

## **Sustainable carbon uptake – important ecosystem service within sustainable forest management**

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Even-aged forest management with natural regeneration under continuous cover (i.e. close to nature management) is considered to be sustainable regarding the yield, biodiversity and stability of forest ecosystems. Recently, in the context of climate change, there is a raising question of sustainable forest management regarding carbon uptake. Aim of this research was to explore whether current close to nature forest management approach in Croatia can be considered sustainable in terms of carbon uptake throughout the life-time of Pedunculate oak forest.

In state-owned managed forest a chronosequence experiment was set up and carbon stocks in main ecosystem pools (live biomass, dead wood, litter and mineral soil layer), main carbon fluxes (net primary production, soil respiration (SR), decomposition) and net ecosystem productivity were estimated in eight stands of different age (5, 13, 38, 53, 68, 108, 138 and 168 years) based on field measurements and published data. Air and soil temperature and soil moisture were recorded on 7 automatic mini-meteorological stations and weekly SR measurements were used to parameterize SR model. Carbon balance was estimated at weekly scale for the growing season 2011 (there was no harvesting), as well as throughout the normal rotation period of 140 years (harvesting was included).

Carbon stocks in different ecosystem pools change during a stand development. Carbon stocks in forest floor increase with stand age, while carbon stocks in dead wood are highest in young and older stands, and lowest in middle-aged, mature stands. Carbon stocks in mineral soil layer were found to be stable across chronosequence with no statistically significant age-dependent trend. Pedunculate Oak stand, assuming successful regeneration, becomes carbon sink very early in a development phase, between the age of 5 and 13 years, and remains carbon sink even after the age of 160 years. Greatest carbon sink was reached in the stand aged 53 years.

Obtained results indicate that current harvesting practice has no detrimental effect on carbon stored in forest soil. Observed early and long-lasting carbon sink suggest that close to nature forest management can be considered sustainable in terms of carbon uptake. Also, observed carbon sink in the oldest stand is valuable information for potential debate on prolonging rotation period in this type of forest ecosystems.