The effects of noise on forest ecosystems

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Keywords: Forest model, sustainability, stochastic differential equations.

Conservation of forest resources is one of the most challenging problems in ecology and environmental science. For maintaining the ecological integrity of forest ecosystem and preserving biodiversity, knowing forest dynamics is of very importance. One of fundamental issues in these problems is to predict the variation of tree density caused by random factors.

Antonovsky (1975) introduced a mono-species forest model with two age classes of trees. Kuznetsov et al. [J. Math. Biol. 32 (1994)] then introduced a mathematical model of mono-species forest with two age classes which takes into account the seed production and dispersion. Yagi ([3]) presented very interesting mathematical structures for that model including variation of tree and seed densities, and robustness of forest in deterministic environments. No random factor (noise) has been considered in these models.

In the real world, noise including climate change, disaster (floods, hurricanes, tornadoes, earthquakes, tsunamis), and human behaviors always make effect on forest in various levels.

In [1,2], we investigated the effects of noise on the mortality of old trees in the Antonovsky's model. In this talk, we present a clear picture showing the effects of noise on not only that parameter but also others in the model. We prove existence and uniqueness of global nonnegative solutions. We then investigate asymptotic behavior of solutions, showing limitations for sustainability or decline of forest against noise. Results are illustrated by numerical examples.

References

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