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THE CURRENT SITUATION OF THE STOCK OF CARBON IN FOREST ECOSYSTEMS AT REGIONAL AND GLOBAL

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Key words: carbon stock, deforestation, human activities

Abstract. The results obtained in the calculation and analysis of the total carbon stock in the forest environment involves some discussion of quantitative estimation difficulties.
Carbon in forest biomass is considered as an average per hectare is estimated based on the volume of standing timber existing at a given time per unit area. But forest biomass includes shrubs, epiphytes and parasitic plants and ground vegetation. Inventory and calculate the amount of carbon existing in those parts of the forest environment is only indicative and carries a high degree of approximation.
Reducing carbon stock in forests of the world is considered as the difference between annual volume of wood exploited and additions to the volume of standing timber trees resulting from annual increases.
Carbon in soil can be appreciated at all, including amounts incorporated throughout the depth of the profile or, according to FAO statistics, only the top 30 cm which is embedded almost organic carbon.
Current development of forest carbon stocks in the world recorded a continuous decline due to loss of forest biomass by deforestation and land use for other purposes.

Introduction

Total carbon in forest ecosystems is given to existing content in biomass, dead wood, litter and soil in. The highest amounts are found in living biomass (all forest vegetation and fauna) and soil and FAO are estimated at over 662 billion tons worldwide. The evolution of carbon stock is influenced by climatic fluctuations, natural disasters and anthropogenic intervention. Accordingly, causes the dimensions of forest areas, certainly influence the amount of carbon in forest areas. In case of deforestation or fire, carbon stock biomass is reduced by the corresponding amount missing (Dupouey, 2006). Only carbon in litter and soil included persist much longer time, if not removed by fire and erosion. Amount of biomass in forests existing regional standing, estimated in tones per hectare, the obvious differences depending on species composition, forest age and tree density.

1. Global review

Europe has the lowest amount of forest biomass (90 t / ha) due to the predominance of coniferous forests, not everywhere high consistency and taiga trees in some areas have a low waist. In South America, equatorial forests layered, dense and heterogeneous, with large trees, there is the greatest amount of biomass, with values of 247 t / ha, more than double the existing quantities in the forests of Europe or Oceania. Between 1990 and 2010 there were significant regional disparities in terms of carbon stock development.

In Africa, South America and Asia, carbon diminished by the loss of large quantities of biomass, while in Europe and North and Central America increased due plantations, assisted natural regeneration and a management and facilities sustainable forests.

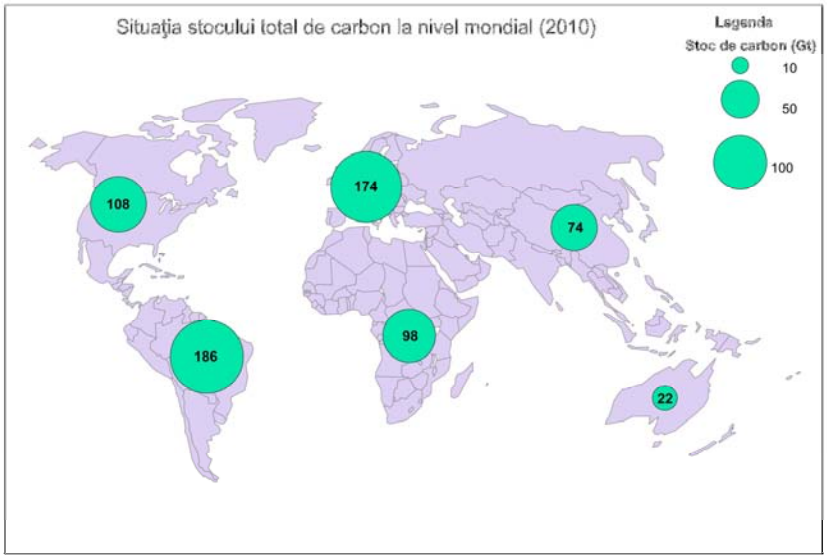

Fig. 1. Total carbon stock in the forests of the world (Gt, 2010, data source: FAO)

