Influence of estimators of the vital rates in the stock recovery rate when using matrix models for tropical rainforests

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The stock recovery rate, the ratio of the wood stock at the end of a felling cycle over the wood stock just before logging, is a key parameter for the management of tropical rainforests. It is thus essential to predict it with a reliable precision. It can be predicted using the stock recovery formula or Usher matrix models, that are projection matrix models for size-structured populations. Both depend on estimates of vital rates, that are mortality rates, recruitment rates and upgrowth rates. The precision of estimation of the stock recovery rate is related to the amount of data available for the estimation of vital rates and to the type of estimator used. As data on tropical tree species are scarce, the choice of an appropriate estimator for vital rates is crucial. Classical estimators include the proportion estimator and estimators based on the conditional expectation of diameter increments. We show that the later are biased and define a correction that partially corrects this bias. In all, fourteen estimators of the vital rates were compared in this study, to predict the stock recovery rate of *Dicorynia guianensis*, a major timber species in French Guiana. These estimators were compared on the basis of the prediction error, of the sensitivity of the stock recovery rate to diameter intervals, and of the bias and variance of the stock recovery rate estimator. The predicted stock recovery rate varied greatly depending on the estimator used for vital rates, with even contradictory conclusions as whether the stock depletes or increases. However some the estimators were strongly biased and gave unreliable estimates. Which estimator was the most statistically efficient depended on sample size. The proportion estimators had a small bias and a large variance and were efficient for large samples, whereas the estimators based on the conditional expectation of diameter increments had a large bias and a small variance and were efficient for small samples. The former were more sensitive to the diameter breakpoints than the latter.