A MULTI-SPECIES FOREST LANDSCAPE MODEL WITH DISPERSAL, SUCCESSION, COMPETITION AND DISTURBANCE FUNCTIONS: EXPLORING DETERMINANTS OF SUCCESSION PATHS AND COEXISTENCE

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Novel tropical forests are just beginning to be appreciated in all their importance. Unfortunately, we know very little about them and experimental research needed to obtain data about these forests can have long maturity periods and be costly. We want to build a landscape model to help us learn about these forests in PR in such a way as to circumvent the temporal and physical limitations of experimental research while complementing it. To this effect, we developed a cellular automata environment written in C++ that mimics the functionality of top-of-the-art forest landscape models and species dispersal mechanisms. The dispersal mechanisms are based on cellular automata for the short-range dispersal process, and on draws from random distributions for its long-distance dispersal process. Each species has its own short- and long-distance dispersal parameters. The succession process allows for several developmental stages and certain response to light availability. Finally, a disturbance process was developed to simulate random fire or wind occurrences. We explored the ability of this modeling framework to replicate certain stylized facts observed in tropical forests of Puerto Rico. In the first stylized fact, succession path would depend on the size of the disturbance occurrence. For smaller disturbed forest patches, a certain pioneering species would begin dominating, whereas in the case of larger disturbed forest patches a different species would begin dominating. The model can replicate this phenomena with species that disperse well but have little tolerance to shade dominating in big open patches, while species that disperse poorly but are tolerant to shade dominating in small open patches. When disturbances are very infrequent, the later tend to dominate in the long run. However, with a higher rate of disturbance over time, one starts to see that coexistence is the norm. When landscape heterogeneity affects species survival randomly, coexistence can be observed at a more local level.