According to the data provided by FAO 2010, the world's forests encompass a total 642 billion tones (Gt) of carbon in forest biomass from which an amount equivalent to 289 Gt, 31 Gt in dead wood, 42 Gt and 292 Gt in the litter layer soil (to 30 cm depth). Although plantings, sustainable management, forest rehabilitation and reconstruction could increase this stock continued reduction of forest cover led to lower it. It is estimated that during 2005 - 2010 carbon stock has decreased by 0.5 Gt per year worldwide.

2.Regional review

The analysis of regional statistics, it can be seen that the highest total carbon stocks are located in South America due to large quantities of biomass retained abundant rain forest. This consistency plant is supported by optimal climatic conditions and high density layered components equatorial forest. Soil conditions, climate and hydrological, reached the stage we know of operation (the climax), favors an intense process of accumulation and formation of large amounts of humus, with a substantial carbon stock in deep lateritics soils.

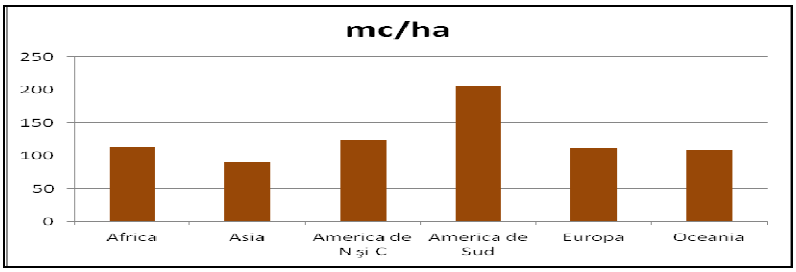

Fig. 2. Standing timber volume per hectare at regional level (m3/ha, 2010, data source: FAO)

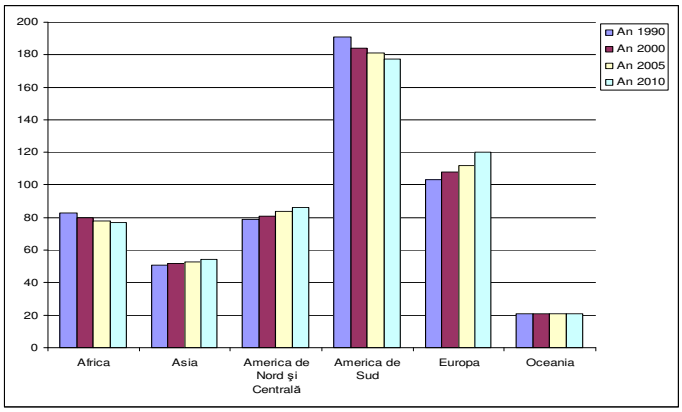

Fig. 3 Standing timber volume per hectare at regional level (m3/ha, 2010, data source: FAO)

The small amount of carbon retained by the forest environment are found in Oceania (due to reduced forest areas) and in Asia, because of the heterogeneity of forest formations adapted to diverse stationary conditions. If trends of forest

restoration will maintain carbon stock will improve significantly in the coming decades.

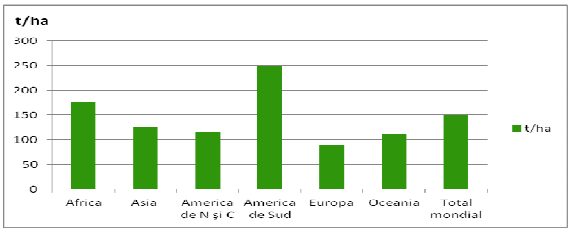

Fig.4. Total biomass stock at regional and global (t / ha, 2010, data source: FAO)

Tree densities vary and quantities of biomass and soil material accumulation are lower, except the equatorial forests. In Asia, these forests located in Insulinda, have greatly reduced the areas in recent decades and properly declined and carbon stock.

