

Lup, Aurel; Ursu, Ana

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## The evolution of forest coverage: Wood trade and its impact on forest functions

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# THE EVOLUTION OF FOREST COVERAGE. WOOD TRADE AND ITS IMPACT ON FOREST FUNCTIONS

AUREL LUP<sup>1</sup>, ANA URSU<sup>2</sup>

**Abstract:** *The material presents the problem of forests, deforestation becoming nowadays a real global problem of mankind. Many millennia ago, population growth required the sacrifice of the forest to make way for crops, today forests are cut primarily for profit, wood being one of the most precious commodities. It is true that in some parts of the world the forest is also sacrificed to increase the arable area. In countries like Romania, for example, both legal and especially illegal logging is done only for money, wood being over 10 times more expensive than any other agricultural product. The consequences of deforestation on many functions performed by the forest are evaluated, such as: carbon dioxide absorption and oxygen release, recreation function, preventing soil erosion with serious consequences on its quality, but also floods, floods, inhabited areas, roads transport and other objectives. The material also tries an evolution in time of the phenomenon both in Romania and globally.*

**Keywords:** *forest, wood, deforestation, profit, erosion*

**JEL classification:** *Q13, Q27*

## INTRODUCTION

The need for economic research on forests is not only timely but also highly relevant given the beneficial role of forest cover in many respects, unfortunately associated with an increasing rate of deforestation throughout the world. If in ancient times - measuring millions of years - the forest was sacrificed to make room for crops. We have data about this beginning only about 10,000 years ago, when the population of the planet was 8-10 million inhabitants. This period, Cailleux calls it "primitive hoe farming". About that period - one of the longest in history - is believed to have reduced annual rainfall by 200-250 mm while producing floods and landslides.

History this time even confirms the destruction of irrigation systems in the Tigris and Euphrates Valley, which eventually led to the loss of Mesopotamian civilization (Ionescu and Staicu, 1980). Historical data confirm that at the beginning of agriculture 70-80% of the land area was covered by forests. It is famous that Carol V's armies crossed Spain, then France, reaching northern Europe without leaving the forest.

But it was not only the need for arable land that was the cause of deforestation. As the population multiplied, other needs arose. In the northern areas, fire was needed to heat homes, trade and wars required wooden ships, steel development, housing construction, the expansion of the railway network and many other human needs required wood. The story of using wood is long and there is no place here to troubleshoot it. Even today, forests are being cleared to increase the cultivable area and for pasture, but the main reason why they are currently being cleared is money. Wood and wood trade is one of the most lucrative businesses, the price of raw wood even (logs) is over 10 times more expensive than any agricultural product.

## MATERIAL AND METHOD

The material is largely bibliographic. Forest cover is analyzed in evolution both globally and in Romania. At the national level, the analysis is deeper, taking into account the catastrophic effects of deforestation in all aspects. Legislative gaps, the inability of the administration to control deforestation have led to the phase in which damage of all kinds, but especially those caused to agriculture, are difficult to assess. The method used is that specific to economic research: material

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<sup>1</sup> Academia Oamenilor de Știință din România; Universitatea „OVIDIUS” Constanța; Societatea de Istorie și Retrologie Agrară din România.

<sup>2</sup> Institutul de Cercetări pentru Economia Agrară și Dezvoltarea Rurală

collection, selection and processing, comparison, synthesis, conclusions and possibly proposals. No special analysis or data processing techniques were used.

## RESULTS AND DISCUSSIONS

**World forest heritage.** At the end of the twentieth century, forests occupied an area of 3,898.0 million ha, representing 30% of the planet's land area (Table 1). According to the data in the table at the level of large geographical regions large areas of forests are found in South America 829.4 million ha (47.3% of the world total), USSR (former) 827.8 million ha (37.8 %) and Central and North America 709.8 million ha (33.2%). On the continents, the most favorable ratio is held: South America (47.3%) and Central and North America (33.2%). As a role, at the planetary level in the first place are the forests of the Amazon area, the tropical forests of Africa and the forests of the region of Indonesia considered the three lungs of the planet (M. Bulgaru, 1996). By countries, the largest forest areas are in Russia, Brazil, China, Australia, R.D. Congo, Indonesia, Peru, India, accumulating 2/3 of the world's surface (St. Mășu, 2011).

