

Population Structure Indicators in an Uneven Aged Mixed Coniferous Stand in North Mexico

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Abstract

1. Introduction

The tree crown is one component of a net primary production and its dimensions reflect general tree health. Dense and large crowns are associated with potential growth rates. Sparse and small crowns can be in response to unfavorable site conditions (competition, moisture, diseases). Tree crown investigation contributes of several key forest ecosystem attributes: biodiversity, productivity, sustainability, forest management, and wildlife. Crown characteristics are useful to predict growth responses in spacing and thinning and to relate growth to soil moisture availability. They are frequently required for growth modelling with tree growth being estimated from crown and other characteristics. These studies emphasize the close relationship between the size of the crown and the amount of photosynthetically active foliage (LAAR and AKCA 1997, JIMÉNEZ, et al. 2002). The knowledge of the crown structure results today from great importance, in the sense that the trees use this tree component as the source of absorption of carbon dioxide.

2. Objective

The objective of this investigation was to develop a methodology for structural characterization in an uneven aged mixed forests, through the application of stem parameters (dbh, height, basal area and age), diameter distribution (bimodal Weibull function) and several crown indices (crown width, crown thickness index, crown spread ratio, crown projection area and crown surface area). This stand characterization would be useful in different forest management applications, biodiversity study and wildlife habitat.

3. Methods and results

The study area is located in the summit of the Cerro El Potosí, Mexico, in a mixed natural forest of coniferous composed by *Abies vejari*, *Pseudotsuga menziesii*, *Pinus hartwegii* and *Pinus ayacahuite*. This stand has 504 trees. It was accomplished a diameter distribution for all species using the Weibull function as one of the most used in the forest management by his relative simplicity and flexibility, as well as by a greater adjustment in uneven aged mixed forests (HESSENMÖLLER and GADOW 2000).

$$f(x) = (c/b) * ((x-a)/b)^{c-1} * e^{-((x-a)/b)^c}$$

For the characterization of the crown structure were accomplished measurements in different sections of the tree crown to determine the following parameters: crown diameter (CD), crown length (CL), light crown length (LCL), crown percent (CR %), light crown percent (LCP %), crown thickness index (CTI), crown spread ratio (CSR), crown projection area (CPA) and crown surface area (CSA).

For the description of specific crown properties related to the tree species the crown thickness index (crown diameter/crown length) and the light crown percentage (light crown

length/crown length) are quite suitable. The variation of these indices is surprisingly high even within the same tree species. The ratio between the crown surface area respectively the surface area of the light crown and the crown projection area differs greatly between the 4 tree species.

4. Conclusions

It is concluded that it exists a great heterogeneity in the corresponding values of the crown indices (CL, CTI, CSR, CPA and CSA) in the high zone I as well as the high zone II, yet greater is the discrepancy between the species within the same strata. The final conclusion of this study is that the uneven aged mixed stand presents a specific structure, according to the stem parameters diameter distribution and crown parameters and crown indices, therefore the methodology developed is reliable to be used in uneven aged stands, being of high value in the forest ecosystems management, where is considered the forest structure of high priority.

Keywords: Crown indicators, mixed forest, population structure, uneven-aged stand, Weibull function