

CURRENT TRENDS OF FOREST AREAS DESIGNED TO PROTECT BIODIVERSITY AT GLOBAL AND REGIONAL

Eugen Rusu¹

Key words: forest biodiversity, conservation, protected area.

Abstract. The forest biodiversity provide many ecosystem services, such as protection of plant, water and soil resources. Forest biodiversity has also important to maintenance of natural ecosystems, contribution to climate stability and social benefits. In forests, biological diversity allows species to adapt to the continuously evolving dynamic environmental conditions, to maintain and improve breeding opportunities for species and to promote ecosystem functions. The long evolution of the primary forest in a relatively stable and undisturbed by human impact environment, biodiversity has been preserved properly. According to FAO estimations, forest area for protection and biodiversity conservation in the last decade has increased by approx. 96 million ha, with an accelerated pace in the last 5 years. These forests represent about 12% of the total area, or 386 million hectares, and are located mostly within national forest parks and protected areas.

Introduction

Forests are dynamic systems, subject to cyclical changes under the influence of periodic disturbances, senescence and ecological succession. Their genetic diversity, particularly in forest formations relatively complex, due not only to the number of species present in a given area, but also the stages of succession (Kemp,1997). Forest biodiversity can be considered at different levels including the regional forest, ecosystem, species and interactions occur within and amongst levels.

The forest is the most eloquent example of biodiversity, which includes a variety of existing life forms, their ecological role and their genetic diversity. In forests, biological diversity allows species to adapt to the continuously evolving dynamic environmental conditions, to maintain and improve breeding opportunities for species and to promote ecosystem functions. Forest biological diversity and complexity is maintained naturally by changing generations of trees and shrubs. In

¹ Prof. PhD., University "Al.I.Cuza" of Iasi, Faculty of Geography and Geology, eurusu@uaic.ro

a forest, an old tree that collapses makes other trees fall and creates a major breakthrough. The open space is quickly occupied by pioneer species of all kinds, taking advantage of new light, growing fast and vigorously.

Biological diversity is illustrated particularly in the equatorial forests, which hold over 70% of all known plant species in the world (with many endemism) and their inventory is far from complete.

1. Global review

According to the Convention of biological diversity, “we can no longer see the continued loss of biodiversity as an issue separate from the core concerns of society: to tackle poverty, to improve the health, prosperity and security of present and future generations, and to deal with climate change. Each of those objectives is undermined by current trends in the state of our ecosystems, and each will be greatly strengthened if we finally give biodiversity the priority it deserves”.

The mechanisms and the most important factors associated with the decline of forest biological diversity are of human origin. The forest biodiversity are in danger by the conversion of forest to agricultural use, unmitigated shifting cultivation, overgrazing, introduction of invasive plant and animal species, unsustainable forest management, pollution and climate change, anthropogenic forest fires, infrastructure development are all negative impacts to the biological variety. Biodiversity loss and forest degradation its weakening resistance to natural and human aggression.

The rapport of WWF 2010 shows the incredible an amazing biodiversity in the Amazon. In the decade 1999 – 2009 more than 1200 new species of plants and animals were discovered in the Amazon forest biome. The new species include 637 plants, 257 fish, 216 amphibians, 55 reptiles, 39 mammals and 16 birds. The Amazon is now a vulnerable region because of the progressive disappearance of large areas of forest and biodiversity loss.

Primary forests, or forests composed of indigenous species, where anthropogenic interference is not visible and where ecological processes have not been disturbed sensibly, occupy approx. 36% of the total global forest cover loss. The long evolution in a relatively stable and undisturbed by human impact environment, biodiversity has been preserved properly. These forests have lost over 40 million ha in the last decade, mainly by selective cutting trees with high economic value and forest conversion into agricultural land.

A positive aspect in the evolution of forest area is the increase in the number of protected areas by creating new national parks and reserves. From 1990 to present, area parks and forest reserves have increased by over 90 million ha, representing 13% of the total number of forests in the world. This slight improvement of the overall situation of forests in the past decade was made

possible by joint efforts, both locally and regionally and internationally or globally. For the first time in modern society, the pace of deforestation has decreased considerably. All states have contributed to this success by improving forest policies and by giving forest management to local communities or local populations.

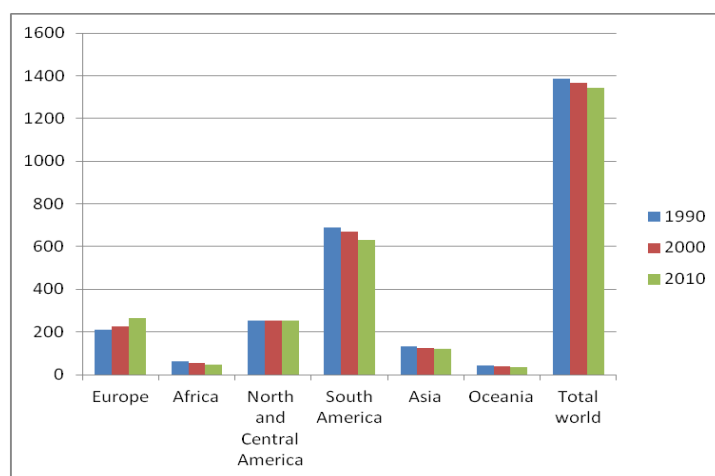


Fig.1 - Evolution of primary forest surface at regional and global level (mil.ha, data source FAO)

