Segregation Patterns of Trees and Grass Based on a Modified Age-Structured Continuous-Space Forest Model

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Abstract : Tree-grass coexistence system is of great importance for forest ecology. Mathematical models are being proposed to study the dynamics of tree-grass coexistence and the stability of the systems. However, few of the models concentrates on spatial dynamics of the tree-grass coexistence. In this study, we modified an age-structured continuous-space population model for forests, obtaining an age-structured continuous-space population model for the tree-grass competition model. In the model, for thermal competitions, adult trees can out-compete grass, and grass can out-compete seedlings. We mathematically studied the model to make sure tree-grass coexistence solutions exist. Numerical experiments demonstrated that a fraction of area that trees or grass occupies can affect whether the coexistence is stable or not. We also tried regulating the mortality of adult trees with other parameters and the fraction of area trees and grass occupies were fixed; results show that the mortality of adult trees is also a factor affecting the stability of the tree-grass coexistence in this model.

Keywords : population-structured models, stabilities of ecosystems, thermal competitions, tree-grass coexistence systems
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