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FOREST MANAGEMENT AND CLIMATIC CHANGES IN ALBANIA

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Abstract- The multi-functional role of forests is widely recognized nowadays. In addition to timber, fruits and seeds they provide a great number of services to the ecosystems. Among others, forests are the only "factory" in the world that produces the oxygen we inhale during all our lifetime. This is why many developed countries have based the development of this sector on the sustainable development. But in Albania the situation of the national forestry stock is not under normal conditions. This is due to the fact that for decades the forests have been cut down more than their natural growth, leading thus to the disruption of the natural balance due to the overuse/ overexploitation of forests. For years the issue of forest management has caused debate among sector experts and policymakers. The main discussions are related to the sustainable management of one of the most important natural resources in Albania- forests. The issue of sustainable management of forests becomes even more difficult in the context of climatic changes. This is due to the fact that the important and irreplaceable role of forests in this respect is already known. In the event of extreme occurrences of cold weather, given that wood reserves in Albania are limited and scarce, the population, businesses and the economy of the country will face serious difficulties. This is because in the rural areas that represent 43% of the country's population [1], fire wood still remains the main source of energy. Firewood accounts about 36% of energy demands for heating and 12% of energy for cooking in the country [2]. The firewood represented 9.76% of the total energetic sources for the country [3]for the year 2010. Due to mismanagement, the forestry sector is presented not as an absorber but as an emitter of greenhouse gases. The issue of addressing the causes of this situation as well as the proposals for solution of problems should be a national priority. This paper aims at conducting an analysis of the situation of the forestry stock over the years, a projection of the progress of forest growth and demands for wood products as well as at giving the relevant proposals of what should be done in this respect.

Key words: Forests, climatic changes, sustainable management, sustainable development

I. INTRODUCTION

Albania has approximately 1,040,881 ha of forests[1] which occupy about 37.23% [4] of the country's territory. But, in the last 60 years, the area and volume of the forestry stock have drastically decreased as their use is very important as an energy source (heating and cooking) as well as for the wood processing industry.

According to the Albania's First National Communication [5] to the Conference of Parties under the United Nations Framework Convention on Climate Change (1994 is the baseline year) turns out that: *"…wood cutting process in Albania is higher (over three times) than annual increment of our forests*". Almost the same situation is reported even in the Albania's Second National Communication [6], (1990-2000): *"…the present situation of the forests in Albania is a consequence of the continuous over- exploitation during last 60 years…*" In all the time line/series of that inventory (1990-2000) as well as in the baseline year (2000) turns out forests emit GHGs in the amount of 750 Gg CO_2. This figure represents a loss of the forestry stock of approximately 800,000 m^3 more than the natural growth of forests for that year. Even the Albania's Third National Communication (2000-2009) turns out that the GHG emissions from the hanges in Forest and Other Woody Biomass Stocks are about 704 Gg CO_2 per year.

II. METHODOLOGY

This paper is based on the data provided by the Ministry of Environment, which is the responsible authority that manages and administrates forests in Albania. Cadastre data of the period 2000-2013 have been analyzed and processed. These data regard the forest area and volume detailed by forest category (conifers, broadleaves and shrubs). Based on the data of period 2000-2013 a projection of the progress of the natural growth of the forests has been conducted, as well as of the expected demands for the forest biomass for the same period of time. The projection of the expectations for forest situation has been carried out for a mid-term period, up until 2050.

The respective volume data have been converted into CO_2 to look into the relevant balance of emission/ seizing of forest GHGs over different years and situations. Conversion into CO_2 of forest biomass was made based on the IPCC Guidelines on Greenhouse Gas Inventory - 1995, 1996 (revised), Volume 1, 2, 3, as it is used for the Albania's National Communications mentioned above.

Also the technological improvements that need to be made have been analyzed, in order to reduce the use of forest biomass by increasing the energy efficiency of this source. Also the amount of the forest area to be forested has been

[1] Based on Law 9385, date 04 May 2005 on "Forests and Forestry Service", forest is defined as an area covered at least 30% by dense trees on more than 0.1 hectare.

