Greek Forests and Climate Change

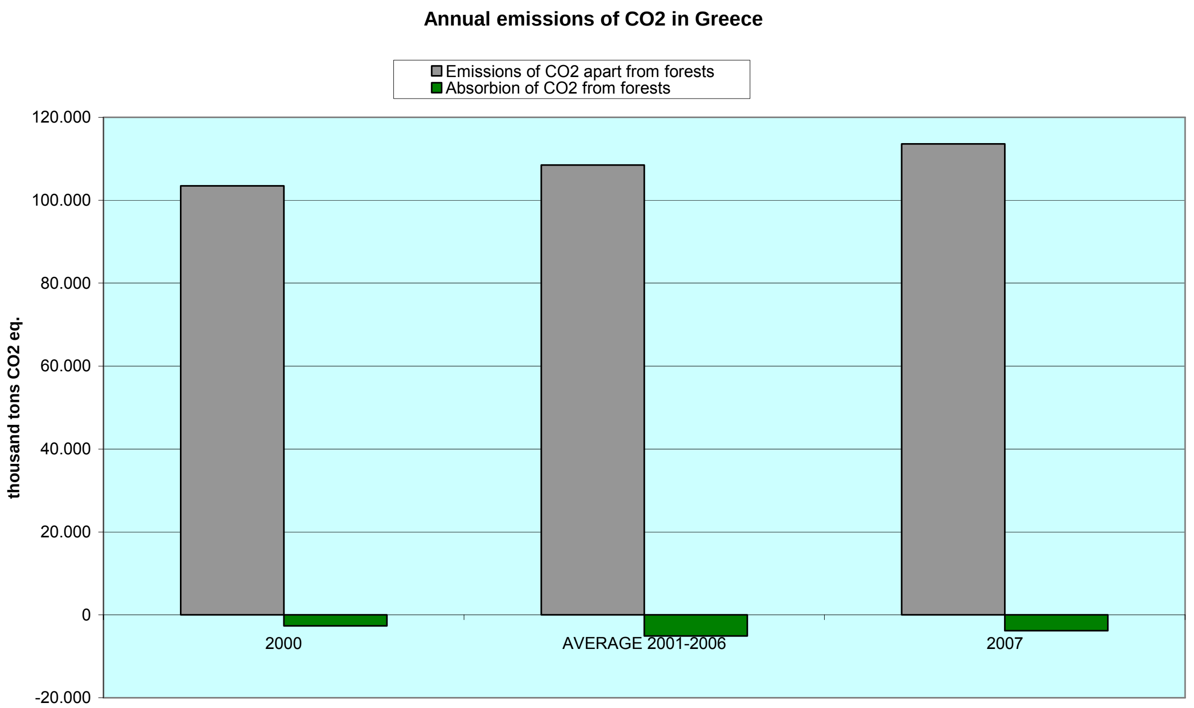
Climate changed is defined the planet's over warming due to the increase of greenhouse gasses at the atmosphere. Carbon dioxide CO2 is the most important from these although the contribution of methane and nitrous oxide can't be ignored.

United Nation established the Intergovernmental Panel on Climate Change, IPCC, and the World Meteorological Organization, WMO, in order to provide information about this issue to global community. The last report of IPPC (2007) clarifies that climate change is probably of anthropogenic origin and if there is no action from humanity, the consequences of any kind will be important.

In these frames and given the expiry of Copenhagen's conference, YLI based on the 1992 inventory of Forest Service, determined the relation of Greek Forest with carbon storage and carbon dioxide absorption and would like to present the results of this work.