Table 1 The size of the global and continental forest fund in 1991

Continent	Land surface -mil.ha-	Forest fund area- mil.ha-	The share of the forest fund in total area %
<b>Worldwide total</b>	<b>13041,7</b>	<b>3898,0</b>	<b>29,9</b>
Africa	3964,0	684,7	23,1
Asia	2679,0	531,7	20,0
America Centrală și de Nord	2137,0	709,8	33,2
America de Sud	1752,9	829,4	47,3
Europa	472,7	157,3	33,3
URSS (fosta)	2190,1	827,8	37,8
Oceania	845,3	157,3	18,6

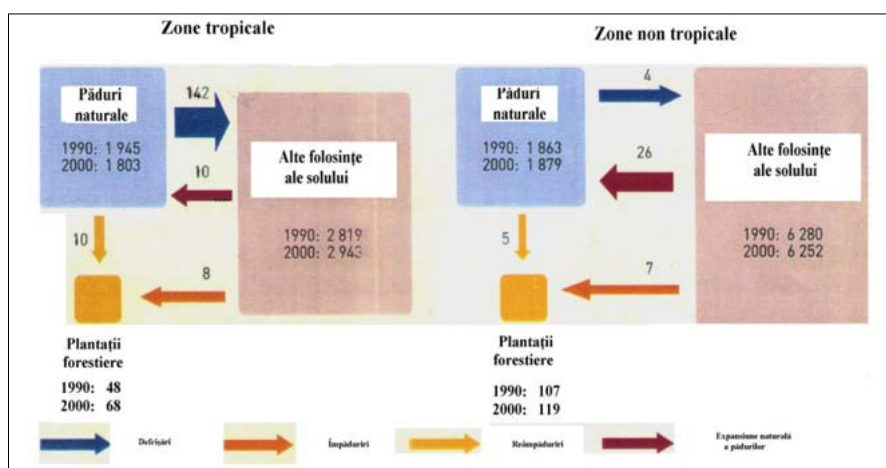
Source: *World Resources 1994* (citad de M.Bulgaru, 1996)

What is serious is the fact that in the countries with the largest forest areas the degree and rate of deforestation is the most advanced, such as in Brazil where the deforestation area represents almost half of the world total, it represents almost half of the world total, this to makes room for grazing for animals (Al.Gore, quoted by Mășu, 2011). On the other hand, Christioan de Perthuis (quoted by Mășu, 2011) states that in order to ensure agri-food products, it is preferable to make more intensive use of existing agricultural land. It is estimated that 13 million hectares or 30,000 hectares are cleared daily.

A relatively recent FAO study (2001) shows that while in the tropics the deforestation process continues, in non-tropical areas there is even an increase in forested area, a deforested area of 142 million ha in 10 years in the tropics and an increase of 1.6 million ha in non-tropical areas in the same period (fig.2).

However, it is estimated from the database - that the pace of deforestation is declining. The same study mentions that in the last decade of the twentieth century, countries such as China, India, the Libyan Arab Jamahiriya, Turkey, Uruguay are foresting more than they are clearing. Some countries, such as Thailand and the Philippines, have banned the exploitation of natural forests. Among the factors that reduce the pace of deforestation are urbanization - cities giving up firewood, economic development, increasing the productivity of agricultural land in operation. But there are also poor countries that have to export timber to buy foreign exchange.

Such situations benefit developed countries that conserve their forests by importing timber from poor countries that need to clear their forests to obtain the much-needed foreign exchange: *"Although the annual volume of timber growth exceeds the cut we need so much wood that the United States has been a major importer since 1950. This policy contributes to deforestation in other countries, depriving them of too little fuel and facilitating the growth of carbon dioxide in the atmosphere. Extensive use of wood means that our forests can be preserved only at the cost of their extinction in countries (Buciuman, 1996)*



Source: FAO, 2001

Figure 1 . Evolution of forest areas (mil.ha) in the years 1990 and 2000

Moreover, the correlation between the level of development of some territories (states) expressed by GNP / place and the share of the forest fund in the area can be proved statistically as can be seen in the data of a World Bank study (tab.2). It follows from the data that countries with a high share of the forest fund - over 30% of the total area - are generally rich countries (with a high value of GNP / place) while countries with a low share of the forest fund are on the contrary poor countries. whose GNP / place is four and almost six times lower, respectively.

As already mentioned for a long time, the forest vegetation had to be sacrificed to obtain arable land with food and non-food plants necessary for man. However, it seems that nowadays deforestation in order to obtain arable land for agriculture is no longer necessary even if in some sporadic cases such situations can still be encountered. The improvement of food production techniques and technologies have been improved so much that much larger crops can be obtained from the current cultivated areas. Land productivity has doubled and even tripled. From cereal crops of 2,500-3,000 kg / ha has reached or can reach 6,000-10,000 kg / ha. This performance in terms of land productivity has allowed some European countries to carry out extensive afforestation programs, including France, Germany, England.

