in virgin and quasivirgin forests' Catalogue.

According to the possession right, Romania's forests are owned by physical entities or legal entities: individuals, territorial administration, educational units, cult units, associative forms of ownership, as we can see in the following label, an area of 142797 ha is not owned and the greatest area is owned by individuals.

Tabel no.1 Property forms of Romania's forests

Property forms	Valid area	Owned area	Not owned area (ha)
0	1	2	3
Persoane fizice	1.409.805	1.304.565	105.240
Unități administrativ-teritoriale	970.039	957.424	12.615
Unități de învățământ	7.503	7.295	208
Unități de cult	129.146	123.719	5.427
Forme asociative de proprietate	764.980	747.131	17.849
Academia Română	16.887	16.412	475
Fundația Elias	2.989	2.006	983
<b>TOTAL</b>	<b>3.301.349</b>	<b>3.158.552</b>	<b>142.797</b>

Source: National forestry Strategy 2017

Regarding the forests' layout according the landform, the plain areas are occupied 8,8% with forest, the plateau and hills areas are occupied 32,7% and the mountain area is covered with forests 58,5%. This layout gives Romania's forests characteristics which diminish the fullfilment of the forests (especially the forests on the hills where the soil erosion process and the landslides are frequent).

The Romania's forests' diminishing is caused both by natural factors and by anthropogenic factors. From the latter factors, the worst effects on the forestry eco-backgrounds of this country are: the privatisation of the forestry fund, illegal woodcutters, fires, illegal restitutions, climate change.

The fragmentation of the forestry fund through the forestry restitution made according to the Law no. 1/ 2000 for the restitution of the ownership right on the agricultural and forestry territories, modified by the Law no. 247/ 2005, confusing laws, gradually elaborated, determined the extension of the restitution of property processes, aiming financial interests. These were a threatening factor to the national forestry fund, biodiversity and the environment protection, the ecological effects have manifested themselves through erosions and landslides. Another consequence of the property restitution right according to an ambiguous and confusing legislation were the forests' abusive requirements made by individuals and different associative forms of ownership which ask for the return of forests' areas of 561600 ha<sup>2</sup>.

The illegal woodcutting represents another frequently seen phenomenon in Romania's forests. The counties which registered the greatest number of illegal woodcutting in 2016 were: Mures (3230 m<sup>3</sup>), Brasov (2964 m<sup>3</sup>), Olt (605m<sup>3</sup>). At the forestry fund level out of the entire Romania the illegal woodcutting have amounted 9442 m<sup>3</sup> from the forestry area.

The consequences of this phenomenon are encouraging the erosion and the soil degradation. A worrying factor because of the frequency and of the damages provoked over the entire forestry ecosystem is the forest fire which in Romania annually affect over 1500 ha of forest. In 2016 there were 135 forest fires most of the being in the counties: Gorj (37), Mehedinti (22), Alba (17).

Other causes which contributed in greater way to the damage of the forestry fund in Romania are:

- mismanagement of the forestry fund by the administrative bodies which is inconsistent in the implementation of the long-term forestry strategy
- the lack of prevention programs within the legal framework;
- forests' areas for which is not provided the administration and for which are established some forestry designs, reduced accessibility of the national forestry fund;
- lack of a national policy regarding the wood valorization so that to obtain a wood's maximization on the market with lower costs and with reduced impact on the environment;
- the underfunding of the sector as well as the unfulfillment of the state's legal obligations which are its according to the legal provisions;
- keeping a miserable payment for the forestry personnel, the instability of the forestry personnel in the forestry leading functions and the lack of competence in promoting these functions.

Preserving integrity and the forestry fund development is materialized in multiple normative acts and strategies that establish actions regarding the durable management of the forest.

The concept of durable development was elaborated in the Brundtland Report in 1987 and it is defined as *the development which replies to the social, economical, cultural and spiritual needs of the present times without compromising the next generations' capacities of satisfying its own requirements*. According to the forestry fund management, this concept is a reinterpretation of the continuity principle by Georg Ludwig Hartig in 1785 which says that the forestries administrations need to establish the woodcutting so that the next generations have at least the same advantages as the actual generation. The relationship which is at the base of the phrase „durable management, preservation, development” seen in the Declaration of the Forestry's Principles is strategy. The forestry's strategies have some management criteria which follow not only obtaining the wanted effects, but also obtaining some quantities and qualities markers so that it reflects the durable management of the forestry fund. The quantity markers include the forestry area, the afforestation percentage, the wooden volume, the accessibility and the wood quantity on the market, the quantity of products, accessories on the industry. The quality markers include the vitality and health of the

forestry ecosystems, the numbers of intensive treatments, the forestry's soil fertility, the biodiversity's markers, the origins and provenance of trees.

