Geophysical Research Abstracts
Vol. 21, EGU2019-16448, 2019
EGU General Assembly 2019

Ten Years of Monitoring the Net Primary Productivity of Pedunculate Oak (*Quercus robur* L.) Forest with Eddy Covariance and Biometric Measurements

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We analysed 10 years (2008–2017) of continuous eddy covariance (EC) CO_2 flux measurements of net ecosystem exchange (*NEE*) in a young pedunculate oak forest in Croatia. Measured *NEE* was gap-filled and partitioned into gross primary productivity (*GPP*) and ecosystem reparation (R_{ECO}) using the online tool by Max Planck Institute for Biogeochemistry in Jena, Germany. Annual *NEE*, *GPP,* and R_{ECO} were correlated with main environmental drivers. Net primary productivity was estimated from EC (NPP_{EC}), as a sum of -*NEE* and R_h obtained using a constant R_h : R_{ECO}ratio, and from independent periodic biometric measurements (NPP_{BM}). For comparing the *NPP* at the seasonal level, we propose a simple model that aimed at accounting for late-summer and autumn carbon storage in the non-structural carbohydrate pool. Over the study period, Jastrebarsko forest acted as a carbon sink, with an average (±std. dev.) annual *NEE* of -319 (±94) gC m^{-2} y^{-1}, *GPP* of 1594 (±109) gC m^{-2} y^{-1}, and R_{ECO} of 1275 (±94) gC m^{-2} y^{-1}. Annual *NEE* showed high inter-annual variability and poor correlation with annual average global radiation, air temperature, and total precipitation, but significant (R^2 = 0.501, p = 0.02) correlation with the change in soil water content between May and September. Comparison of annual NPP_{EC} and NPP_{BM} showed a good overall agreement (R^2 = 0.463, p = 0.03), although in all years $NPP_{BM}$was lower than NPP_{EC}, with averages of 680 (±88) gC m^{-2} y^{-1} and 819 (±89) gC m^{-2} y^{-1}, respectively. Lower values of NPP_{BM} indicate that fine roots and grasses contributions to *NPP*, which were not measured in the study period, could have an important contribution to the overall ecosystem *NPP*. At a seasonal level, two *NPP* estimates showed differences in their dynamic, but the application of the proposed model greatly improved the agreement in the second part of the growing season. Further research is needed on the respiration partitioning and mechanisms of carbon allocation.