Status of Romania's Primary Forests

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Introduction

Since times immemorial until present day, people have associated the forest with the wilderness – vast spaces, inaccessible or hardly so, inhospitable and unexplored, refuges for fauna and its predators, all in all inspiring fright and uneasiness (Gilg, 2004.) After the last Ice Age (which ended approx. 10,000 years ago), forests have expanded on almost the entirety of the European continent, ending up covering from 80 to 90% of its surface by the last days of the Neolithic period. Therefore, the forests represent the potential natural vegetation for an overwhelming surface of Europe in today's bio-geographic environment. Independent of forest management associations, their existence and development was exclusively the result of the ecological evolution and its perturbing factors along the centuries.

Moreover, for a long time, the forests of Europe have developed exclusively under the influence of natural factors, without any anthropogenic intervention. Depending on the environmental factors that modelled the temporal dynamic of the primeval forest, it featured a great quantity of dead wood – in various forms, from standing trees, stumps and stubs to fallen trees or branches; a great difference in the age-span of its trees – from seedlings and saplings to ancestral trees that have reached their physiological limit, all alongside a mosaic of micro arboretums of various sizes, found in different degrees of development. In this way, the primeval forest encompassed a grand variety of ecological niches and microhabitats capable of sustaining a high level of biodiversity. (Halkka & Lappalainen, 2001; Gilg, 2004.)

Starting with the beginning of the Neolithic period (7000 – 4500 B.C.), and to this day, man has progressively interfered with the European timberland, more often than not becoming a determining factor. Deforestation has led to the fragmentation and reduction of forest surface while forest management has influenced its composition, structure and dynamic by degrading the structural and functional layout.

Today, only a third (33%) of Europe's surface is still covered by forests, and a big part of this includes only simplified species from a structural and compositional point of view (aged trees, monocultures, allochthonous planting etc.) (FOREST EUROPE, 2015: State of Europe's Forests 2015). This deterioration suffered by the forests generated a negative impact on biodiversity – the disappearing, degradation or fragmentation of certain habitats followed by the extinction or decline of some species.

However, relics of the primeval forests have survived, isolated, in some regions of Europe, until present day. There are even cases where degraded forests (following anthropogenic activity) were excluded from any artificial interactions and have evolved to resemble natural and primeval structures. Studies conducted in the last two or three decades show that primeval forests constitute only 1-3% of the European forest surfaces. What's more, only

half of those are strictly protected (0,7%), insofar that their surface decreases continuously. (Parviainen, Kassioumis, Bucking, Hochbichler, Paivinen, Little, 2000; Gilg, 2004; Frank, Parviainen, Vandekerhove, Latham, Schuck, Litle, 2007).

Large areas of Europe, especially from the west and the south of the continent, have completely lost these forests. On the other hand, even the regions who do still posess such forests are finding themselves under constant pressure being exerted by the allochthonous and internal exploitation companies.

Romania is privileged to still possess large surfaces of virgin and quasi-virgin forests. They represent an immeasurable natural asset which welcomes scientific and cultural interest not only inside Romania but also in the larger European or planetary perspective. (Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001).

2. What is a virgin forest? Concepts, definition, terminology.[1]

The concept of 'virgin forest' has been born from the need of knowledge concerning the structure and processes of the forest untainted by man, in order to create management measures of the forest. The interest towards this concept has been manifesting in Europe after the silviculture treaty written by K. Gayer (1878) which foreshadowed the use of natural laws in creating and maintaining the forest.

Works of a bigger span which were based on observations made in the virgin forests of the centre and south-east of Europe (amongst which we count Romania's), are starting to develop in the first decades of the XXth century (Fröhlich, 1925, 1932, 1940, 1954; Rubner, 1934; Rădulescu, 1937 etc.). But a systematic research of the virgin forests left in Europe was organised by a work group of the International Union of Forest Research Organizations (IUFRO), lead at first by H. Leibundgut, a Zurich silviculture professor, followed by H. Mayer, a Vienna silviculture professor, (Leibundgut,1959; Mayer, 1976, 1978). Works concerning the ecology of virgin forests were presented in the symposiums organized by this work group, more notably the monograph *Wälder Europas* by H. Mayer (1984), which enlists the main structural characteristics of a great number of virgin or quasy-virgin forests which the author has been researching along the years (Doniță, N. în : Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001).

Any presentation, analysis or attempt to study/learn about the virgin forest is faced with an unavoidable obstacle from the beginning: the multitude of concepts and definitions. The most used **concepts** linked to the virgin forests which evolved exclusively under the

[1] This chapter of the paper has been adapted with some additions from N. Doniță, *Virgin forests of Romania*. Theoretical fragments published in a work by Giurgiu V., Doniţă N., Bândiu C., Radu S., Dissescu R., Cenuşă R., Stoiculescu C., Biriş I. A., 2001. Les forêts vierges de Roumanie. ASBL Foret Wallonne. Louvain la Neuve. 210 p.

influence of natural factors (with the anthropogenic influences amount being negligible) that are used in academic literature are enlisted hereafter (as per după Doniță, N. în : Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001; Lund, 2002; Gilg, 2004):

pădure virgină (in English – *virgin forest*; in French - *forêt vièrge*; in German - *Urwäld*; in Russian – *devstvenâi les*), promoted by the German and French silviculture schools of thought or **pădure primară** *(primary forest)*, promoted by the Anglo-Saxon school of thought, refers to the forest formed exclusively under the action of natural factors and whose bioprocesses are produced without any direct or indirect anthropogenic influence since their spontaneous creation until present day. The main international organisations concerned with nature's conservation which represent global authorities in the field (International Union of Forest Research Organizations - IUFRO, Food and Agriculture Organization of the United Nations - FAO, The Convention on Biological Diversity - CBD) are using the term 'primary forest' to name a forest with a high level of naturalness. Recent approaches define primary forests by measuring their level of naturalness/lack of anthropogenic influences – the integrity of their structure, the ecosystem's functionality, the genetics' and species' diversity, the biotope's variety;

pădure naturală (*Naturwäld, forêt originelle, natural forest*), refers to a forest which has a structure that presents direct or indirect anthropogenic influences, but largely preserves its natural structure and contains tree species specific to the area;

pădure climax *(climax forest),* a forest resulted following a succession of ecological processes and which has reached a point of balance and stability *(steady state).* This concept is narrower than the 'virgin forest' because there are virgin forests in many other development stages apart from the climax one (e.g. forests formed from pioneer species which represent a pre-climax and which, with few exceptions, are born without any anthropogenic influence).

pădure seculară *(old-growth forest),* promoted by the North-American school of silviculture – refers to a forest old enough to contain natural diversity and a wide age-span among its trees, which have reached their physiological longevity; it may also contain other characteristics that point to its naturalness (dried-out standing trees, stumps found in a variety of decaying stages on the soil, plants and animals that suggest a healthy maturity of the ecosystem). It may also have been possible that a number of isolated trees have been extracted from it without bringing major changes to its composition and structure. In some interpretations, this concept mainly highlights the time-space continuity of said forest, not necessarily the lack of anthropogenic influence; (e.g. *ancient woodland/ancient forest*, used in the Great Britain to better elicit the forests with the best natural conservation).

pădure originară *(pristine forest, original forest, primeval forest, native forest)* – a forest that has the composition, structure and functions specific to its original state, respectively the primary one.

In the situation where no certain information is available regarding the primary, unaltered character of the forest, specialists tend to use wider and more permissive concepts such as pădure cu caracter natural *(natural forest, forêt a caractère naturel*) or pădure cu grad ridicat de naturalitate (*forest with a high degree of naturalness, forêt à haut degré de naturalité*). It is worth mentioning that from an international perspective, the usage of ambiguous terms or terms with a much wider or dual meanings are preferably avoided. A couple of examples of such terms are: păduri seminaturale, cvasivirgine, subprimare etc. (*seminatural, cvasivirgin, subprimary forest*).

For each of the concepts concerning forests with a high level of naturalness, there are also an accompanying number of definitions. For a more complete image of the variety of used definitions linked to these forests (on a national or international level) one may consult the following works: *Definitions of old growth, pristine, climax, ancient forests, and similar terms* (Lund, 2002: http://www.grida.no/geo/GEO/Geo-2-408.htm) or *Proceedings of Second expert meeting on harmonizing forest-related definitions for use by various stakeholders* (FAO, 2002: http://www.fao.org/docrep/005/Y4171E/y4171e00.htm).
It is worth saying that FAO has identified 22 definitions for the term *primary forest* (www.fao.org/docrep/005/Y4171E/Y4171E36.htm) and 98 for the term *old-growth forest* (www.fao.org/docrep/005/Y4171E/Y4171E34.htm). In a work signed by Gyde Lund (2002) there are 18 definitions mentioned for the term *primary forest* and 85 for *old-growth forest.*

Due to these reasons, the clarification of concepts, definitions and terms is essential to the understanding and unitary approach to debates concerning forests with a high level of naturalness – esp. in regards to criteria and indicators of identification and evaluation, the evaluation of structural and functional indicators, naturalness state etc.

In this work we will use the concept or virgin forest in the classic sense, the one adopted by the European schools of silviculture since the first half of the XXthe century (Fröhlich, 1925, 1932, 1940, 1954; Rubner, 1934; Leibundgut,1959; Mayer, 1976, 1978, 1984; Brüning and Mayer, 1980; Korpel, 1995, Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001; Biriș and Veen, 2005).

For this reason, H. Leibundgut (1959), one of the big promoters of the study of virgin forests, defines **virgin forests** (*Urwälder*) to be the ones formed exclusively under the action of natural factors and whose bioprocesses are produced without any direct or indirect anthropogenic influence, and **natural forests** (*Naturwälder*) as the ones in whose structure we recognise direct or indirect anthropogenic influence but which are keeping most of their natural structure and are mainly consisting of types of trees specific to the area.

H. Mayer (Brüning and Mayer, 1980, proposes an understanding of the virgin forests which characterizes them as 'natural forests, (*Naturwald)* with a natural structure of the arboretum.' Virgin forests can be **primary** forests – completely without having suffered anthropogenic influence in the past or the present or **secondary** – which don't present any obvious anthropogenic influences in the present or such influences haven't manifested at all (or they have, but in negligible amounts) in the past. H Mayer uses the term of **natural forest** (*Naturwald)* for the forests that have been born **without anthropogenic influence**, considering that the concept of natural forests corresponds somewhat to the concept of **climax forest**.

According to Š. Korpel (1995), 'the virgin forest is a forestland whose composition, structure, growth and other vital processes are conditioned primarily by the specifics of the environment before any other climatic factors.' It is an ecologically stable forest, featuring dynamically balanced and consolidated interactions between soil, climate, and organisms while being isolated from anthropogenic influences that might interfere with its vital processes and structure, being categorised, according to Korpel's opinion, as climax forest. By way of consequence, all the specifics and characteristics of a developing virgin forest enlisted by Korpel are referring, mainly, to virgin climax forests. They are as follows:

1. The unchangeable composition of the arboretum through a dynamically time-space balance.
2. The long time-span of ecological balance and equilibrium.
3. Age diversity.
4. The long stagnation found in the growth of species developing under mountain peaks, in the case of shadow-specific species.
5. Varied structure depending on the development stage.
6. The presence of dead stumps on the soil that are to be found in a variety of decaying degrees.
7. The aftermath of biomass accumulation = 0
8. Great natural resistance to impact.[2]
9. A special texture resulted from the alternation of arboretum surfaces found in various stages and phases of development.

Discussing other notions such as **primary forest, virginal forest, natural forest** (the latter having a dual meaning in German – *Naturwald* which refers only to forests being born without anthropogenic influence and *natürlicher Wald* which refers to a cultivated forest, where the arboretum consists of tree species specific to the area.) Š. Korpel does not consider these notions equivalent to the *virgin forest* one. This author, just like H. Mayer, admits however the existence of primary and secondary virgin forests, all the while highlighting the fact that secondary virgin forests do not usually end up being identical to the primary ones.

[2] This is referring to natural impacts.

In a study concerning virgin forests in Eastern Europe (including Greece and Turkey) (Iberos, 1994), *virgin forests* are defined as 'natural forests, wide enough to maintain their natural characteristics, whose expansion, vegetation, strata composition of trees and structure are determined exclusively by their natural localisation and environmental factors, without any contemporary or past anthropogenic influences (such as stubs, firewood or pastures.)' Apart from those, there is also a mention of *old-growth forests*, old enough to contain a natural diversity of species of various ages, trees that have reached their physiological limit alongside other characteristics which attest their naturalness (dried-out standing trees, stumps found in a variety of decaying stages on the soil, plants and animals that suggest a healthy maturity of the ecosystem.) It is also mentioned the fact that the term **natural forest** does not have a set of specifications unanimously accepted, but being considered nevertheless synonymous with the term *virgin forest* as per Leibundgut (1982.) One final term worth noting is the **seminatural forest**, which contains a great number of natural elements and which, under limited anthropogenic influences, can maintain its structure and the natural ecosystem processes it features.

In the project titled *Inventory and strategy for sustainable management and protection of virgin forests in Romania* (PINMATRA), set up by the Royal Dutch Natural History Society (KNNV) in a partnership with National Institute for Research and Development in Forestry (ICAS), International Union for Conservation of Nature (IUCN) and the Forestry Progress Society (SPS) alongside independent international experts, the following definition of the v*irgin forest* has been used: 'a natural forests where trees and shrubs species are found in different stages of their life cycle (seedlings, twigs, young forest, mature forest, old forest) as well as in the form of dead wood found in various decaying stages, generating a vertical or horizontal structure more or less complex, a consequence of ecological natural processes which ensure the continuity of the forest for an undetermined period of time. In the virgin forests, the natural dynamic of the forest (meaning living ecosystem) is mainly determined by the characteristics of the edifying tree species and the impact of biotic and abiotic factors on the ecosystem. A temporary manifestation of gaps in the arboretum or of wider spaces which aren't featuring trees is part of the specific dynamics of the virgin forest. According to their phytogeographic area, the virgin forests are forming various types of forests with a specific structure, composition, dynamic and diversity according to the area conditions and/or biotope – such as altitude, geomorphological, geological, hydrological, climatic and pedological conditions. Virgin forests reflect the close link between the forestry biocoenosis and environmental factors which has been developing along the years. (Biriș and Veen, 2005).

> *'Virgin forest is a natural woodland where the tree and shrub species are in various stages of their life cycle (seedlings, young growth, advanced growth, maturity and old growth) and as dead wood (standing and laying) in various stages of decay, thus resulting in more or less complex vertical and horizontal structures as a*

product of a dynamic process, which enables the natural forest community to exist continuously and without limit in time.

In virgin forests the dynamics inherent to living systems are connected to ecological properties (including longevity) of the dominant tree species, impact of other organisms (e.g. outbreak of insects) and to the impact of abiotic factors related to substrate, climate and to the complex of topography and water table (e.g. wind, snow, flooding). Part of this dynamics is the temporary occurrence of gaps or larger tree-less stages.

Virgin forests differ within the given phytogeographic zone, forming specific types of forest communities with characteristic species composition, spatial structure, dynamics and overall diversity due to site conditions related to the position above sea level and topography, macroclimate, and nutrient and water availability. Virgin forests reflect herewith the natural unity of forest community and abiotic conditions, fully rooted in their millennia-long continuous Holocene development.'

For a better demarcation of the concept of virgin forest, one must not forget to taqke into consideration the following (Doniță, N. in: Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001):

- The notion *forest* has such a general meaning because it refers not only to ecological events such as forest ecosystems, but to geographical ones as well – forest geosystems and levelling geosystem units (province, subarea, area, region, subregion.)The notion of *virgin forest* has the same level of general meaning, as it includes forest ecosystems as well as geosystems. The notions of *forest* and *vorgin forest* respectively feature a great degree of complexity, referring not only to the living side of things (biocoenosis in the case of ecosystems and the territorial complex of biocoenosis in the case of geosystems) but also to the non-living elements, the environment where the biocoenosis is born and the territorial complex of biocoenosis. Therefore the definition of the *virgin forest* has to mention what it is referring to, a virgin ecosystem or geosystem and the definition must also include the living environment.
- The concept of *virgin forest* **can't limit itself only to the climax forest** because there are also virgin forests in other developing stages apart from the climax one (e.g. the forests constituted of pioneer species which represent a pre-climax and which, with few exceptions, are born without any anthropogenic influence.)
- In conclusion, the characteristics proposed by Š. Korpel for the climax virgin forest aren't entirely valid for the virgin forest found in other developing stages; characteristics must be identified that can encompass the whole span of virgin forests.
- The distinction done by H. Mayer and Š. Korpel between the primary and secondary virgin forest is useful because, in Europe, as well as in Romania, most forests being

considered virgin are, in reality, secondary virgin forests because they've suffered an anthropogenic influence to some extent. Furthermore, air pollution, which includes radioactive particles and gas among other things, has had and still has harmful influences on the all the forest ecosystems.