*"European national policies over the last 100 years have focused on protecting and expanding the productive potential of forest resources, by combating pests and preventing excessive felling. The European forestry potential*

*has doubled in the last 40 years, to which the inventory and monitoring works carried out according to scientific methods contribute. At the same time, correlated with the new requirements of the forest, the investment needs increased, appealing both to the public funds and to the forest owners to cover the expenses. Many countries are struggling from this point of view, as the cost of forest maintenance works is below the level of demand. Thus, some European countries have long-term national programs that also aim to expand forested areas on unprofitable agricultural land. In France, between 1950 and 1990, the forest area increased by about 2.0 million ha, which can lead in the long run to a fairly important economic recovery. The forests of France have the largest area in Europe, being almost 15 mi.ha, occupying 25% of the country's surface and also 25% of the forest area of the 12 countries of the European Community. Among the forest species, deciduous trees are dominant in proportion of 62%, and in terms of property 71% belong to the private sector, 10% are owned by the state and 19% by some communal communities. In Germany, as shown by the report of the Ministry of Agriculture, Water and Forests (1993), the forests of Germany are*

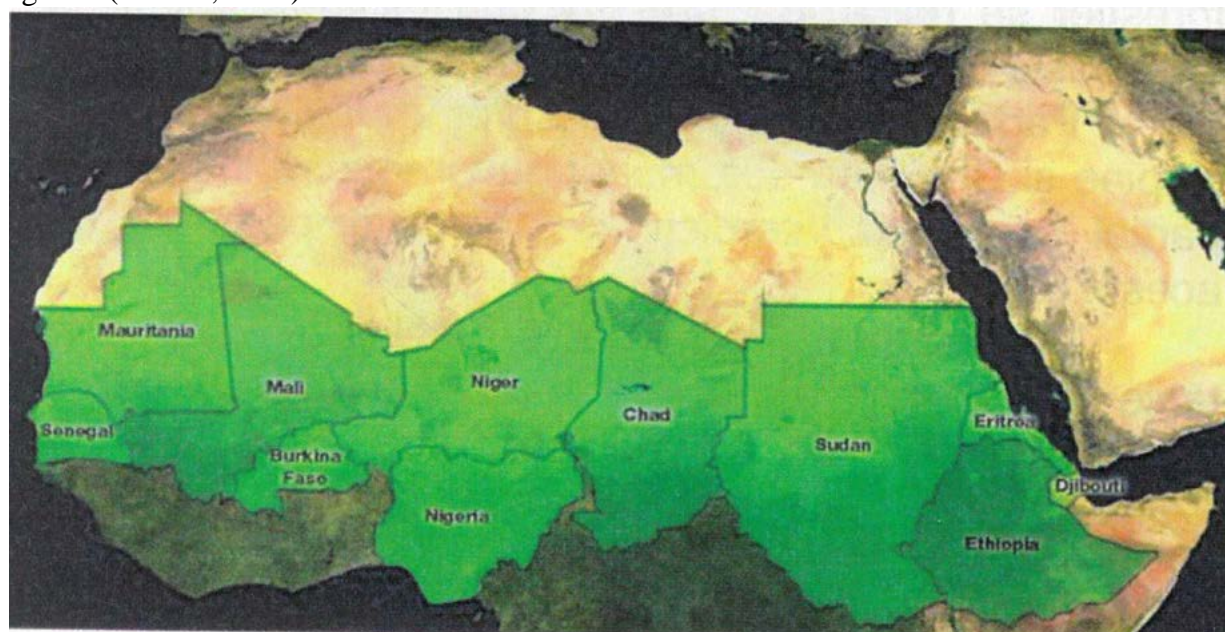
Table 2. The relationship between the forest fund and economic growth

The share of the forest fund in the total area%	Number of territories	P.N. B. %	Population %	PNB/loc dolari
Over 30%	70	62,2	27,2	9624
15-29%	40	18,4	31,1	2490
Under 14%	52	14,3	34,6	1680
No data	45	-	-	-

Source: M.Bulgaru, 1996

going through a difficult situation because 64% of the area is more or less critical. Thus, 32% of the oak species, 22% of the spruce species, 20% of the pine species and 55% of the fir species are sick. This situation is caused by air pollution, mainly due to oxides removed by vehicles. It is estimated that the car, which is the symbol of German economic power, kills the oak, which is the national emblem and the symbol of immortality. In England, the area occupied by the forest has continuously increased from 4% to 11% of the total national territory. Currently, England is again in an ambitious reforestation program, to improve timber production, increase recreation areas for population and development of forest-specific fauna and flora (Teaci, 1995).

