Modelling Fire as Discrete Events in Some Tree-Grass Interaction Models with Explicit Soil Water Resource

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Savannah is a grassland ecosystem characterized by various trees density. It occurs in areas with annual rainfall from 300 to 1800 mm. If rainfall plays an important role in this savannah ecosystem, big fire events also can disturb the whole dynamics. Several continuous competition-based models have been proposed to explain different tree-grass patterns, taking into account fire events (see for instance [1] and references therein). We first consider a tree-grass model, but instead of considering continuous fire forcings, we consider fire as discrete events and derive an impulse differential system. A qualitative analysis show that a periodic equilibrium can exist as well as local and global equilibria, according to some threshold parameters. Then, we consider an eco-hydrological model recently published [1], that takes into account rainfall through a soil moisture equation. We perform a mathematical analysis and develop a nonstandard numerical scheme, that is able to preserve all qualitative properties of the model. Finally, using appropriate numerical schemes [3], we perform several numerical simulations. We conclude and present further possible developments.

References

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