

Historic Fire Occurrence in Hemi-Boreal Forests: Exploring Natural and Cultural Scots Pine Multi-Cohort Fire Regimes in Lithuania

Authors : Charles Ruffner, Michael Manton, Gintautas Kibirsktis, Gediminas Brazaitas, Vitas Marozas, Ekaterine Makrickiene, Rutile Pukiene, Per Angelstam

Abstract : In dynamic boreal forests, fire is an important natural disturbance, which drives regeneration and mortality of living and dead trees, and thus successional trajectories. However, current forest management practices focusing on wood production only have effectively eliminated fire as a stand-level disturbance. While this is generally well studied across much of Europe, in Lithuania, little is known about the historic fire regime and the role fire plays as a management tool towards the sustainable management of future landscapes. Focusing on Scots pine forests, we explore; i) the relevance of fire disturbance regimes on forestlands of Lithuania; ii) fire occurrence in the Dzukija landscape for dry upland and peatland forest sites, and iii) correlate tree-ring data with climate variables to ascertain climatic influences on growth and fire occurrence. We sampled and cross-dated 132 Scots pine samples with fire scars from 4 dry pine forest stands and 4 peatland forest stands, respectively. The fire history of each sample was analyzed using standard dendrochronological methods and presented in FHAES format. Analyses of soil moisture and nutrient conditions revealed a strong probability of finding forests that have a high fire frequency in Scots pine forests (59%), which cover 34.5% of Lithuania's current forestland. The fire history analysis revealed 455 fire scars and 213 fire events during the period 1742-2019. Within the Dzukija landscape, the mean fire interval was 4.3 years for the dry Scots pine forest and 8.7 years for the peatland Scots pine forest. However, our comparison of fire frequency before and after 1950 shows a marked decrease in mean fire interval. Our data suggest that hemi-boreal forest landscapes of Lithuania provide strong evidence that fire, both human and lightning-ignited fires, has been and should be a natural phenomenon and that the examination of biological archives can be used to guide sustainable forest management into the future. Currently, fire use is prohibited by law as a tool for forest management in Lithuania. We recommend introducing trials that use low-intensity prescribed burning of Scots pine stands as a regeneration tool towards mimicking natural forest disturbance regimes.

Keywords : biodiversity conservation, cultural burning, dendrochronology, forest dynamics, forest management, succession

Conference Title : ICCCEP 2021 : International Conference on Climate Change and Environmental Physics

Conference Location : Amsterdam, Netherlands

Conference Dates : September 16-17, 2021