But so-called third world countries have also noticed the adverse effects of deforestation and have initiated reforestation programs. For example, in 2010, eleven African states proposed a project entitled "The Great Wall of Africa" (Fig. 2) to combat the Sahara Desert. In Asia, China also has an extensive afforestation program that will compete with the Great Wall of China (4,400 km). South Korea, India and Vietnam also have ongoing reforestation programs. Other positive examples in such actions are provided by some Central American states, such as: Costa Rica or the Dominican Republic. Also in the new continent, the USA and Canada carry out reforestation programs (Bavaru, 2014).



Source:: Bavaru, Bercu, 2014

Figure 2. The great African green wall

**Romanian forest fund.** The case of forest cover in our country is one of the worst. Overall, the share of forests represents 26.9% of the country's territory, thus fulfilling the norms of the European Union of at least 22-25%, but the 27% forest fund is in total while the large agricultural areas are practically cleared of forests. In 2018, for example, the share of forests in the county was 5.2% in Brăila; 5.5% in Constanța; 11% in Tulcea, 5.7% in Ialomița; 9.3% in Olt; 10.4% in Giurgiu; 4.6% in Teleorman; 11% in Dolj.

The forested areas in thousands of ha are presented in table 2. From the same table we see that in 2018, the total area of forests decreased compared to 1989 by over 260 thousand ha, although in that period some reforestation was done.

Table 3. The situation of the Romanian forest fund at the end of 1989 and 2018

No	County	Years		No.	County	Years	
		1989	2018			1989	2018
	<b>Total</b>	<b>6678,5</b>	<b>6418,2</b>	21	Harghita	232,2	260,2
1	Alba	226,7	202,3	22	Hunedoara	312,4	312,0
2	Arad	212,9	207,4	23	Ialomița	25,9	24,8

3	Argeş	289,3	271,7	24	Iaşi	98,5	95,1
4	Bacău	279,3	266,4	25	Maramureş	293,5	253,2
5	Bihor	197,6	207,6	26	Mehedinţi	149,2	146,8
6	Bistriţa Năsăud	205,6	188,1	27	Mureş	215,8	213,6
7	Botoşani	57,4	55,9	28	Neamţ	260,2	257,9
8	Braşov	199,3	202,2	29	Olt	57,8	51,3
9	Brăila	23,2	24,9	30	Prahova	152,3	144,2
10	Buzău	168,4	158,1	31	Satu Mare	78,4	71,0
11	Caraş-Severin	409,7	419,9	32	Sălaj	106,5	94,5
12	Călăraşi	21,8	21,2	33	Sibiu	202,6	199,1
13	Cluj	169,3	166,1	34	Suceava	456,8	425,2
14	Constanţa	39,0	34,6	35	Teleorman	29,6	26,6
15	Covasna	167,4	169,7	36	Timiş	108,8	104,0
16	Dâmboviţa	121,0	116,6	37	Tulcea	95,5	93,8
17	Dolj	81,5	81,6	38	Vaslui	83,4	71,7
18	Galaţi	44,4	35,4	39	Vâlcea	285,9	260,6
19	Giurgiu	37,7	36,7	40	Vrancea	191,4	177,2
20	Gorj	264,4	244,2	41	Bucureşti	25,7	24,9

Source: *Attic Yearbooks of Romania 1990 and 2019*.

Also here we must mention the fact that in Romania, as everywhere in the world, the decrease of the areas occupied by forests is a historical trend. Regarding deforestation, the historical trend in Romania is also proven by the following quotations belonging to the 3rd decade of the twentieth century.

In the magazine *Viaţa agricolă* from November 1928, the future prof.univ. N.Cornăţeanu writes: „the south of Dobrogea needs afforestation ... the population here uses tizic (used manure) and those who consume wood, consume wood brought from Bulgaria. Also in 1928, in the calendar of ploughmen M.Florescu, forest inspector, reproduces the words of the inheriting prince Ferdinand I from 1905: “he sinned a lot through the reckless exploitation of forests, although the forest fund represents a great national wealth ... enough forests, it is not possible”.