Greenhouse gases emissions from Greece

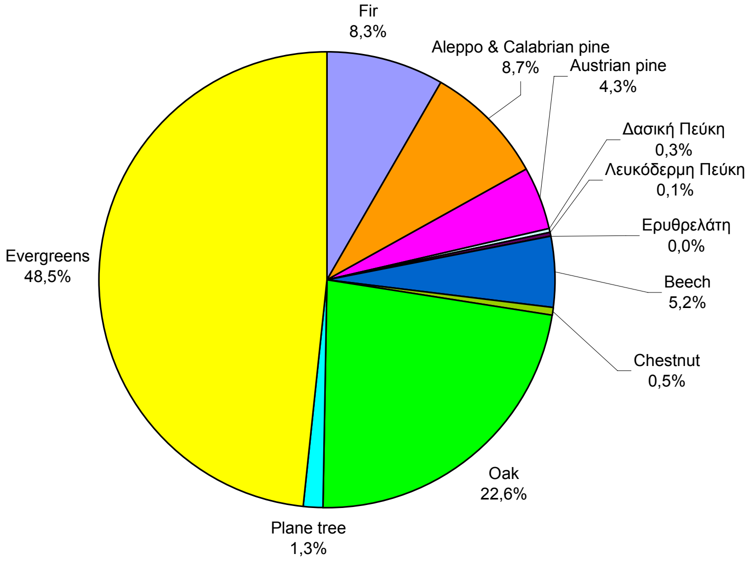
The most important greenhouse gas is by far the CO2, **and** in Greece, as it is officially recorded in the national annual reports to United Nations. It participates in national emission at about 85% in relation to the other gases. The sector of energy (release of energy from combustions) that includes industry, transportations and domestic consumers is the one with the biggest contribution to national emissions (80% approximately). Forests are the sector that absorbs; it has negative sign to emissions. The percentage of emissions, by the other sectors, that forests absorb does not exceed 5%. It is however a natural way of absorption and this is important. We observe that years with big forest fires (2000 and 2007) the forest absorption ability decreased considerably.



YLI – Environmental Projects
Evripidi 18, Athens 2103213695
www.forest.gr

Forest in Greece and CO_2 absorption

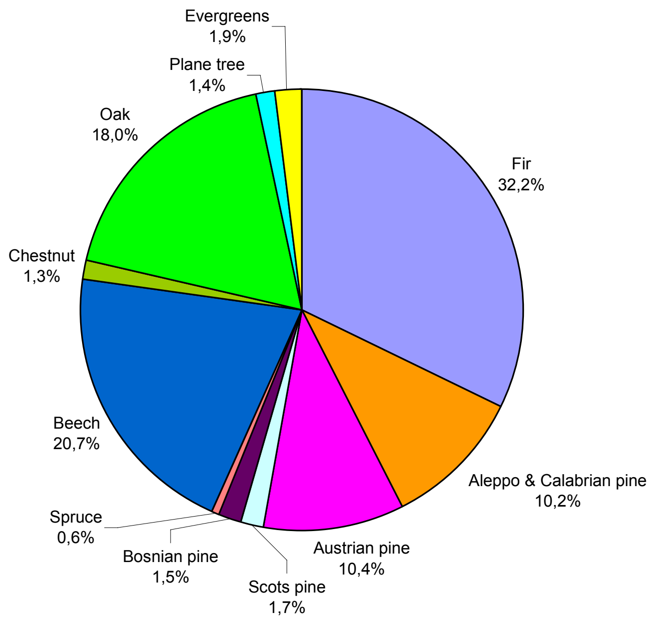
Area distribution of the Greek forest types



Forests in Greece, as in other Mediterranean countries, are characterised by shrub dominance. These are formations of evergreen shrub species (keep their foliage during winter) the most important of them being kermes oak (Quercus coccifera), strawberrytree (Arbutus spp.), lentisk (Pistacia lentiscus), mock privet (Phillyrea latifolia) and junipers (Juniperus oxycedrus, J. phoenicea).