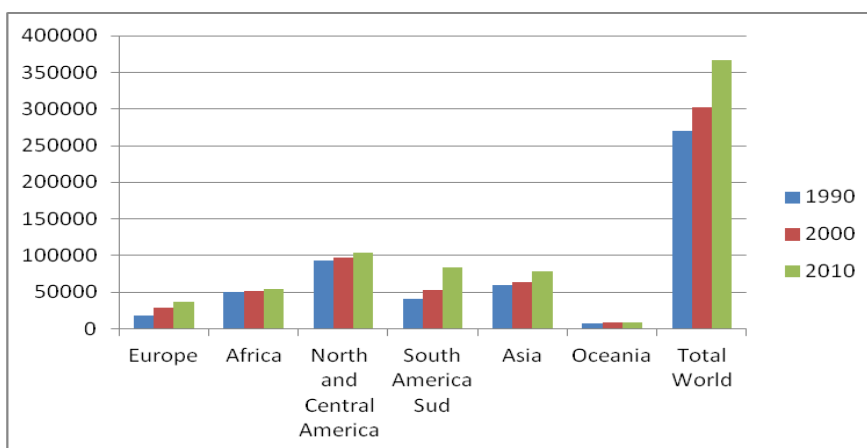


Fig. 2 - Evolution of forest areas for biodiversity conservation at regional and global (thousand ha, data source FAO)

Forest area for protection and biodiversity conservation in the last decade has increased by approx. 96 million ha, with an accelerated pace in the last 5 years. These forests represent about 12% of the total area, or 386 million hectares, and are located mostly within national forest parks and protected areas. National parks, wildlife reserves, natural areas and other protected areas currently occupy over 13% of total forest area. Besides having the main function for biodiversity conservation, they also fulfill the role of protection for the soil, water and cultural heritage (Forest of Fontainebleau).

2. Regional review

Between 1990 and 2010, according to the FAO, forest area of **Europe** region increased continuously, with rates varying from 989.5 million to 1005 million ha, with an average annual addition of approx. 800 000 ha. Expanding forest areas is primarily the result of new plantations, and natural expansion of forests into agricultural areas abandoned. This increase is due almost exclusively to the contribution of the old continent, with a net total of 15 million ha in the range mentioned. In the Russian Federation, the increase was not significant (1 million ha) in relation to the total forested area and it was made in the decade from 1990 to 2000. Among the countries that recorded important additions to their national forests in the decade 2000 – 2010, we include Spain (118 000 ha / year), Sweden (81 000 ha / year), Italy, France, Norway and Bulgaria. Countries with low forest blanket, such as Iceland and Moldova have registered the highest rates of addition relative to the total area. Instead, Estonia, Finland and the Russian Federation recorded a reduction in forest cover in the last decade.

Tab.1 - Evolution of total areas of forest in Europe (thousand ha, data source FAO)

	1990	2000	2010
Russian Federation	808 950	809 269	809 090
Europe without RF	180 521	188 971	195 911
Europe	989 471	998 239	1 005 001

In Europe, the primary forests occupy about 26% of the total area, being located mostly in the Russian Federation, due to vast empty spaces or with poor human presence in Siberia. On the old continent only 3% of the forests are considered primary, the rest of them being affected by anthropogenic activities to varying degrees. Forest areas are located in inaccessible areas of the northern continent and in the mountains with rugged terrain.

In the developed countries of Europe, primary forests were mostly converted into or secondary forests. Some fragments of primary forests are also found in inaccessible mountain areas.

Tab. 2 - Evolution of primary forest areas in Europe (mil.ha, data source FAO)

	1990	2000	2010
Russian Federation	235	220	260
Europe without RF	5	6	6
Europe	240	226	266

Global efforts to allocate increased proportions of Forest Biodiversity Conservation Area, have found a positive echo in the European Region, where, according to FAO assessments, the area reserved for this purpose increased to over 37 million ha, between 1990 and 2010. This means that the areas affected by this type of protection increased by 35%. During that period, the old continent, the area of forest to preserve the biodiversity doubled and now represents 10% of forests. In the Russian Federation, designated area increased less in the same period, reaching 2.2%, which represents an absolute of 17 million ha.

Tab. 3 - Evolution of forest area for biodiversity conservation in Europe (thousand ha, data source, FAO)

	1990	2000	2010
Russian Federation	11 815	16 190	17 572
Europe without RF	6 840	13 203	19 407
Europe	18 655	29 393	36 979

Forest spaces included in the various types of European protected areas in the region occupy about 40 million hectares, which means about 4% of the total. The highest proportion is found still throughout the old continent, which introduced 12% of its forests into protected areas. Forest areas to protect soil and water have increased in the last two decades, currently reaching 9% of the total forest in this region, Russian Federation contributed substantially to this share (7%).