Without going too far in history even comparing the forested area in the second half of the nineteenth century and the first half of the twentieth century we will find that the area of forests has shrunk. In Dobrogea, for example, under Turkish occupation, the forest was leased to the English, who cleared it with mechanical saws powered by small steam engines (the ancestors of today's chainsaws).

In Romania in the first decades of the twentieth century, oak forests were cleared and later replaced and partially with acacia. And this happens in the most fertile areas such as the Romanian Plain. In a period atlas are presented the areas of the forest fund in the former counties bordering the Danube in 1931. Here are the results: Dolj forest fund 5,838 ha - 8.9% of the county area; Romanians 25,569 ha - 7.2%; Olt 25,275 ha - 8.8%; Teleorman 20,634 ha - 9.5%; Vlaşca 44,197 ha - 9.8%; Ilfov 45,612 ha - 8.8%; Ialomiţa 28,973 ha - 4.1%; Brăila 18,809 ha - 4.4%; Tulcea 72,059 ha - 7.3%; Constanţa 13,621 ha - 2.0% (Statistical Atlas 1938).

Even during the totalitarian-communist regime, the figures representing the degree of forest cover do not have a real-positive evolution with all the apologetic comments specific to the epoch (tab.4).

Table 4 The evolution of the forest fund of Romania in the period 1950-1989, compared to 1938 -thousands of hectares-

Specification	1950	1960	1970	1980	1985	1986	1987	1988	1989
Total forest fund	6446	6403	6315	6337	6339	6342	6353	6361	6372
Total forest area	5729	6044	5870	6169	6182	6187	6210	6228	6249
Afforestation and reforestation	60100	59757	50453	50254	42380	39541	38290	46450	41409

Source: *Statistical Yearbook of Romania, 1990*.

Regarding the structure of the species, at least in afforestation, priority was given to conifers, a fact criticized even by N. Ceaşescu: "where beech has been growing for centuries, we



introduced conifers with negative results on the soil" (Socialist Agriculture, January 8, 1985), "We will substantially reduce the share of conifers."

Exploitation of the forest fund during 1950-1989. About the forest fund during the communist-totalitarian period, professor Giurgiu after listing the notable achievements such as zoning and integral forest management, reforestation especially on empty and degraded lands, making curtains, etc. But much greater were the damages caused to the forestry between which we note the following:

- the brutal violation of the property right over the forests, their nationalization being done without compensations and compensations (the state owned until 1948, only 30% of the forest area. It should be added here that only in the period 1985-1989 the state exported 728.4 thousand cubic meters of wood for pulp; 5137 thousand cubic meters of timber; 445.4 thousand cubic meters of plywood; 22219 thousand cubic meters of veneer; 4454.1 thousand cubic meters of parquet; 5506.5 thousand cubic meters of chipboard; 526.8 thousand cubic meters of beech boxes furniture worth over 35 million lei foreign currency and others without paying anything to the former owners;

- excessive exploitation of forests, reaching in some years 26-28 million cubic meters well above the support capacity of the forest fund (21 million cubic meters / year)

- the creation of an oversized forest industry and the excessive export of timber and timber products;

- substitution of local and highly stable species (beech, sessile oak, oak, etc.) with species from other natural vegetation areas (spruce, pine, Euramerican poplars, etc.), which has led to an ecological imbalance of many forests;

- generalization of chemical methods to control defoliating insects, which has long affected the balance of forest ecosystems;