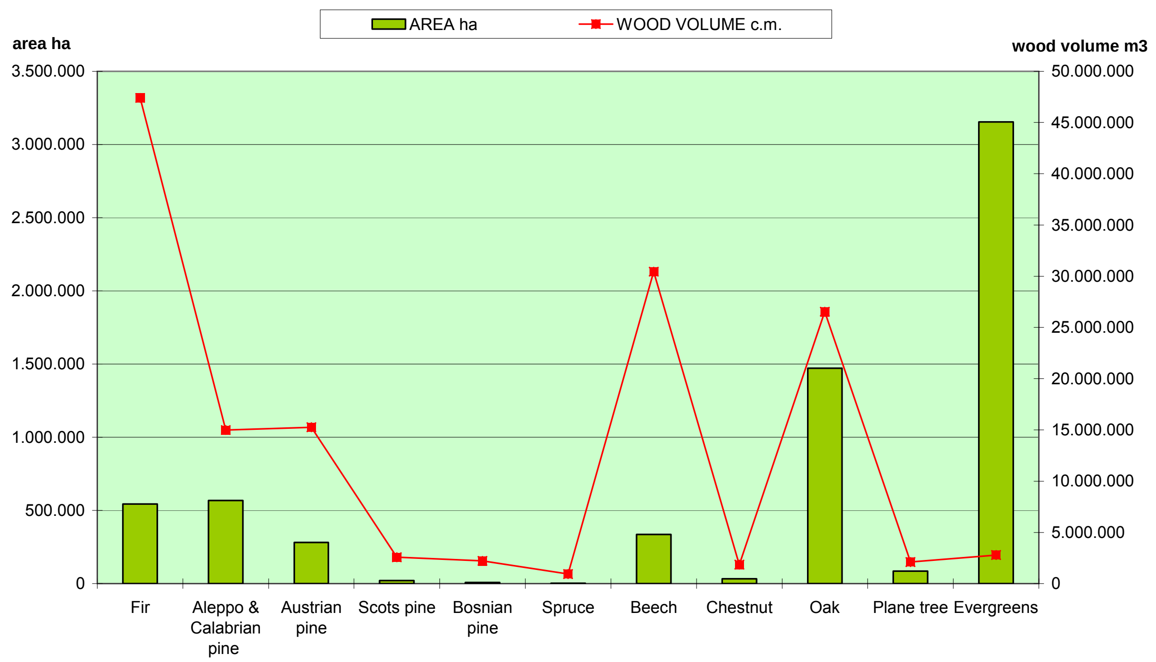
The majority of shrublands derive from the degradation of high forests where trees were dominant but due to various reasons they are destroyed and could not manage to recover. The causes have mainly anthropogenic origin and include fires, overgrazing, forest clearances for building and agriculture, over-logging. Overall, they cover approximately half of our forests with main presence in areas of low or medium altitude, being able to reach about 1000m. The other species however (oak, pine species, fir, beech, plane tree, chestnut) are very important as they cover extensive mountainous areas giving various products, protection to the soil and value to the landscape.