In **Africa**, according to the data provided by FAO, forests and other wooded areas, occupied in 2010 approx. 675 million ha (23% of the total area of the continent), which represents 17% of the total global forest area.

At regional level there are differences insofar areas occupied by forests are concerned, as well as differences in terms of their use and management. Central African Continental represents 37% of the continental forest, Southern Africa 29%,

12% North Africa, East Africa 11% and West Africa 11%. Uneven distribution is determined, on the one hand, by natural conditions and, on the other hand, by the human densities and by the type of forest recovery.

African Forest area has decreased continuously in recent decades. FAO recorded that only between 1990 and 2000 in Africa, there disappeared about. 60 million ha of forest, which means an annual loss of approx. 0.7% of the forest. Between 2000 and 2010, losses were diminished to approximately 35 mil.ha, which represents an annual decrease of approx. 0.5%. The reduction rate of disappearance of forests is more evident in northern Africa, where measures to reduce cutting and planting annual net loss decreased from 540 000 ha, 41 000 ha. Countries with large forest areas have had the greatest losses: Cameroon, Nigeria, Tanzania, and Zimbabwe.

To these states with smaller areas of forest are added, but the massive disappearance of forest area has been registered in: Togo, Uganda, Mauritania, etc. At the opposite end, there is a series of states where forest areas have increased considerably, due to planting and efficient administration of the forest: Ivory Coast, Tunisia, Morocco, Rwanda, etc.

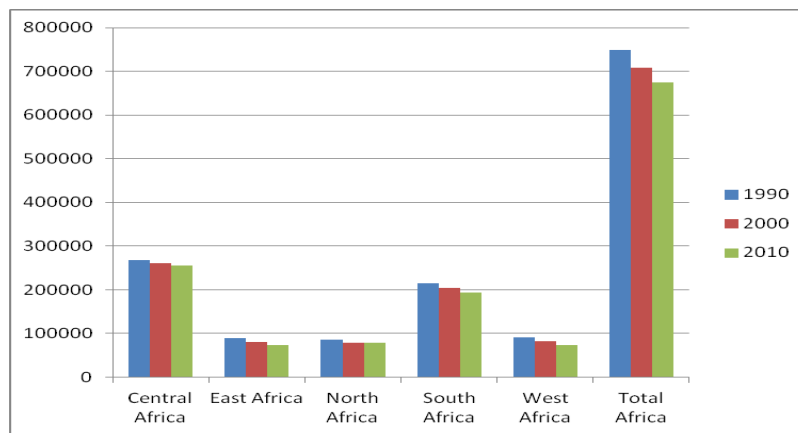


Fig. 3 - Evolution of total areas of forest in Africa (thousand ha, FAO data source)

Primary forest represents about. 10% of the total forest areas in Africa, a figure probably underestimated due to the lack of statistics in some countries in the central continent. The highest percentage, characterized R.D. Congo, Gabon, Madagascar, Central African Republic, Sudan, etc

Of the total African forests, 14% are for biodiversity conservation and 3% for soil and water protection. Areas affected by the forest biodiversity protection have

increased over the past decade in most African states, through the integration of the growing areas in this category.

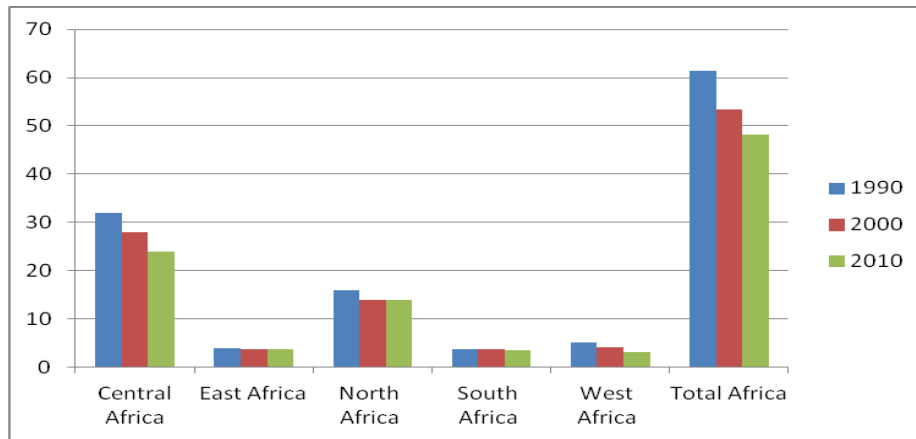


Fig. 4 - Evolution of primary forest areas in Africa Region (mil.ha, data source FAO)

However, the same forest areas with multiple functions are sometimes declared and recorded several times statistically. If these areas have increased by 27 mil.ha, at global level, in Africa there has been a loss of approx. 1 million ha, in the last decade.

