Carbon mitigation potential in Peri-Urban Conifer Forest in Greece under Different Thinning Intensities

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Forest ecosystems provide regulating services of carbon sequestration and mitigate the climate changes. In degraded forest ecosystems, adoption of sustainable forest management practices (i.e. thinning, fertilization, harvesting) is strictly associated with climate change adaption and mitigation. The thinning density can, among others, increase its role as carbon sink and reduce greenhouse gases (GHG) emissions in the atmosphere. The aim was the reliable estimation of changes in C stocks in the forest carbon pools two years after the thinning treatments in order to provide guidelines to increase the climate change mitigation potential of these ecosystems.

The study area was the periurban planted coniferous forest in Xanthi (41º 09' 27.3' N – 24º 54' 09.8' E, Greece) dominated by *Pinus brutia.* The planting activities began in 1936 and took place periodically up to 2007. Today, forest broadleave species are established in the understory. Two different thinning treatments were applied, the traditional and the selective. The thinning operations were implement in 2016. The thinning operation resulted in statistically significant changes in basal area with control plots as references. Basel area was reduced by 21% in traditional thinning and by 40% in selective thinning.

Carbon pools were measured, before, after thinning, and two years after. The measured pools were above and below ground biomass, the dead wood, litterfall, litterfloor and soil carbon. The effects of thinning on greenhouse gas soil fluxes were measured also. We measured the CO_2, CH_4 and N_2O, that amount at about 80% of the total GHG. In the study area 36 monitoring sub-areas (2 areas per each of the 3 treatments replicates were established). Forest variable (diameter at breast height (DBH), total height (H), species and position of all trees) were measured in circular 13 m – radius sample areas. Aboveground biomass was estimated through species specific biomass expansion factors (BEF) and wood basal density coefficients (WBD) which convert wood volume to biomass dry weight. Below ground biomass was derived from above biomass using root/shoots conversion factors. Dead wood was estimated from the standing trees plus the lying deadwood or logs. Littefall was collected once at the end of each season during study period through two traps (50x50x30 at 1 m height from ground) for each monitoring sub area. Forest floor litter was collected once a year in two positions in each sub-plot by pressing a 700 cm^2 collar into forest floor and collecting all litter material above soil. Soil samples was collected once a year from the same position as forest floor at depth 0-10 cm and 10-30 cm. Carbon and nitrogen was determinate in the soil. The gases emissions have been studied using the static closed chamber method in the course of a year. In total, eighteen collars (30 cm in diameter) were set up in all trial sites. Estimation of Global Warming Potential (GWP)

of GHG emissions for each thinning treatment has been assessed, thus giving an initial picture of mitigation potential of thinning practices against global climate change.

The results showed after two years from thinning, both thinning treatment had higher year increment although the total biomass was not significant effects by the treatment. The Xanthi peri-urban forest is characterized by a low total amount of deadwood the 48% are from stumps. Tinning treatment had significant effect on litter floor and forest floor production, Thinning reduced both total litterfall production and conifer fractions but the selective thinning increase deciduous production. The results showed also a significant effect of thinning as a management practice on the range of GHG exchange between soil forest-atmosphere, and thus on containing of their global warming potential. However, a long-term research is essential in order to extend the responses of all carbon pools and the GHG fluxes to thinning treatments and thus to extract definite conclusions for management options in global change mitigation targets. The applied thinning treatments especially selective will accelerate the conversion of those peri-urban forests in to broadleaved forests or in to mixed forests of conifers and broadleaves. These will have resulted in future, in reduction of fire risk and in increased stability of the ecosystem.
These results may allow in the future the decision-makers in management practices regarding the increase carbon sequestration and sustainability of forest ecosystem.

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