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A Novel Delayed Logistic Equations with Decay-Consistent Delay in Growth

We derive an alternative expression for a delayed logistic equation, assuming that the rate of change of the population depends on three components: growth, death, and intraspecific competition, with the delay in the growth component. Following Arino et al. (J Theor Biol 241(1):109–119, 2006), in our formulation we incorporate the delay in the growth term in a manner consistent with the rate of instantaneous decline in the population. For our new model, we provide a complete global analysis showing that no sustained oscillations are possible. We further extend our formulation to a two species competition and use adaptive dynamics to conclude that, assuming certain trade-offs between the growth rate and the delay, the evolutionary trend is to make the delay approaching an optimal value.