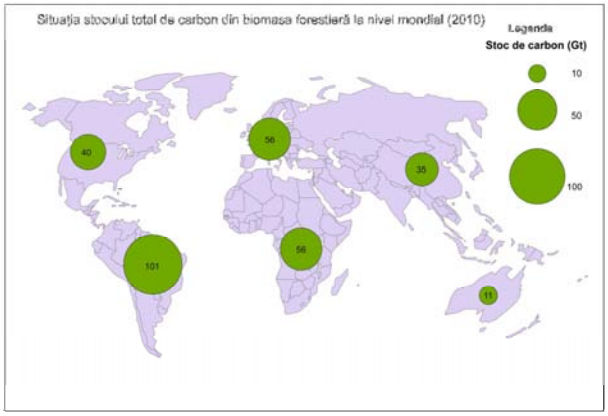

Fig. 5. Total carbon stock in forest biomass at global level (Gt, 2010, data source: FAO)

Europe and North America fall with high carbon stock due to large areas of forests in remote areas of densely populated areas and unaffected than natural disasters. The vast Canadian and Siberian taiga areas covered by primary forest in general, in addition to biomass itself, there is a lot of deadwood, litter not harvested and consistent, which includes significant amounts of carbon.

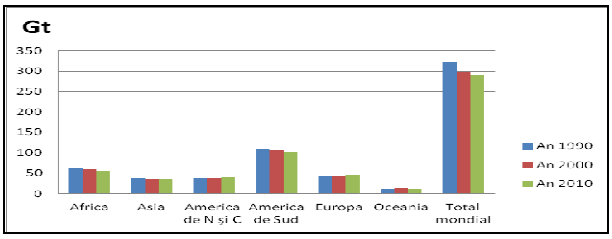

Fig. 6. The evolution of global carbon stocks in forest biomass (Gt, data source: FAO)

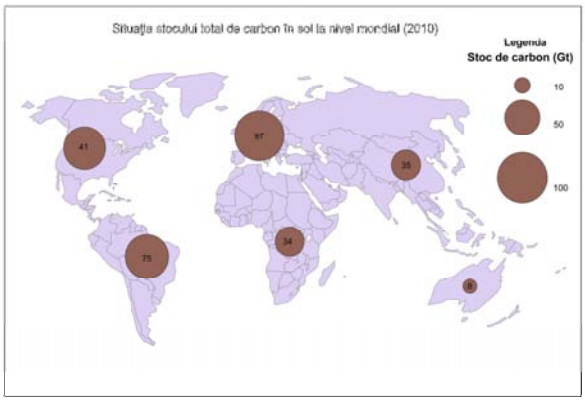

Fig. 7. Carbon stock in forest soil at global level (Gt, 2010, data source: FAO)

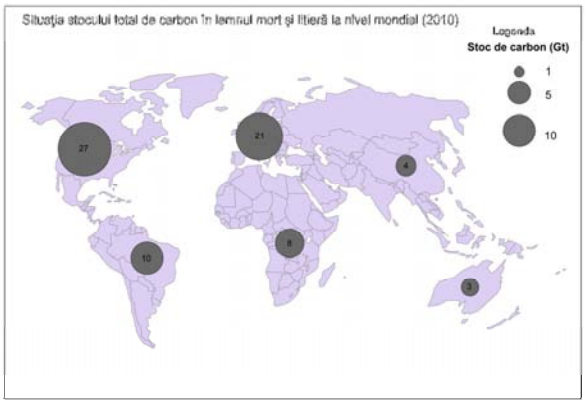

Fig. 8. Carbon stock in dead wood and litter at global level (Gt, 2010, data source: FAO)

In these forests, the carbon is recycled and maintained as natural mechanisms only natural fires or some weather (storms, heavy snowfall) sometimes occur at the local level in carbon flow.