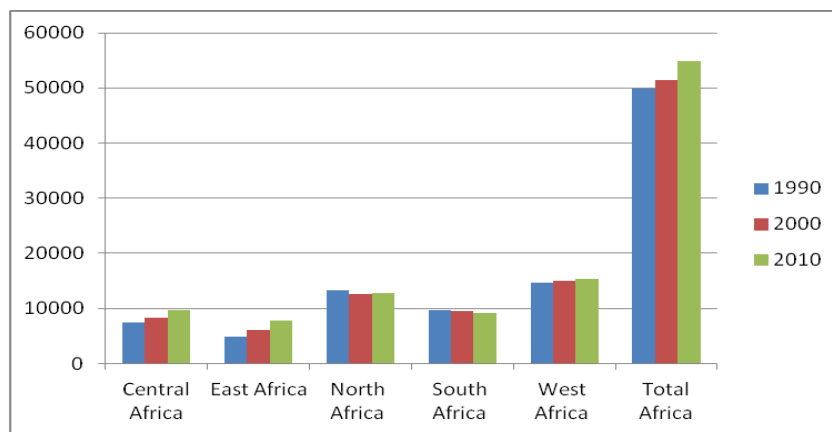


Fig. 5 - Evolution of forest areas for biodiversity conservation in Africa (thousand ha, FAO data source)

North and Central America is a forest region in which forests occupy 34% of the territory, representing a share of 17% of the world total. In 2010 the total forest area was estimated by FAO at 705 million ha. Canada and the U.S. record sensitive areas equal (310 and 304 respectively mil.ha) and Mexico participate in the regional total to 65 million ha, followed far away from the rest of Central America and the Caribbean with 19 million ha with 7 million ha . The evolution of forest between 1990 - 2010 puts in opposition a substantial increase in forest cover in the U.S. to the significant decreases in the forests of Mexico and the rest of Central America, while Canada maintains a balance between exploitation and plantings. Central America reported the disappearance of 54 000 ha of primary forest per year in the decade from 1990 to 2000 and 74 000 ha / year in the decade from 2000 to 2010.

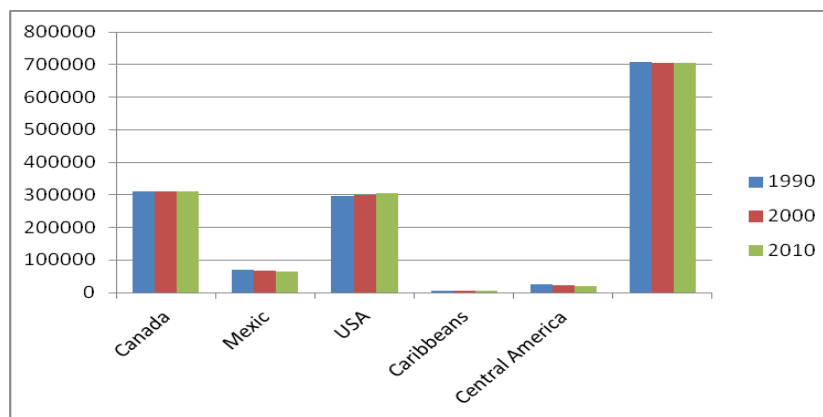


Fig. 6 - Evolution of total areas of forest in North America and Central (thousand ha, FAO data source)

North American States have large areas of forests located in remote areas of human habitats, allowing the operation of many forest ecosystems in their natural state. Forests occupy 41% of the total continental primary forest, which is approx. a quarter of the world's primary forests. In Canada and Mexico more than half of the forests are classified in this category, and in the U.S., a quarter of the forests are considered without visible traces of human activity.

The smaller areas for this purpose in Canada are not to be explained by the lack of concern, but by the Canadian boreal forest relative monotony and status of primary forest in the north, which is very sparsely populated, and where protection is intrinsic.

Forests designated as biodiversity conservation areas, adding up 15% of the total, but with major regional differences, are to be found: 25% of U.S. forests, 13% in Mexico and 5% in Canada.

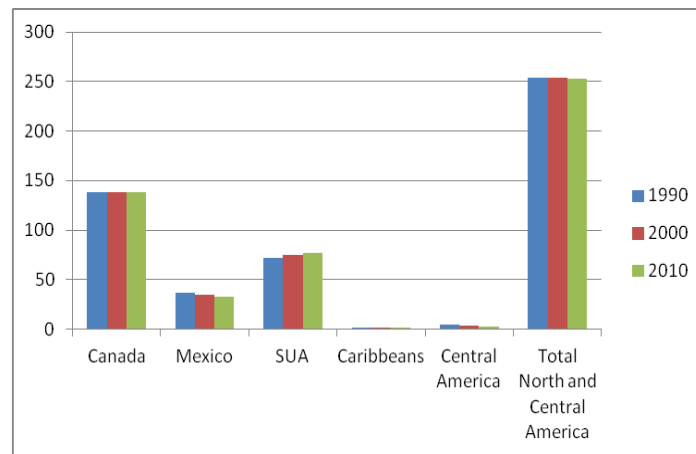


Fig. 7 - Evolution of primary forest areas in North and Central America region (mil.ha, FAO data source)