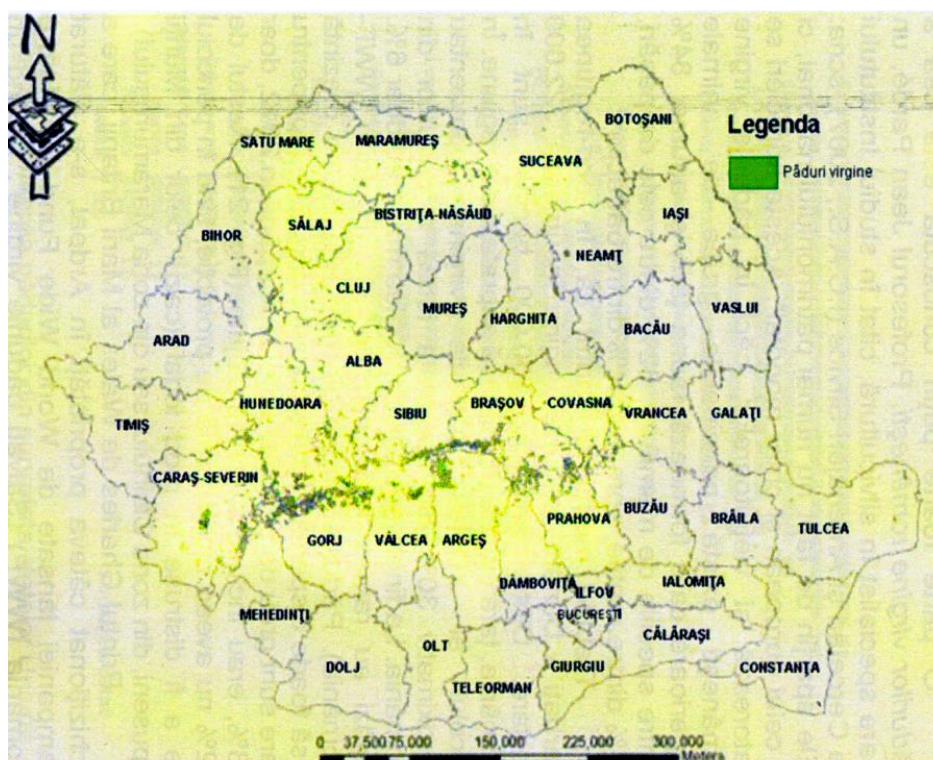
- the promotion of non-forestry activities in the forest fund (sericulture, industrial salmon farming, horticulture, fish farming, etc.) which have diverted the attention of foresters from the fundamental problems of the forest;

- application of non-ecological wood exploitation technologies (crown tree technology);

- legislation and practice of grazing on 50-60% of the forest area

During this period, the highest rate of exploitation of virgin and quasi-virgin forests in Romania took place, their surface decreasing from about 700 thousand ha in 1948, to about 400 thousand ha in 1984. This narrowed and brutalized a exceptional natural heritage of the country and Europe. The establishment of protected areas in the forest fund was practically abandoned, especially after 1970.

In the last decades of the analyzed period, the phenomena of abnormal drying of the trees as a result of the ecological imbalance, the pollution of the pasture in the forests and the droughts have accentuated (Davidescu, 2000). Among the virgin forests (fig.3) there are also those from the reservation-national park Cheile Domogled-Valea Cernei, where there are still species of trees and plants characteristic of the Mediterranean climate (fig.4). Deforestation that Romania did not need was carried out in the 1960s (20th century) and in the Danube Meadow.



Source: Bavaru și Bercu, 2014

Figure 1. Map of the Romanian virgin forests in 2003

In 1962, Gh. Maurer, not as an ecologist but as prime minister, signed HCM 1050/1962 to drain 300,000 ha to increase the arable area of the former state households (future state agricultural enterprises).

On this occasion, an unsubmersible dam was built with a length of over 1,000 km, followed by high-performance irrigated agriculture. This did not happen because the water infiltrated through the dam was not kept under control, the land became impoverished quickly, there were saltings, swampy areas. Instead, on this occasion, an area of almost 90,000 ha was deforested and good quality wood was sacrificed, including centuries-old specimens as can be seen in fig.5.

Forest functions and trade in timber products. In an information of the National Forests Authority - Romsilva that manages the state-owned forest fund, it is mentioned that the Romsilva Authority that manages at the end of 1990, an area of 6,341,260 ha of forest still manages at the end of 2018, 3,135,927 ha of forest the remaining 3,205,333 ha being returned to the former owners (fig.6).

The state forests with an area of 3,135,927 ha are composed of:

- Lands covered by forest ..... 3,031,700 ha
- Other categories of use ..... 104,227 ha

In turn, the area actually covered by forests - 3,031,700 ha is divided into 2 functional groups:

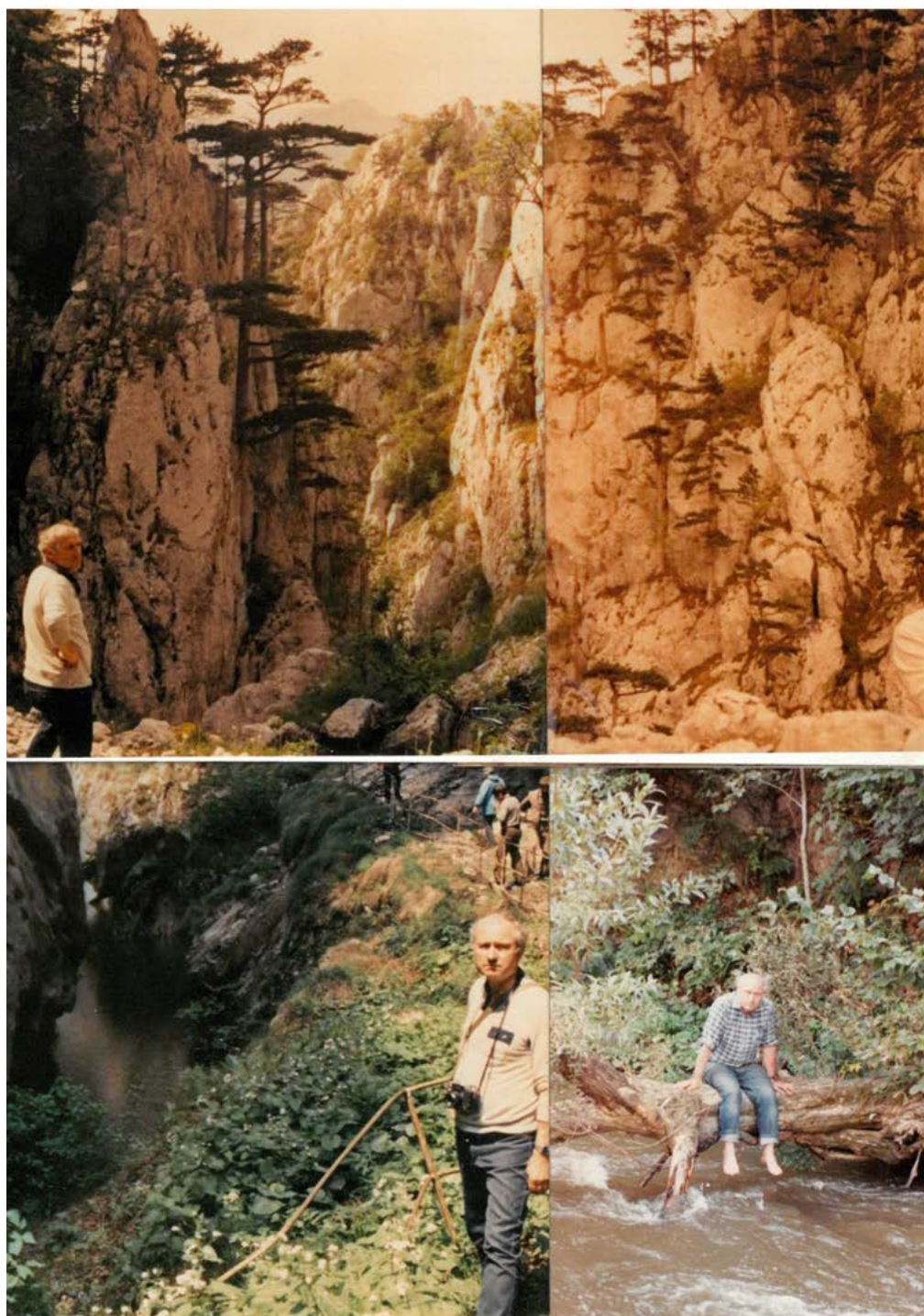
- Functional group I (forests with special protection functions) ..... 1.99.014 ha with ugly distribution:

- Forests with water protection functions: 31%;
- Forests with land and soil protection functions: 42%;
- Forests with recreation functions: 11%;
- Forests of scientific interest and for the protection of the forest fund and the forest eco-fund: 10%, of which approx. 17,779 ha are included in the National Catalog of virgin and quasi-virgin forests.

- Functional group II (forests with production and protection functions 1,037,786 ha.



From the entire forest area managed by the Romsilva Agency, between 3 and 8 cubic meters of timber are harvested annually (Romsilva National Agency).