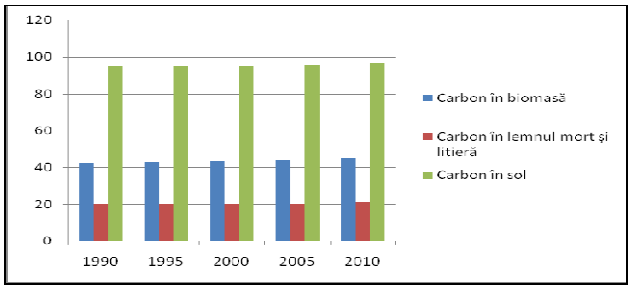

Fig. 9. The evolution of carbon stock in Europe (Gt, 1990 - 2010, data source FAO)

In Europe, forest policies advanced engineering works and maintenance of forests is reflected positive growth in annual volume of wood. According to the SEF, in the year 2010, Europe's forests have experienced a total addition of about 115 billion cubic meters, of which more than 81 billion m³ in the Russian Federation and nearly 33 billion cubic meters in the old continent. For the same year, the EU27 has increased by approx. 24 billion m³. Properly species structure of forests of Europe, the most significant increases were recorded in conifers, namely 71% of the total.

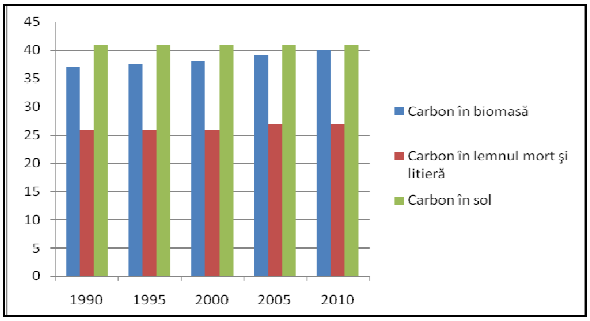

Fig. 10. The evolution of carbon stocks in North America (Gt, 1990 - 2010, data source: FAO)

Forest biomass increases are accompanied by a corresponding increase in carbon stocks in forests embedded Europe. For 2010, they recorded the existence

of over 46 GT of carbon in forest biomass in Europe. This indicator had an upward trend between 2005 - 2010, with a CAGR of 0.5%, due to increased planted areas in the EU. The total carbon stock is observed also added significantly, from 157 in 1990 to 163 Gt in 2010

Forest situation in North America is encouraging due to recent policies by planting massive restoration and conservation of forests, based on strong legislation that supports the management and use of forest products honest. An important role of environmental attitudes generalized become even traditional forest environment. The economic crisis is felt by reducing demand for wood and wood products, which could lead to diminishing funds for forest protection and ecoforests diluting or abandoning existing programs.

These trends are reflected positively in the evolution of total carbon pool of forest throughout North America, showing a slight increase in the stock of at 104 Gt in 1990 to almost 108 Gt in 2010.

Africa is the continent which states that deforestation rate will remain at current rates alarming or even to accelerate in the near future. Kickback agriculture, population growth, urbanization accelerated, rising prices of food and energy will put new pressures on forest area. Prolonged droughts in the Sahel decades have led to the disappearance of huge areas of forest vegetation on. In the absence of other energy systems for rural African population, firewood is the main source of energy for cooking. For some parts of Africa, firewood is becoming increasingly difficult to obtain, and steadily increased speculative trading prices.

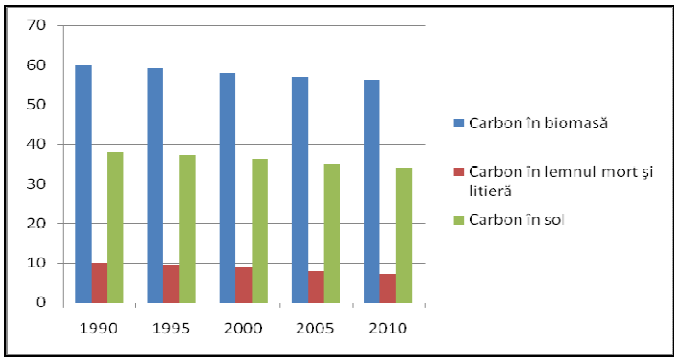

Fig. 11. The evolution of carbon stocks in Africa (Gt, 1990 - 2010, data source: FAO)

Reduction of African forests and agricultural land due to growing needs (in terms of low agricultural output) and current development of transport infrastructure and expanding human habitat. Even though there are national and

international programs to save African forests, the mechanism for implementing the local and regional level is still very weak, because continental generalized poverty.