Wood volume distribution of the Greek forest types

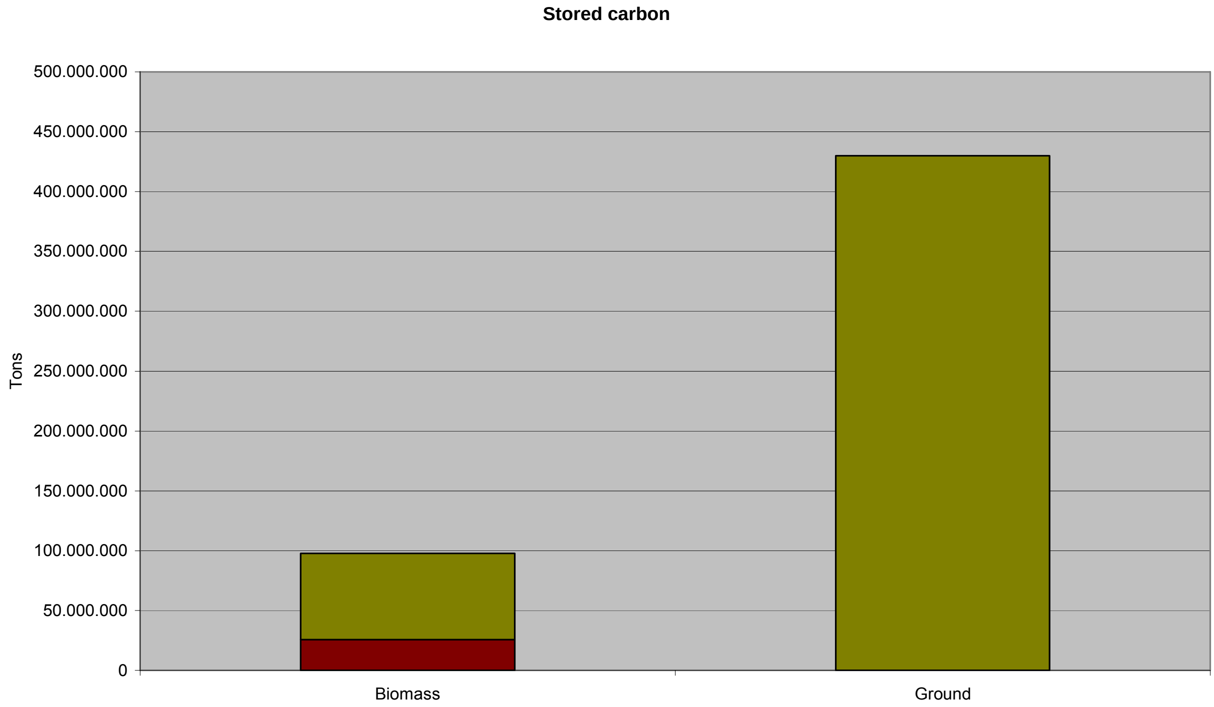


Wood volume is the total volume of wood found in a forest. The wood volume includes the entire trunk of living trees (merchantable trunkwood + apexes) but no branch wood. We note that the wood volume of the evergreen shrublands is insignificant as biomass quantity despite the fact that they cover half of the total forest land. On the contrary, the great value of fir, beech and and oaks is apparent; these species occupy 8.3%, 5.2% and 22.6% of the area but 32.2%, 20.7% and 18% of the wood volume respectively.
The above observation is better illustrated in the following diagram where the wood volume is contrasted with the area covered and there it comes the conclusion that fir, beech and oaks are the most valuable species.

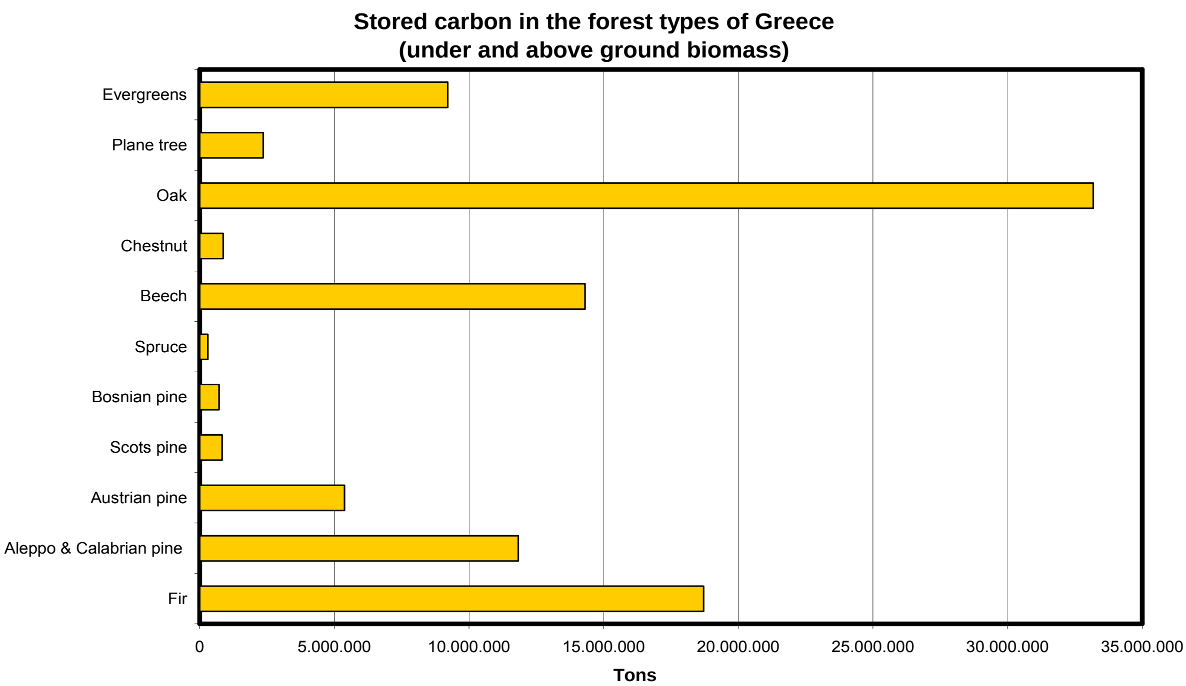
Comparison of wood volume to area for the Greek forest types



Carbon is stored in the above ground biomass (trunk, bark, leaves, branches, understorey), in the under ground biomass (roots, stumps), in the forest soil and as dead leaves and dead wood. In the soil is stored a much bigger amount than that in the biomass.