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analyzed so that the forestry stock of Albania can be managed in a sustainable way.

The average growth of the area proposed to be forested has been estimated to 2, 01 m^3/ha/year, based on local studies (Tabaku et al. 2006 "*Vleresimi i rritjes mesatare te disa llojeve te pyllezuara ne disa rajone te Shqiperise*").

III. RESULTS AND DISCUSSIONS

Based on the forestry cadastre data, the situation (area and volume) of the forestry stock during the period of 2000-2013 is as follows: (shown in the figures 1 and 2 below);

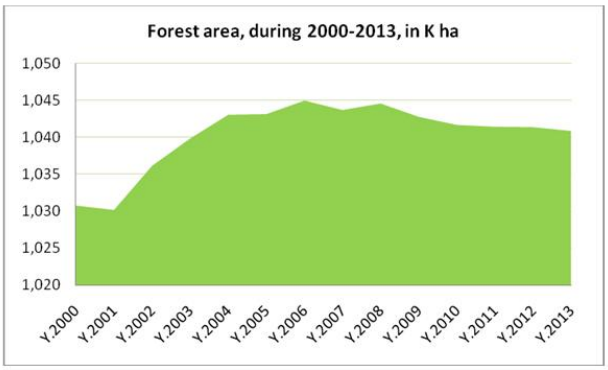

Figure 1. Forest area during 2000-2013

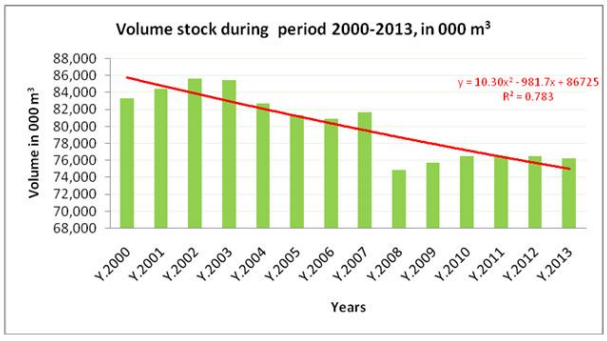

Figure 2. Volume stock during period 2000-2013

As it can be seen, the volume of forestry stock in Albania during the period 2000-2013 has increasingly decreased in a substantial way. The forestry stock has decreased each year by about 540,000 m^3. This is shown in figure 3 too, where the progress of forest volume by their relevant categories is given:

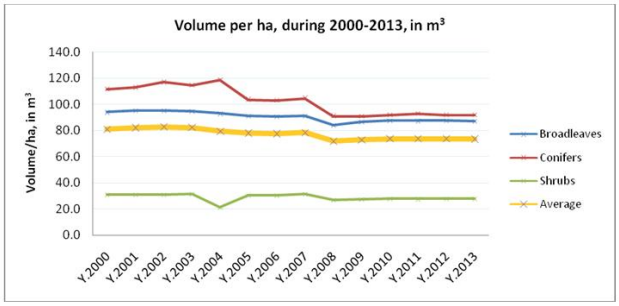

Figure 3. Volume stock per ha, during 2000-2013

All categories have undergone a decrease in volume per unit (ha) during this period, but this decrease is more pronounced in conifers. This is because the demand for timber from conifers has been and is still higher. The decrease in conifers is mainly caused by construction industry, mining industry and wood processing industry. Meanwhile the decrease in broadleaves is mainly due to their being used to generate energy. In order to ensure a sustainable management of forests, it is very important to provide a positive ratio between natural forest growth and their cutting. The relevant data have been shown below for this purpose:
Annual natural forest growth is shown in figure 4:

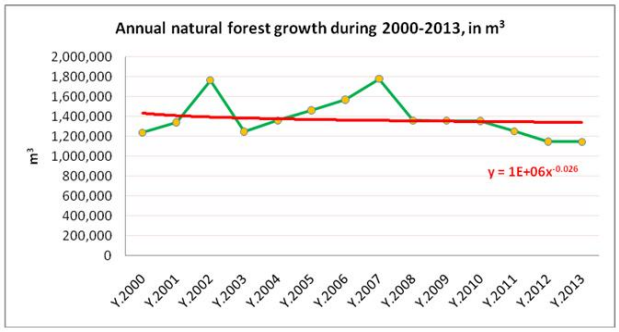

Figure 4. Annual natural forest growth during 2000-2013

As it can be seen, this growth ranges from 1.2-1.7 million m^3/year, which corresponds to an annual average growth of 1.1-1.7 m^3/ha/year.