Taking these considerations into account, there are several mentions to be noted **concerning concepts, definitions and terminology referring to the virgin forest.**

1. The concept and term *virgin forest* can be kept and used within their general meaning. But when speaking of specific situations, one must mention if the discussion revolves around an ecological unit, meaning a forest ecosystem, or a geographical unit, meaning a forest geosystem (or another geosystem unit of a higher rank.)
   This is necessary because the systems and processes found in an ecosystem differ from those found in a geosystem.
2. By **virgin forest ecosystem** it is to be understood that specific ecosystem where the area and biocoenosis haven't suffered significant anthropogenic influences which lead to the alteration of the processes and structures found in the biocoenosis or the characteristics of the area, nor to the alteration of biocoenosis and area interactions.
3. Through **virgin forest geosystem** it is to be understood that geosystem where the living coating (composed of forest biocoenosis) as well as the non-living coating (air, relief-rock-soil, water) haven't suffered significant anthropogenic influences that would alter these coatings (and subsequently the composing ecosystems.) However, an anthropic geosystem can also feature virgin forest ecosystems if the anthropogenic influence hasn't extended on its entire surface.
4. Both ecosystems and geosystems can be **primary**, in which case they haven't been interfered with anthropogenically in the past or in the present or **secondary**, if they have suffered anthropogenic influnces in the past but they haven't left a significant mark on the structure or processes found in the ecosystem and the geosystem.
5. In the case of the forest ecosystem, the *virgin* quality isn't referring to the climax state but to any developing stage of that particular system.
6. In order to recognize a **virgin forest ecosystem**, we may use the following criteria:
   - In the phytocoenosis composition we can find local species corresponding to the characteristics of the area.
   - The lack of new or old stubs.
   - The presence of dead stumps on the soil that are to be found in a variety of decaying degrees.
   - The lack of pastures and domesticated animals.
   - Unaltered soil, covered in natural litter in various decaying stages.
   - The lack of man-made paths or trails.
   - Difficult access (away from cities or villages, cabins, sheepfolds, roads etc.)
7. In order to recognize a **virgin forest geosystem**, we may use the following criteria:

- The lack of exploited, cultivated or artificial forest biocoenosis, as well as the lack of secondary biocoenosis generated by anthropogenic activity (secondary pastures, wall-climbing biocoenosis.)
- Soil and relief unaltered by anthropogenic activities.
- Lack of any human activity (settlements, roads, mining activities, various installations etc.)

It is worth mentioning that in the world, such geosystems can only be encountered in the boreal and equatorial areas, which are still lacking roads and settlements. In Europe one might encounter at most fragments of such geosystems, in National Parks established before human alterations having been done to the landscape. These are also known as intact forest landscapes. This concept and the technical definition associated to it were recently developed – in the last 15 - 20 years, following the development of IFL technology by a team of researchers and conservers from University of Maryland, Greenpeace, World Resources Institute, and Transparent World, 'to contribute to the creation, implementation and monitoring of policies concerning the decay and fragmentation of large scale landscapes – from a regional level to a global one' (http://www.intactforests.org).

8. The term **natural forest** is to be used as a synonym **only** for the *virgin forest* and not for forests where anthropogenic action has been taken.
9. The term **old-growth forest** is useful and can be used with the meaning suggested by North-Americans (Moir, 1992; Kaufmann, Moir, Covington, 1992; Iberos, 1994).
10. The term **seminatural forest** may be used for denoting forests that have suffered anthropogenic influences but have managed to keep the natural composition of tree strata.
11. Other terms such as **pristine forest, original forest, native forest**, are mainly referring to the *virgin forest* as well, but their use isn't recommended in order to avoid nominal and conceptual confusions.
12. Terms such as **seminatural forest, quasivirgin, subprimary**, which have a wider, ambiguous or dual meaning, are to be avoided in connection to the *virgin forest* term.

3. The complexity of virgin forests.

The virgin forest is a creation that has been perfected during a lengthy period of time, exclusively under the action of natural laws without any anthropogenic influence. The virgin forest reflects nature's perfection which enchants us with its beauty and harmony, with the animal and vegetal diversity, their associations, the variety of landscapes changing with each step and season, the light and shadows games, the discreet music of leaves falling,

birds singing and even the serene silence which reigns of the winter months. (Biriș and Doniță, 2002).

The virgin forest impresses us, ahead of anything, with its lack of spatial uniformity. On various surfaces, often tiny ones, one might find a cluster of old trees, some still rising strong while others are dried-out or in the process of dying; one might also find an opening where a new set of trees is just sprouting, or even a young shady arboretum. This way, the forest seems to present a mottled cover which changes, here and there, the appearance of trees' strata and at the same time, other related living organisms – shrubs, weeds, moss, lichens, mushrooms, insects, birds, mammals etc., the reason for the existence of the latter being the fact that some of them live in the old arboretum, some in the mature or young arboretum while others reside in the seedlings that are just sprouting.

Most of the virgin forest researchers have described them as being a „complex de microarborete" (*eco-units*) sau un „mozaic silvatic" (*sylvatic/forest mosaic*) (Leibundut, 1959, Oldeman, 1990; Korpel, 1995; Cenușă, 1996; Vlad et al., 1997; Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001).

The virgin forest is the Bible and inspiration for any forestry knowledge. It's the book useful not only to the forest warden, but to everyone who are expecting to get the forest's byproducts and services. (Biriș și Doniță, 2002).

The main characteristics of virgin forests are[3]:

- **Complex texture (horizontal structure).** It is the result of the natural phases of development particular to the arboretum and the surface occupied by the aforementioned phases in a forest massif. As per H. Leibundgut (1959) the phases are as follows: regeneration phase, the (initial) youth phase, the (optimal) maturity phase, the old phase and the decaying phase. In the case where arboretum encompassing all these phases covers only small surfaces (a couple of hundred or thousands of square feet), meaning the case of micro-arboretum, the structure of the entire arboreta appears to be quite diversified (mosaic forest.) But in the case where arboretum is covering large surfaces (such as entire acres or more), the structure seems to present a type of uniformity. The length and stability of such phases are usually different (Cenușă, 1996), with the decaying, regeneration and youth phases being shorter and alterable, while the maturity and old phases present a more stable state. It is for this reason that the longer and more stable phases can be encountered on larger surfaces, giving the impression that this is the standard structure of that specific arboreta.

[3] This part of the work is adapted, with some additions, after N. Doniță and I.-A. Biriș, *Virgin forests of Romania. Characteristics of the virgin forests*, published in Giurgiu V., Doniţă N., Bândiu C., Radu S., Dissescu R., Cenuşă R., Stoiculescu C., Biriş I. A., 2001. *Les forêts vierges de Roumanie*. ASBL Foret Wallonne. Louvain la Neuve. 210 p.

- **Irregularly vertical structure.** Depending on the developing phases – it usually presents a greater uniformity in the decaying, regeneration and youth phases with a bigger diversity in the (optimal) maturity and old phases. A determining role in the formation of arboretum structure in the case of the virgin forest is given to the species temper and their relationship to light. For light or semi-shadow species, whose saplings can't survive too long under the shadow of old trees, it is only natural that their horizontal structure (texture) is rougher (with widely-aged arboreta on larger surfaces) and their vertical structure is smoother (one level or at most two or three, but the vertical distribution of trees isn't very homogenous.) It is the case of pine species, larches, cypress, populus or sallow species. In forests composed of shadow species (beech, fir) there can be two types of structures depending on the regeneration process of the arboreta. If the regeneration is continuous on small surfaces, and natural selection, the shift in the position off young and mature trees as well as the decaying of old trees have the same specifics, a structure with a wide age-span is developed (similar to the gardening type) which may persist for a longer period of time. If the regeneration is happening on larger surfaces, along the arboreta growing in age, the height differences may fade, the majority of small-caliber trees is eliminated, a sole plant community canopy is formed, with depths depending on the specifics of the species. The canopy consists mainly of thick trees which also possess the larger wood mass. Only in the old and decaying phase does the vertical structure diversify.
- **Arboreta composition** corresponds to the potential natural vegetation. This, in turn, depends on the area's characteristics and the ecological behavior of the tree species which refers not only to their interactions with the abiotic medium but with their inner interlinked interactions and with other plant and animal species from the biocoenosis. In this sense, virgin forests may be constituted both of pure and mixed arboreta. Usually, virgin forests with pure arboreta are more often than not found in areas that feature special circumstances, where only a species that has adapted to the aforementioned circumstances can develop, even if it's competivity isn't that high (like sallow species in areas with prolonged floods, the oak species in steppe areas, pine species or larches on rocky areas, Hungarian oak species in areas rich in clay etc.) But virgin forests with pure arboreta may also exist in areas with a high ecological potential, occupied by very competitive tree species, one example being the beech in its optima ecological environment, whose wide shadow eliminates other species. Virgin forests with mixed arboreta are usually constituted in areas with great ecological potential, where the natural demands of various complementary and mutually tolerant species are being fulfilled. Such arboreta may appear in border areas of competitive species, where their competitive streak is reduced (the case of the beech in colder or drier climates than its optimal one or the case of the spruce in high altitudes or in colder climate than the optimal one.)

- **Trees of big scale and old age**. In the virgin forests one can encounter old-growth trees, true giants and rulers of the vegetal life in the temperate climate, deposits of precious archival dendrological information, and worth of in-depth research. In the virgin forests, the trees find optimal conditions to prove their genetic potential, not only under biodiversity's umbrella, but also scale-wise, reaching huge diameters and a height of 60m for the spruce, 55m for the fir and over 45m for the beech and 40m for the sessile.
- **High genetic diversity.** Tree species are characterised by a remarkable genetic and phenotypic diversity, manifested through the presence of numerous subspecies, varieties, shapes, ecotypes (climatic and edaphic), origins (of population), and hybrids, with various adaptive and productive traits. In the virgin forests one can localise one of the most valuable genetic centres for tree species.
- **High level of dead wood,** constituted either of dried-out trees which are still standing, but especially fallen trees, found in various stages of decay. In some cases, one might encounter mature trees that have been uprooted, following strong wind or massive quantities of snow. Next to the uprooted trees there are holes from which the adjacent soil, which has clung to the roots, has been moved into monticles/small swells. The abundance and distribution of dead wood varies in time and space, according to the development stage of the microarboretum and its perturbing factors. The importance of dead wood resides in the fact that it generates a multitude of specific habitats for a number of insect, mushrooms, plant and other species, contributing to a specific trait of the forest's biodiversity. Another important fact resides in the characteristics of bio-geo-chemical cycles in these forests; the existence of dead wood requires an almost-perfect manifestation of said cycles, with the organic mass being kept in the system and recycled (not lost through exploitation as in the case of cultivated forests.) Dead wood is an indicator that encompasses many naturalness elements and has become a point of reference for natural forests. Dead wood is a key component for conserving the biodiversity because i) its recycling corresponds to the catabolic phase in the forest dynamic, being just as important as the anabolic growing phase ii) it is an important functional compartment which ensures the storage of huge energy mass and a great number of nutrients in the ecosystem iii) it initiates a number of the original segments of the food chain which are essential to many species in the forest ecosystem iv) constitutes a variety of original microhabitats which are indispensable for the survival of many rodent species, bats, birds, insects and moss. Even more, these microhabitats facilitate the natural regeneration of trees; v) amasses a number of organism associations, being able to contain thousands of species, including rare ones. (Vallauri, 2003).
- **A high variety of ecological niches and habitats.** Through the high diversity of the vertical structure (multiple strata), of the horizontal structure (mosaic forest), the presence of old trees and habitat trees, of dead wood etc, a huge variety of habitats

for flora and fauna species are being born, which explains the richness of species and the abundance of living organisms in virgin forests.

- **High biodiversity.** Virgin forest are situated on a higher level than other terrestrial or forest ecosystems. The exceptional biological diversity is conferred and ensured by by the multitude of ecological niches, biocoenosis and biotopes that it encompasses and generously facilitates for to a wide array of living beings, to which it provides food and shelter. In these forests, the biodiversity is being conserved and developed permanently, following complex laws and connections still to be discovered, but vouched for by their wide territorial spread, multiple-century longevity of the trees and the perenniality (regeneration) of the aforementioned ecosystems and, last but not least, by the harmony and balance of the dynamic ecosystems established here, in the absence of anthropogenic influence. The complex, multi-layered and mosaic structures of these forests are fully contributing to the formation of these 'treasuries of maximum biodiversity' which, in turn, ensure the stability and continuity of the ecosystem. The presence of relict or pennant species is often associated with forests that have a high degree of naturalness, being considered by some authors a true 'Noah's Ark.' (Gilg, 2004).
- **Wood production (wood cord/foot)** in the virgin forest depends, of course, firstly, on the area potential and the one specie or various species that constitute it. The values indicated by a number of authors vary greatly. In the European forests, including Romanian ones, there have been found cords measuring up to 1500 m^3ha^{-1} or even more. Usually, these cords are characteristic to the arboretum that includes species with high growth intensity even in the old age such as fir or beech. However one mustn't forget that such arboretum includes old-growth trees that have been accumulating wood for a number of centuries, but if we calculate the average growth rate, the result isn't as high. Normally, the wood cord varies between 300 and 1200 $m^3\ ha^{-1}$.
- From the point of view of **wood quality** (which refers to wood used as a material), it is generally agreed that the trees found in virgin forest tend to be faultier than those in the cultivated forest, due to the fact that through natural selection, the sturdier trees (with the best crowns, the best trunk diameter and which present an irregular diameter depending on their position adapting with age) are being the ones holding up, while through artificial selection, the trees with the best trunk conformation are being maintained. We must however observe the following truth regarding Romania's case: until present day, the most valuable type of wood has been found in the virgin and quasyvirgin forests (spruce as resonance wood, beech and oak as aesthetic veneer wood, beech as rotary wood etc.)
- **The dynamic of forestry vegetation (successions)** in the virgin forest is linked to one of the two theories referring to regenerative units: the theory of developing phases (Leibundgut 1959, Cenuşă 1996) and gap theory by Watt (1947).

- **The regeneration process** in the virgin forest is somewhat periodical and not always continuous, due to the periods of fruit but also due to the developing phases of the arboretum. Arboreta that feature exclusively odd aged trees, where one might encounter trees of all ages, are quite rare. The predominant kind features arboreta with several generations of saplings, resulted from successive fructifications, which interfered with the decay and regeneration phases. In case of catastrophic events which can destroy the arboreta off large surfaces, there might be some even aged trees areas (with anemochory[4] species, such as spruces, pine trees or larches.) In the regeneration process some successive phases might interfere, which feature pioneer species (in the case where the regeneration of original species hasn't happened instantly.)
- **The stability of the arboretum** and the entire biocoenosis of the virgin forest is correlated to biodiversity; it is, generally speaking, higher than its equivalent in the cultivated forest, since the control over the population's dynamic and the population equilibrium is better regulated due to a co-adaptive long-term evolution. But the stability also depends on the nature of the area and the ecological complexity of the biocoenosis. In areas with the less variable regimes of ecological factors and in more complex biocoenosis (with a better developed food chain web and multiple regulators of the population dynamic), the stability is higher. As seen by the research done by R. Cenuşă (1996), the forest's biocoenosis stability also depends on the development phase of the arboretum. It is worth mentioning however that the relatively high stability of the virgin forest and its great capacity for regeneration referrers to the naturally-occurring perturbing factors, and not to non-ecological anthropogenic influences. For example, pollution affects these forests, especially those which contain species of fir.

4. The importance of virgin forests

Like any living organism, the forest has two main components: a material component – wood, mainly – which is the visual part, giving the forest its aesthetic, and giving us the first impression of the forest - it is more accessible to our knowledge and easier to evaluate, measure, quantify; and an informational component, represented by the informational treasure accumulated and saved in storage since the forest has been created; it contains what we may call the 'soul of the forest', the spiritual side of it, which is harder to decipher, but very important, it is the one giving the virgin forest its invaluable trait.