The durable management of the forestry fund in Romania represents one of the strategic aims in the National Forestry Strategy. The evaluating instrument which proves the forests' management efficiency is the forestry management certification. This certificate is made on the international evaluating standards and founded on the principles and the concepts of the sustainable development integrated in the social and economical policies of development and of measures that aim at the environmental protection. The documents on which the forestry fund management relies are: The Forestry Code in 2008 updated, the land fund Law no. 18/ 1991, republished with the modifications and further addings, the Government Ordinance no. 96/ 1998 regarding the regulation of the forestry regime and the forestry fund administration, the National Catalog of the forestry reproduction materials, the national afforestation report, the National forestry strategy for 2018-2027.

The measures and actions that need to be done for the forestry fund sustainable management are:

- incoherence and inconsistency of forest legislation, materialized in regulations that are not applicable;
  - the extension of the forests' area and of other lands with forestry vegetation and with farming lands useless;
  - supplying the forestry material of reproduction;
  - the markers establishment and harmonization of durable forestry fund management in Romania with the European markers' system;
  - the protection and improving of the forestry ecosystems biodiversity, especially of Riparian forests, marginal and threatened habitats;
  - the forests' adaptation to the climatic changes by rebuilding deconstructed forests, introducing some species of trees resistant to climatic changes;
  - the extension and development of the forestry fund improving;
  - The quantification and monitoring of the forestry ecosystems services;
  - The implementation and extension of some performant technologies of wooden harvest with minimum impact on the environment;
  - The gradual elimination of the technologies that have a negative impact on the environment;
  - The priority usage of the forestry ecosystem services in the benefit of the local community;
  - The implication of the local communities in decisions regarding the protection and the forestry management.

An important measure of the durable forestry fund management programme is the forests regeneration. This action has as aim the forestry's fund integrity and continuity insurance through the regeneration of the used stands whose surface diminished as a result of the regeneration cutting or of the illegal cutting. In 2016 there were made forests' regenerations on an area of 28456 ha (INS). The forestry areas on region layout is drawn in the following picture.



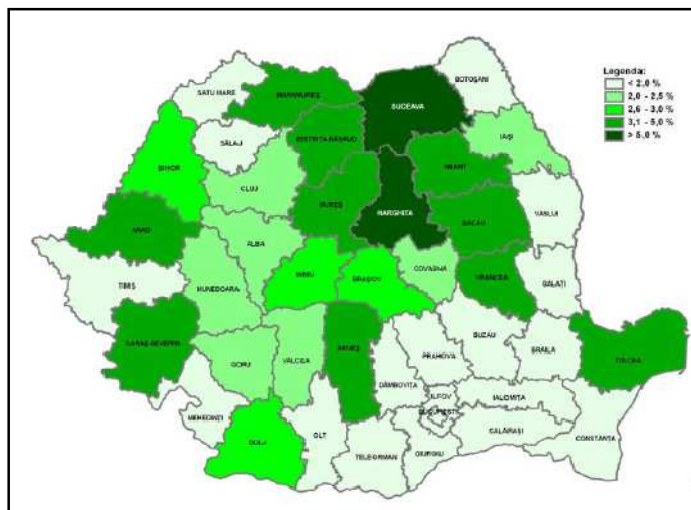


Fig. The forest regeneration according to the regions

Source: the National Institute of Statistics

The measures for the forestry sector's management have an economical, social, ecological impact and it gives a specific criteria to the durable development. The forestry fund may become a resource which on the long run will offer multiple benefits without its diminishing value.

### Conclusion

The greatest problem in applying the measures of durable forestry fund management is the intensifying of the wooden products valorization that needs a balance between the exploitation of the forest as a resource and the need of preserving it. Disrespecting this balance has as result the diminishing of the forestry surfaces. Another problem is the insufficient funds necessary for the durable forestry fund management. A better knowledge of it will allow the elaboration of some projects and obtaining fundings needed for integrated fitting of the forestry fund and the forestry infrastructure. Concerning the legislative system which aims at the regulation of the forestry domain it needs updates and adaptation to European regulations to stimulate the human resources involvement in the forestry sector in protecting and preserving forests. The education and awareness of the society on the value of the forest has as result the increasing vigilance and the implication of the society and of O.N.G. for protecting and preserving forests.

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Julian Boldea, Dumitru-Mircea Buda, Cornel Sigmirean (Editors)  
MEDIATING GLOBALIZATION: Identities in Dialogue  
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