Compared to consumer demands for timber, this growth is too small. Figure 5 helps us to compare the natural forest growth and the quantity of timber obtained from forests:

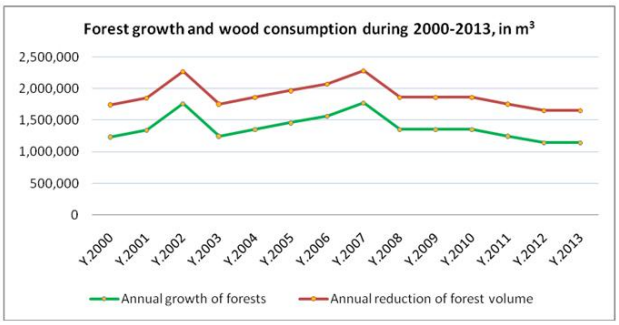

Figure 5. Forest growth and wood consumption during 2000-2013

The chart infers that the natural forest growth is on average 27% smaller than wood/timber consumption in Albania. The chart also shows that for years, cutting is obviously higher than the natural forest growth. This means that the national forestry stock has been and is still being managed in a non-sustainable way.

Another important fact regarding this process is that the majority of the decreased volume is a result of illegal cutting or use of forests. This is illustrated by figure 6 below:

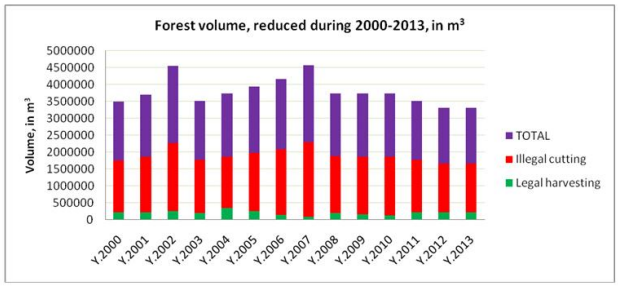

Figure 6. Forest volume reduced during 2000-2013

As it can be noticed, only 10% of the total volume of forestry biomass that is cut is legal, whereas the rest is obtained illegally from the forest. This figure is too high and constitutes the main reason of the degradation of Albanian forests. From a global perspective, the effects of forest degradation and forest-cover loss on biodiversity may be significant, as Albania is located within the Mediterranean Basin that is recognized as a global biodiversity hotspot in terms of endemic flora and fauna species (Myers et al. 2000) [7].

Situation analysis

The current situation of forest in Albania has been inherited over years and very often aggravated due to forest fires or massive cutting. The major influencing factors are:

1. Losses resulting from the technological process of forest harvesting
2. Low energy efficiency of timber/wood
3. Lack of investments in forests (afforestation, forest improvement, fire protection, etc.)
4. Energy policies that favor wood as basic option for heating and cooking
5. High scale of informality and lack of law enforcement

Analyzing these factors it can be noticed that each of them bears an important weight in the current situation.

1. Low level of mechanization in forest exploitation. In general Albanian companies dealing with forest exploitation are very little or not at all mechanized. There is a lack of specialized tractors for internal transportation, of cable cars and other necessary means for forest exploitation. According to recent evaluations conducted by the Faculty of Forestry Sciences, about 20% of forestry biomass that is cut remains in the forest due to the lack of mechanic specialized machineries. This means that losses caused only during the exploitation process are 20%.
2. Low energy efficiency. The main means the population use for heating and cooking are not efficient at all. There is a general use of fireplaces and simple stoves. Another important issue is that there are almost no central heating systems in Albania (with the exception of several social buildings) or buildings with thermal-insulation. National Agency of Natural Resources estimates that the (average) efficiency of appliances used for heating and cooking is approximately 50%. This means that only 50% of biomass is efficiently used.