Adequately fell continuously and stored carbon stock in forests African from 108 Gt in 1990 to 97 Gt in 2010.

Geographical area of Asia, which is home to almost 2/3 of the world population, the contrasting situations in forestry. On one side are top of the hierarchy states in planted areas (China, India, Vietnam), and on the other hand there are countries where deforestation continues at alarming rates (Indonesia, Thailand). In emerging Asian countries, demand for wood and wood products is accelerating due to population growth and income, but poor countries, forests are cleared to make way for subsistence crops. China and India are countries that will soon become dependent on imported wood used as constraints on space and water resources will not allow sufficient domestic production of wood.

Assessed by FAO, the total volume of wood extracted is enormous and exceeds 1 billion m3 annually. Wood consumption decreased slightly in the last two decades, from 1.1 billion m3 in 1990 (of which approx. 857 million m3 of firewood), from 1 billion m3 in 2010 (of which approx. 755 million m3 of wood fire).

These massive withdrawals explained primarily by high consumption of firewood. Asia, home to 4.1 billion people, ie 60% of the world population, of which two thirds live in rural areas and use mainly wood as energy source. The slight decrease in the consumption of firewood is explained, on the one hand, the massive exodus of rural population (especially in China) and secondly by using and other local energy sources.

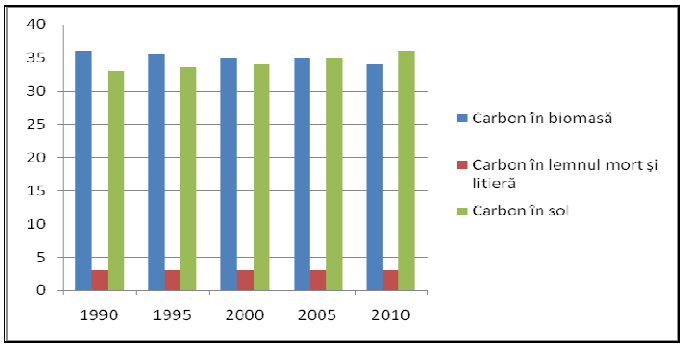

Fig. 12. The evolution of carbon stocks in Asia (Gt, 1990 - 2010, data source: FAO)

Decrease in wood consumption, coupled with a balance between logging and massive planting of East Asia, maintain carbon stocks capped at a year the past two decades, with a slight increase in recent.

If the global areas allocated for productive purposes and socioeconomic experienced a continuous decline in recent years in South America these categories of forest growths. To justify the exploitation, some states interested in wood turning its own large percentages of state forests for this purpose: Guyana 97%, Uruguay 64%, Venezuela 49% and Chile 46%. Largest quantities of wood extract but are registered in Brazil. Most affected by mines are massive Atlantic Forest region of Brazil and Amazonia Plateau. From Atlantic forests that were exploited in large scale and were replaced by monocultures for export, there are only a few areas disjoint.

Across the region, firewood extracted exceeds the industry. The last three decades have increased quantities of wood exploited constantly. The total volume of industrial wood increased from 46 million m3 in 1970 to 188 million m3 in 2010, and the firewood from 153 million m3 to 239 million m3 in the same period. In South America, firewood represents a significant proportion of the total extract, which reflects the almost total dependence of local populations of this energy source and reduced opportunities to implement other energy alternatives rural poor.