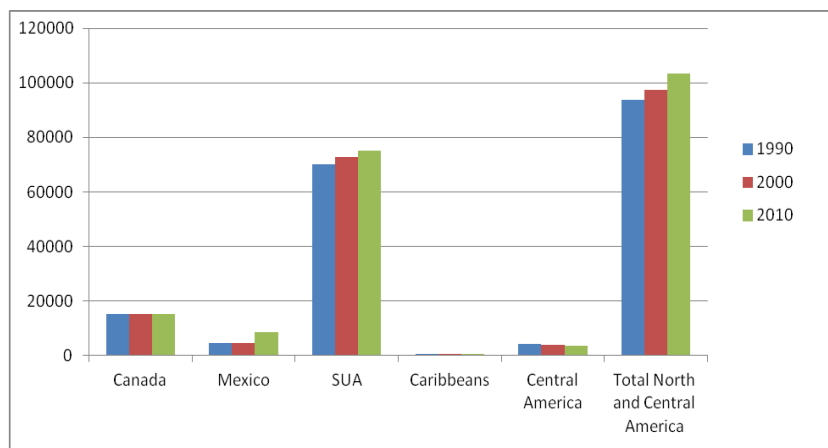


Fig. 8 - Surface Evolution for biodiversity conservation in North America and Central Region (thousand ha, data source FAO)

In Canada and the U.S., the concern for the preservation of natural values of ecosystems has become a modern generalized one. There are countries with high

financial potential that can afford to allocate substantial funds to the designation and management of large protected areas.

More than 31 million ha (8%) of forest or other wooded land in Canada are within protected areas, and 30 million ha are considered strictly protected (industrial activities such as forest harvesting, mining and hydroelectric development are prohibit).

They have established a functional legal system in this field and provided an education, mass awareness and effective monitoring of the functioning of forest parks and nature reserves. Over 8% of Canadian forests, 10% of the U.S. and 13% of Mexican forests have currently protected forest area status, which is about one tenth of the continental forest.

South America. Forest resources of this region are richer from a quantitative point of view, but they stand out especially in terms of biological diversity. From this perspective, Amazonia is to be mentioned, a region with a remarkable and relatively compact forest biodiversity.

In 2010, almost half (49%) of South American territory was covered by forests, in absolute numbers as assessed by FAO, the forest area occupied 864 million hectares, the equivalent of 22% of the world total. This distribution reveals the dominance of Brazil states, the state which has the largest equatorial and tropical forests, almost 13% of global forests. Other well-forested countries are Peru, Colombia, Venezuela and Bolivia, which together with Brazil have 84% of forest area.

Tab. 4 - Evolution of total areas of forest in South America Region
(thousand ha, FAO data source)

	1990	2000	2010
South America	946 454	904 322	864 351

The forest area of South America continues to decrease. At the regional level, the forest lost approx. 88 million ha between 1990 - 2010, having an average loss of 4.2 million ha annually. These reductions represent 64% of the total concern worldwide and although losses have taken place at a slower pace, they are still at a high level.

Primary forests of South America are located in difficult-to-reach areas or in protected areas. They are remarkable due to the Amazon rainforest biodiversity and to the long evolution in natural regime reaching the stage of biostazie and due to the enormous area they occupy in the same morphological-pedological-climatical conditions. According to FAO data, the overall percentage of primary forest region is very good, representing 75% of the forests of South America and about. 57% of

the world total. But in recent decades, especially in Amazonia, large areas of primary forest have been converted to other uses or have been cleared for timber exploitation. Central America in turn reported the disappearance of 54 000 ha of primary forest per year in the decade from 1990 to 2000 and 74 000 ha / year in the decade from 2000 to 2010.

Tab. 5 Evolution of primary forest areas in South America Region
(mil.ha, FAO data source)

	1990	2000	2010
South America	690	670	630

Integrating general current understanding of the necessity of preserving the forest as a guarantee of maintaining the environmental planetary balance South American states have adopted effective measures to protect forest areas of high interest in terms of biological diversity and soil and water protection. In this context, areas totaling approx. 18% of total regional forest were declared protected areas of different types. Areas of biodiversity conservation occupy about. 14% of forest area and these areas recorded during 1990 to 2000 an annual increase of approx. 1 million ha and since 2000 an annual increase of approx. 3 million ha, according to FAO assessments.

Tab. 6 - Surface Evolution for biodiversity conservation in South America Region
(thousand ha, FAO data source)

	1990	2000	2010
South America	40 683	52 548	84 222

Asia is presented at a regional level without Siberia, which is included in FAO statistics presented in the Russian Federation and Europe region.

