



Stand Structure Alterations in Forest Stands



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Abstract

Forest stands are usually classified according to regime (high forest or coppice), structure (even-aged or uneven-aged) and composition (pure or mixed). Through time there were shifts between the preferred stand structure frequently due to the desired productions; coppices for small dimension timber and high forest for large dimension ones, pure even-aged for a more uniform timber dimensions and quality and mixed or uneven-aged for when both timber and services were the target production. The alteration of regime (conversion of regime), structure (conversion of structure) and composition (transformation) has a long history in forestry. Overall, all regimes, structures and compositions contribute to the sustainability and diversity of the forest and their products and services. The alteration of stand structure varies from simple to very complex and from short to long term. The focus should be directed to a suite of guidelines, flexible models of silviculture and monitoring to enable adapting the silvicultural practices, especially during the transition phase from one stand structure to another.

Keywords: Conversion of regime; Conversion of structure; Transformation; Transition phase; Models of silviculture

Introduction

The vast forest areas have provided several products and services [1,2] and their management varies from overexploitation to of abandonment [3,4]. The development of silviculture occurred simultaneously with the shortage of forest products and was focused on providing wood and guided to the even-aged systems [1,5-9]; coppice systems for small dimension wood [7] and high forest for large dimension wood [5-9]. Meanwhile the reduction of the pressure on woody products and the environmental concerns altered the focus to broader production objectives that included timber, non-timber products and services. The paradigm's shift directed silviculture to new approaches where the emphasis was focused in multiple use systems and uneven-aged and mixed stands and the emulation of natural processes. This resulted in the development of many approaches, methods and techniques were developed [1,10-22].

The variation of products and services expected from the forests created the need to develop methods, techniques and tools to enable the stand structure alteration. In the next sections it will be described and discussed the criteria and definitions used to classify (section 2) and to alter (section 3) stand structure, as well as the main forces that drove the shifts between the different stand structures.

Stand Structure

Forest stands are a group of trees linked by a set of patterns and interactions that originate the stand structure, which was determined by the past processes and where the ongoing processes determine the future one. Stand structure and their

analysis is described in nearly all silvicultural text books [5-9,23-24]. It is used not only to describe the forest stands but also for their management, whether the stands' production is timber, non-timber products or services [9,23,25-28]. According to several authors [23-24,29] the variability of stand structure is wide and as it is determined by the tree's neighbours and their interactions. It is primordial to the stand development and dynamics, namely growth, mortality, silvicultural practices, harvests and regeneration. The variability of stand structure is also associated to some degree heterogeneity, both within and between stands, linked with the range of tree dimensions, their spatial arrangements in the horizontal and vertical planes and the number of species [23,30]. Stand structure can be defined as the spatial and temporal arrangement of the trees in a stand and is classified with three criteria; regime, structure and composition [5-9,23-24].

Regime of a stand is characterised by the type of regeneration: high forest for the stands where regeneration is of seed origin and coppice for those of vegetative origin [5,7,24]. However, there is a continuum from high forest to coppice (Figure 1) i.e, in the same stand can exist individuals of both seed and vegetative origin, thus originating intermediate forms, from the coppice with standards to the high forest with coppices. The threshold is set for the proportion of the number of individuals of each of the two types of regeneration [7]. Regime is also dependent on the species, while high forest is suited for all forest species, coppice can only be used with species that are able to sprout from stumps or roots [7,31] (Figure 1).