Only the two above mentioned factors (lack of mechanization and low energy efficiency) account for the loss and lack of usage of 50-55% of forest biomass. This is a very high figure, which has brought about the consequences of the current situation.

3. Lack of investments in forests. No significant investments have been made in forests in the last 25 years, in spite of massive damages they have witnessed during this period. There have been some insignificant investments in afforestation (50-100 ha/year) or in silvicultural treatment of forests, but these investments have not impacted at all the improvement of situation. On the other hand, the lack of law enforcement has brought about a damage of forestry stock of high proportions.
4. Unfavorable energy policies. Due to the lack of central heating systems, the absolute majority of houses and apartments have no thermal insulation at all. On the other hand, given the high price of electric power, the only option left to the population as major energy source is forestry biomass.
5. As it was highlighted above, about 90% of the forestry biomass is extracted informally. This is accomplished through: (i) the use of forestry biomass by rural areas population for heating and cooking; (ii) illegal cutting by companies and local businesses; (iii) damages caused by fires and storms and (iv) corruption [8] and declining investments, lack of forest management and maintenance, lacking public supervision and law enforcement, lack of ownership status [9]. Average losses are estimated to approximately 7-10 million EUR/year.

Expected development for the period 2015-2050

Two relevant scenarios were prepared to see what the progress of forests up until 2050 would be: the trend of expected forest natural growth and the trend of expected wood/timber consumption for the period 2015-2050. Both scenarios were prepared based on the data regarding the period 2000-2013, and more specifically on the following equations:

- Projection of demand for timber/wood was based on the equation: $y = 2E+06x^{-0.026}$
- Projection of expected forest natural growth was based on the equation: $y = 1E+06x^{-0.019}$

After processing the relevant data, it turned out that the expected forestry situation up until 2050 will be as shown in figure 7 below:

Thus, taking into account the situation of the period 2000-2013, it turns out that up until 2050 the difference between forest natural growth and demands for wood/timber would be too high, obviously weighing against forest growth.

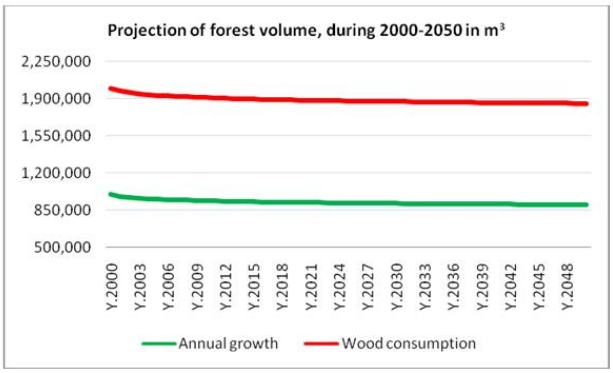

Figure 7. Projected of forest volume for period 2015-2050

In other words, the projection of forest situation still considers forestry sector a GHGs emitter as long as the pace of forest cutting is approximately twice as high as the pace of their natural growth, which is shown in the figure 8 below:

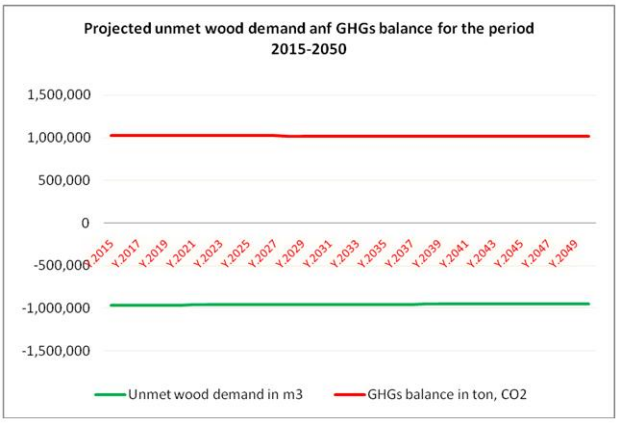

Figure 8. Projected unmet wood demand and GHGs balance

What are the proposed solutions?