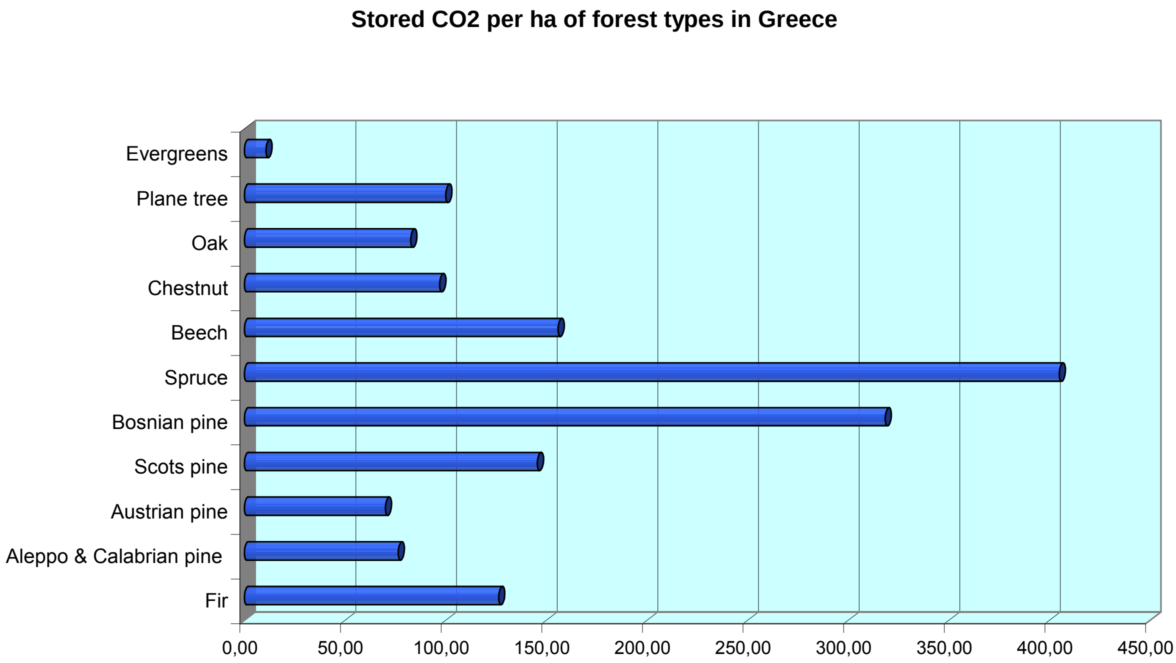
The stored carbon is linked with wood volume. The wood volume is converted to above ground biomass in tons of dry mass with BCEF factors (Biomass Conversion and Expansion Factors) according to IPCC 2006 (Guidelines for National Greenhouse Gas Inventories). We used factors from the table 4.5 for the climate zone Mediterranean. These factors are taking into account branches, leaves, shrub layer as well as the wood density in different kinds of forest types. Afterwards the underground biomass was found with factors of the table 4.4 and led to the total biomass. The biomass is converted to stored carbon with the called carbon fraction which, according to the above mentioned source, is 0.47. The next diagram presents the stored carbon of above and under ground biomass in Greek forest.



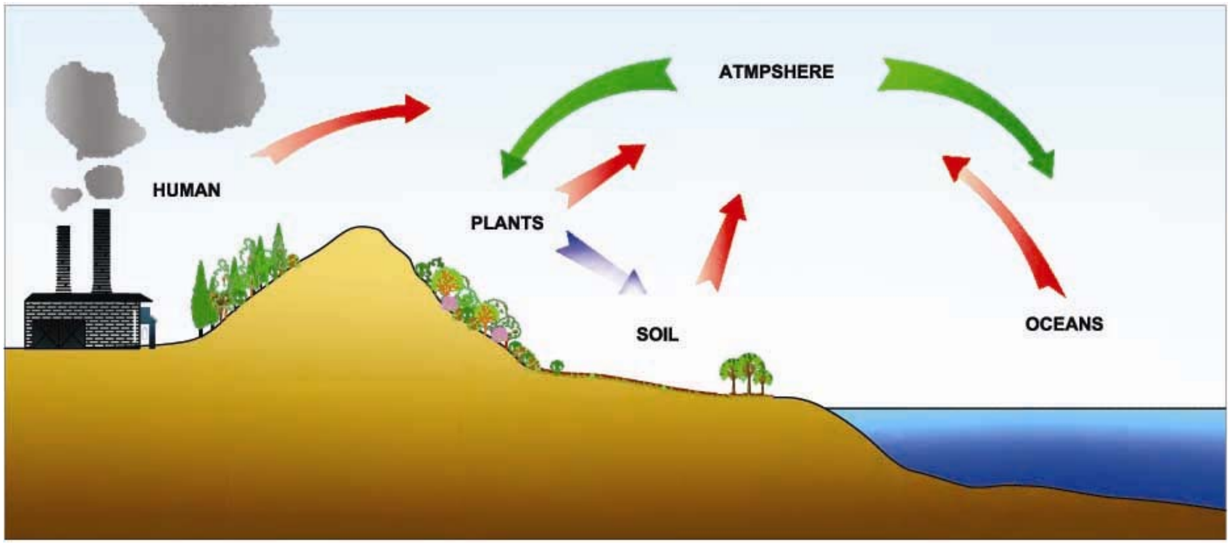
YLI – Environmental Projects
Evripidi 18, Athens 2103213695
www.forest.gr

