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Conference Abstract

Disentangling the effect of stand structure on the C-balance of Mediterranean Pine forests using a process-based forest model

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Abstract

Adaptive management of Mediterranean pine forests can contribute towards carbon farming and fire protection, under current global change conditions. Local scale process-based forest models can be used to identify the optimum stand structure for this dual aim. For this purpose, we established a monitoring network within the PineOptim project, which includes two Calabrian pine (*Pinus brutia* Ten.) and one Aleppo pine (*Pinus halepensis* Mill.) forests in Greece, differing in stand structure due to the applied management priorities and natural post-fire dynamics. Thus, at the Aleppo pine site at Sani, Chalkidiki, which also belongs to eLTER, plots differing in the manipulation of understory shrub vegetation to minimize fire risk, were established. At the Calabrian pine site at Xanthi, our plots represent different thinning intensities that were applied to favor the introduction of broadleaf species. Finally, at the non-managed Calabrian pine forest on Lesvos, the established plots are characterized by different post-fire ages. These three

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management regimes represent the mainstream approaches towards forest management of low elevation pine forests in Greece and result in discrete stand structures. This study presents a set-up of simulation exercises to identify the optimal stand structure for maximizing carbon sequestration, using a locally parameterized version of the TFS model for low elevation Mediterranean pine species. By applying a harmonized across-sites monitoring protocol, leaf-level ecophysiological (photosynthesis - light response curves of sunlit and shade needles, relative needle water content), tree-level biometric (diameter at breast height, height, canopy projection, leaf area index), and stand-level C-flux (annual litterfall flux, litter decomposition, soil respiration) data have been systematically gathered across our monitoring network. The leaf-level ecophysiological data were used to parameterize a daily photosynthesis algorithm. The tree-level biometric data were used to develop a tree-by-tree light competition algorithm. The stand-level data were used to parameterize a C turnover algorithm related to tree mortality, litterfall, litter decomposition and soil respiration. The model's predictive ability was evaluated using daily GPP (Gross Primary Productivity) and NEP (Net Ecosystem Productivity) data from the eddy flux tower at our eLTER site at Sani, Chalkidiki. Subsequently, the model was used in a leave-one-out simulation experiment to evaluate the role of stand structure, including that of the understory, in optimizing C-storage and cycling.

Keywords

Mediterranean pines, carbon sequestration, process-based models, forest management

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Conflicts of interest

The authors have declared that no competing interests exist.