The wood is, without a doubt, a valuable material, but like any other material it is subject to decay and has a shorter or longer life-span depending on the way we use it: if we burn it, it becomes smoke and ash, if we use it to produce the objects that surround us – parquet, panelling, musical instruments or wood-painted icons – it may last thousands of years. But

[4] Whose seeds have adapted to be wind distributed.

time is unforgiving – even with wood. And by cutting virgin forests, soon not much will be left of it.

The information that has accumulated in the virgin forest is ten times more valuable than its wood and what's more important – little of it has been deciphered or discovered until today. We are learning about it as we develop our knowledge, our investigative power and our tools and research equipment (which are being updated constantly.) It is for this reason that we must not rob future generations of such forests, we mustn't abandon them now. We must preserve them as they are, in order to allow our children to deepen their understanding of forests, more than we might be able to do, and even more than our ancestors did.

Once gone, the virgin forests cannot be recreated. Identically to the extinct species: specie that has been extinct is gone forever, taking with it the entire informational database it possessed.

Forests with a high degree of naturalness are particularly essential nowadays due to their numerous ecological and socio-cultural characteristics, and, last but not least, economical ones. (Beadle et al. 2009, Hilbert & Wiensczyk 2007). Compared to those that have been interfered with and managed by man, the aforementioned forests present a set of specific attributes, due to the structures and natural processes like the presence of old-growth and large trees, genetic diversity or those linked to the ecosystem's functionality (e.g. circulation of nutrients) (Frelich & Reich, 2003), characteristics which are essential to preserving and restoring the biodiversity of the forest. Moreover, the grand number of niches that is the result of compositional and architectural diversity as well as dead wood, creates habitats that are required by some species (including rare ones) (Brang 2005) or general regeneration support (Harmon et al. 1986, Schulze et al. 2009). Not to mention that, from the angle of a general ecological management of the forest, those might server as a point of reference (checkup) in evaluating the state of the arboretum in a specific man-managed area, compared to the demands (standards) of quality regarding biodiversity and the environment. (Frelich & Reich, 2003, Peterken,1996).

From a socio-cultural point of view, one of the encountered approaches is the open-air 'museum', also known as the living witness of the old primeval forests (Frelich & Reich 2003), where the forest is seen through its aesthetic, cultural or spiritual quality, being associated with the image of emotional effect it produces. (Beadle et al. 2009).

From an economical point of view, the importance of its products especially reminds us of the age when the forest was seen exclusively as an endless wood supply, when huge cords of wood of questionable quality (moldy) were associated with terms such as 'decadent, decrepit' (Arsenault 2003), determining in turn exploitation and the substitution with more 'productive' plants (Hilbert & Wiensczyk 2007). Today, their value is being reconsidered

from the point of view of the 'ecological services' they provide: biodiversity or carbon storage (Beadle et al. 2009, Teodosiu, 2012).

We will enlist, in short, a number of the intrinsic values associated with virgin forests:

- **Historical witness,** in situ, of what were and still are some of our forests. It would be visibly unfair for the next generations to be robbed of one of the nation's treasures, some sort of 'in situ' model from which they can learn and gather unmediated information about the ways in which nature work freely, unperturbed by anthropogenic influences, and what might be the aim of a truly ecologically silviculture. If this archetype model was gone, only books would have been able to offer the required information for a good forest management, and the agreement man-forest-biosphere would have to suffer. If for the socio-cultural area, man has created village museums, why wouldn't the natural area demand a forest of the past exhibit, mirroring the unaltered, ingenuous nature?
- **Valuable thesaurus of genetics, species and representative ecosystems**, 'in situ', for large biogeographic areas, well adapted to the environment and with an out-of-the-ordinary reproductive and environmental potential. Numerous species of rare, endemic or extinct-prone plants and animals are being sheltered and safely protected, as well as important biogenic structures for the protection of fragile, vulnerable biotopes. The scientific and ecological importance of these natural values has been unanimously recognized; they represent starting points from which, in the future, many decaying ecosystems will regenerate.
- **Source of scientific information** concerning the functional and adaptive long or average-term mechanisms of the primeval forest, created by nature, which are due to correctly-scaled structures and interactions between part and whole, as well as successive entering and leaving throughout the long, complex and substitutable food chains. This is where the relative ecological equilibrium, the stability, the sustainability, the cenostructural flexibility and great adaptability to the normal variety of environmental factors originates; this where the secret of the 'immortality' appearance of the forest resides. Those are important qualities that have been gathered in a long time-span, following numerous trials and experiments done by nature herself, from which man may learn and get inspiration for his own practical activities. Rightfully so, the virgin forests are called 'in situ laboratories' for the study of biodiversity and forest functionality, of the evaluation of the naturalness level in man-managed forests, of interfering factors and resistance to those, of the climax state and of the natural processes (regeneration, competition, mortality etc.)
- **Basic components of the system of protected natural areas.** The forests constitute the strength pillars for the conservation and protection of nature actions, for the centres where ecosystems are still maintaining their unaltered state, unaffected by

anthropogenic decay, which can, in turn, transfer external influences needed for the healing of wounds and regeneration of deteriorated environment.

- **Carbon storage reservoirs.** Virgin forests have a high capacity for carbon storage, not only in their vegetation but in their necromass and soil as well, therefore contributing to the reduction of greenhouse effect.

- **Role in education.** From an educational perspective, virgin forests constitute an appropriate frame for the understanding and assimilation of the virgin forest vitality, diversity, complexity, stability, dynamism and beauty. (Carbenier, 1995; Biriș, Radu, Coandă, 2002; Gilg, 2004).

- **Natural heritage of universal value and an expression of cultural identity.** Researches and scientific communities – decision makers in the area of European and global forest policies – unanimously admit the fact that these forests represent a global patrimony due to their natural, scientific, cultural, informational, educational and aesthetical landscape value. They are encompassing original flora and fauna and rich in rare or extinction-prone species, all the while fulfilling numerous ecological, protective and environmental functions. At the same time, virgin forests constitute representative examples of ecological processes concerning the evolution and dynamic of forest ecosystems which are constantly unfolding. It is for this reason that forests represent an important component of the European natural capital, among which beech forests are considered representative of the European identity on a global level. (Knapp 2008) The beech (*Fagus sylvatica* L.) is the European specie with the widest kind of spread, expanding from the Atlantic to the Black Sea and from Mediterranean mountains to the south of Scandinavia. (Bohn et al. 2000). Considering the large distribution of beech forests in Europe and their ecological importance, World Heritage Centre UNESCO has decided that a representative web of old-growth and virgin beech forests serve as a remarkable example of species evolution, and the conservation of the most depictive samples of beech from the entirety of beech forest area is of global importance. Therefore, this UNESCO propriety is indispensable for understanding the history and evolution of the Fagus species at a global level. (Knapp 2008; Knapp și Fichtner 2011; Kirchmeir & Kovarovics 2016).

5. Protecting the virgin forests

In the last century, an accelerated and alarming decay of the environment has been registered, including the forest, having dramatic consequences that feature irreversible effects. All these effects have clearly highlighted the fact that the management of renewable resources based exclusively on economic performance/efficiency is unviable and long-term deficient. To sum up, it's a type of self-destruction where we're sabotaging ourselves.

Therefore, since the beginning of the 90s, there has been a shift in paradigm regarding the use of renewal and classical resources, with the intention of transitioning to a standard that

satisfies the growing demand for products with the environmental conservation requirements. In other words, maintaining the environment in the most unaltered state possible is a fundamental prerogative for ensuring a durable development.

THE FOREST is a renewable resource, the forest translates to ENVIRONMENT before it translates to WOOD, and therefore the enduring management of it is even more necessary than previously thought.

After the 1990s, at an international level (more so in Europe and North America), the interest for an enduring and responsible management of the forests has grown, in a close-knit relationship with their preservation and the importance of environmental services they provide.

The number of those that highlight the role, growing importance and preservation necessity of areas kept intact or with little anthropogenic influence has also been on the rise. A special interest has been given to virgin forests. This, in turn, is determined by the informational treasure accumulated throughout time in the virgin forests that haven't been touched by anthropogenic influences and by the possibility of researching laws and ecological processes in ecosystems clear of anthropogenic influences. Those forests are, at the same time, witnesses for a comparative analysis of the efficiency of ecological management measures that have been applied to man-made forests and studying those ecosystems may offer solutions of enduring management for the forests.

Their uniqueness and 'rarity' are arguments for their preservation.

In truth, the virgin forest is the most rich and complete source of information regarding the organisation and functionality of forestry ecosystems and surely constitutes an essential guide for finding the most adequate measures of enduring man-made management, based on the ecological heritage of the forest.

However, despite the role and importance almost unanimously recognized of the virgin forests, they aren't able to benefit off their deserving statue. Quite contrary, they are being subjected with growing frequency to human activity pressures, and the virgin forests are constantly reducing their surfaces, completely disappearing in some regions and taking with them the invaluable treasury of biodiversity and interactions still unknown and undiscovered.

5.1 International and European regulations concerning the protection of virgin forests

On a European and global scale, a series of regulations and agreements which ensure the enduring management of natural heritage in general and forests in particular have been settled. A number of these agreements have been co-signed and ratified by our country as well.

- *1979 Bern convention on the Conservation of european wildlife and natural habitats* (ratified through law 13/1993) The convention sees to a closer collaboration of the signing countries concerning nature's preservation admitting, among other things, that 'conservation of natural habitats is one of the essential elements of flora and fauna protection.'
- *The 1992 United Nations Conference* on *Environment and Development* has adopted a *Declaration on Environment and Development and Agenda 21* which, among other things, stipulates that 'Aside from encouraging a viable use of forests, we must create and expand a system of protection areas for preserving certain forests. Such forests must maintain the ecological systems and diversity as well as landscapes and habitats of wildlife. The forests must be preserved for their social and spiritual values as well, including those linked to the traditional habitats of indigenous people.'

The problematic proposed by the Rio conference has been reopened within other conventions, regulations and international programmes concerning the enduring management of forests and preserving their biodiversity. Some of those are:

- *The 1992 Rio Convention on Biological Diversity* – ratified by law 58/1994; *Ministerial Conference on the Protection of Forests in Europe* (Strasbourg – 1993; Helsinki 1995; Lisbon – 1998 and Vienna - 2003). Preserving the forestry biodiversity, including that of virgin forests, has been adopted within the following resolutions:
  - implementation of the European web of researching forest ecosystems (S.6.). - Strasbourg, 1990;
  - general guidance towards preserving the biodiversity of European forests (H.2.) – Helsinki, 1993;
  - criteria and pan-European indicators for an enduring management of the forest (L.2.) – Lisbon, 1998;
  - conservation and improvement of biological diversity in European forests (V.4.) – Vienna, 2003;

The Vienna convention establishes (in the second appendix of the Resolution) a number of 3 classes of management for the forests that can be found in protected areas, protection forests and other woodlands, linking the classification proposed by EEA (European Environment Agency) and IUCN (International Union for Conservation of Nature.) For the forests whose main management objective is biodiversity, there are three subclasses which suggest 1. No active interventions; 2. Minimal interventions; 3. Preserving biodiversity through active management.

- *The CEE Directives/409/1979 (Bird directive)* and *CEE/43/1992 (Habitat directive).* The major objective of the ecological web Natura (Nature) 2000 is to establish a 'favourable preservation state' for habitats and species of community interest. Art 4 of the Habitat Directive postulates that for site, management measures must be established from the beginning which ensure the favourable state of preservation for

habitats and species, while art. 6 postulates that for 'special preservation areas (SAC), member states establish the necessary preservation measures, involving, if needed, adequate management plans, specific to the sites or integrated with other management plans as well as legal, contract or administrative measures corresponding to the ecological necessities of the type of natural habitats from annex I and species in annex II of the Habitat Directive, presented in sites. According to the stipulations of art. 11 of the Habitat Directive (92/43/CEE), each member state of EU is bound to ensure the maintenance or reconstruction of the favourable preservation state of natural habitats and wildlife fauna and flora species for the community interest, in order to contribute to maintaining the biodiversity. ('Member states ensure surveillance of the preservation state of natural habitats and species stipulated in art. 2, with a predilection for prioritized habitats and natural species').

- *The EU Biodiversity Strategy to 2020*, adopted in 2011 by the EU, concerning the priority aim for 2020 in the biodiversity field. In order to achieve the aims that will stop the loss of biodiversity, some actions are being suggested, with deadlines and accompanying measures. Part of the third objective of the Strategy, 'the Growing of agricultural and silvicultural contribution in order to maintain and enrich biodiversity', one may find art. 11 (Encouraging forest owners towards protecting and enriching forestry biodiversity) and 12 (Integration of measures concerning biodiversity in forest management plans), which feature measures for protecting wild areas (12) and adoption of new mechanisms (e.g. payments for ecosystem services) in order to finance the maintenance and reconstruction of ecosystem services provided by the multifunctional forests (11b).

  There isn't a general EU policy concerning forests, each country featuring its own regulations in the field. Nevertheless, there are a series of policies and European initiatives which affect the forests (e.g. regulations concerning protection of forests against fires, regulations concerning the protection of community forests against atmospheric pollution, directives concerning the production, certification and genetic control of forest reproduction materials). In 2013, the European Commission has adopted the EU Forest Strategy (COM(2013) 0659), which contains the suggested directions for the elaboration of sector policies which impact the forests. The ruling principles of the strategy are the enduring management of the forests and promotion of their multifunctionality, efficient use of their resources and EU's global responsibility for the forest. The strategy is to be completed by an yearly action plan which suggests concrete measures that are to ensure the promotion of competition and sustainability of the forest sector, the support of urban and rural areas, developing of the knowledge database, protection of forests and preservation of their ecosystems, improving coordination and communication and a more enduring use of wood and non-wood forest byproducts.