Asia is the continent with the largest expansion latitude and longitude, occupying nearly one hemisphere in both directions. This progress has helped to install the world in all climates known latitudinal direction (longitudinal and multilevel nuanced altitude) and accordingly, all forest formations. The forest diversity depends on the diversity of physical and geographical conditions, displaying from the equator to the Arctic Circle equatorial forests and mangrove forests as well as deciduous tropical moist, subtropical forests, temperate forests and mountain forests, each having different local composition imposed by local conditions.

According to the data provided by FAO in 1990, the Asian forests occupied 576 million ha, and in 2010 the area increased to approx. 592 million ha.

Regionally, the most spectacular growth has been in East Asia, which has added nearly 50 million ha in the last two decades. By contrast, in Southeast Asia there were quantitative losses of over 30 million ha. In each country, major discrepancies are found in the area occupied by forests: China (206 million ha), Indonesia (95 million ha), India (95 million ha) Myanmar (31 million ha) and Japan (24 million ha) have the largest forest areas. At the opposite pole there lies the states on the Arabian Peninsula (Qatar, Oman, Bahrain) with minor areas of forest. Highest proportions of forests in national territory are recorded in some member monsoon, with a favorable climate for forest ecosystems: Brunei (72%), Bhutan (69%), Japan (69%), Laos (68%) and Malaysia (62%).

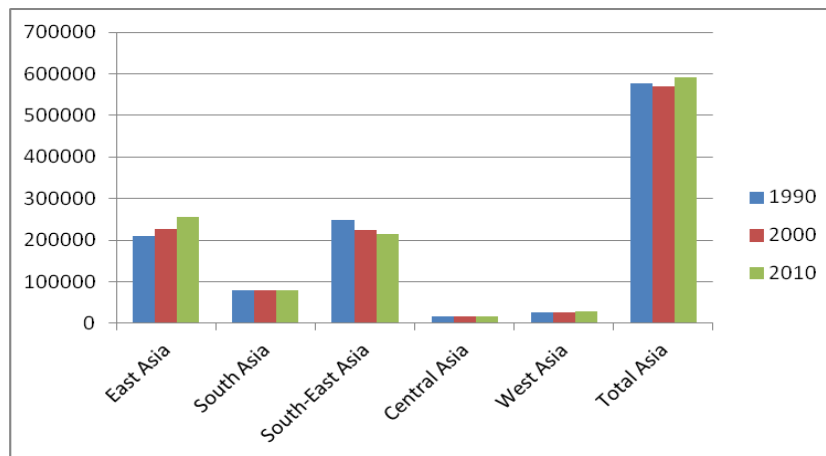


Fig. 9 - Evolution of total areas of forest in Asia (thousand ha, FAO data source)

Primary forest is about 130 million ha, namely a proportion of 22% of the total forest in the region. The general trend of the last two decades has been to reduce the area occupied by this type of forest. Significant losses were recorded in Southeast Asia, amounting to about 8 million ha, followed by East Asia with approx. 3mil. ha. In other sub-regions there are low variations. At regional level, protected forest areas occupy large areas, representing about 24% of all forests. The highest rates are recorded in Southeast Asia, which represents 32% of the total. Biodiversity protection areas affected have increased from about 60 million ha in 1990 to over 78 million ha in 2010.

According to the data provided by FAO in 1990, the Asian forests occupied 576 million ha, and in 2010 the area increased to approx. 592 million ha. Regionally, the most spectacular growth has been in East Asia, which has added nearly 50 million ha in the last two decades. By contrast, in Southeast Asia there

were quantitative losses of over 30 million ha. In each country, major discrepancies are found in the area occupied by forests: China (206 million ha), Indonesia (95 million ha), India (95 million ha) Myanmar (31 million ha) and Japan (24 million ha) have the largest forest areas.

At the opposite pole there lies the states on the Arabian Peninsula (Qatar, Oman, Bahrain) with minor areas of forest. Highest proportions of forests in national territory are recorded in some member monsoon, with a favorable climate for forest ecosystems: Brunei (72%), Bhutan (69%), Japan (69%), Laos (68%) and Malaysia (62%)

Primary forest is about 130 million ha, namely a proportion of 22% of the total forest in the region. The general trend of the last two decades has been to reduce the area occupied by this type of forest. Significant losses were recorded in Southeast Asia, amounting to about 8 million ha, followed by East Asia with approx. 3mil. ha. In other sub-regions there are low variations.