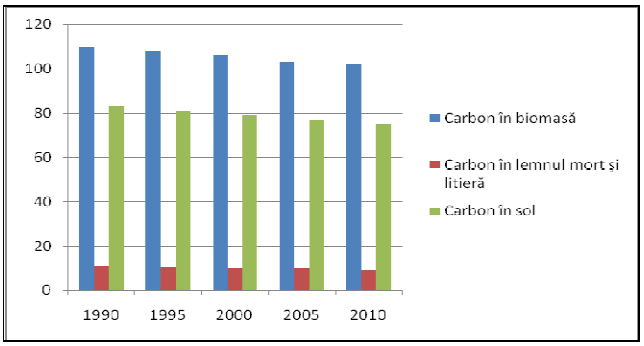

Fig.13. The evolution of carbon stocks in South America (Gt, 1990 - 2010, data source: FAO)

South America is likely that the process of deforestation, especially in Amazonia, to slow down in coming years. Although population density is still low, pressure is exerted on forests in two ways: first wood speculative trading with economic value, on the other hand the policy of the Brazilian government, the deployment of a part of poor southeastern crowded areas and farmland transformation of parts of the Amazon rainforest. Implantation new Amazonian

agriculture in the area was done by major pioneer fronts that have been moving along rivers and roads, and then insinuated lateral ribs inside the forest. These main causes are added to food price increases in fuel and energy, leading to increased deforestation process for obtaining pastures (especially for cattle farms) and for different cultures forage, subsistence, plantations and the last two decades of producing biofuel crops, required in this global market.

Forest areas dedicated to the production function occupies small areas in Oceania, only 11 million hectares, representing only 5% of the forest area. Many forests are however included in the category of multiple use, including production.

Extracted wood volume is much lower than in other parts of the world. Although in recent decades there has been an increase in the extraction of timber in the region, the total reaches only approx. 68 million m3 of firewood which is a small proportion. Firewood is used for cooking overwhelmingly because warm climate of the region do not require energy for heating. Only New Zealand and southern Australia need winter energy sources, but a large part of consumption is provided by geothermal and other energy systems adapted to current environmental imperatives in these countries.

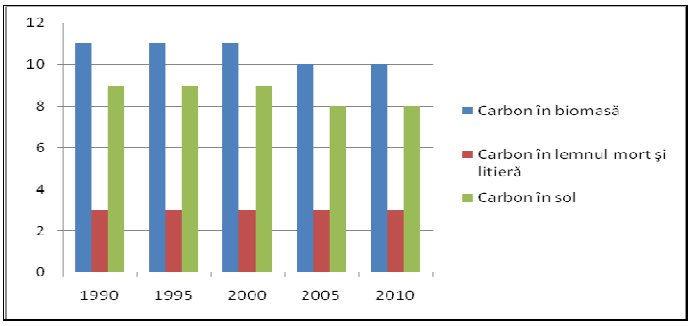

Fig. 14. The evolution of carbon stocks in Oceania (Gt, 1990 - 2010, data source: FAO)

In Australia and New Zealand issues are well managed forest ecosystems due to advanced Forest management policies and keeping in good health and vitality of forests. Caring nature and especially to forests, were implanted into the national consciousness of both peoples to protect and ensure the principles of balance in the functioning of natural ecosystems. In Papua - New Guinea and the small islands of Oceania, expanding production plantations and farmland diminishes worrying forest areas and threatens forest ecosystems. In this context, carbon stock decreased slightly in the last two decades.

3.Discutions

The results obtained in the calculation and analysis of the total carbon stock in the forest environment involves some discussion of quantitative estimation difficulties.

Carbon in forest biomass is considered as an average per hectare is estimated based on the volume of standing timber existing at a given time per unit area. But forest biomass includes shrubs, epiphytes and parasitic plants and ground vegetation (Loustau, 2003) . Inventory and calculate the amount of carbon existing in those parts of the forest environment is only indicative and carries a high degree of approximation. There is great variability constitutive forest ecosystems and should be taken into account several variables: age structure and forest species analyzed, all forest density and compactness, durability of components analyzed during active vegetative (Boulier J.,2010) etc.