Taking into account the current situation of the forestry sector in Albania, the major solutions should be focused on these main directions:

1. Improvement of technological aspect of forest exploitation. Given that only during this process 20% of the forestry biomass is lost, the attention should be focused here. This means introducing modern and efficient equipment/ vehicles to be used in forest exploitation and forest transportation. The use of these equipment/vehicles will increase the efficiency (will reduce losses) up to 96% from the current figure of 80%.

2. Use of efficient appliances for heating and cooking (high efficiency stoves). There are appliances with efficiency of up to 85% on the market (the efficiency of the ones currently in use is 50%) and these could substantially improve the energy efficiency of users of forestry biomass, reducing the used quantities.

3. Drafting and implementation of a national plan of afforestation/reforestations.

These first two measures together would enhance the efficiency of use of timber up to 42%, so we would save up to 42% of the forestry biomass which is currently being used in the country. These two measures could be implemented starting from 2015 up until 2030, with an annual average pace of 2.625%/year for 16 successive years. After year 2030 the above mentioned measures would be no longer effective as it is foreseen to have achieved the peak of their effectiveness.

The current and proposed values for the improvement of efficiency in the exploitation of forests and timber/wood for heating and cooking are shown in figure below:

Activity	Current efficiency	Improved technology
Forest harvesting Harvesting 1 m^3 of wood	80% 0.8 m^3	96% 0.96 m^3
Wood burning Burning of 1 m^3 of wood	50% 0.5 m^3	85% 0.85 m^3
Final result	0.8*0.5=**0.4 m^3** 0.4 m^3 or **40%** efficiency	0.96*0.85=**0.82 m^3** 0.81 m^3 or **82%** efficiency

The effect of the implementation of these two technologies in combination during the period 2015-2050 is shown in figure 9:

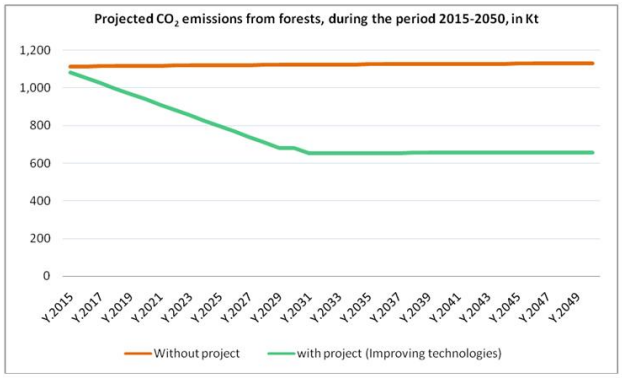

Figure 9. Projected CO_2 emissions from forest during 2015-2050

But even the successful implementation of these two technologies seems to be not sufficient, as forests continue to be GHGs emitters with about 650 Kt CO_2/year.

Therefore it is important to take other additional measures, so as forests would be transformed from GHGs emitters to GHGs absorbers. Such activities are afforestations, with a

view to enhancing the national forestry stock in area and volume. Two scenarios for the implementation of a project at the national level of the afforestation of respectively 500ha/year and 1,000 ha/year, up until 2050 are described below, thus, respectively 18,000 and 36,000 ha of afforestation up until 2050.

The absorbing capacity of GHGs of afforestations of 500 ha/year and 1,000 ha/year is shown in figure 10:

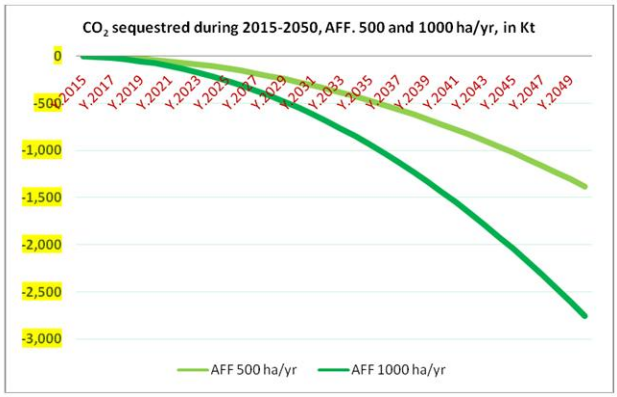

Figure 10. Projected CO_2 sequestration during 2015-2050 through forestations

As it can be seen in the chart, the implementation of this afforestation project is the most optimal solution to improve the balance of forests in Albania. Each of the two options shown in the chart give their effects in time and quantity, and it is obvious that a greater area has a bigger absorbing capacity of CO_2. Therefore, the afforestation of an area of 1,000 ha/year up until 2050 is recommended for a recovery as quick as possible of the forestry sector.