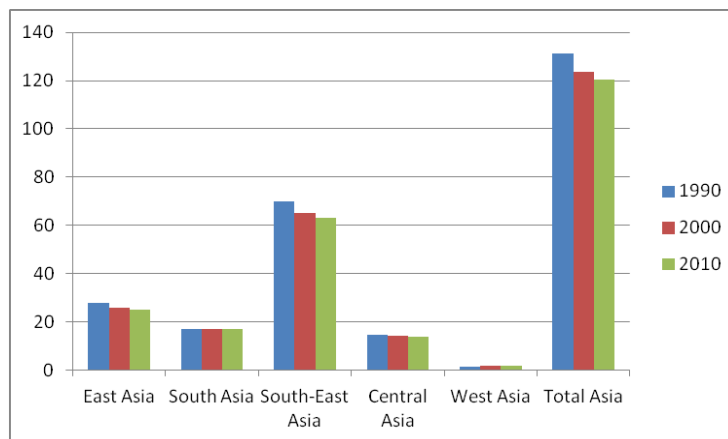


Fig. 10 - Evolution of primary forest areas in Asia (mil. ha, FAO data source)

Region **Oceania** includes Australia, New Zealand, Papua - New Guinea and archipelagos scattered in the warm Pacific. Except for reef and volcano-origin islands, the large continental fragments were part of Gondwana and southern mega-continent had a common trend until late Mesozoic. The evolution policy and subsequently in other isolated systems have favored preservation of the Gondwana ecosystems, flora and fauna elements, which are unknown on other continents. According to FAO statistics, in the entire region, the loss of forest areas, in the last two decades, have decreased from about 200 million ha in 1990 to 191 million ha in 2010. Losses due to logging and land use change to forestry vocation, especially

in Australia (0.5 million hectares lost between 2000 to 2010) and Papua - New Guinea (loss of 300 000 ha between 1990 - 2010).

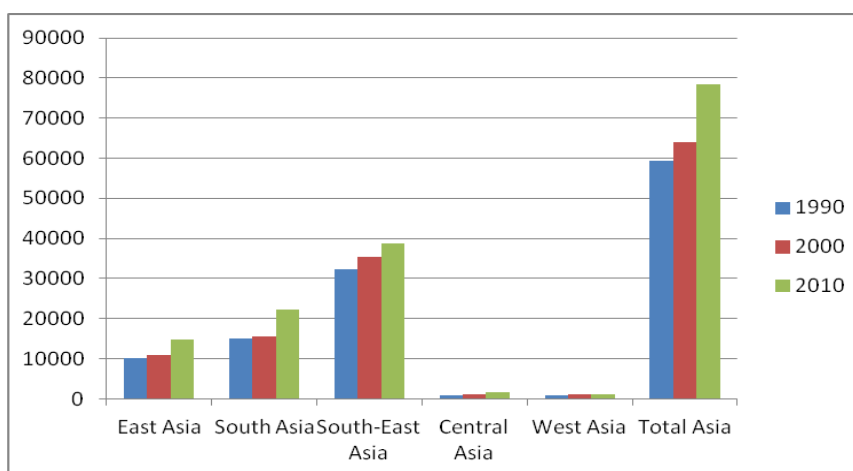


Fig. 11 - Evolution of forest areas for biodiversity conservation in Asia (thousand ha, FAO data source)

Tab. 7 - Evolution of total areas of forest in Oceania Region (thousand ha, FAO data source)

	1990	2000	2010
Oceania	198 744	198 381	191 384

Primary forests are still to be found in significant proportions in Oceania and occupy approx. 38% of the total forest of the region. In the last two decades, however, there was a decrease in natural forests from 41 million ha in 1990 to 37 million ha in 2010. The decrease occurred by changing the use of forest land and practiced selective exploitation into commercial purposes. The most affected one was the Papua - New Guinea, where some primary forest were consumed by wild instant fires and deforestation by fire was applied.

Tab. 8 - Evolution of primary forest areas in Oceania Region (mil.ha, FAO data source)

	1990	2000	2010
Oceania	41	38	36

Mainly affected areas of biodiversity conservation have increased in the decade 1990 - 2000, from 7.1 million hectares to 8.4 million ha, but in the last decade, these types of forests have contracted slightly by the passage of land use category or by assigning multiple other functions. The same thing happened to forests to protect soil and water, which after a slight increase between 1990 -2000, had a significant decrease in the last decade, from 1 Mil. ha to 890 000 ha, due to mining in accessible areas.

Tab.9 - Evolution of forest areas for biodiversity conservation in Oceania Region (thousand ha, FAO data source)

	1990	2000	2010
Oceania	7 196	8 412	8 234

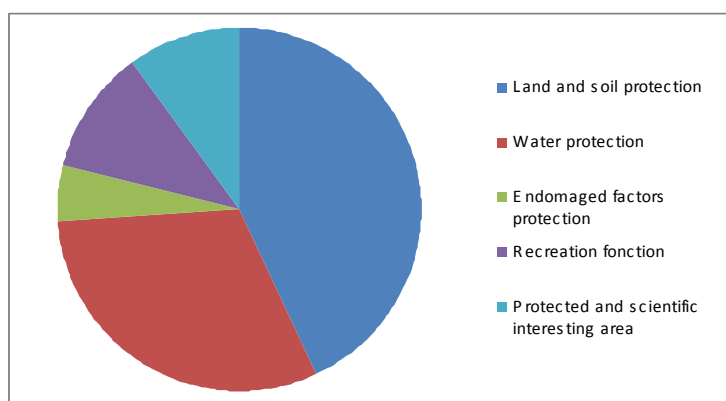


Fig. 12 - Structure of forest surfaces included in the Functional Group I (% , data source: MADR)

Protected forest areas in Oceania reach a proportion of 22% of the total in the last decades due to the attention given to preserving natural forests in the state of functionality. The top country in the region is New Zealand, where almost a third of the forests are protected through general awareness and environmental imperatives of subordination of all activities.

