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An approach to estimate the productivity of various species on sites in Sweden by choosing individual climate and productivity values and the MIAMI-model with modifications

Johann Trischler[1], Dick Sandberg[2], Thomas Thörnqvist [3]

[1] PhD student, Linnaeus University, SE-351 95 VÄXJÖ, Sweden

[2] Professor of Forest Products, Linnaeus University and Professor of Wood Technology at Luleå University of Technology, SE-931 87 SKELLEFTEÅ, Sweden

[3] Professor of Forest Products at Linnaeus University, SE-351 95 VÄXJÖ, Sweden

Corresponding author: johann.trischler@lnu.se

Abstract

The literature contains a large variety of bioclimate, climate, biometric models for estimating the production of different species or stands under specific conditions for a defined site, or general models giving a worldwide overview of a single species. Depending on the model used, the amount of input-data varies considerable and is often related to a large investment in time and money.

The purpose of this study was to create a model to estimate the productivity of various species of interest for biomass production using only easy available input data defining the site conditions. Further, if the site-specific input-data is the same for all species, the model allows a comparison of different species on a single site. For this approach, the MIAMI-model of Lieth et al. was used as basic model with some modifications.

This modified model differs from recently developed models regarding the combination of species-unspecific site data and the species-specific productivity data. As the site data change with geographical location, easy handling data are profitable. The species-specific data require more extensive investigation, but once established as a database they can be used for all sites without changes. Mean annual temperature and mean annual precipitation were chosen as site-defining data and the mean annual temperature of the native distribution area of each species in combination with the highest biomass production found in the literature were chosen as the species-specific data. This combination makes this model very efficient to estimate the productivity of various species on different sites once the database is established.

This first version of the model is restricted to sites in Sweden where changes in soil and groundwater level are relatively small. Vegetation is then mainly controlled by energy input expressed for example as temperature or irradiation. As the maximum biomass production is estimated, lower nutrient and water supplies in the soil lead primary to a decrease in biomass

production, but this negative impact can be influenced by culture and treatment such as fertilising which is common in conventional agriculture. When extended to other regions with a more Mediterranean climate, for example, the impact of soil, water-storage and distribution of precipitation has to be evaluated first and if necessary included in the model formulation.

A validation of this model with data from the literature on the one hand and data estimated by another model on the other hand showed that it seems to be possible to use the model for purposed suggested here.

Keywords: Biomass production, MIAMI-model, MAT, MAP, Norway spruce, Paulownia, Miscanthus, Reed canary grass