5.2 Actions of the scientific community concerning the knowledge, study, and preservation of virgin forests.

- The international scientific community and preserving organisations have manifested in the latest decades a growing interest for studying and preserving the natural forests of Europe. This has been manifested through symposiums, monograph publications, science projects etc., with one single goal: studying and preserving the forests through official protection means. Hereafter you will find the actions that have been organised and finalised towards this goal, in chronological order:

- The establishment of the work group IUFRO being led by professors H. Leibundgut (Zürich) and eventually H. Mayer (Vienna) and the presentation of research papers concerning virgin forests at the IUFRO Congress in Norway (1976);
- Scientific reunion 'Urwald Symposium' – Vienna, 1982;
- Symposium 'Forest dinamics research in Western and Central Europe', Wageningen, the Netherlands, 1985 (J.Fanta editor), 1986;
- Heiss, G. 1987: Inventory of natural (virgin) and ancient semi-natural woodlands within the Council's member states and Finland. Council of Europe, Strasbourg;
- Koop, H., 1989: Forest Dynamics. Springer Verlag;
- Albrecht, L. 1990: Grundlagen, Ziele und Metodik der waldokölogischen Forschung in Naturwaldreservaten. München;
- Patrimoines naturels forestiers. Revue Forestière Francaise, numéro special, 1990;
- Symposium 'European Forest Reserves' – Wageningen, 1992 (Broekmeyer, Vos & Koop eds.);
- The WWF report 'The Status of Old-Growth and Seminatural Forests in Western Europe' (Ibero, C), 1994;
- Symposium 'Conservation of Forest in Central Europe', Zvolen, 1994 (Paulenka & Paule eds.);
- Korpel, Š., 1995: Die Urwälder der Westkarpaten. Gustav Fischer Verlag. Stutgart, Jena - New York;
- Peterken, G.F., 1996: Natural Woodland. Ecology and Conservation in Northern Temperate Regions. Cambridge University Press;
- International Congress "Naturalité et forêts d'Europe". Strasbourg, 1997;
- Gonin, P., 1998: Contribution à l'étude de l'évolution des forêts non-exploitées dans les Pyrénnées. Ass. Forêts pyrénnées. Saint Gaudens Cedex;
- Symposium 'Virgin Forests and Natural Reserves in Central and East European Countries'. Ljubljana, 1998;
- Study conducted by the European Forest Institute: 'A Review of Approaches to Forestry Research on Structure, Succesion and Biodiversity of Undisturbed and Semi-Natural Forests and Woodlands in Europe' (Schuch, Parviainen & Bücking, 1999);
- The Phare study: 'Conservation and Sustainable Management of Forests in Central and Eastern European Countries'. European Commission Phare Programme, 1990 (wrong data concerning the virgin forests in Romania);
- Final report COST Action E4: 'Forest Reserves Research Network in Europe'. EFI, Joensuu, Finland, 2000;
- Gestion de la biodiversité. Réalisations concrètes. Revue Forestière Francaise, numéro

spécial, 2001;

- The WWF report 'La protection des forêts en Europe'. WWF, Gland, Suisse, 2001 (wrong or non-existent data concerning Romanian forests).
- Action COST E4: Research web of forest reserves (FR-NET),1996-2000;
- Action COST E27: Protected forest area in Europe – analysis and harmonizing (PROFOR), 2001-2005 ;
- Inventarul pădurilor virgine din Carpați (Inventory of Virgin Forests in the Carpathians). The Carpathic Convention stipulates in art. 10 the necessity of identifying and protecting the Carpathian virgin forests. More so, the Strategic action plan for implantation of protocol regarding enduring management of the forests in the Carpathian region stipulates on objective 6.1 the creation of a virgin forest inventory. To this purpose, during the COP4, the Criteria and indicators for identifying virgin forests of the Carpathian mountains has been adopted, as well as a common framework of data collection and map creation.
- Trans-national nomination of some old-growth and virgin beech forests as sites of UNESCO's World Heritage 'Beech forests – natural heritage common to Europe as a whole.' Considering the large distribution of beech forests in Europe and their ecological importance, World Heritage Committee has decided that they represent a remarkable example of species evolution and the preservation of specific samples of beech from the entirety of the beech forest areas has a global importance. Therefore, in 2007, surfaces of primary and old-growth beech forests from the Carpathian mountains situated on Slovakian and Ukrainian territories have been included as sites in the World Heritage List (UNESCO) as a series titled 'old-growth forests in the Carpathian mountains.' It encompasses 6 components with a surface of 23,512 ha in Ukraine and 4 components with a surface of 5,766 ha in Slovakia. In 2011, this web has been extended through the inclusion of the most valuable old-growth beech forests in Germany, under the title 'Beech Forests in the Carpathian mountains and old-growth beech forests of Germany' (5 components with a surface of 4,391 ha.) The UNESCO propriety amasses 15 components, with an effective surface of 33,669 ha and a buffer zone of 62,400 ha (Knapp and Fichtner 2011). In the years 2012-2015, a process of extending the UNESCO propriety has been unfolding. 10 european countries (Albania, Austria, Belgium, Bulgaria, Croatia, Italy, Romania, Slovenia, Spain and Ukraine) have suggested additions to the 15 components already being enlisted as series propriety in the UNESCO World Heritage List by Ukraine, Slovakia and Germany (with a surface of 33.669 ha), which included 67 new components (with a surface of 61,661 ha) (Kirchmeir and Kovarovics, 2016) by enrolling them on the UNESCO World Heritage List of the trans-national series titled 'Virgin beech forests of the Carpathians and other European areas' in order to expand the existing UNESCO propriety 'Virgin and old-growth beech forests of Germany' (1133bis.) On a country-level, based on the level of importance, the biggest contributions to the series nomination have been brought forth by Ukraine and Romania (30,4% respectively 25,2% of their entire surface) followed by Bulgaria and Austria (11, 5% respectively 7,5%).
- Rețeaua făgetelor europene (European Beech Forest Network) (2015) is constituted from a series of natural beech forests from the entire specie's diversity and it is dedicated to preservation and ecological research. An important part of the composing forests of this web have been selected as potential candidate components for the expansion of UNESCO's propriety.

- Inițiativa Europa Sălbatică (Wild Europe Initiative (WEI)) – has been promoting in the last 15-20 years the concept of wild areas/wilderness. This concept has been winning ground in Europe, an important step being marked by the adoption in February 2009, of the European Parliament Resolution on Wilderness. Wild areas are considered an important component of the natural and cultural heritage of Europe http://wilderness-society.org/european-wilderness-definition/).

5.3. Protection of virgin forests in Europe

According to the report State of Europe's Forests 2015 (Forest Europe, 2015), the surface of forests without anthropogenic influences (*undisturbed forests*) amounts to approx. 7,3 million ha (3%), of which only 3,1 million ha are state members of the EU, the rest of them being in Russia and ex-soviet territories. It must be mentioned that the undisturbed forest category, aside from the virgin forests, also includes forests that have suffered some interfering in the past and which are presently developing freely, without any silviculture intervention. The largest surfaces with such forests can be found in Northern Europe/Scandinavia
(Sweden – 2 417 000 ha, Finland – 230 200 ha, Norway – 160 000 ha) and in South--Eastern Europa (Romania – 280 000 ha, Bulgaria, Ukraine – 59 000 ha, Slovakia – 24 000 ha, Slovenia – 49 000 ha, Montenegro – 109 000 ha). West and Centre European countries do not feature the aforementioned forests (Great Britain, Ireland, France, Germany, Spain, the Netherlands, Belgium, and Hungary) or feature them in smaller proportions. This state reflects the history and intensity of anthropogenic activities, with the largest surfaces of undisturbed forests being found in the most isolated or farthest areas, away from any living areas or in some inaccessible areas with difficult climatic and topographic conditions.
The constitution of natural protected areas is the most used and efficient method of forest preservation, with a high level of naturalness, representing an essential pillar for the laws concerning nature preservation in Europe. According to the report State of Europe's Forests 2015, approx. 12,2 % of Europe's forests are part of protected areas (approx. 29,9 million ha), but only 1,5 % (approx. 3,1 million ha) are under strict protection („no active interventions – category 1.1. MCPFE". Almost 2/3 din of the forests being strictly protected are in the Northern countries – Finland și Sweden.
The ratio of protected forests varies from 0,1% in Switzerland, Croatia, etc. to more than 6,6% in Finland. In absolute values, the surface of virgin forests varies according to the forestry surface, from a c9ouple of hundreds ha in Switzerland to more than 1,500,000 ha in Finland.

The establishment of a **strict forest reserve** (assimilated to the Ist category according to IUCN classification) is the instrument the most used in Europe for the preservation of forests with a high naturalness degree and ensuring their free development. The establishment of the aforementioned reserves are strictly regulated by (COST Action E4, 2000):

- Code/laws regarding nature preservation: Austria, Denmark, Finland, France, Germany, Italy, Great Britain, the Netherlands, Portugal, Spain, Sweden.
- Code/laws linked to silviculture: Belgium, France, Germany, Hungary, Italy, the Netherlands, Slovenia, and Great Britain.
- Both codes and laws: France, Germany, Italy, Great Britain.

- Administrative regulations (contacts) or ministerial orders: Austria, France, Germany, Denmark, the Netherlands, Great Britain.

In no European country the exhaustive protection of forests without any anthropogenic influences has been regulated. But in Scandinavian countries – Finland and Sweden – there have been Rezervații Forestiere Stricte ('Strict Forest Reserve') founded on large surfaces, ever since the last decade of the XXth century, following the implementation of resolutions from the *Ministerial Conference on the Protection of Forests in Europe* (Strasbourg, 1993; Helsinki, 1995), Resolution .6 to be precise: The Implementation of an European web for forest ecosystem research and Resolution H.2: General guidance for the preservation of European forest biodiversity.

Today, the **northern countries** have the largest strict forest reserve system: Finland over 1,520,000 ha, Sweden approx. 800,000 ha, Norway 50,000 ha. Great surfaces of forests without any anthropogenic influences have been included in other European strict forest reserves: Italy 62,000 ha, Germany 25,000 ha, France 15 000 ha, Great Britain 10,000 ha, Austria 6,000 ha, Hungary 3,650 ha, the Netherlands 3,000 ha, Belgium 1,300 ha, Slovakia 96,000 ha.

Propriety regime. In the majority of the aforementioned countries, the strict forest reserves include mainly government-owned forests. As an example, Sweden, approx. 250,000 ha of production forests without any anthropogenic influences have been included in the strict forest reserves by the National Forest Administration. Moreover, public forests that are propriety of territorial-administrative units – municipalities, villages – are well represented in some countries: Finland, Sweden, the Netherlands. There are some countries where private forests which are propriety of Owners' Associations, corporations, foundations, NGOs or even citizens are included in thr web of strict forest reserves: Austria, Belgium, Germany, Denmark, the Netherlands, Spain, Sweden, Finland, and Great Britain. As another example, Finland has more than 50,000ha of private forests that haven't suffered any anthropogenic interference and were included in the strict forest reserves.

Administration of the strict forest reserves is being done either by the government forest administration services – in most of the countries – either by the public entity/entities responsible of preserving nature – in the Netherlands, Sweden, Spain, Hungary, and Portugal. In some situations, administration is done by private entities: Great Britain, France, the Netherlands, Hungary – or by NGOs – Austria, France, the Netherlands.

Scientific coordination. In most cases, the web of strict forest reserves is the object of monitoring and researches programmes. These are mainly coordinated by the national research institutes, the state forestry association or the entity responsible with nature preservation. There are numerous entities involved in the research and monitoring programmes: universities, museums, private research institutes, NGOs, professional associations, independent experts of various backgrounds.

Another way of preserving the forests with a high naturalness degree is by including them in some categories of **protected natural areas – mainly natural reserves and national parks –** which have a protection regime that ensures not only the free development of the forest, but also the ability to conduct monitoring and research activities. This solution has been

used in the majority of the European countries, including those in the south and south-east of Europe: Slovakia, Poland, Ukraine, Belarus, Romania, Bulgaria, Greece, Serbia, Montenegro, Macedonia, Albania, Croatia etc.

Regarding countries in the Carpathian area, the Convention that frames the protection and an enduring development of the Carpathians, known as the Carpathian Convention, has created a framework for adopting and creating an enduring harmonized management of the area's forests and particularly for protecting the Carpathian virgin forests.

The Carpathian Convention, built on the model of the Alpine Convention, has been adopted by seven countries – the Czech Republic, the Hungarian Republic, the Polish Republic, Romania, Serbia, the Slovak Republic, Ukraine and the EU on the 22nd of May 2003, in Kiev. Romania has ratified to the convention through law 389/2006. As part of the convention, member states have agreed, among other things, to: 'adopt adequate measures in order to ensure a high level of protection and enduring use of natural and seminatural habitats (..)' (art 4, line 1) and to promote 'policies which aim to designate natural protected areas, especially virgin forests, in such a number and size that will aid in achieving the goal of restricting or adapting their use in order to achieve the preservation objectives' (art 7, line 5). In order to achieve the aforementioned objectives, the states might adopt various protocols. Such a document is titled 'Protocol concerning the enduring management of forests' adopted by Bratislava on the 27th of May 2011 and ratified by Romania through law 76/2013, which aims to 'promote enduring management and protection of the Carpathian forests, to the benefit of present and future generations'. Some of the actions through which member states contribute to the realisation of the protocol's aim are the unfolding of activities and cooperation towards the 'identification and protection of natural forests, especially virgin ones' (art 1, line 2, point g). It is for this reason that article 10 postulates the following specific measures:

1) Each Member will take measures on its national territories, in order to identify and protect natural forests, especially the virgin Carpathian ones, by instituting protected natural areas numerous and wide enough and through other specific measures of protection.
2) Each Member will take measures for including in the protected natural areas enough surfaces to cover all the types of natural forests identified in the Carpathians.
3) It is of particular importance that each Member will take specific measures for the preservation of the natural forests' genetic resources, especially in the case of virgin forests.
4) Each Member will take specific measures to compensate any costs or economic losses resulted after applying measures taken following the first three points.

As of COP4, the Member have adopted 'Criteria and indicators for the identification of virgin forests in the Carpathian mountains and building a common framework for data collection and map creation' and currently, some inventory activities of the virgin forests and their protection are being unfolded. Protecting the virgin forests works with the help of the following tools:

- the national system of protected areas (categories Ia, Ib and II IUCN);
- the development of the **National catalogue of virgin and quasyvirgin forests** as a tool of enlisting and ensuring a strict protection of these forests;

- voluntary engagements or private contracts of the forests' owners concerning the protection of forests that have a high naturalness degree.

One can confirm the fact that currently, states that partook in the Carpathian Convention have the largest legal framework in order to protect virgin forests. The biggest challenge currently and in the near future is the best, fastest and correct application of these regulations, so much so that not much more of this exceptionally European natural heritage will be lost.

6. Virgin forests in Romania

6.1 From the historical knowledge of virgin forests in Romania

Currently, there are some voices, in the country and outside it, which are trying to advocate the fact that the Carpathians don't have any virgin forests left, all forests having been explored by woodcutters in the past and we are dealing exclusively with man-managed forests. And the forests that do contain arboretum that is 140-160 years old are actually forests where trees have been selectively picked out, only of some species, either with economic value at the time – e.g. softwood or sessile, either trees featuring a higher quality of wood. Such affirmations are coming either from an ignorance of the forest's history and implicitly of Romanian silviculture, either from the intention of questioning their preservation process that are currently being developed.

In the following part, we will present a series of declarations made by relevant scientific entities about the existence of Romanian virgin forests, as well as data and documents which confirm their words.

The first declarations concerning the existence of virgin forests in the Romanian area and the importance of studying them have been made in the last two decades of the XIXth century, following the arguments concerning 'the adopted standard for managing forests in the Romanian Kingdom (the German standard of the even aged forests or the French one for odd aged forests)' (Dissescu și Doniță in: Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001). In 1890, the silviculturist G. Hüffel, invited by the Romanian government as an expert to analyse the state of the forests, describes the virgin forest Piscul Câinelui (the Dog's Peak) from the Sinaia Forest Area (Ocolul Silvic Sinaia) – as noted in a bulletin of the Agricultural and Propriety Ministry from 1890). The same author describes in French the virgin forests of Romania (in 'Revue des eaux et forêts'), an article which has been also translated to Romanian, in Revista pădurilor (Hüffel, 1894) (Forest magazine). In 1881, silviculture professor Petre Antonescu writes about the Letea and Caraorman forests from the Danube Delta in the same magazine, showing that they're 'forests of European reputation' and are introduced by 'various foreign writers, reputable foresters which have researched the forests in Dobrogea and all of them are speaking highly of these forests.' In the same year and in the same magazine, P. Antonescu describes the gardening treatment, shortly after in France A. Gurnaud has been sketching the outlines of this treatment, and recommended its application in the unexplored forests of the

Carpathian mountains. Concerning virgin forests, in 1903, as part of the settlement of the Special Silviculture School from Brănești, P. Antonescu declares that 'in our country there are many forests, especially in the mountain area, which due to the lack of means of transportation hasn't been explored. In such forests, the arboretum has the shape of forests that have been irregularly gardened, meaning that the ages and dimensions of trees are unevenly mixed or present themselves as small even aged clusters or bouquets, distributed evenly all over the surface of the forest.' This description showcases the author's good knowledge of the Carpathian virgin forest's characteristics. In 1908, the same author, some of the first supporters of nature preservation in Romania, uses for the first time in the Romanian academic and scientific literature the term 'natural monument' and shows his indignation about the fact that 'nobody has shown an interest in Romania towards natural monuments, nobody has taken any measure to preserve the integrity of the treasures that once adorned so thoroughly our beautiful country.' Later, as part of a forestry activity programme he has initiated (1915), he requested 'the absolute need of passing a law which will launch an inventory and a defence for the destruction of (...) all natural monuments' and 'a part of the virgin forests to be preserved in order to not salvage their specific aspect for posterity and to study the vegetation of its vegetal giants, which will soon become a rarity.' (Antonescu, 1915). In 1906, in Bucovina, some actions are taken towards the development of the Old-Growth Slătioara Reserve, on a surface of 671,11 ha, which encompassed 'a forest that hasn't been touched by the axe'(Gușuleac, 1937, cited by Ichim, 1988).