Comparing the different forest types we can note the value of oak, fir and beech forests on the carbon storage capacity. Oak forests that include all the tree species of oaks (including kermes and holly oaks with tree forms) are ejected due to high BCEF factor, that is the reported wood volume does not attributes the rich biomass because of branches, tree crown e.t.c. Similarly, the evergreens have big factor and rise significantly compared to the wood volume.

The stored carbon is considered that means maintenance and storage of CO2 (carbon dioxide), via a unified factor 44/12 for all forest. Therefore the CO2 is directly proportional to stored carbon.
Taking into account the absorption of CO2 per area covered by the forest types, spruce has the greater potential to retain CO2 but it occupies only a very small area of 2,754 hectares. Bosnian pine comes second with great storage capability but small area (0.1% of the forests), and Scots pine, beech and fir follow. The smaller capability is that of evergreen shrublands, however they can be converted into high forests with suitable management, with much bigger CO2 storage capacity.



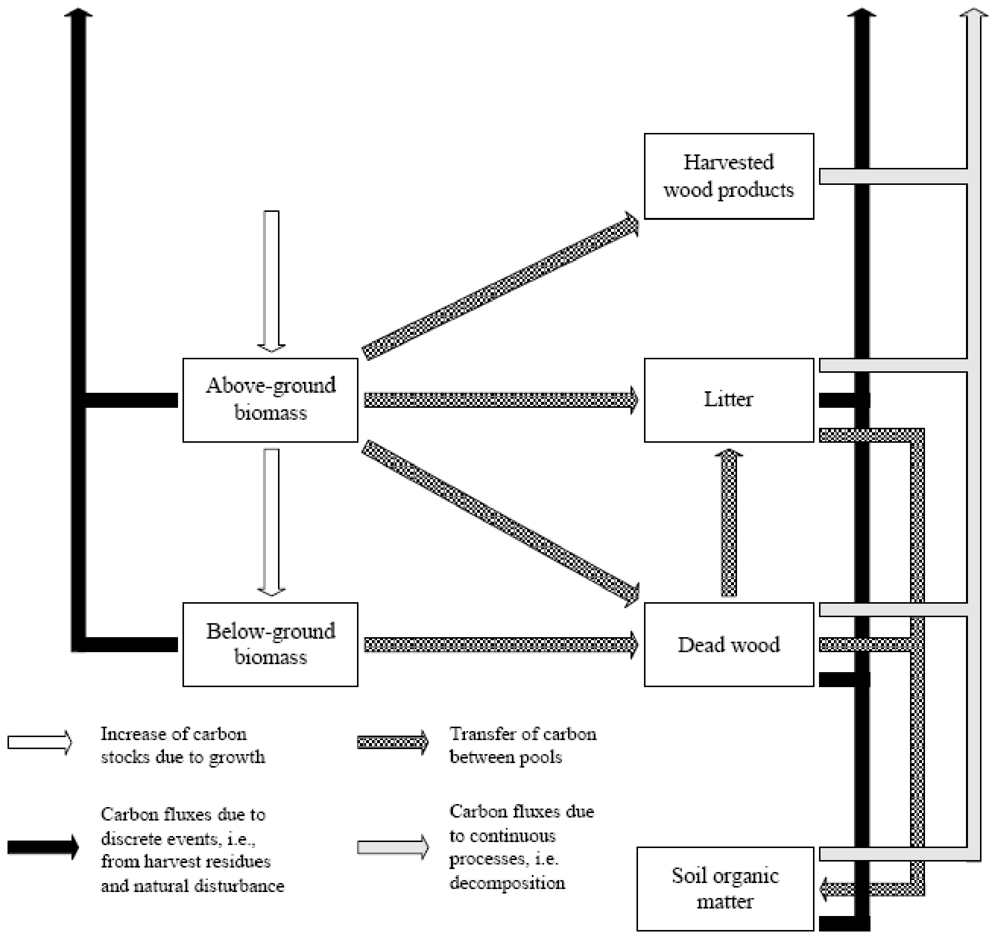
Carbon cycle and human interference



Up to 1860, carbon circle was in equilibrium. Afterwards, the industrial revolution had as a consequence the increase of CO2 total net emissions to the atmosphere due to decrease the extent of forest and the increase of combustions (from human and plants) in a degree non regulated from natural processes. From 1960 and onwards, the combustion of fossil fuels is the leading contributory factor to this phenomenon.

The field of real human interference is primarily to reduce its emissions but also to increase the extent of plants.

Figure 2.1 **Generalized carbon cycle of terrestrial AFOLU ecosystems showing the flows of carbon into and out of the system as well as between the five C pools within the system.**



A general schematic representation of the carbon cycle shows the following:

- Basic C loss emanates from extraordinary disturbances as fires, change of land uses from forests to another form and diseases-epidemic
- The other diode outflow is the forest products. The intensity of production and the quantity of the products show the size of the losses. In Greece the intensity is low and the quantities are small
- Inflow component is the primary production of biomass which can increase with the an increase of the forest covered area and provided the improvement of the habitat so as to produce more biomass.

