

## ABSTRACT

### **Three-dimensional modeling of the dynamics of a tropical heterogeneous forest tree population: crown morphometric plasticity and growth dynamics relationships in wet evergreen forest in the Western Ghats of India.**

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The high complexity of tropical rain forests makes it difficult to understand the critical processes and parameters of their dynamics. Modeling has become essential to test for ecological mechanisms involved in such complex ecosystem dynamics at large spatio-temporal scales; likewise to explore scenarios for sustainable forest management.

Our objective is to get a generic model of heterogeneous forest dynamics which will provide different stakeholders with useful tools.

The main standard site is the Uppangala permanent sample plot (Western Ghats), a 28-ha experimental station established in 1990 by the IFP in an undisturbed wet evergreen forest. The monitoring of about 3,500 trees during fifteen years provides a unique dataset on three main dynamic parameters: tree growth, mortality and recruitment. Moreover, this primary forest stand presents the advantage of being dominated by four species representing 48% of the trees, an exceptionally favourable opportunity for modelling purpose.

Numerous studies have been conducted here. A model of stand dynamics based on a 2-D representation of the crown surface was implemented (Moravie et al. 1997). However, Moravie et al. (1999) demonstrated the predictive ability of tree social status (related with light availability to the tree and on its height) for growth dynamics, which suggests that taking into account the three-dimensional crown development could increase accuracy of individual growth predictions.

An obvious extension of the previous work would be the calibration and validation a 3-D model of heterogeneous forests dynamics, by using new measurement methods of the crown envelop and porosity based on modern laser hypsometer. As the light interception by the tree crown is considered as the critical parameter for forest dynamics, we aim at integrating the three-dimensional arrangement of tree crowns and their interactions, particularly the competition for light and space, in this model. It will be based on the Spatially Explicit Individual-based Forest Simulator (Vincent G., Harja Asmar D.), involving the light interception by crown (SLIM module) and the crown shape flexibility in response to space and light limitations (STReTCH module).