In 1906, in the paper The State's Forest Statistics, put together by the Ministry of Agriculture, Commerce, Industry and Propriety, there is a mention of the fact that in the year 1905, only 22,7% (208,984,95 ha) of the surface of public domain forests has been exploited, the surface of the unexploited forests amounting to 709,840 ha. In the aforementioned paper, which is the second forestry statistic in Romania, created 6 years after the 1899 one (that was published in 1900), there is a mention of the lack of a satisfying development of the forest sector due to the high pollution of unexploited forests and that only after the year 1900 some of these forests have been valued better in the public eye: 'It is our duty to explain that our forest situation, taking into consideration only the public domain forests, isn't as desirable as one would think, since the overall 709,840,54 ha surface contains firstly 242,032,20 ha of beech forests, which only lately have been started to be adequately valued, secondly there is a significant area of the 20,867 ha softwood forest that has been sold for long periods of time (1-10 years, 1-15 years or 1-20 years) – as seen in table 10, which hasn't been exploited yet, and last but not least there's the multitude of oak, Austrian oak and Italian oak forests....' In the same paper, one might find a situation of unexploited forests divided by counties, with big numbers in the mountain areas. We must point out that the aforementioned data refers to the land pertaining to the Romanian Kingdom with the borders it featured in the first decade of the XXth century, with a surface of 13,135,300 ha and without Transylvania, Bucovina, Banat, Crișana and Maramureș, and it refers only to the public domain forests, which amounted to approx. 39% of the overall forests in the country. Surely, large areas of unexploited forests could be found, at the time, in the property of the King and of the villages, public establishments and private owners.

This situation can be explained by the lack of means of transportation that facilitated the access to the forests in the mountain areas, through the slow development of the forestry industry and to the little interest for beech wood available at the time. Telling of the

importance of beech wood is the declaration of M. Boiu (1904), published in Forest Magazine, in a paper titled 'A supported report and the possibilities of our old-growth mountain forests': 'where the beech mixes with the fir, without having any value whatsoever, which is usually the case in the mountains, where landscapers would classify it as a bush, or as a kind of weed, and will showcase its existence in the mountain chains by appreciating or even calculating is value as wood mass, but would greatly avoid taking into consideration its potential. To sum up, only from a cultural point of view would the landscapers suggest its eradication (axing down), which is a barbaric method, but the only one able to absolve the softwood forests of this invader, which in man-managed forests expands with an unmatched annoying kind of nerve.' In 1912, the forest engineer V. Golescu declares that 'the most efficient means to protect the landscape (...) would be the creation of national parks similar to the United States (....) in some of the public domain forests. These parks would allow for interesting research to be conducted on the virgin forests, which are soon to become quite rare.'

In the interwar period, a series of researches concerning the structure and processes developing in the Carpathian virgin forests have been conducted by foreign foresters (Frölich, 1925, 1930, 1937, 1940; Rubner, 1934, 1940), and by Romanian ones (Popescu-Zeletin, 1936; Rădulescu, 1937; Rucăreanu, 1939; Prodan, 1944). In the PhD thesis by I. Popescu-Zeletin that has been presented in Giessen in 1936, by N. Rucăreanu in München in 1939 and by M. Prodan in Freiburg in 1944, all dedicated to man-managed forest treatment, the importance of virgin forest research towards organising man-made management centres in the forests that were treated as such was highlighted. (Dissescu și Doniță in: Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001).

After the Second World War, I. Popescu-Zeletin together with his collaborators initiates the widest research programme of virgin forests. I. Popescu-Zeletin will identify in 1943 and subsequently will install, with the help of his collaborators, L. Petrescu and M. Stănescu, in 1949, five surfaces for the study of virgin forest dynamic that includes a beech-fir-spruce mix in the south-east Carpathian mountains, publishing the first results in 1956 and 1958 (Popescu-Zeletin et. Al., 1956, 1958.) The results of this research (Popescu-Zeletin, Dissescu şi Puiu, 1961; Popescu-Zeletin and Dissescu, 1962, 1964, 1967; Dissescu and Florescu, 1961, 1964; Popescu-Zeletin and Florescu, 1968; Dissescu and colab., 1968, Bândiu and Mocanu, 1975), completed by other similar research by other foresters in the country (Predescu, 1953; Costea, 1962; Leahu, 1970, 1971, 1972, 1984; Târziu, 1969, 1970, 1973; Papavă, 1977; Dissescu and Leahu, 1980, 1982, 1984; Cenușă, 1986) have brought significant contributions to the knowledge database of Romanian virgin forests. Unfortunately, the bigger part of this research, being published exclusively in Romanian, did not reach the international academic community, especially the forest science community outside the borders of the country.

Of an incommensurable value and relevance to the signalling of virgin forests in the Carpathian mountains are the declarations of forest engineer Zeno Oarcea, which he has given throughout his professional career as a forest management engineer, which spanned

between the years 1957-1990 (Oarcea, 2016). The author, whose career has become forest management above anything else, has started his activity in the summer of 1957, still being a silviculture student in his last year, beginning with the second cycle of forest management. During the forest management campaigns, having direct contact with the virgin forests and the fascinating Carpathian landscapes, he understands the importance of their preservation. He approaches the issue of forest management in the context of biodiversity conservation, protected national areas and touristic and recreational forest management, being the initiator of new directions in the field nationally and internationally, that weren't regulated in the instructions and technical norms of forest management at the time. In 1964, once the Retezat mountain forest management started, he managed to expand the set-up to a national park, the only one at the time, which is being officially established in 1935 but which had been existing informally without an assigned administration. He pleads for the establishment of the National Retezat Park administration, but the idea is being obstructed by the project coordinator and the proposal doesn't get the support of the central authorities of the state. Starting with 1973, he proposes and supports the establishment of the Romanian national parks system at a time when concerns for preserving biodiversity through the creation of protected natural areas were almost non-existent in our country. Between the years 1973-1978 he elaborates fundamental research for the establishment of 13 national parks, but those aren't being used by state authorities. We will reproduce here a couple of quotes from the book that are signalling virgin forest areas, which were still taking up large areas in the south-west Carpathian mountains of Romania:

> ***14th of May 1958 – Gura Scocului (UP IV Pleștioara, OS Runcu, county Gorj)***
> *'After a couple of days of break, throughout which I put all my efforts in my diploma thesis, on the 12th of May I went up to 'Gropul' with engineer Vucea, the site coordinator. We were entering a closed-up virgin forest area of approx 1200 ha, a bottomed area without any lodging possibility. It was a nice trip during a sunny day. We first walked the path under the Balta through, under the Pleașa peak. A small stop and some photos taken in the Gainușa Meadow, followed by a steady and then abrupt descent on the Gruiul Băiașului, with the last stop at the bottom of the valley, in a small meadow near Gura Socului. No sheepfold or other form of lodging available. Before night came upon us, we fashioned sort of a hut. It was spacious enough to accomodate the entire team. A sole steep roof, covered with bark and fir needles, on the ground leaves and fir needles. The open side of the hut was facing the Șipot river which was flowing furiously a couple of feet ahead. We used a couple of old boards we found on a nearby old sheepfold ruin. We spent 10 days there, until our supplies ran out and we finished the bottomed area: Bazinetul Scărişorii, Pârâul Infundat, Pârâul Tisului,Pârâul Gruiul Băiaşului. Everything was tightly filled with trees that belonged to a very interesting beech virgin forest that I haven't seen before.10 days where I've seen only forest all around me, and no other view. Lucky us, we had maps that featured level curbs and also an altimeter. We were leaving in the morning, climbing a hill, then before the evening we were crossing to other hills and at last we returned to the hut. The village workers, that haven't step foot here before, were completely lost. Trouts and beech mushrooms abounded. They were growing in bunches on the bark of old-growth beech trees. We could easily feed off them. The multi-layered beech virgin forest, with*

clean tree trunks, smoothed by the passing of ages, with all their secrets, has bestowed a great impression upon my mind.'

20th of August 1958
'From our camp site in Paltina, we have finished working around the entire Pleștioara unit. It can be already considered a victory. Over 4000 ha managed, beech virgin forests, chalk area with incredible landscapes, wilderness, loneliness, long and tiring trips.'

18th of July 1960 (OS. Băile Herculane, county Caraș Severin)
'We started proper work. We approached at first the Iauna Mare basinet. Both Iauna basinets are completely filled with impressive beech virgin forests. I am starting to decipher their secrets. A compact mass, from the bottom of the valley up to the open peak on top of Cerna. Discreetly, as a sub-layer, we found fir trees. The beech escalates up to the open peak, around 1400-1500m. The spruce layer is missing.'

25th of September 1960 – La Schit (OS. Băile Herculane, county Caraș Severin)
'Two more weeks have passed of hard work on the Valea Craiovei. A wild valley, completely populated by beech virgin forests. A path barely traced in the valley. Otherwise, virgin river bed, with fallen and rotten trunks, with weeds often the size of one man, with many rocks, with hard to access areas. And (...) daily we have to climb between 5-8km in this valley.

I have been preoccupied as well with the virgin forest issue, particularly the endless virgin forests I have encountered in this trail. Firstly, their oddly-shaped trunks that have been trimmed for ¾ of their length, which means their type variety is even richer than the one enlisted in the tables. Secondly, the overall structure of these arboreta. Another aspect which shocked me is the presence of fir trees among this arboretum, which has been partially extracted by people. Made into logs on the spot and then carried with horses in the village. The only anthropogenic interference in these arboreta.'

13th of June 1961, U.P. IX Cernişoara, OS. Băile Herculane, county Gorj)
'The forest in the area is the same beech virgin forest that I already know well. The peak is only reached by the beech trees. However, in Vlăsia mare, we also encountered spruce, isolated in clusters, on 'sun-shines' according to the beautiful local language.'

17th of August 1961 (Izvoarele Cernei, OS. Băile Herculane, county Gorj)
'On our way to Cerna (...) on the beautiful strategic road to Soarbele. The view is terribly beautiful in some areas, then there's the rare beauty of the virgin forest from the Răchițeaua basin.'

(1970 campaign - UP IV Higeg Bărănel, O.S. Teregova, county Caraș Severin)
'After the deluge days that have kept us locked up in the cabin, the sun is finally out. Forced labour to recover the delay. Valea Higegului, stiffed, with dark beech virgin forests. Long hours of walking until the Poioana Tâlharilor, close to Țarcu. Slept under beech trees. Not a soul in the entire valley.'

(Zeno Oarcea: Amintirile unui amenajist. Editura Silvică, Seria IV: Diseminare/Promovare, 2016, 286 p.)
(Zeno Oarcea: The memories of a man-made forest manager. Silvica publishing house. 4th series. For publication/promotion. 2016. 286 pages)

In the last decades of the communist period, the scientific knowledge of virgin forests has been pushed to the side, forest research and action being mainly redirected to other goals, like those concerning the expansion of cultivated local species such as softwood (spruce, pine trees) outside their natural areas and of some exotic species (douglas, Weymouth pine, etc.); cultivation of cloned Euro-American poplars; chemical extinction of the forest's pests etc.

After 1990, the interest for the Carpathian virgin forests encounters a renaissance. The Romanian virgin forests have started to gather the interest of thee international scientific community, from preservation specialists to foresters and biologists from various countries. In the last two or three decades, several scientific research projects have unfolded which were aiming to decipher as much information as possible from the informational treasure amassed by the virgin forests, which has eventually led to certain scientifically-relevant results, many of those being of use to PhD thesis or being published in prestigious scientific magazines that made the rounds of the international academic scientific associations.
A detailed presentation of the projects that have been developing in the last three decades on a national level (concerning the study and preservation of virgin forests) can be found in subchapter 6.3 'Recent actions concerning the study and preservation of Romanian virgin forest'.

6.2. National regulations concerning the preservation of Romanian virgin forests

In the interwar and communists periods, **the main factor** which contributed to the preservation of large surfaces of virgin forests to this day was **the lack of access** available for man. It is for this reason that in isolated mountain areas, which didn't have any man-made paths, the forests were fortunately preserved, even though man-made management has included them in the economic circuit.

Another important **mean** of slowing down the accelerated destruction of the virgin forests was man-made forest management, in particular **the functional area-dissemination of arboreta.** Through forest area-dissemination criteria (Popescu-Zeletin, 1952; Giurgiu et al. 1978; Giurgiu, 1988), a large portion of forests fulfilling biodiversity preservation needs or playing other important roles have been evicted from the economic circuit. Here are a couple of examples:

- old-growth forests of incommensurable value;
- forests whose purpose was to preserve rare species of indigenous fauna;
- forests situated on areas with a slope bigger than 30 (35) degrees, on cliffs and rocks;
- forests that can be found in higher altitude areas, on the superior border of forest vegetation;

- forests in river bed areas;
- forests found near avalanche-prone areas and their respective originating areas.

Through the natural circumstances and specifics of Romania's Carpathian mountains, in the aforementioned forest categories the virgin and quasyvirgin level is quite high, especially in the case of the first kind, old-growth forests. All these forests have been subjected to a special preserving regime. Unfortunately, anthropogenic interferences of low intensity have been permitted, including trimming interventions (extraction of dead wood, decaying wood, of fallen or wounded trees etc.) Since many of these forests have been and still are inaccessible and wood gathering wasn't possible or even profitable, virgin or quasyvirgin arboreta that have been subjected to the special preservation regime continue to develop more in their natural conditions, maintaining their original structure.

Relatively few forests have been preserved in **protected natural areas** that have been built in the interwar and communist periods. Until the XXth century there weren't any special regulations for the creation of protected natural areas, case in point for the preservation of virgin forests. The first natural reserve built through royal degree is established as late as 1927 (Pădurea Niculițel in Dobrogea). Later, through the decisions made by the Agriculture Ministry, a number of virgin forest areas are being decreed natural reserves: Cocora, Slătioara, Cazanele Dunării, Piatra Craiului, Retezat etc. The passing, in 1930, of the first 'law for the protection of natural monuments' has allowed the building of the first protected natural areas. The Retezat natural Park has been constituted (in 1935), constituting mainly of virgin and quasyvirgin forests. On the same basis, the forest fund has legally constituted 15 natural reserves, many of them including virgin forests: Pădurea Domogled, Pietrosul Mare, Slătioara, Giumalău, Bucegi, Beuşnița etc.

During communism, only a couple virgin and quasyvirgin forest areas have been legally registered as protected areas: Cetățile Ponorului and Valea Galbenei, Pietrele Doamnei, Defileul Crişului Repede. Otherwise, during the years 1954-1972, thanks to the considerable help of the foresters, through man-made management of the forest and local administration decisions, numerous natural reserves have been constituted, which include virgin and quasyvirgin forests; the aforementioned reserves have not been legally recognised. (Toniuc et al., 1992).

At last, another **mean of preservation**, at least partially, of the aforementioned forests, touches on a silvicultural dimension. Meaning that through specific regulations, some virgin and quasyvirgin forests have been suggested for regeneration through the man-made management method, with little interference, which, due to not being profitable, has not been completed.

Older actions which pleaded for the reconsideration of protected areas and the role of virgin forests in our country have been brought back with enthusiasm after the fall of communism.

After 1990, the main points of reference regarding the legal framework for nature's protection and biodiversity's preservation and which contributed to the protection of some virgin forests in our country are:

- Ever since February 1990, through ministerial decision, 13 national parks have been constituted (some of those eventually becoming natural parks) covering a total surface of 394,000 ha (including buffer areas), all of them encompassing important virgin and quasyvirgin surfaces: Rodna, Călimani, Ceahlău, Cheile Bicazului-Hăşmaş, Bucegi, Piatra Craiului, Cozia, Retezat, Domogled-Valea Cernei, Semenic-Cheile Caraşului, Cheile Nerei-Beuşnița, Apuseni, Delta Dunării. The fundaments for declaring the 13 aforementioned areas national parks have been the studies conducted by dr. ing. Zeno Oarcea during the years 1973-1978.
- Law 137/1995 concerning environmental protection stipulates the obligation to protect the arboretum which, according to man-made management, doesn't feature any forestry interferences (nor is it allowed to feature) as well as the inclusion in the national system of protected areas of samples representing all types of habitats. The same law postulates that plans for man-made management regarding biologic resources, including forests, has to be done in accordance with the management objectives of biodiversity.
- The following National Strategies and Action Plans for Biodiversity Preservation (SNPACB), which have been created in 2000, respectively 2012, have been focusing their efforts on preserving biodiversity and the implementation of the Natura 2000 web on a national level, as well as on adopting and implementing management plans and preservation methods for species and habitats of public interest, together with taking adequate measures for the enduring socio-economic development of local communities in the protected natural areas, through the promotion and support of the natural and cultural capital and of the traditional and present-day activities and actions which favour the sustainable use of natural resources and their respective lands. (SNPACV 2013-2020). Concerning virgin and quasyvirgin forests, SNPACB 2013-2020 stipulates that 'presently only 75% of those have been included in protected natural areas and only 18% can be found in strict protection areas, where any anthropogenic influence is forbidden. 10% of the PFI surface (intact forest landscapes) has not been put under any protection status and only a small part can be found under the complete or strict protection area, where any anthropogenic influences are forbidden', but SNPACB 2013-2020 does not bring to the table any other measures or actions that are to be taken in order to preserve the aforementioned forests.
- The enduring development strategy of the Romanian silviculture between 2000-2020 (MAPPM, 1999) has the following objective 'II.6 The preservation of biodiversity and the maintenance of forest stability, health and its multifunctional role.' which stipulates the following concrete measure dedicated to preserving virgin forests: '6.1. The protection of forests that feature natural and seminatural structures', part of which includes the following: 'alongside the preservation, maintenance and monitoring actions, it is now imperiously needed to include the virgin, quasyvirgin and primeval forests in the national and international scientific circuit, for the study of structural and functional laws in their natural ecosystems, in order to be able to

man-manage cultivated forests. These forests can and have to become a true (in situ) laboratory
of international scientific interest.'