Chart 11 shows the combined effect of the three measures proposed above: (i) improvement of the technology of forest exploitation; (ii) improvement of the technology of wood/timber burning; and (iii) afforestation of an area of 500 ha/year and 1,000 ha/year, up until 2050.

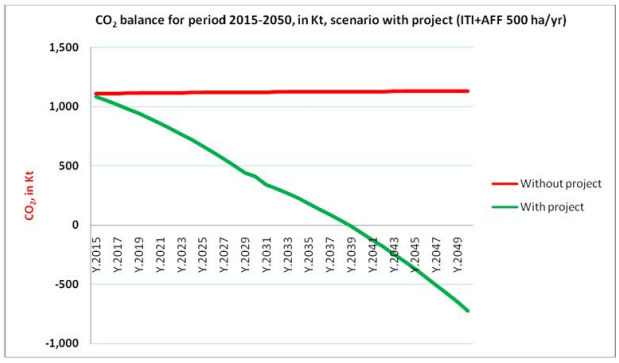

Figure 11. The balance of CO_2 for period 2015-2050, scenarios with project (aff.500 ha/yr)

The implementation of the two measures of technological character as well as the afforestation of 500 ha/year up until 2050, will make the forests achieve the sustainable development level only after 25 years (year 2040). Meanwhile, in the event of afforestation of 1,000 ha/year, the situation is different, will make the forests achieve the sustainable development level after 18 years (year 2032), as shown in the figure 12 below:

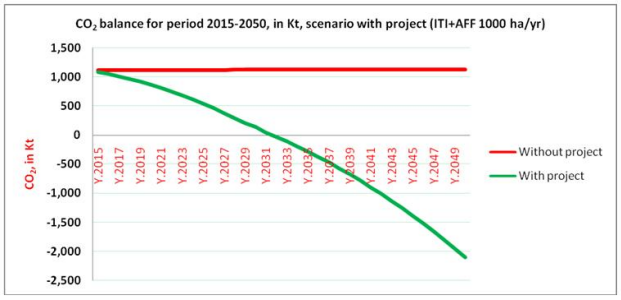

Figure 12. The balance of CO_2 for period 2015-2050, scenarios with project (aff. 1000 ha/yr)

As it can be seen in figure 12, the implementation of the three measures mentioned above will significantly improve the situation of forestry stock in Albania. And after the effective implementation of the two measures of technological character and afforestation of an area of 1,000 ha/year until 2050, the sustainable management of forests in Albania will be start only in 2032.

Taking into account the above description, the current situation of the forestry sector in Albania makes taking the proposed measures in this study necessary.

IV. CONCLUSIONS

- The data show that the Albanian forestry stock has not been managed in a sustainable way, transforming it for decades into a GHGs emitter.
- The improvement of the technological process of exploitation would save up to 16% of the forestry biomass currently in use.
- The improvement of energy efficiency by introducing modern appliances for heating and cooking would save up to 35% of the forestry biomass. Both these measures would improve the situation of forestry stock in Albania, but forests still remain GHGs emitters.
- Carrying out the afforestation at an average pace of 1,000 ha/year up until 2050, along with the implementation of technological measures would make Albania achieve the balance of sustainable development of forests in 2032.
- If 500 ha/year were planted and measures of technological character were implemented, then the sustainable development of this sector would be achieved only in 2040.
- If the measures described above are not taken, forests will continue to be GHGs emitters in the upcoming period, and their current situation will become even worse.

ACKNOWLEDGMENTS

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