In **Romania**, in accordance with current guidelines in the European and world forestry, biodiversity conservation function has become extremely important, given that this feature is threatened by the expansion of vital forest habitat and human activities. In Romania, this function is performed by “protected and scientific

interesting area” in Functional Group I. These forest areas occupy 10% of this group (0.350 million ha) and are spread all over the country.

Located in the temperate continental moderate climate, having the interference of different types of other climates, the flora and fauna elements are preserved in Romania in a different way, Ponto-Caspian, Mediterranean and Western Europe, which gives a greater biodiversity than in European regions affected by typical climates. Its territorial diversity, from the delta and steppes, the deciduous forests, boreal and alpine meadows Carpathian, favors the presence of many elements of biodiversity, some of which are endemic, in the Romanian space.

The forests in functional Group II, production and protection forests, account for 47% of the total forest area of the country. According to FAO assessments, Romanian has a different functional structure, with 48% of forests for the production function, 39% allocated to soil and water protection, 5% to biodiversity conservation and 6% is designated to cover social function.

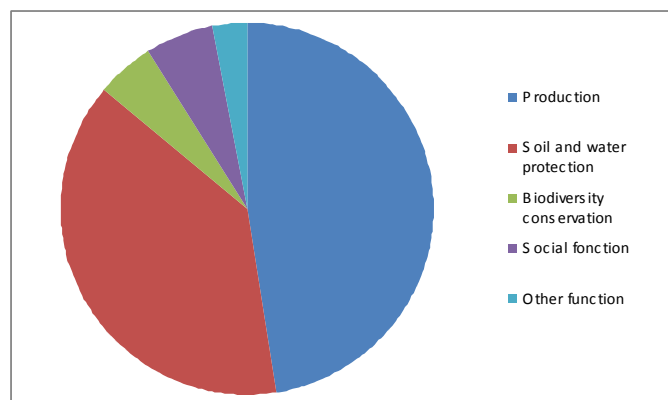


Fig. 13 - Functional structure of forest surfaces in Romania (% , data source: FAO)

Protection and Biodiversity Conservation is achieved primarily in legislative protected territories such as national parks, natural parks, protected areas and nature reserves. This function is also fulfilled by other forests belonging to Group I function. In Romania there were established over 20 national parks and natural protected areas and more than 1,000 nature reserves, some of which are of world importance, included in UNESCO. All these territories include protection forest areas of great scientific importance for biodiversity conservation. According a 2003 inventory, the Carpatian Mountains are home of the wider of virgin forests in Europe, with more 250.000 ha.

Evaluation and forest certification ensures responsible management of forests and social and economic benefits for local communities. In Romania is developing projects to protect forests and promote forest certification as a tool for their efficient management. By 2010, over 700,000 hectares of private and state forest FSC were in Romania. This guarantees that forests are managed responsible, based on social, economic and environmental.

References:

- Birot Y, Lacaze J.F. (2006)**, *La forêt*, Ed. Flammarion, Paris.
- Briant G. et al. (2010)**, *Habitat fragmentation an the desiccation of forest canopies. A case study of eastern Amazonia*. Biological conservation.
- Butler, R. (2011)**, *Rainforests*, Create Space.
- Kemp, R.H, Palmerg-Lerche C., (2007)**, *Conservation des ressources genetiques forestieres*, Dossiers FAO, Rome.
- Kemp, R.H. (1992)**, *La conservation des ressources génétiques des forêts tropicales aménagées*. Unasylva, 43(169).
- Lawrence et al., (2000)**, Forest loss and fragmentation in the Amazon : implications for wildlife conservation, Oryx, 34
- Radu Stelian (2002)**, *Inventar preliminar al pădurilor virgine și cvasivirgine din teritoriul arondat și învecinat Parcului Național Retezat*, APNR
- Stănescu, V. (1997)**, *Flora forestieră lemnoasă a României*. Ceres, București
- Whitmore, T.C. (1990)**, *Tropical rain forests*. Oxford, Clarendon
- *** MADR, 2007 – *Raport privind starea pădurilor României*, București
- *** FAO, 2011 -*Situation des forets du monde 2011*, Rome
- *** FAO, 2010 – *Evaluation des ressources forestières mondiales 2010*, Rome
- *** WWF – *Ecoregion Carpatian montane coniferous forests*
- *** WWF – *Raport anual 2010 WWF Romania*
- *** WWF – *Amazon alive. A decade of discovery 1999-2009*.