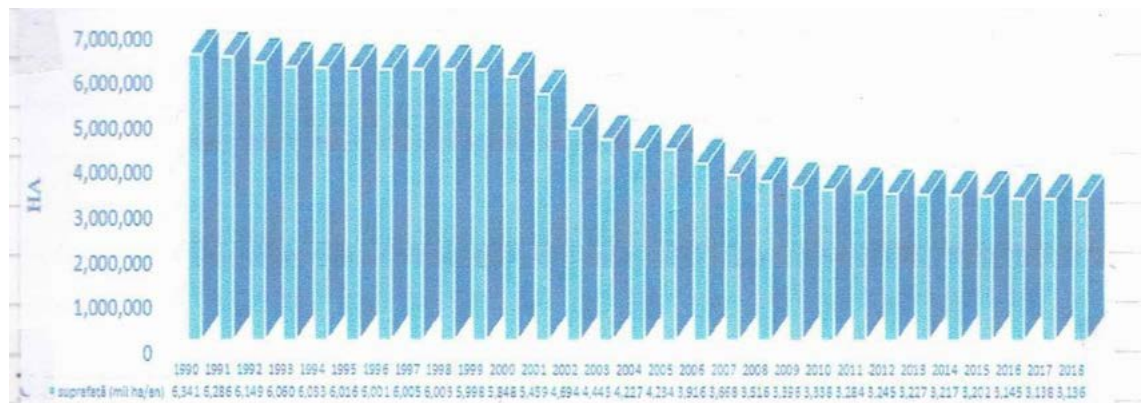
*Source: A.Lup*

Figure 4. Mediterranean vegetation (Banat black pine and aspects from the Domogled-Valea Cernei national park



Source: Stoiculescu, 2008

Figure 5. Good quality wood and multisecular specimens taken from Danube meadow on the occasion of its drying



Source: Regia Romsilva

Figure 6. Graph representing the area of the forest fund at the end of 1990 and reduction of this area (2018) due to the restitution of the forests of the former owners

The amount of wood harvested by Romsilva is insignificant compared to the illegal logs that occur annually. From the same source (Romsilva) we find out that in the period 2013-2018, the illegal cuts were as follows: 2013: 108,751 cubic meters; 2014: 56,836 m<sup>3</sup>; 2015: 57,080 m<sup>3</sup>; 2016: 47,788 m<sup>3</sup>; 2017: 47,713 m<sup>3</sup> and 2018: 31,706 m<sup>3</sup>; in total 349,874 cubic meters (Romsilva Agency). Valued only at 350 lei / cubic meter, it results that during this period wood was illegally cut in the amount of 122,455,900 lei or 20.4 million annually. In order to realize the profitability of the timber trade, we find out that in 2013 logs worth 63 million lei were sold on 900 ha (Bavaru-Bercu, 2014). Comparing the 63 million lei to 900 ha, we obtain no less than 70,000 lei / ha, the equivalent of 77.7 tons of wheat at current prices. This means the production of 10 ha of wheat, a production that is carried out by only a few top companies in Romania. And as a wheat production of over 3,800 kg / ha is obtained only in good years, the value of one hectare of illegally cut wood is equivalent to the value of over 20 hectares of wheat. In this way we come to realize why wood is stolen. In fact, Romanian folklore reflects the situation by singing "*money is made in the forest with lace and sackcloth, money, money*".

## CONCLUSIONS

With all the beneficial role that the forest has in human life, but also in the economy, the forest fund is sacrificed for money, the timber trade being over 10 times more profitable than any agricultural product.

There are still poor countries where the forest is still sacrificed to increase the arable land or land.

Rich and poor countries have noticed the damage caused by deforestation and consequently set out to restore forest cover.

However, it seems that the reforestation effort will be slow and much less extensive than its reverse, deforestation.

In the 19th century Chateaubriand wrote: The forest precedes the wood, the desert follows it.

## BIBLIOGRAPHY

1. Bavaru A., Bercu Rodica, 2014; *Protejarea mediului, a resurselor sale – o șansă pentru viață*. Editura Arhiepiscopiei Tomisului, Constanța.
2. Buciuman E., coord., 1986: *Hrană pentru șase miliarde*. Ed. Politică, București.
3. Bulgaru N., 1996: *Dreptul de a mânca*. Ed. Economică București.
4. Constantinescu N. (coord.), 2000: *Istoria economică a României*, vol.II, Agricultura. Ed. Economică, București.
5. Davidescu D., Davidescu Velicia (coord.), 2002: *Secolul XX. Performanțe în agricultură*. Ed. Ceres, București.
6. Ionescu A., Stancu R., 1980: *Ecologie și protecția ecosistemelor*. Pitești.
7. Mășu Șt., 2011: *Omenirea secolului al XXI-lea și Guvernul mondial*. Ed. RAO, București.
8. Stoiculescu Cr., 2008: *Recunoștința ecologică a zonei inundabile a Dunării românești*. București.
9. Teaci D., 1995: *Agricultura și silvicultura românească 2020*. Editura Omniapres, București.
10. x x x: 1938: *Agricultura în România anilor '30 (Atlas statistic)*.
11. x x x: 1990 și 2019: *Anuarele statistice ale României*.
12. x x x: 2001: *Anuarul FAO*.
13. x x x: 2018: *Agencia Națională ROMSILVA*.