Modeling post-fire damage and tree mortality in forest stands in Portugal

This paper discusses research aiming at the development of post-fire mortality models that can be used for enhanced integration of forest and fire management planning activities in Portugal. Post-fire mortality was modelled using biometric data, site conditions and topographic characteristics from 2005/2006 National Forest Inventory plots and other sample plots within 2006, 2007 and 2008 fire perimeters. Thus, data from over 241 plots and 2520 trees within wildfire perimeters were fitted based on logistic regression methods. A three-step modeling strategy was used.

The first equation predicts the probability of mortality if a wildfire occurs in the stand. The second quantifies the degree of mortality (i.e. proportion of dead-trees in the stand) caused by a wildfire on stands where mortality occurs. The third, estimate the probability of a tree to die due to a forest fire. The models are based on easily measurable forest characteristics so that forest managers may predict post-fire mortality before the fire occurs based on forest structure and topographic characteristics. The damage models show that the probability of death occurring in a stand increases with variability of tree sizes within the stand and decreases with higher tree sizes. Moreover, the relative damage increases with stand density and steep slopes. Small and dominated trees are more prone to die due to a fire. The model further indicates that in the same conditions, conifers are more prone to die than eucalypt and broadleaves.

Keywords: Forest fires; Forest management; Damage model; Post-fire mortality; Logistic regression