- The issue of virgin and quasyvirgin forest protection has been mentioned in 'The development policies and strategies for the Romanian forestry sector 2001-2010' which stipulated in one of its objectives that 'The preservation of the biodiversity found in forest ecosystems and the adoption of an adequate institutional framework' was a measure meant for the preservation of virgin and quasyvirgin forests (A7.4).
- Law 5/2000 which was concerned with the validation of the Land landscaping plan – section III: Protected areas – includes a number of objectives which target virgin forests. According to the inventory which resulted from the PINMATRA/2201/018 project, approx. 25% of the 220,000 ha of the inventoried virgin forests were located in protected natural areas. Approx. 16% were part of national and natural parks, but they weren't always found in the complete protection areas, which allowed for exploitation in some parts, and approx. 9% were part of natural reserves, outside national or natural parks.
- The technical norms for forest management that have been set up in 2000 (MAPPM) stipulate the establishment of a functional category dedicated to virgin forests: '1.5k to include virgin and quasyvirgin arboreta, as well as old-growth arboreta that aren't classified as protected areas, but bring quite the added value to biodiversity preservation' under the secondary group 1.5 – Forests which present scientific interest and may protect the forestry ecofund and geofund. There forests 'won't be included in the wood production process regulation. They may feature in the management plan in order to be included in trimmings and other actions that won't affect their wood production value. With the right justification, and through agreements, other valuable forests may be enlisted as protected: odd-aged natural forests of exceptional value, arboreta that are on the bridge of extinction or disappearance etc. Under this measure, forests that are meant to become reserves of various sorts may be protected according to the environmental-protection Law.' Very few surfaces that feature virgin forests will be included in the 1.5k functional category as of next decade's management – probably around 5,000-6,000 ha. Moreover, some of those require tree trimmings as per their current landscape.
- The 2008 forest code (law 46/2008), has a first mention of virgin forests in article 26: 'The preservation of the forest ecosystems' biodiversity involved enduring long-term measures, through intensive care treatments, which are promoting the natural regeneration of the species that are native to the forest and through the preservation of virgin and quasyvirgin forests.' Operationally speaking, this measure did not improve in any way the actual preservation of virgin forests.
- Forest management certification or, in short, 'forest certification', has been initiated nationally as of 2000. Forest certification systems require a set of principles for the management of forest resources, in order for the wood used in any wood-related industries to come from a known and accountable source. Due to the forest certification process, Forests with a High Preservation Value

(PVRC) have been identified, and their specifications are as follows (as per www.fsc.org):

- biodiversity clusters (which feature rare, endemic, extinction-prone or threatened species) of global, regional or national value;
- extended forest landscapes of global, national or regional significance with viable populations of local species in their natural manifestations of distribution and density;
- rare, threatened of extinction-prone ecosystems;
- essential environmental emergency services (including water sources, erosion control, pollution elimination etc.);
- they are essential for fulfilling the needs of local communities (subsistence, health);
- they are essential for the preservation of the religious and cultural identities of certain areas or communities.

In the PVRC 2 category some virgin and quasyvirgin forests have been included, but the most important surfaces have been omitted. Presently, in Romania there are over 2,5 million ha of uncertified forests, of which 2,3 million ha state forests (administered by RNP Romsilva through 28 forest directives and 216 forest districts.)

- In 2012, the Forest and Environment Ministry produces O.M. 3397/2012 concerning the establishment of criteria and indicators of identification for the Romanian virgin forests, following the *Salvați Pădurile Virgine!* (Save the Virgin Forests!) campaign initiated by WWF Romania. This order has offered the landscapers a tool for identifying virgin and quasyvirgin forests, towards their adequate classification in forest landscapes. Although WWF has identified and forwarded the Ministry documents for about 30,000 ha of virgin forests, the process of including those in the appropriate functional categories 1.5j – virgin forests and 1.5o – quasyvirgin forests has been quite slow. Between the years 2012-2016, approx. 6-700 ha of virgin and quasyvirgin forests have been included in their respective functional categories through forest landscapes, a rhythm too slow for the eradication of their destruction. The central public authority which is responsible of silviculture has invoked the owner's and/or forest managers' lack of cooperation, as well as the lack of rigorosity in the application of this order by landscapers. Moreover, the legal procedures concerning the protection of virgin forests, before their classifications into functional categories 1.5j – virgin forests and 1.5o – quasyvirgin forests, have proven to be inefficient, due to the following reasons:
  - instating the strict protection is long process, with the identified virgin forests being cleared for adequate functional classifications once the forest landscapes are being redone (which happens once every 10 years);
  - they don't always entail a transparent and **participative process**;
  - **the protection status is not guaranteed** for long periods of time;
  - **the prevention system**, instituted until the process of forest identification is finished, is **inefficient** because it applies to less than 80% of cases (practically-speaking, the procedures only refer to forests included in the recurring decade plans of the main products'

harvest – and it's not referring to preservation tree cuttings, trimmings or accidental cuttings).

- Law 133/2015 for the modification and completion of law 46/2008 – Forest code changes the content of art. 26 and postulates in line 3 that 'Virgin and quasyvirgin forests will be strictly protected and included in the "National Catalogue of Virgin and Quasyvirgin Forests", that has been instituted as a tool for keeping the evidence and order management by the leader of the central public authority which is responsible of silviculture. For the recognition of the exceptional value and for their long-term protection, virgin and quasyvirgin forests shall be included in UNESCO's National Heritage, scientific reserves and/or their integration in the areas of strict protection found in national or natural parks.'
- Through the Environmental, Water and Forest Minister's Order nr. 1417/11.07.2016, the institution of the National Catalogue of Romanian Virgin and Quasyvirgin Forests has been approved, as a tool of registering and management of virgin and quasyvirgin forests of Romania. According to the items mentioned in in article 1 line 2 of the Order 1417/11.07.2016, 'the institution and permanent actualisation of the Catalogue shall be done by the central public authority responsible of silviculture' and will be published on their website. In the first stage, the central public authority responsible of silviculture suggests, based on art. 2 of O.M. 1417/2016, the enlisting of landscaping units (UA) that fit the functional categories 1.5j and 1.5o (main, secondary and tertiary functional category) in the Catalogue according to forest landscapes and which fit the criteria and identification indicators of virgin and quasyvirgin forests mentioned in Order 3397/2012. This process has seen to the selection of only those UA enlisted in the 1.5j and 1.5o functional categories which fit the criteria and identification indicators of virgin and quasyvirgin forests mentioned in Order 3397/2012 and the exclusion of those that have been ridden with anthropogenic influences that have affected the naturalness level over the accepted limit accepted by the criteria and identification indicators of virgin and quasyvirgin forests mentioned in the aforementioned normative act. Special land units (Forest Guards) have sent to MMAP overviews of forests found in their activity range, in private or public ownership and which feature a proper forest landscape, as well as overviews put together by RNP Romsilva, for the forest fund found in the public ownership of the state. Table 1 presents the centralised situation of virgin and quasyvirgin forest surfaces found in the state's property whose Catalogue inclusion has been suggested by RNP Romsilva, while table 2 presents the centralised situation of virgin and quasyvirgin forest surfaces found in public and private ownership, whose Catalogue inclusion has been suggested by the Forest Guards. The detailed situation of UA enlisted in the functional categories 1.5j and 1.5o (main, secondary and tertiary category) which fit forest landscaping plans and the criteria and identification indicators of virgin and quasyvirgin forests mentioned in Order 3397/2012, suggested by special territorial units of the public central authority responsible of silviculture to be enslited in the National Catalogue of Romanian Virgin and Quasyvirgin Forests

is featured as an appendix, following the structure and standard featured in annex 1 of Order 1417/11.07.2016.

Table 1. The situation of virgin and quasyvirgin forests found in the state's property and included in forest landscapes as of the end of 2016.

Nr. crt.	Forest District	Surfaces of forests included in the 1.5j functional category (ha)	Surface of forests included in the 1.50 functional category (ha)	Total surface (ha)
1	Bacău		153.21	153.21
2	Bihor	920.98	647.62	1568.6
3	Caraş Severin	318.94	6152.7	6471.64
4	Hunedoara		405.45	405.45
5	Maramureş	611.59		611.59
6	Prahova		525.59	525.59
7	Sibiu		93.8	93.8
8	Suceava	107.12		107.12
Total		**1958.63**	**7978.37**	**9937.0**

Table 2. The situation of virgin and quasyvirgin forest surfaces found in ÙAT and private ownership and included in forest landscapes as of the end of 2016.

Nr. crt.	Forest Guards	Surfaces of forests included in the 1.5j (ha) functional category (ha)	Surface of forests included in the 1.50 functional category (ha)	Total surface (ha)
1	Braşov	54.6	1640.7	1695.3
2	Ploieşti		82.1	82.1
3	Suceava	369.2	623.5	992.7

4	Timişoara	186.6		186.6
Total		**610.4**	**2346.3**	**2956.7**

- Through Order of the Water, Forest and Environment Minister nr. 2525/31.12.2016, Order 1417/2016 has been modified, since its application has highlighted a series of deficiencies and incongruences which are slowing down the process of identification and mapping of forests, while also creating the administrative issues which are preventing the voluntary contribution of interested third parties towards the preservation efforts of this natural heritage.
- The application of a government help scheme for a compensation system that will balance out the products that haven't been harvested by owners, due to protection functions established by forest landscapes, which determine some restrictions concerning wood gathering. According to art 97 line 1 in the Forest Code, the state provides economic support from its yearly budget, through the public central authority's budget which is responsible of silviculture 'compensations representing the equivalent of products that aren't being harvested by owners due to protection functions established by forest landscapes, which determine some restrictions concerning wood gathering.' Moreover, art.97 line 2 of the Forest Code stipulates that 'the imposition of restrictions on forest owners, through forest landscaping, through regulations of national and natural parks, biosphere reserves or Natura 2000 sites, or through other norms, including those establishing various types of functional groups, may be done either with the owner's approval, either through the payment of an adequate compensation upfront, paid yearly, which would completely compensate the income that has not been received by the forest's owner, may that be private or public entity.' For this reason, there's the European Committee Decision nr C(2016) 8769/3.01.2017 which mentions that the state help scheme for the regulation of a compensations representing the equivalent of products that aren't being harvested by owners due to protection functions established by forest landscapes, which determine some restrictions concerning wood gathering 'is compatible with the internal market, based on art. 107, line 3, letter c of the Treaty Concerning 'Treaty on the Functioning of the European Union' (TFUE). The EC decision is applicable between 3.01.2017 and 31.12.2020, and the total approved budget is approx. 285,000,000 lei (63,186,122 euros). The payment beneficiary may be 'private forest owners and their associations which own forests that fall under strict environmental restrictions.' The estimated number of beneficiaries is over 1000. The next step in obtaining this favourable decision from the EC requires the HG approval for the Methodological norms of granting, use and control of compensations. The implementation of a mechanism that would grant compensations for the equivalent of products that aren't being harvested by owners due to protection functions would signify an important step in the collaboration of all parties involved for a faster preservation of virgin forests.

However, despite the role and the importance almost unanimously recognised of virgin forests, they're hardly taking advantage of their deserved status. Although an existing and appropriate legal framework for their identification and protection exists, the application is quite slow and cumbersome. At the same time with the virgin forests protection process, some obstruction/interference and even exploitation actions are being undertaken by owners and administrators, with the passive assistance of special territorial units and of the central public authority responsible of silviculture, which are invoking either criteria that hasn't been met, either exploitation works commencing, for the purpose of not meeting the virgin forest requirements. Although both state and private forest management institutions are in possession of the necessary information to study identify and even pursue studies that are to protect virgin forests, they haven't actively pursued the required actions to legalise the process. For this reason, the virgin forest protection process must be accelerated and finished in the shortest time possible in order to stop the surface reduction of exploited areas.

6.3 Recent actions concerning the study and protection of Romanian virgin forests

Under the communists, the general concerns for the preservation of biodiversity and for virgin forest protection in particular were almost non-existent (or at most secondary.) In the forest sector, objectives for the economic use of the forest were considered a priority, such as increasing forest products through: expanding local softwood species such as spruce and pine trees through cultivation outside their natural developing areas and the expansion of some exotic species such as douglas or Weymouth pine and the cultivation of cloned Euro-American poplars; chemical extinction of the forest's pests, the use of non-wood forest byproducts etc.

After 1990, the main actions which have addressed the issue of Romanian virgin forests are:

- the publication, with the help of Societatea Progresul Silvic (Forest progress society) of the following works: 'Salvați pădurile României, patrimoniu național şi european!' (Giurgiu et al. 1993), 'Protejarea şi dezvoltarea durabilă a pădurilor României' (Giurgiu et al. 1995);
- the publication, in Romanian and German, of works concerning the Banat virgin forests: 'Pădurea seculară – Cercetări ecologice în Banat' (Bândiu, Smejkal, Vişoiu-Smejkal 1995), apărută în limba germană sub titlul 'Banater Urwälder' (Smejkal, Bândiu, Vişoiu-Smejkal, 1995);
- research being conducted on the structure, functionality and stability of virgin spruce arboreta from the Giumalău şi Călimani (Carpații Orientali – East Carpathian Mountains) reserves by R. Cenuşă (1992) and the publication of his work, 'Probleme de ecologie forestieră. Teoria fazelor de dezvoltare. Aplicații la molidişuri naturale din Bucovina.' (Cenușă, 1996);
- the organisation, in Romania, by Pro Silva Europa, of the national symposium 'Silvicultura şi pădurea naturală'(Timişoara, 1998), which allowed European foresters to encounter the impressive Carpathian virgin forests and draw attention to the fact that 'that virgin and quasyvirgin forests of Romania require a status of total

protection and this is an objective of imment urgency' in front of the scientific community and other deciding third-party participants. (Otto, 1999);

- the publication, in Romanian and French, of the paper 'Pădurile virgine din România', (Giurgiu, Doniță, Bândiu, Radu, Cenuşă, Dissescu, Stoiculescu şi I.A. Biriş, 2001), (with its French equivalent titled "Les forêts vierges de Roumanie", being published in Belgium, by the publishing house ASBL Forêt Wallonne);
- the project 'Inventarul şi strategia pentru gestionarea durabilă şi protecția pădurilor virgine din România' (PINMATRA/2001/018), (Inventory and strategy for sustainable management and protection of virgin forests in Romania) set up by the Royal Dutch Natural History Society (KNNV) in a partnership with National Institute for Research and Development in Forestry (ICAS), International Union for Conservation of Nature (IUCN) and the Forestry Progress Society (SPS) alongside independent international experts, between the years 2001-2004. The implementation of the project has been conducted with the help of the Ministry of Agriculture, Alimentation and Environment (MAAP), Ministry of Waters and Environmental Protection (MAPM) and National Forest Registry (RNP). The aim of the project has been the creation of a framework for and scientific/technical support for the long-term preservation of virgin and quasyvirgin Romanian areas and forests through applying a set of protection measures and of enduring management regulations. In order to achieve said aim, a series of objectives have been suggested, which are to be successively completed according to a schedule, following well-established terms and which reflect the main activities of the project, which are as follows (Biris, I.-A., Veen, P., 2005):

- the elaboration of a criteria set and of recognition and selection indicators for virgin and quasyvirgin forests;
- the elaboration of a criteria set and of evaluation indicators of the ecological quality of virgin and quasyvirgin forests;
- the elaboration of an inventory and evaluation methodology of the ecological quality of virgin forests, based on the criteria and indicators previously developed for this purpose, the completion of terrain standard forms and of appendices featuring the necessary information for the ecological evaluation of virgin forests (e.g. a list of ecosystem types, the red list of plants and animals of Romania which can be found in forest ecosystems);
- the elaboration of a brochure which would promote the importation of virgin forest preservation among civilians and third-party decision makers;
- the inventory of virgin and quasyvirgin forest, the description and evaluation of their ecological quality;
- the creation of databases;
- the elaboration of maps featuring virgin forest distribution;
- the elaboration of a strategy and an action plan for the conservation of Romanian virgin forests;
- the organisation of a national workshop in order to reach entities that are involved in forest management (forest owners, administrators, public, central and local authorities) with concerns for the importance and necessity of virgin forest preservation;

- In 2007, ICAS has conducted the study 'Inventarierea, cartarea şi

elaborarea măsurilor de management durabil a regiunilor cu peisaje forestiere intacte.' (Inventory, mapping and enduring management development measures for areas with intact forest landscape') following the request made the Ministry of Environment and Enduring Development. The study has identified the existence, in the Romanian Carpathian mountains, of an area that fits the criteria for intact forest landscapes, in the west part of the Carpații Meridionali (middle Carpathians) which amounts to 100,000ha. This includes most of the National Retezat Park, areas from the Domogled-Valea Cernei National Park and of the Hațeg Dinosaur Geopark, as well as significant nearby surfaces, not yet part of natural protected areas (ICAS, 2007). Unfortunately, this area has been sectioned due to infrastructure projects, therefore no longer fitting the intact forest landscape criteria.

