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## Environmental Influences on Forest Structure and Woody Species Diversity after Forest Fires in Mexican Pine-Oak Forest

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### Abstract

Forest fires in pine-oak forest in Mexico's Sierra Madre Oriental have had a remarkable relevance since the extraordinary fire season in 1998, due to their direct contribution to deforestation, changes in forest structure, species composition, and recently to their impact to the increment of carbon dioxide in the atmosphere. Nevertheless, few studies have investigated post-fire stand dynamics or natural regeneration. The influence of environment, fire year and stand location on natural regeneration was studied in 23 post-fire stands in the Mixed pine-oak forest of Nuevo Leon state.

Our goal was to describe the present forest structure and woody plant species composition along a fire chronosequence in pine-oak forest in the SMO to (1) increase the understanding of successional patterns in mixed pine-oak forest in this region, and (2) to relate successional patterns to environmental variability. Besides using time-since-fire as a control variable, other parameters may also have an impact on forest succession and woody plant species composition, thus we included analyses of site aspect, elevation, slope and potential solar radiation. Multivariate analyses showed that local environmental factors, including fire year, continue to structure species composition. Environmental factors explained 45 % of the species variance. *Arbutus xalapensis*, *Ceanothus coeruleus*, were clearly associated with stands with lower slopes and younger post fire stands while *Quercus canbyi*, *Quercus laeta*, *Quercus polymorpha*, and *Quercus rysophylla* were associated with steeper slopes and higher incomes of potential solar radiation. Older post fire stands, appear to be associated with lower elevations stands dominated by *Pinus pseudostrobus*, *Juniperus flaccida*, *Quercus laceyi*, and *Cercis canadensis*. *Quercus virginiana*, *Prunus serotina*, and *Juglans mollis*, were associated with stands that had experienced the most recent fires of all. The woody species composition and abundance in post-fire stands appeared to be determinate by a complex of environmental factors, including fire. Different species were clearly favoured in stands with different topographic and different fire histories. Fire history varied with elevation, implying that topography and fire may exert mutual influences. Thus, while current forest fires in the Sierra Madre allow natural regeneration to continue, Mexican foresters should consider incorporating natural disturbance regimes into their management practices.

**Keywords:** Forest fire, forest structure, Mexico, pine-oak forest, Sierra Madre Oriental