Reducing carbon stock in forests of the world is considered as the difference between annual volume of wood exploited and additions to the volume of standing timber trees resulting from annual increases. Of total annual consumption, firewood is entirely destroyed by burning in household consumption and carbon recycling in the composition of the atmosphere and increases the greenhouse effect. In contrast, the volume of industrial wood, only some of the carbon is destroyed or transformed by processing. Most timber construction and wood used for furniture production keep a certain number of years, most carbon sequestered, depending on the lifetime of the product developed. Active forest biomass releases large quantities of carbon dioxide into the atmosphere at night. This part of the carbon sequestered in wood industrial products becomes stable for a period of time and not actively participate in exchanges with the atmosphere. Therefore, this carbon is stored on one hand and on the other hand becomes inactive and does not contribute to the enrichment of carbon in the atmosphere at night.

Carbon in soil can be appreciated at all, including amounts incorporated throughout the depth of the profile or, according to FAO statistics only the top 30 cm, which is embedded almost organic carbon. Quantitative assessments are difficult because after deforestation, forest land lost significant amounts of organic carbon by reducing input and storage of organic matter (Arrouays, 2003). These reductions are due to either change the type of litter or erosion faced by upper soil horizons. It is important that some of the carbon stock in forest soils eroded is not lost, but is reshuffled by transport and is found in sedimentary areas (meadows, floodplains, lakes, deltas, seas and oceans).

In recent decades there have been many signs, some of which are alarming, proving that global climate disruption is ongoing. These climate changes have been

defined as a set of transformation anomalies and climatic parameters beyond the limits of normal variation.

Current concerns regarding the future of the world climates are determined, on the one hand, by human activities which generate pollution, and, on the other hand, by the relation forest - atmosphere and the fluctuations of atmospheric carbon and fixed. According to FAO, forests have a crucial role in climate change mitigation and adaptation of the areas of land to these variations. The most important consequences of climate change on forests are not caused by increasing global temperatures, but by the frequency and magnitude of climate perturbations. Strong deviations from the normal regime of variation of climatic elements cause damage or rapid and massive changes of forests. Tropical cyclones, storms, drought, heat, frost, hail, are meteorological phenomena with much more serious consequences on the forest, rather than a warming climate.

In terrestrial environments, increasing temperature determines an increase in the amount of natural atmospheric CO2, which would significantly boost photosynthesis, and enhance metabolism as well as increase the amount of vegetation biomass. Forest productivity stimulated in this way would lead to an increase of the total volume of standing timber, as wll as to the addition of wood per hectare per year. Climate warming can be beneficial, especially in temperate zones, in addition to the extension of the growing season and the period of annual growth rings of trees. A study by Météo-France, shows that the Lozère department of France, during the annual vegetation grew on average by 22 days during the last 50 years.

It is also estimated that an increase in temperature favors the expansion of plant species and may lead to an increase in forest biodiversity. In areas situated at high latitudes in Alaska, Canada and Russia, the melting of permafrost would allow the extension of the vegetation to extend northwards as well as the extension of agricultural and forestry areas, having positive economic consequences.

Conclusions

Current development of forest carbon stocks in the world recorded a continuous decline due to loss of forest biomass by deforestation and land use for other purposes. Carbon losses are recorded and forest litter where deforestation destruction by fire and by reducing organic matter in potting soil as humus forest. Carbon stock registered in all global forest is influenced local and regional anthropogenic activities and climate change.

Human activities contribute significantly to reducing carbon stocks stored in forest ecosystems primarily by burning huge quantities of firewood, which releases carbon into the atmosphere timber. Second, carbon reserves are reduced by deforestation by fire and wood products as different radically alters the chemical

composition of wood. According by Riou-Nivert (2007), from climate change, the most damaging phenomena are droughts, which reduce the processes of photosynthesis and carbon accumulation by annual growth of trees.

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