- In 2011, WWF Romania ran a campaign called 'Salvați Pădurile Virgine!' (www.padurivirgine.ro) (Save virgin forests!) by launching a petition which has been signed by over 100,000 Romanian citizens. Following this campaign, WWF Romania has taken on a set of objectives which were to efficiently protect the last Romanian virgin forests (wwf.ro/ce_facem/paduri/pduri_virgine/):
  - supporting the identification of Romanian virgin forests;
  - the development of the 'National catalogue of virgin Romanian forests' as an official tool for enlisting and managing said forests;
  - including virgin forests which are classified as functional type I (TI) > Forests with a special role in nature's protection, who wood or non-wood exploitation is forbidden by law without the approval of the authorities demanded by law;
  - the development of a proposal regarding compensation payments made for forests between 2014-2020;
  - identification of alternative financial mechanisms for compensating virgin forest owners.

- The unfolding between 2014-2020 of some studies and research in the Romanian virgin forests by researchers from the National Institute for Research and Development in Forestry (ICAS), (e.g. (ex. 'Studiul factorilor de stabilitate in ecosistemele forestiere naturale. Evaluarea posibilităților de ameliorare a practicilor silvice în vederea gospodăririi durabile a pădurilor' – 'The study of stability factors in natural forest ecosystems. The evaluation of improving possibilities for forest management towards an enduring forest management.' – 2004-2006, by PhD. eng. R. Tomescu; 'Cercetări privind rolul ecologic al lemnului mort în ecosisteme forestiere cvasivirgine' – 'Research concerning the ecological role played by dead wood in quasyvirgin forest ecosystems' – 2005- 2006, by eng. O. Merce, eng. D. O. Turcu; 'Structura şi dinamica ecosistemelor forestiere naturale, suport pentru fundamentarea de măsuri silviculturale apropiate de natură şi pentru o gestionare durabilă a pădurilor' – 'Structure and dynamics of natural forest ecosystems seen as a framework for establishing a set of silviculture measures linked to nature and an enduring management of the forests' – 2006- 2008, by PhD. eng. I. A. Biriş; 'Cercetări privind dinamica structurii arboretelor şi a mortalității arborilor din Rezervația Ştiințifică Izvoarele Nerei' – 'Research concerning the structural dynamics of arboreta and death of the arboreta found in the Scientific Reserve Izvoarele Nerei'

– 2007, by PhD. eng. R. Tomescu; 'Cercetări privind fenomenul de mortalitate normală a arborilor în făgetele cvasivirgine din Rezervația Izvoarele Nerei' – 'Research concerning the natural death of trees phenomenon in beech quasyvirgin forests found in the Izvoaree Nerei reserve' – 2009-2010, by eng. D. O. Turcu);

- Conducting research for the purpose of PhD thesis based on and in the virgin forests of the Romanian Carpathian mountains, not only by Romanian authors but by foreign authors as well: 'Cercetări privind dinamica structurii făgetelor virgine şi a mortalității arborilor din Rezervația Naturală Izvoarele Nerei' – 'Research concerning the beech forest dynamics and death of trees in the natural reserve Izvoarele Nerei' (Turcu, 2012), 'Structura şi dinamica arboretelor de molid din ecosistemele Rezervației Giumalău' – The structure and dynamics of spruce species in the Giumălau reserve ecosystems' (Teodosiu, 2012), 'Cercetări asupra relației dintre structura pădurii şi regenerarea naturală în Codrul Secular Slătioara' – 'Research concerning the relationship between forest structure and natural regeneration in the Old-growth Forest Slătioara' (Jalubă, 2013), 'Cercetări privind diversitatea structurală a arboretelor din cadrul rezervației naturale Runcu – Groși' – 'Research concerning structural diversity of arboreta in the natural reserve Runcu – Groși' (Merce, 2016). This research has made important contributions towards completing the information concerning forests featuring a high naturalness degree and their structure and biomass, their relationship (particularly between biomass and structural diversity), as well as their regeneration in the presence of a number biotic and abiotic determiners.
- The publication under the tutelage of Greenpeace of the paper 'Beech Romanian virgin forests in an European context and under the influence of climate change' (Stoiculescu, 2013). The paper gives an excellent retrospective over beech forests in Romania and their management along the years and pleas for the need to protect the Romanian virgin forests in the context of a growing European interest for the preservation and sustainable management of beech forests.'
- The organisation of the 'Concerning virgin and quasyvirgin forests of Romania' symposium by the Romanian Academia and the Agriculture and Forest Science Academia 'Gheorghe Ionescu-Șișești', on the 24th of february 2012, and the publication of works present in the volume 'Virgin and quasyvirgin forests of Romania' (Giurgiu – editor, 2013).
- The publication of scientific articles based on the research conducted in the Romanian virgin forests, articles that have been published in prestigious scientific magazines. Scientific results have been gathered which are to completely shift some opinions concerning those forests, their ecologic behaviour, their natural regeneration strategy, their development and growing dynamic etc., thanks to the scientific community collaborating with foreign scientific research entities, accessing scientific results published abroad as well as state-of-the-art research equipment that has been purchased in the last year.

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These activities and other scientific papers have awaken in the European scientific community and in the local and European public perception a lively interest towards our

natural treasures, virtually unknown before the last two or three decades, and a strong support for the necessity of their preservation.

7. The destruction of virgin and quasyvirgin Romanian forests

Exact data concerning the dynamic of surface reduction in virgin forests on a national level along the years is non-existent. What is more, more or less precise data on the forest surfaces in the Romanian historic territories date back only to the end of the XIXth century and the beginning of the XXth, beginning with the first official statistics regarding forests (1876-1877 for Transylvania and Bucovina, 1899-1900 for the Romanian Principalities). The growth of the human population and resource consumption, altogether with human activity diversification have led to the diminution, decay and fragmentation of forests on a global level. Such period and events which have triggered to deforestations and ample decays of forests are identified and supported by historical documents of the time, also in the case of historic Romanian territories:

- documents linked to the Dacian kingdoms of Decebal and Traian (82 B.C. - 106 A.D.);
- linked to the the transition of Dacia into a Roman province (106 – 271 A.D.);
- starting with the XVIIIth century, after the Karlowitz Treaty (1699), when the Habsburgs became the dominant political power in Central Europe, taking over Transylvania from the Ottomans by considering it under their protection (which extended to Bucovina, Banat and Maramureș). The costs of the war against Ottomans and the economic development policy of the Habsburg Empire looking to strenghten its power have led to the rise of fiscal charges and the expansion of tax fees. In this context, Mother Theresa signs a decree refering to official regulations regarding taxes for serfs and peasants and their protection against nobility and land owners. In the following period, the first official inscriptions are being produced in Transylvania - the census of serf households. Since the majority of tillable land was owned by the state and by nobility, peasants were forced to procure the land for cultivation, pastures and meadows through their own efforts through deforestations (also known as lăzuiri), fallows, trenches and dams. This official regulation has produced in the following decades a drastic reduction of Transylvanian forest surface, wet lands, and meadows, as they were replaced by tillable lands for serfs, allowing for deforestations, fallows, trenches and dams. At first, these new cultivated surfaces have been considered non-classified from a judicial point of view ('pământuri remanențiale') but progressively they've been integrated as serf lands (sesii) and taxed as such (Kovach, 1978). As a standard for future cases, following this official regulation, in Arad county, for 3 decades, the surface of tillable lands and serf meadows have grown from 137,568 iugăre (approx. 275,136 ha) in 1771/1772 to 280,079 iugăre (approx. 560,158 ha) in 1802, mainly due to forests, many of them not having been exploited until then. In the XVIIIth century and the first half of the XIXth century, until the empirial forest law was passed in 1852 which forbode deforestrations, in Transylvania, Bucovina, Banat and Maramureș, over 2 million ha of forests have been cut down;

- between 1830-1860, after the Adrianople Peace Treaty (1829) which allowed a free market for cereal trade, livestock, and wood, when the Romanian Principalities have gained economic independence. In this period, estimations count deforestations as high as 3 million ha from Țara Românească and Moldova.
- after the agriculture reform in 1864, when the appropriation process of peasants and serfs that were attached to estates and their forests, which were mostly cut down and transformed into tillable land and pastures (in Țara Românească and Moldova.)
- in the last decade of the XIXth century and the first decade of the XXth century, following the adoption of laws concerning foreign capital, which allowed the selling of tenancy forests without fragmentation, on prices that were undervaluing the market, to exploitation and wood production commercial companies, which have cut them down with no qualms. Anton Carp, ministry of Agriculture and Estates, has made the following assertion regarding the reasons behind the Forest Code of 1910: 'Big exploiting companies, constituted almost exclusively of foreigners, ensured the support of the leading yeomen and peasants by buying all of their forests offering small and almost unacceptable prices compared to their value. The yeomen or leading peasants took most of the money, leaving the other working to fight over insignificant sums. Through these means, foreign companies have managed to own the large and beautiful yeomen forests, obtaining hefty revenues off the poor yeomen or peasants who were victims of their own simplicity, as none of them, either leader or follower, were aware of the value of the forests they had sold.' This situation has given way to large debates over the forest situation since the beginning of the XXth century, and on the basis of an unprecedented decay of the country's forests, following their 'merciless exploitation by foreign exploitation companies and the purchase of incredibly large forest areas from the yeomen and peasants for an incredibly small price', the deforestation without any regulation of private and public forests, the 'existing lack of respect for public property', the politicians of the time understood the need for a common agreement against the destruction of forests and for the support of the forest sector development. It is for this reason that during the years 1910-1918, a series of brave and modern laws (at the time) have been passed aiming to stop forest decline (e.g. Forest Code from 1910, the law of establishing The State Forest House, the law for the organisation of forest management, the law for forest education being created, the law for the establishment of a forest fund, the law of exploitation regarding state forests etc.);
- in the interwar period, after the agriculture reform of 1921, over 1,500,000 ha of forests have been cut down and interfered with in the Romanian provinces (Moldova, Muntenia, Oltenia, Dobrogea, Transilvania, Banat, Crișana, Maramureș, Bucovina și Basarabia), with this being considered as the strongest deforestation in Europe in the XXth century, which has startled international entities at the time: 'The national programme for the preservation and development of the forest fund between 1976 and 2010' (product of law 2/1976) mentioned: 'The intensity of forest exploitation has reached the

> highest point in the interwar period – in 1930 surpassing with 60% the growth that has been happening in the current accessible forests – where companies with foreign capital have been emptying numerous valleys – *Vrancea, Arieș, Lotru, Ampoi, Sebeș, Trotuș etc. – by exposing them to erosions and, at the same time, through unrational deforestation of mature forests, which ended up destabilizing their age structure. The exploitation level has continued to follow the same ascending trend between the years 1949-1964, the wood mass volume in the main products – mature forests - surpassing the 'possibility' (the normal deforestation rate) by 19-47% overall and by 37-104% in the case of softwood, especially in the cases of Bistrița, Moldova, Oituz.'*

during the communist period, especially between 1946-1975; in the first stage (1946-1959), a 'stealing exploitation of accessible forests' has taken place, where numerous valleys have been cut down while in the second stage (1960 – 1975) some 'inaccessible forests have been valued' through a forest accessibility programme that has been established in 1959 (Bradosche, 2013). 'The national programme for the preservation and development of the forest fund between 1976 – 2010' (product of law 2/1976) mentioned as a negative fact the presence of 'a million forest hectares, mostly beech, that have surpassed their exploitation age, situated mostly in inaccessible areas, where wood mass production is reduced (2-3 mc/year/ha)' in the forest fund. When the forests have been nationalized, less than 40% of their surface was accessible from a technical point of view (at a medium collection distance under 1 km), as to what concerns the forests in mountain areas, this statistic dropped to 25% (Bradosche, 2013). Immediately after the end of the Second World War, a devastating role over forests has been played by the Soviet-Romanian Society for the Exploitation, Industrialisation and Commercialising of Wood (SOVROLEMN) established on the 20th of March 1946, its official aim being 'the exploitation, industrialisation and capitalization of wood', which truly meant the recovering of pretend war debts Romania owed to the Soviet Union. Between 1946-1956, some of the best managed forests of the country have been mercilessly exploited through thorough deforestation (e.g. those administered by the Autonomous House of State Forests, by The Bucovina Church Fund, the Garden Community Treasure of Năsăud, etc.). Correlating this to the decreasing trend of the forest surface along the years, we may get an idea about the regression happening in the virgin forests. Before 1880, at least in Țara Românească and Moldova, we can't speak of a systematic exploitation of the forest: 'the forest produced shingle and potassium, and for timber debts, isolated trees of best quality were especially picked out, from the easy-access areas of the forest' (Sburlan, 1938). In the same manner, firewood and other household uses was gathered from dry or green wood trees from easily-accessible areas, situated near communities. Therefore, we may state that in the first decades of the XIXth century (1800-1830), virgin forests were covering approx. 3,000,000 ha of Romanian province territory (Giurgiu, 1999, 2013).

Starting with the second half of the XIXth century, the population growth and the industrial revolution have led to an increased need of wood, therefore large forest surfaces have been granted by the state for a period of 1-20 years and as a result, they've been intensely exploited. (Sburlan, 1938). In this context, large forest surfaces had been destroyed or degraded through trees that have been cut down, trimmed (in the case of oak species) or through select extraction of quality specimens (in the case of softwood with trees of a calibre higher than 20cm on the small end) from softwood forests and beech and softwood mix forests. At the end of the XIXth century (1890-1900), 2,000,000 ha of forests were still

virgin forests according to information found in forest statistics of the time and in documents concerning forest situation`(the Ministry of Agriculture, Commerce, Industry and Propriety – Silvic service, 1900; 1907; Bedö, 1885; Stinghe: 'Pădurile Transilvaniei', (Transylvania's forests) published in 'Transilvania, Banatul, Crișana și Maramureș, 1918—1928'. Vol. I.; Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001).

In the first 4 decades of the XXth century, following the development of the wood industry, of massive investments and in wood-processing machines and of the railway system being development, large-scale forest exploitation has flourished, including some forests that haven't been exploited before. To these, the effect of large surface deforestation has been added, from the forests that have been returned to their initial owners based on the agricultural reform of 1921, for the purpose of creating meadows and tillable land. In this context, when forests were nationalised (1948), we can estimate the existence of approx. 700,000-800,000 ha virgin and quasyvirgin forests (Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001; Giurgiu, 2013), data that has been backed by information from the first forest ladnscape cycle (1948-1956) and by the forest fund inventory developed based on this data (Bradosche, Giurgiu, Milescu, 2011).