YLI – Environmental Projects
Evripidi 18, Athens 2103213695
www.forest.gr

In order to measure or even to appreciate the changes (e.g. annually) in the carbon balance, there is the equations methodology developed by IPCC. Actually we should have a national system for measuring carbon in forests. **And into this, it is included the necessity of a new national forest inventory.**

Even in smaller areas reporting requires:

Have a region e.g. Parnitha where area and cover categories will be known. Have local data about wood volume, annual yield and annual mortality. Also, local data about BCEF factor, that is wood volume in biomass. Consequently in an extraordinary disturbance, such as the fire of 2007, we can estimate the loss in tones C and CO2.

With the existing data we can say the following.

The burnt forests and forest areas are 3,638.8 ha in the peripheral zone of Parnitha National Park. The total amount of stored carbon in the burnt biomass was 120.467 tones and the stores CO2 441.711 tones (0.12% of the country). This released almost entirely to the atmosphere due to the intensity of the fire. Based on data of annual yield we find that the annual biomass absorption of CO2 at the burnt area was 10,248.5 tones. Consequently, this area needs 43 years for the fixation of the lost CO2

Data were obtained from Parnitha's local forest (www.parnitha-np.gr) service and the work of Amorgiannioti C., Angelopoulos, A. 1995. Research of structure and evolution of Parnitha's fir forest.

References

1. Υπ.Γεωργίας, Γ.Γ.Δασών & Φυσ.Περιβάλλοντος, 2000. Κριτήρια και δείκτες αειφορικής διαχείρισης των δασών της Ελλάδας. Αθήνα
2. Υπ.Γεωργίας, Γ.Γ.Δασών & Φυσ.Περιβάλλοντος, 1992. Αποτελέσματα πρώτης εθνικής απογραφής δασών. Αθήνα
3. IPCC 2006 Guidelines for National Greenhouse Gas Inventories. Prepared by the N.G.G.I Programme. Eggleston H.S., L. Buendia, K. Miwa, T. Ngara, K. Tanabe (eds) Published IGES, Japan.
4. ΥΠΕΧΩΔΕ. 2009. Annual Inventory Submission under the Convention and the Kyoto Protocol for greenhouse and other gases for the years 1990-2007.
5. Kimmins J.P. 1987. Forest Ecology. Macmillan publishing company, 531pp
6. Άνδρου Απόστολος 2000. Ποσότητες και παράγοντες που επηρεάζουν την αξιοποίηση της βιομάζας από εκτάσεις δασικού χαρακτήρα στο Ν.Αττικής. Εισήγηση σε Ημερίδα της Γ.Γ.Δασών & Φυσ.Περιβάλλοντος με τίτλο «Ενεργειακές δυνατότητες των δασών ως παράγοντας προστασίας τους».