

## Abstract

There is a demand in forest management for reliable estimation of growth and yield parameters with biologically realistic models. Theoretical nonlinear biological models are expressly formulated to produce consistent growth and yield estimates and have long been recognized as ideal for quantifying the characteristic sigmoid pattern of a biological growth process by a set of differential equations. Moreover, these models provide the mathematical and biological basis for the principle of sustained yield management in forestry.

The main objective of this thesis is to introduce several methods of estimation to estimate the parameters of various forms of six nonlinear growth models namely; Monomolecular, Gompertz, Logistic, Weibull, Von Bertalanffy and Chapman Richard. There are total eleven forms of growth models are considered and a total of thirty one methods of estimation are introduced to estimate the parameters. These methods of estimation are computationally easy to apply and can use to have successful results for any growth model.

In this thesis, the nonlinear growth models are thoroughly investigated. The detailed mathematical properties of the parameters of each growth models are studied briefly by observant its nature on forestry. Five well-known forestry data are used for testing the validity of the proposed methods. After fitting the growth models using different methods of estimation, the best-fit model is selected based on a specific selection criterion. The selection criterion consists of six distinct steps. Results show that each method, introduced in this thesis is performed well.

This study also present a comparative study for describing the growth pattern of Teak (*Tectona grandis*) and Babul (*Acacia Nilotica*) in India. This study also presents a comparative study for top height age, the mean diameter at breast height data and the cumulative basal area production originated from the Bowmont Norway spruce thinning experiment, sample plot 3661. According to the results, it can be concluded that the Monomolecular growth model is more reasonable over the remaining growth models to describe the growth of Teak in India. In case of height growth pattern of Babul tree in India, the Monomolecular growth model (method E or method F) is preferable whereas Weibull growth model with four parameters can be used to

describe the growth of maximum diameter of Babul tree. Again to describe the growth pattern of mean diameter at breast height data, originated from the Bowmont Norway spruce thinning experiment; the Logistic growth model with method F is more suitable. Whereas Gompertz growth model with method F can be used to describe the height growth and cumulative basal area production from the Bowmont Norway spruce thinning experiment.

A software package is developed in FORTRAN 77 and in MATLAB version 7.11 for the fitting of the models using the introduced methods of estimation.