Startin with the year 1985 until 1990, we may estimate the existence of approx. 400,000 ha of virgin and quasyvirgin forests, based on information provided by the forest fund (1985) (Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001; Giurgiu, 2013). We may state that between 1900-1980, the highest level of virgin and quasyvirgin forest liquidation has been registered which, according to theory of the 'normal forest' proposed by German foresters J.C. Hundeshagen (1826) and C.J. Heyer (1841), and taken on by Romanian silviculture, were 'exceeding' and had to be urgently exploited in order for a balanced age distribution of production units to be realised. Therefore, old-growth virgin forests with an age exceeding 120 years were considered abnormal/non-conforming with the theoretic standard instituted by foresters, and were to be cut down in order to reach a stage of simplified forests, distributed equally on ages from 1-120, which represented the 'normal standard.'

As of 2000, before the start of the massive forest restitution process to their ancient owners or their next-of-kin, an evaluation done as part of the 'Inventory and strategy for sustainable management and protection of virgin forests in Romania' (PINMATRA/2001/018), has led to the identification and mapping of approx. 220,000 ha virgin forests with a minimal surface of 50ha. To these we may add smaller surfaces but which, according to their preservation status, are of reduced importance (Biriș și Veen, 2005; Veen, Fanta, Raev, Biris, de Smidt, Maes, 2010).

Presently, as of 2016, estimations made by various organisations (WWF Romania, Greenpeace Romania) and by independent experts are suggesting a number as small as 100-120,000 ha. By summing up the aforementioned reference points concerning the surface reduction of forests, including virgin ones, on a national level, we are faced with the outcome presented in table 3.

Table 3. The main historic events leading to forest surface reduction, including that of virgin forests, on a national level.

When	**Associated historic event**	**Estimated surface of virgin**	**Main information source**

		forests (ha)	
First half of the XVIIIth century in Transilvania, Banat and Maramureș	Before the Imperial decree of the 10th of July 1765,concerning official regulations; the decree has encouraged the growth of tillable land to the disadvantage of forests, wet lands and meadows, allowing deforestations, fallows, trenches and dams, phenomena which lasted until the Imperial law of 1852 which forbade forest deforestation	? (quite possible that the surface of forests found in Transilvania, Banat și Maramureș may have been well over 5-5,5 million ha at the beggining of the XVIIIth century – mostly virgin – and has reached approx. 3,3 million ha in the middle of the XIXth century.)	Official regulations of Transilvania; V. N. Stinghe: 'Pădurile Transilvaniei', (Transylvanian forests) published in „Transilvania, Banatul, Crișana și Maramureș, 1918—1928". Vol. I.; Sabău, Vasile 1931. Romanian forest statistics of 1929; Kovach, 1978.
Beggining of the XIXth century (1800-1830), in the Romanian Principalitie4s	Before the Adrianopole Peace Treaty	≈ 3 000 000	Giurgiu, 1999, 2013
End of the XIXth century (1890-1900), in the Romanian Principalities	Before the start of concessions for forest exploitation	≈ 2 000 000	The Ministry of Agriculture, Commerce, Industry and Propriety – Silvic Service, 1900; 1907; Bedö, 1885; Stinghe: 'Pădurile Transilvaniei', (Transylvanian forests) published in „Transilvania, Banatul, Crișana și Maramureș, 1918—1928". Vol. I.; Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001
1948	Before the nationalisation of forests by	≈ 700 -800 000	Giurgiu, Doniță, Bândiu, Radu, Dissescu,Cenuşă, Stoiculescu, Biriş, 2001; Giurgiu, 2013;

	communists		Inventory of Romanian forests 1959 – data from the first forest landscape cycle (1948-1956); Bradosche, Giurgiu, Milescu, 2011
1985-1990	End of the communist era	≈ 400 000	Forest fund inventory (1985); Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001; Giurgiu, 2013
2000	Before the process of massive restitution of forests to their ex-owners	220 000	project 'Inventory and strategy for sustainable management and protection of virgin forests in Romania' (PINMATRA/2001/018); Biriș și Veen, 2005; Veen, Fanta, Raev, Biris, de Smidt, Maes, 2010
2015-2016	Start of virgin forest protection process	100 000 - 120 000	Estimation done by WWF based on field evaluation of % of virgin forests in the PinMatra project which still meet the OM 3397/2012 criteria (for Transylvanian counties); Knorn et al., 2013; Greenpeace study and University of Maryland concerning Romanian forest decay; field evaluation done by Greenpeace concerning virgin forest areas in Cumpăna și Cumpănița, from OS Vidraru în 2016.

Illustrative for the decreasing dynamic of forests located in mountain areas is the situation as presented by R. Ichim (1988) for forests from the Putna Forest District (Table 4) for which he had obtained landscape data since the first forest landscape set-up in 1878 (Giurgiu, Doniță, Bândiu, Radu, Dissescu, Cenuşă, Stoiculescu, Biriş, 2001; Giurgiu, 2013).

Table 4. Dynamics of virgin forest surfaces in OS Putna

Year	The virgin forest tendency in OS Putna (%)
1878	82
1888	70
1922	51
1944	33
1968	0

In the last 25 years, especially after 2000, the law and international framework in the forest field has suffered basic paradigm shifts, thus generating deep structural changes of forests/forest funds. The reducing and decay of forests, generally speaking

and of virgin forests in particular has continued and even increased after 2005.

The main causes which have contributed to the loss of virgin forests in the last decade are:

- fragmentation of forest property following a succession of land laws lacking vision, showcasing confusion and sometimes contradicting each other. These have led to a forest property fragmentation bigger than the one existing before the nationalisation process and to countless abuses of power, conflicts and litigations which render the finalising of the forest restitution process impossible even 25 years after its commencement.
- the incapacity of the central public authority responsible of silviculture to ensure an appropriate framework (policies, strategies, programmes) and to manage the forest sector while it transits from a centralised state economy to a free economic system specific to a free market. The organisational instability of the ministry, the often shift of dignitaries, the technical undeveloped apparatus, the lack of staff motivation, the lack of mechanisms which allow for the instruction and improvement of staff, the constant reorganisations etc. have obstructed the formation of a clear long-term strategy and vision concerning forests.
- the critical lack of financial aid concerning silviculture, not only from the state budget but from external funds as well (structural funds, the National Programme of Rural Development). Moreover, the smallest percentage of the profit realised by the forest sector of which various funds have used (e.g. Environmental Fund) have been turn-around funds for the development of silviculture investments and an enduring management of the forest.
- the incapacity of state and private silvic administations to ensure adequate silvic services and silvic regime regulations, both for state owned forests and the ones returned to their owners. As such, large forest surfaces have been the target of illegal activities, which broke forest regulations. Only as of 2005, 14 years after the beginning of forest land restitutions, regulations for the owners to set up forest districts for their forests are being established, and this aim is still to be 100% completed.
- the deficient and incoherent legislation which hasn't facilitated the application and abiding of forest regulations in all forests, independent of propriety type. The legislation contains no references to virgin forest protection.
- an inefficient control system concerning the forest regime regulations. The establishment of the first forest control committees has been made after the year 2000, over 10 years after the start of the forest restitution process. Professional training, equipment distribution and logistics required for the unfolding their activities has been greatly delayed and encountered various obstructions.
- the design and implementation of an insufficiently advanced system for protected areas, incapable of ensuring a proper preservation of the biodiversity, including the forest one.
- a deficient system of managing protected natural areas, which hasn't managed to stop illegalities occurring in protected areas.
- the promotion of forest managed focused almost exclusively on economic

success and the lack of objectives/indicators in protecting the forest. Only as of 2016 the central public authority responsible of forest management has included indicators for biodiversity preservation and virgin forest protection on the management performance evaluation list.

- the lack of will and determination and the incapacity of forest management to enlist virgin and quasyvirgin forests in the functional categories created for their protection. In some situations, the landscapers have suggested inappropriate technical solutions which would have led to virgin forest exploitation.
- the poverty level in some of the rural areas, following workplace penury and lack of other income for locals has led to the search for alternative income, including illegal deforestation.
- the lack of financial support for small forest owners aimed for covering the costs of guarding and management, has led to a situation where almost 1 million forests aren't being managed and do not benefit of forest services. Those were the first ones to suffer illegal deforestations.
- the lack of compensations given out to protection forest owners for the wood mass which shouldn't be harvested has led to added pressures regarding the virgin forests. Not even in the 3 year transition period negotiated in Romania's Accession Treaty to the EU (1st of January 2007 – 1st of January 2010), where compensation regulation was left to the government or afterwards, following the 1st of January 2010, when compensation regulations were filtered through EU regulations, have these compensations been given out. Although law 46/2008 from the Forest Code features specifics regarding compensation for the price of the forest's protection, and the European Committee has agreed to these compensations for the products the owners aren't harvesting, due to protection function established through forest landscaping which set up restrictions for wood gathering (Decision 5.166 of the 19th of July 2012 and Decision nr. C (2016) 8769/3.01.2017), the aforementioned compensations haven't been paid.
- the accessibility required by inaccessible arboreta and the exploitation/gains linked to virgin forests. What's more, part of the National Programme for Rural Development features finances aimed specifically at building roads towards accessing protected areas or virgin forest spaces.

In order to stop the decline of virgin forest surfaces, in 2016, the legal framework for the constitution of National catalogue of virgin and quasyvirgin forests of Romania (Order MMAP 2525/2016) and for the allocation of resources from the Environment Fund in order to make an inventory of the aforementioned forests and enlist them in the catalogue has been set up. (HG 945/2016).

Under these circumstances, the actions taken by authorities towards the protection of virgin forests have been met by forest owners and managers' opposition and by a passive attitude of the local central public authority's institutions which was in charge of silviculture. In other words, a race has started between actions concerned with forest preservation and actions of exploitation. Any delay or time-tempering actions in the preservation process are used as a shortcut for their exploitation.

Until present day, the catalogue features virgin and quasyvirgin forests that classify under the functional categories 1.5j and 1.5o (main, secondary or tertiary functional

category) according to forest management and which can fit the criteria and identification indicators of virgin and quasyvirgin forests specified in Order 3397/2012.
Although a series of national and international specialists and NGOs have been actively implicated in the development of essential studies for catalogue inclusion, the registration and verification process is incredibly cumbersome.
It is necessary for the central public authority in charge of silviculture to adopt a schedule of activities for the catalogue's realisation and to also monitor the institutional activity concerning this process.

8. The vision concerning the protection of virgin forests

Virgin and quasyvirgin forests currently amount to 2-3% of Romania's forests.[5] In the last century, their destruction/elimination progression has been unprecedented. We currently are in a situation which demands that we save the last remains of the grand monumental old-growth forests that were once covering the Romanian Carpathians.
We assume that in the foreseeable future, people's attitude towards forests with a high degree of naturalness will continue being biased: on one hand, people will seek to consider them production forests for a profit, while on the other their protection will be sought, for the preservation of their scientific, genetic, ecologic and cultural value, impossible to replace after their disappearance.
The first option was used by classic forest management, which treats forests as a renewable resource, exploiting them in order to obtain income from wood sales. Even in the happiest cases, when the qualification of a Ist grade functional forest is recognised (which requires special protection), the difference between the primeval forest which bears deep historic, scientific and ecologic significations and the rest of the forests is non-existent. By being treated and managed the same as other forests, with regards to time renewability as well, the virgin forests lose their original quality of an organisation archetype, and a structural and functional ecosystem, and they become 'cultivated forests'. Following the same forest policy principles, without an adequate protecting framework, we risk to progressively lose, in a short time, the majority of our virgin forests, with the exception of those found in protected areas. It would be a definitive, huge loss, given that the primeval/original forests can never be recreated. This way, we would lose important scientific, genetic, and ecological values, which concern not only our country's forests but all of Europe's forests, as it barely has any of its original, unmodified primeval nature left, especially when we look at its virgin forests.

The second option is that of a strict protection of virgin and quasyvirgin forests, as regulated by the Forest Code (art 26, line 3), given their scientific, ecological, cultural and landscape importance. In order to reach this ideal scenario, a number of steps have been taken in the last couple of years, such as the institution of the National catalogue of virgin and quasyvirgin forests of Romania as a recording and management tool of virgin and quasyvirgin forests of Romania by the Order 2525/2016 of the Environment, Waters and Forests Ministry.

[5] The current estimate for 2015-2016 can be found in table 3 alongside the main historic events which have led to forest surface decrease, including virgin forests, on a national level.

In the following, we present our vision concerning the protection of virgin forests and the main reference points of an action plan to this aim.

Objective 1: The strict protection of virgin and quasyvirgin forests and their adequate management

Actions:

1.1. The identification and inclusion of all forests which the criteria specified in the National catalogue of virgin and quasyvirgin forests of Romania (by conducting fundamental studies or/and through enlisting the forests in either of the functional categories 1.5.j or 1.5o in the forest management process);

1.2. The continuous update of the National catalogue of virgin and quasyvirgin forests of Romania;

1.3. The investigation of integration possibilities for the protection of virgin and quasyvirgin forests enlisted in the Catalogue by using biodiversity tools and protection mechanisms provided by the national system of protected areas and the forest management certification system (FSC) – which requires refrain from interferences on a minimum of 5% of the certified areas and the development of an ecological web in the Carpathian mountains;

1.4. The designation of virgin and quasyvirgin forests as protected natural areas or their inclusion in protected natural areas by expanding those;

1.5. The inclusion/development of the virgin and quasyvirgin forest preservation issue in the technical norms and instructions for forest management;

1.6. The introduction of the obligation/postulation that virgin forests are to be included in the functional category with high preservation levels (VRC 2) in the forest certification instructions;

1.7. The realisation of a web app for citizen use, where civilians can mark virgin forest areas; the app may include information/fundamental studies to be investigated by specialists in order to make them eligible for the Catalogue; it may also contain the possibility of creating notification posts concerning illegal actions/trespassing of protected forest areas as stipulated in the Catalogue.

Objective 2: Compensating companies and individual virgin forests owners in x exchange for their protection

Actions:

2.1 The application of a schema of governmental aid for offering compensations in exchange for the products which owners don't harvest, due to protection regulations established through forest management, which determine restrictions in wood gathering.

2.2 The purchase by the state of virgin forests which present special interest from private company and individual owners.

Objective 3: Rising awareness among civilians and private virgin and quasyvirgin forest owners.

Actions:

3.1 The development of an online database of the National catalogue of virgin and quasyvirgin forests of Romania (maps and descriptive information);

3.2 The development of a mobile app for Romanian virgin forests (App – Catalogue of Virgin Forests)

3.3 The creation of information documentaries/materials concerning representative virgin forests

3.4 The development of a web communication and informing platform linked to the Catalogue;

3.5 The organisation of symphosiums, conferences, workshops and courses for virgin forest managers and owners as well as for civilians;

3.6 Book, study, reports and photo album publishing on the theme of virgin forests.

Objective 4: The development of ecologic tourism activities

Actions:

4.1 The realisation of an infrastructure/visiting facilities;

4.2 The instruction/hiring of staff for guiding and managing guests;

4.3 Promotion of guided tourism as a main attraction;

4.4 The development of circuits similar to the 'Natural Wonders Route' or mixed circuits featuring natural and cultural sites ('Natural and Cultural Wonders Route');

4.5 The organisation of ecologic camps with a diversity of profiles and objectives (artistic, filmography, technical photography, science, research etc.)

4.6 The continuous and professional staff training (guides, administrators, etc.) – e.g. even through ERASMUS programmes;

Objective 5: The realisation of a national programme of virgin forest research

Actions:

5.1 The design and placing of a web of permanent research surfaces, representative for each of the most important virgin forests in the country;

5.2 The development of interdisciplinary research in the virgin forests;

5.3 The inclusion of virgin forests of Romania in transnational/European networks (ex. Forest Reserve Research Network – FR-NET; Beech Forest Network –BFN; Long-Term Ecosystem Research in Europe – LTER Europe, Mountain Research Initiative-MRI, etc.);

5.4 The realisation of an integrated monitoring programme (the virgin forest dynamic, biodiversity, ecological pressions, visitors etc.)

5.5.The establishing of an institute or European/international centre concerning virgin forests.

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